US 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

April 2023

Wilmington District – U.S. Army Corps of Engineers

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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.

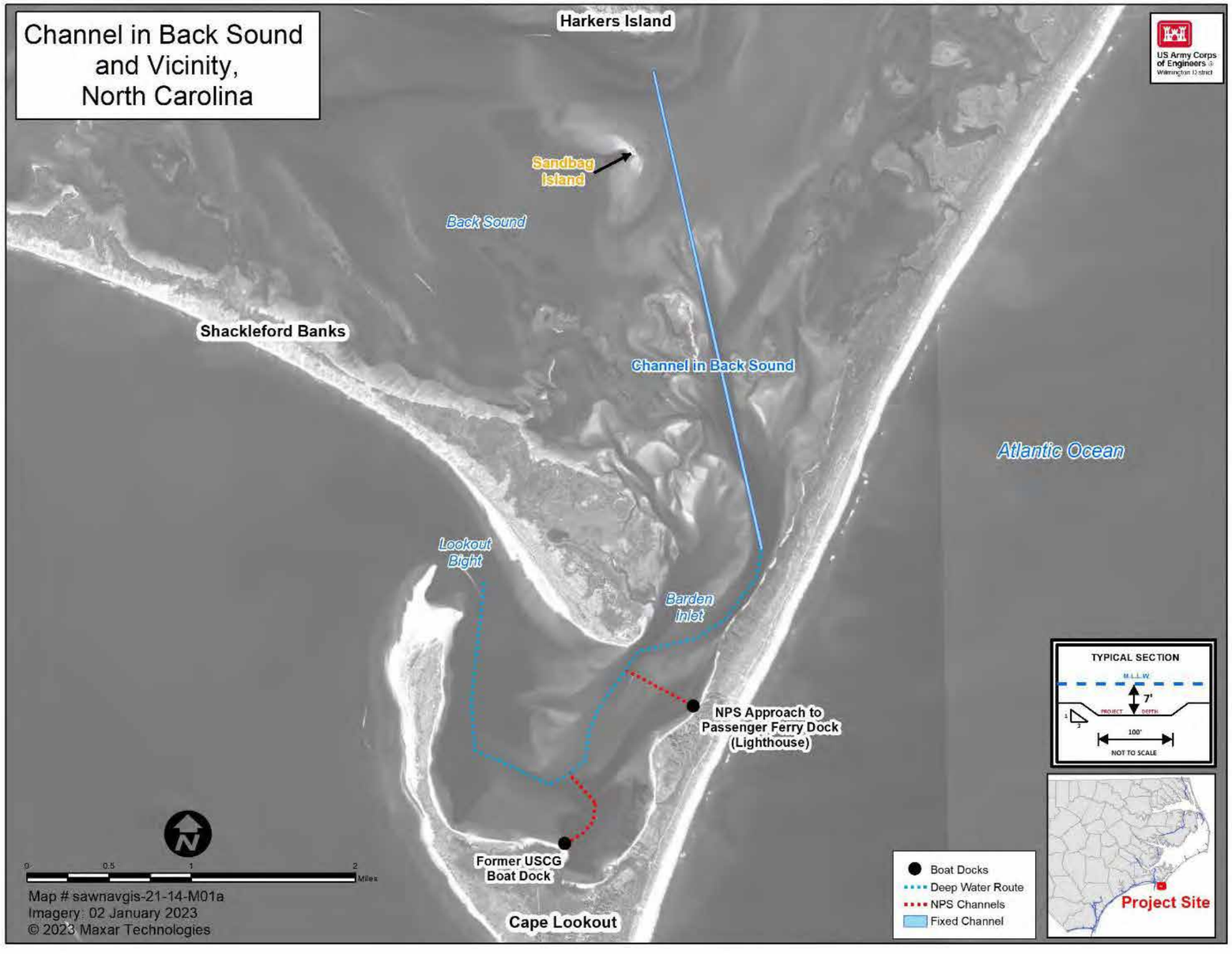

Figure 1. Project Area Overview

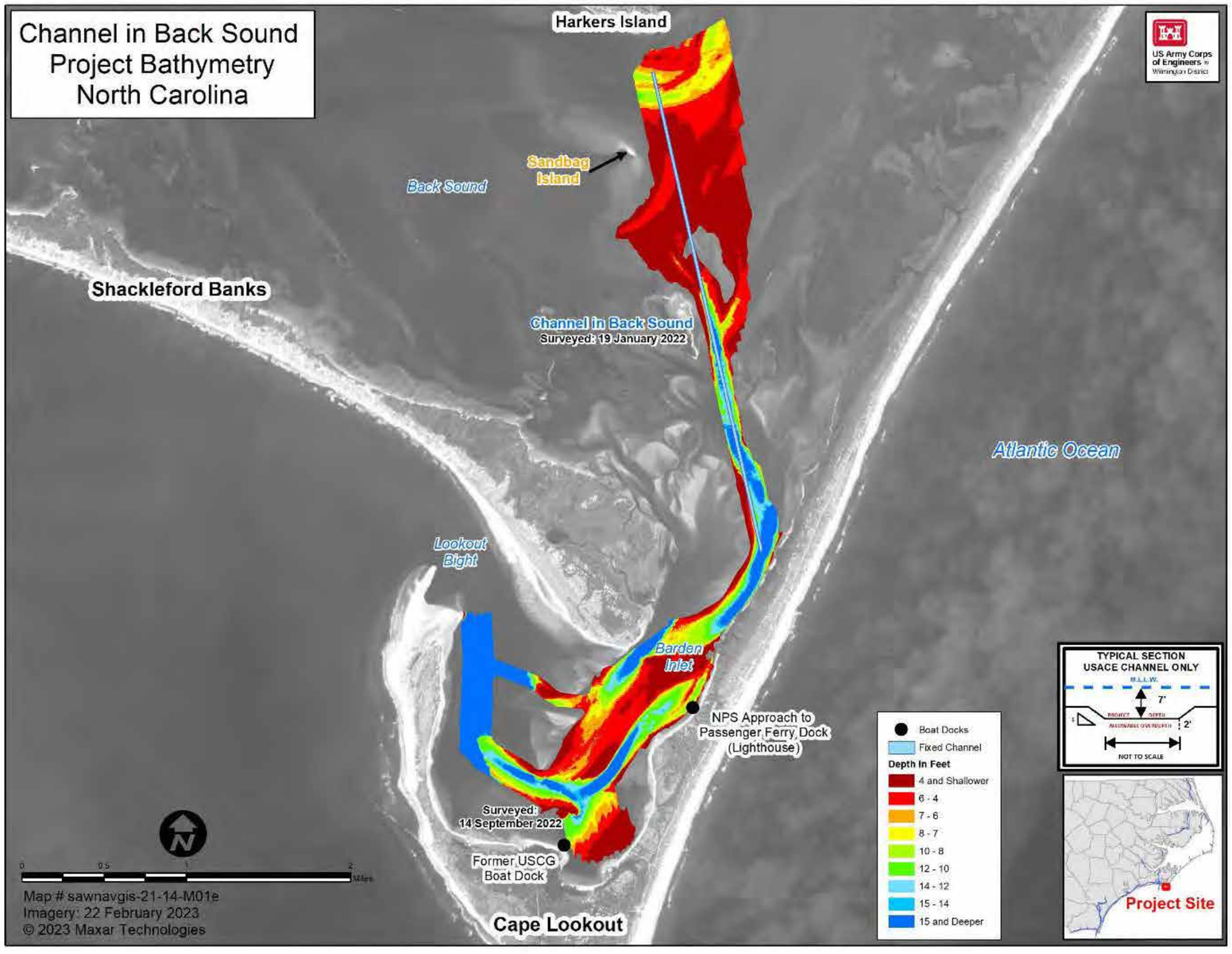

Figure 2. Project Area Bathymetry

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 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) + 2 feet 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 mean lower low water (MLLW) + 2 feet allowable overdepth that extends from Barden Inlet through Lookout Bight.

1.1.2 NPS Channels

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 channel dimensions for the channel to the Lighthouse dock would be 40 feet wide by 7 feet deep +1 foot overdepth, and the channel to the old USCG Station dock would be 40 feet wide by 4 feet deep +2 feet 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 MERITT 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. 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 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 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 bird island 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.

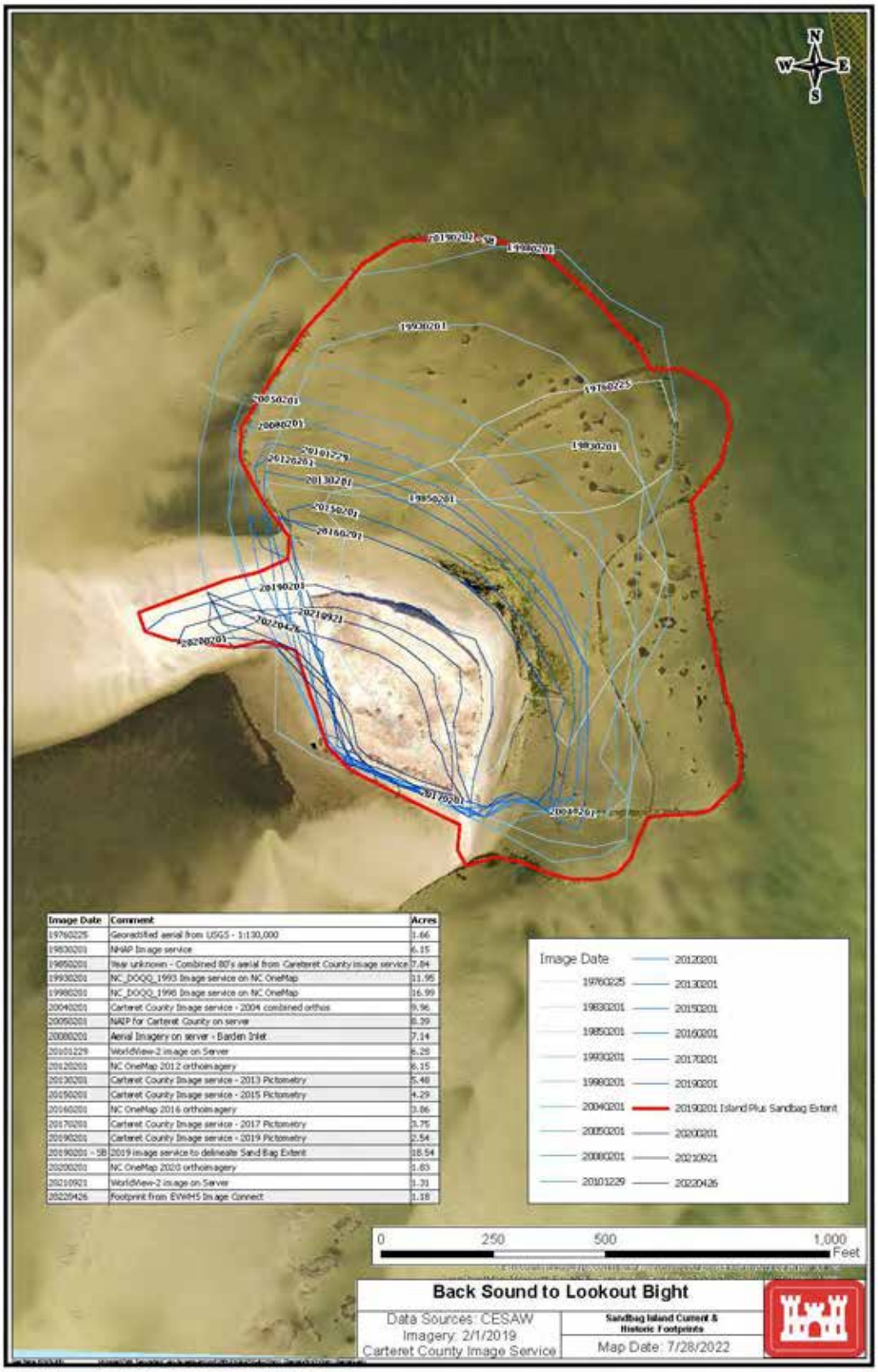

Figure 3. Sandbag Island Dredged Material Placement History

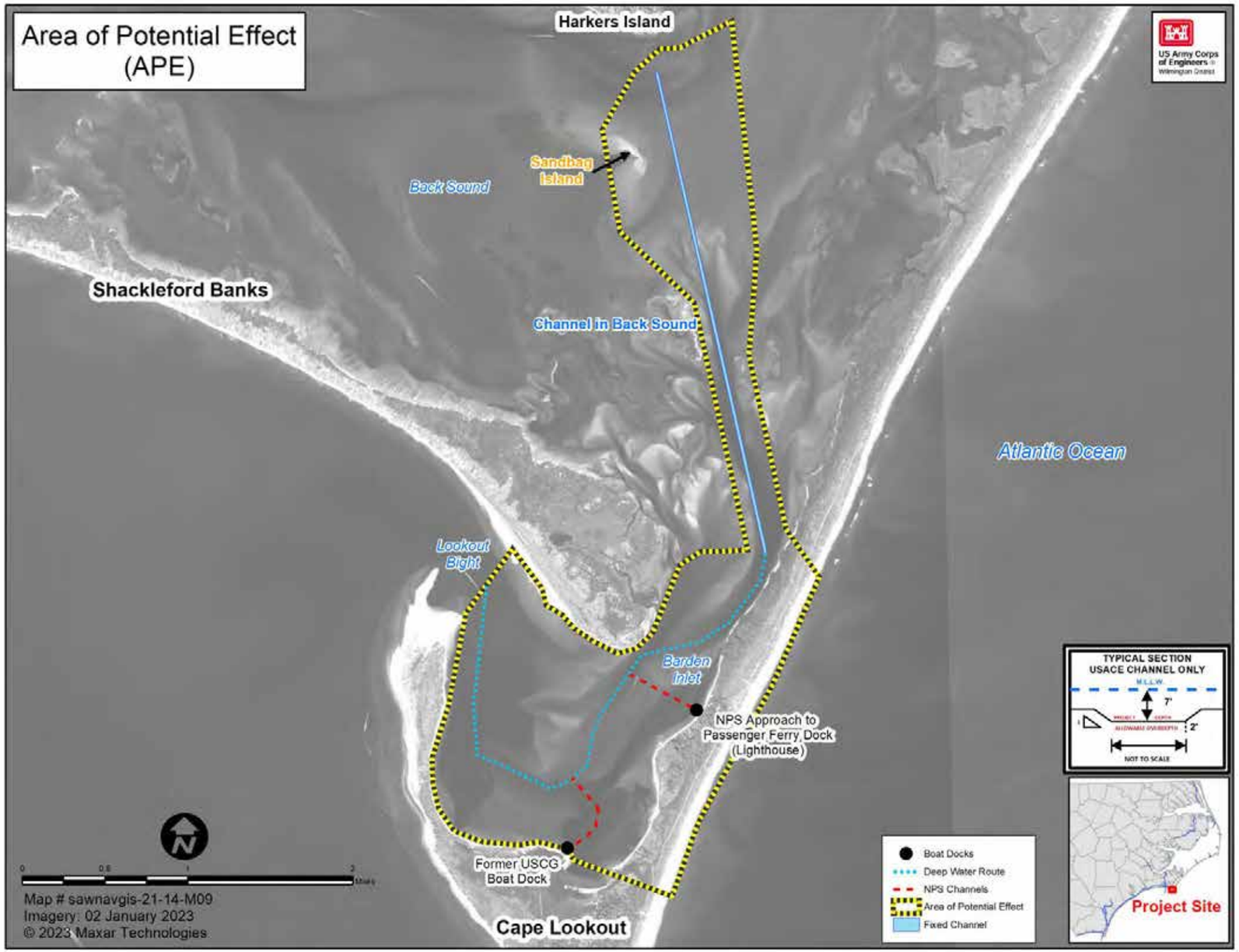

Figure 4. Area of Potential Effect

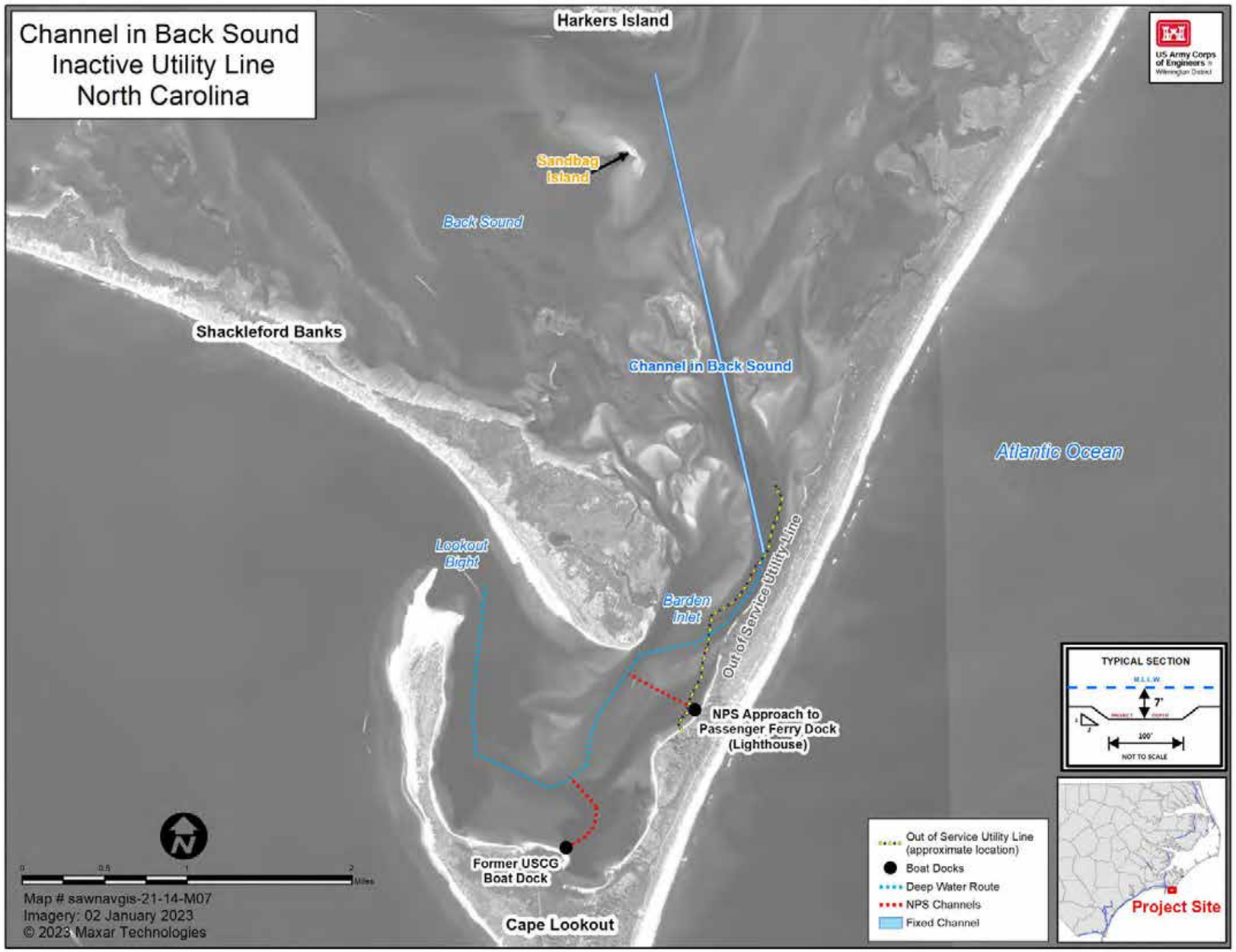

Figure 5. Abandoned Utility Line Location

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 + 2 feet allowable overdepth with 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. 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 +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 +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 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. CALO oceanside beach placement would occur when there is no need for material on Lighthouse beach; or when quantities exceed the limits of Lighthouse beach. If this is to occur, a Wetland Statement of Findings (WSOF) and Special Use Permit (SUP) will be acquired as needed from the NPS prior to oceanside beach placement.

1.3.5 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.

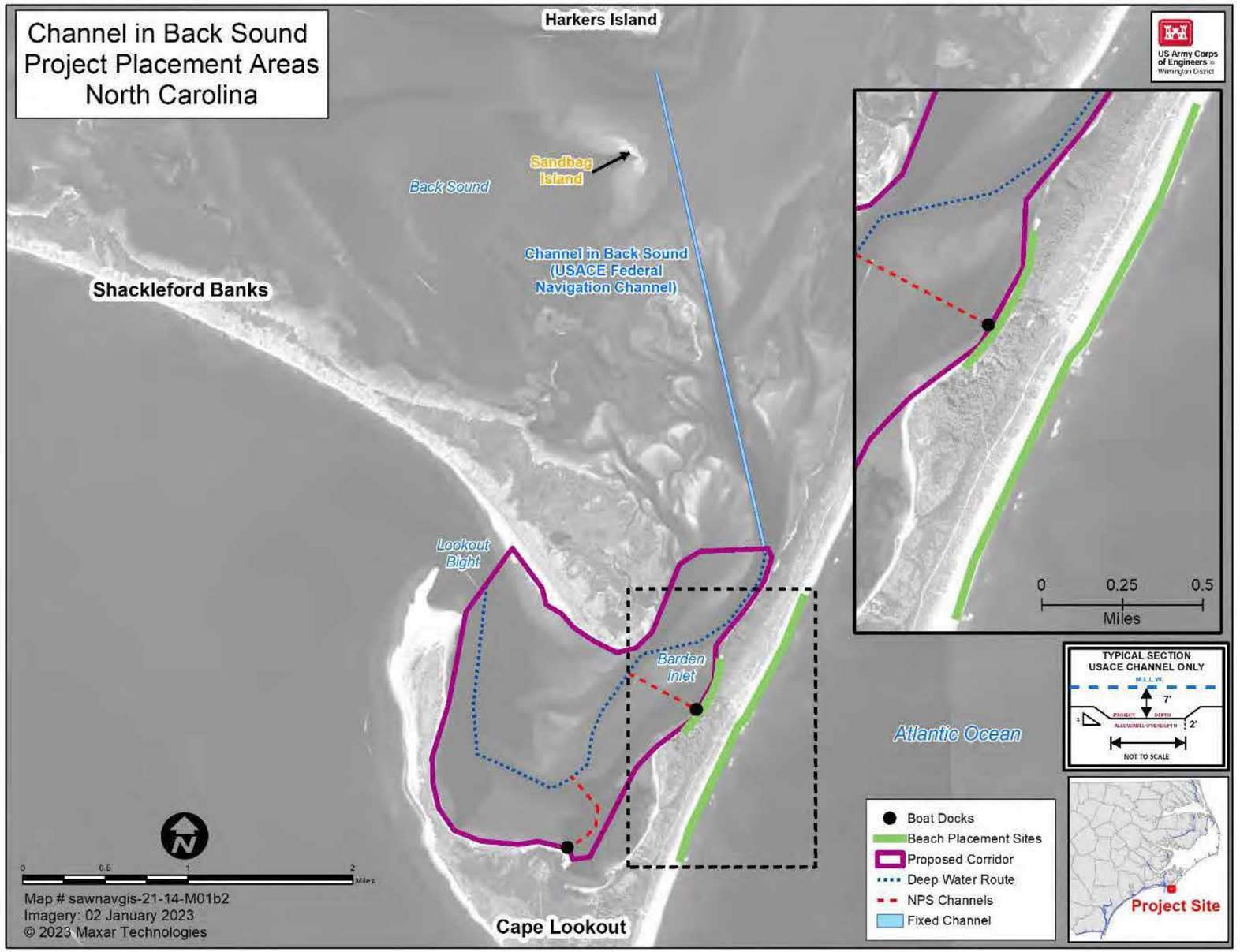

Figure 6. CALO Soundside and Oceanside Beach Placement Areas

1.3.6 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 (≥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, 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 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 U.S. Coast Guard (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.

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 (≥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. 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 1 September – 31 March for the protection of nesting birds and fledglings, per USFWS. Initial dredging in FY23-24 is expected to place approximately 160,000 CYs onto Sandbag Island from the Back Sound channel.

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).

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 (1 September – 31 March) to protect nesting birds and fledglings. Lighthouse beach is not known to provide sea turtle nesting habitat (*personal comms 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 sea-craft. 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 foot.

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 16 November – 30 April for protection nesting sea turtles and hatchlings, as required by USFWS in the 2017 NC State Programmatic Biological Opinion. This would require a Wetland Statement of Findings (WSOF) and a Special Use Permit (SUP) from the NPS prior to placement. 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 1 October – 31 March timeframe as per NMFS and NCDMF recommendations, to minimize impacts to SAV, blue crab spawning and egg/larval stages of fish. Should an unexpected weather event occur that requires dredging outside the 1 October – 31 March 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 1 October – 31 March to minimize impacts to SAV, blue crab spawning and for egg/larval stages of fish, and only as needed during that period. Should an unexpected weather event occur that requires dredging outside the 1 October – 31 March 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+ 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+ 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.

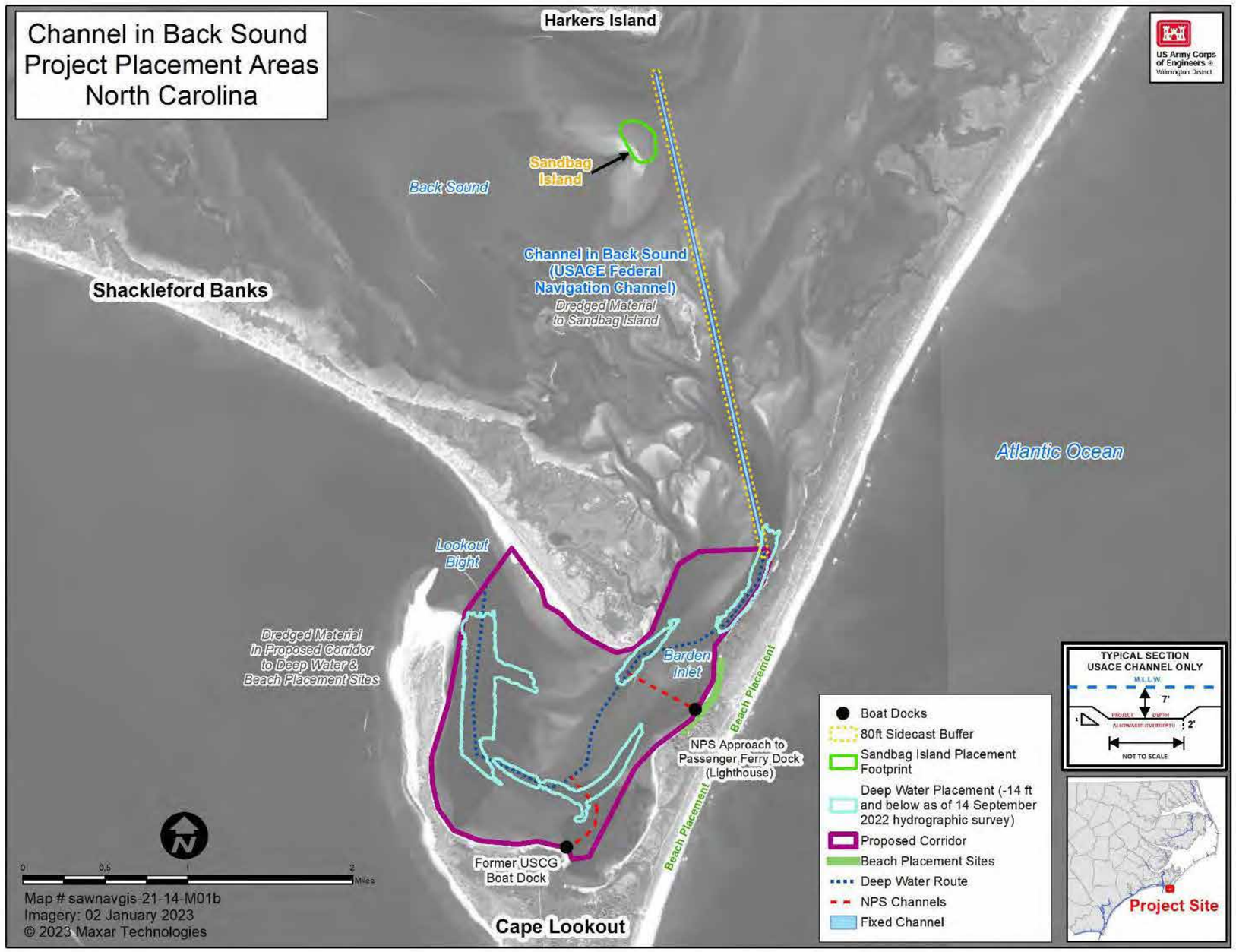

Figure 7. Proposed Dredged Material Placement Areas

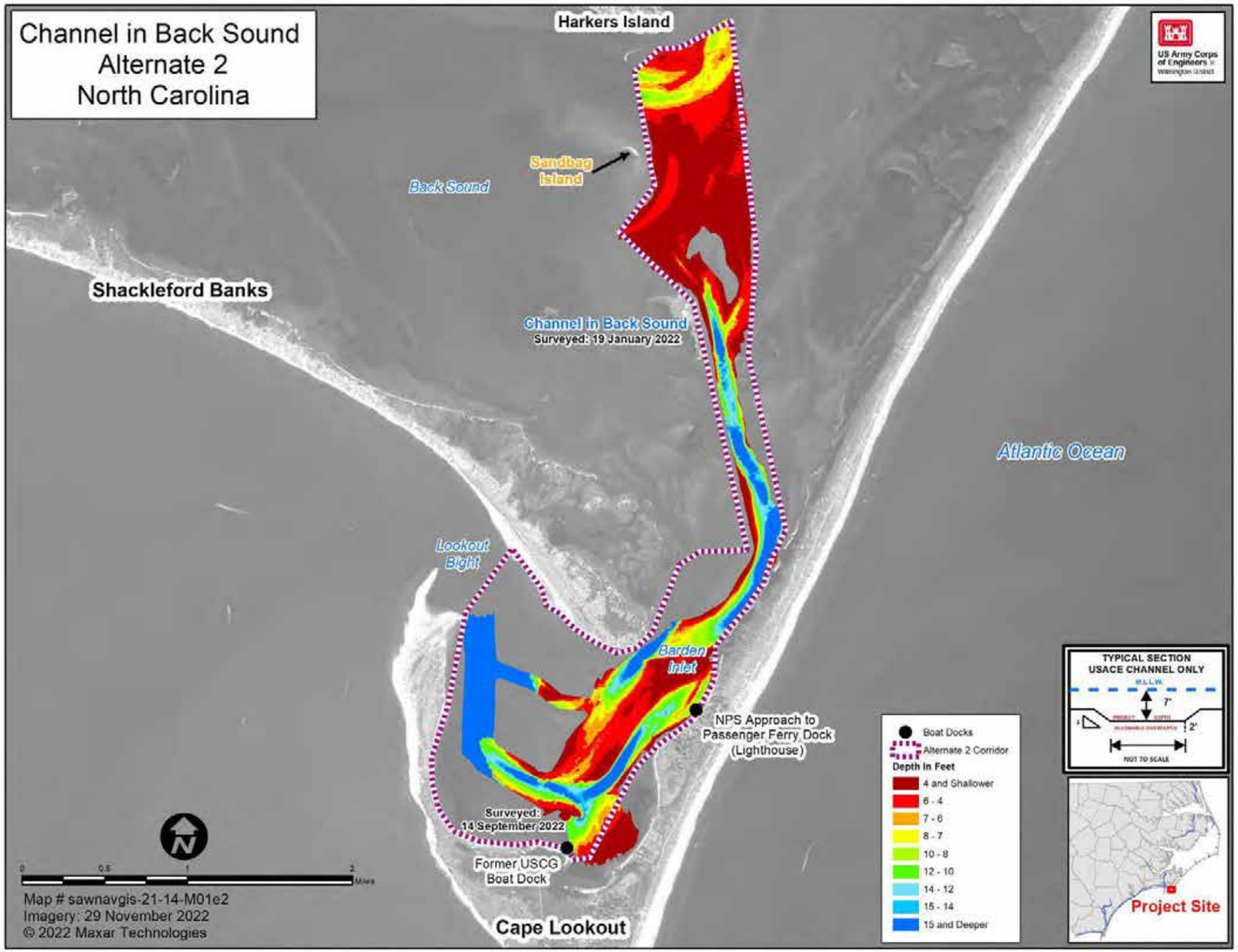

Figure 8. Alternative 2, Full Project Corridor

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).

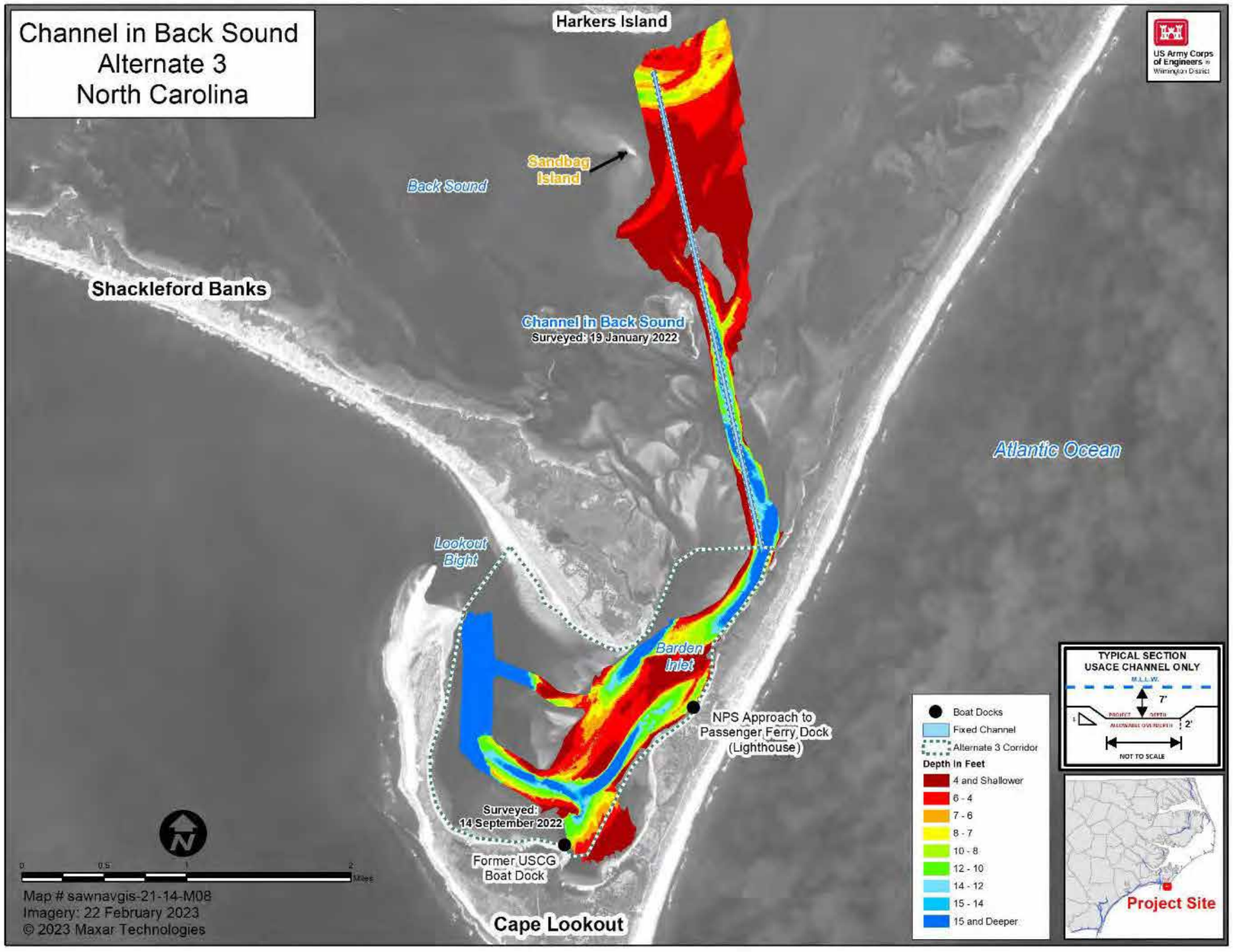

Figure 9. Alternative 3, Partial Project Corridor

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 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, 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 (16 November – 30 April) and shorebirds (1 September – 31 March) and Government Plant dredging would occur between 1 October and 31 March 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 National Park Service (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 ft. MLLW with 2 ft. 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.

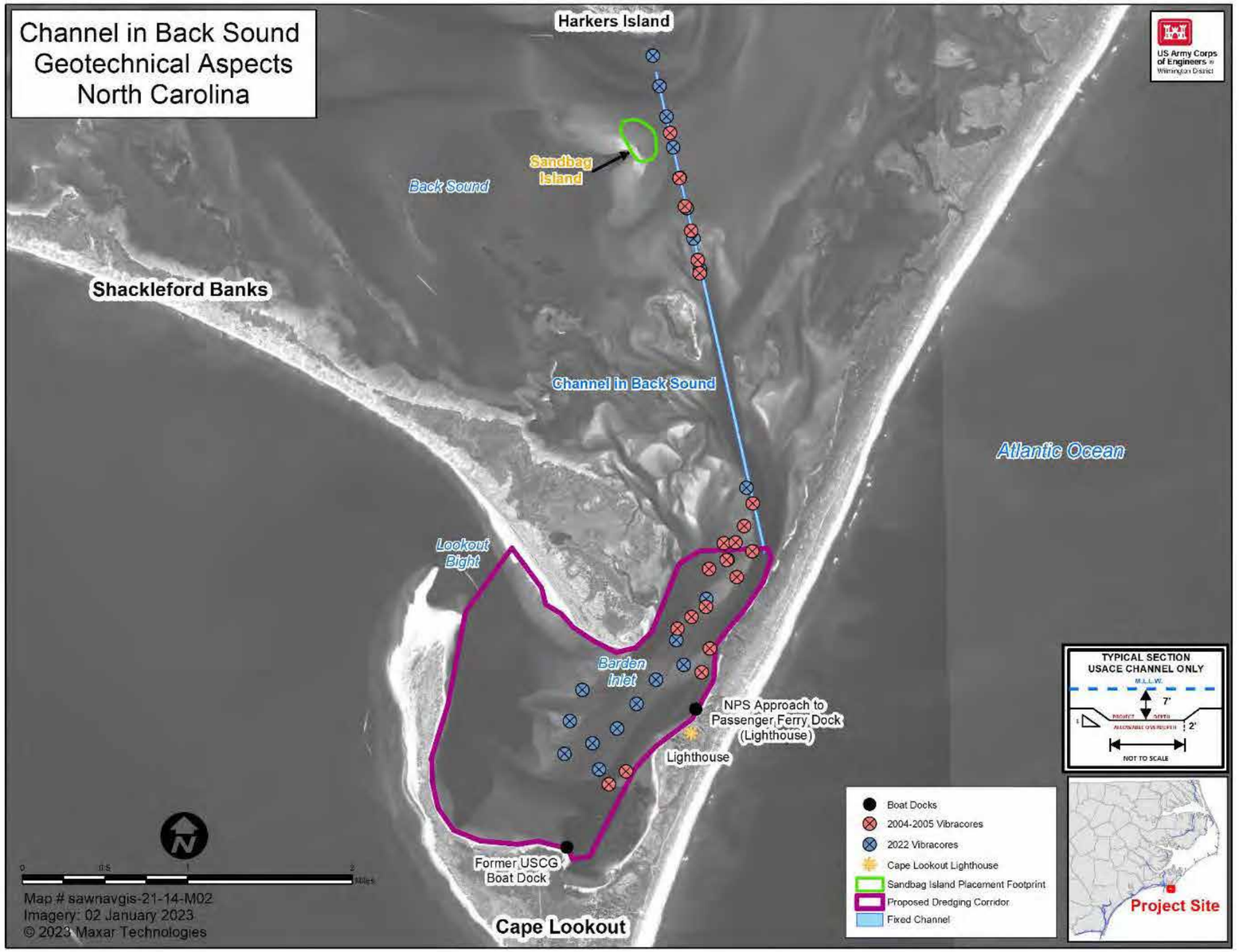

Figure 10. Location of 2004-05 and 2022 USACE Vibracores

Vibracores were strategically placed to target areas of significant shoaling. Areas deeper than -9 ft. 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 the 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 happening, 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 the soundside 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.

Native Grain Size (Soundside Beach)			
Passing No. 200 Sieve	Mean (mm)	Mean (phi[1])	Std. Dev. (phi)
2.5%	0.45	1.15	0.92

From 2004-2005, 20 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) were investigated. 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

[1] 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 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 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 (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.

Location	**Mean (mm)**	**Percent Fines (Clays/Slits**	**Sorting (phi)**	**Overfill**
Northern Section	0.22	4.63 %	0.61	>2 (Unstable)
Southern Section	0.38	1.12 %	0.85	1.60
Native Beach	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 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.

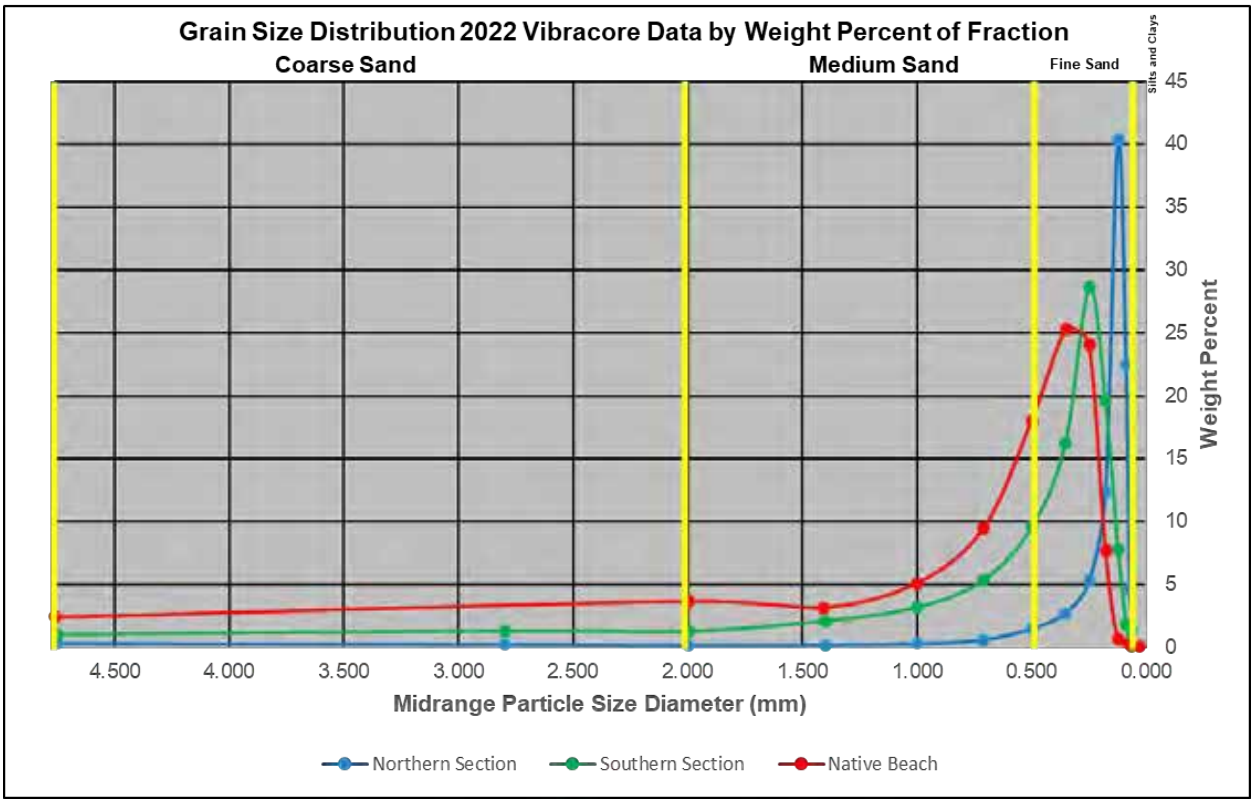

Figure 11. Grain size distribution curves showing the midrange particle diameter (mm) from the 2002 data comparably to each location.

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

Environmental Consequences- Sediments.

Alternative 1 - No Action:

Under the No Action alternative, the 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 the 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 – 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 Sandbag 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. 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 have been tested in 2004-2005 the 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 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 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 within this area 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 historical structures are being compromised. Placing material 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 the 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 Sandbag 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. 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, mean lower low water. 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 ft at nearby NOAA station 8656483 located at the Duke Marine Lab in Beaufort, NC. MSL is equivalent to -0.37 ft 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)

NCDWR classifies Back Sound at the project site as SA and OWR. SA waters are protected for commercial shell fishing along with all designated SB and SC uses. Class SA commercial shell fishing waters in Back Sound are assigned a Shellfish Growing Area Status of "Approved" based on North Carolina Division of Marine Fisheries (NCDMF) Shellfish Sanitation fecal coliform criteria. 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 ≥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 (USACE 1997).

North Carolina Division of Water Resources (NCDWR) Section 401 Water Quality Certification (WQC) under the Clean Water Act of 1977 (PL 95-217) are issued for projects that result in a regulated discharge of material. 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 the 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 the 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 sandbags, geotubes and the construction of berms to control effluent and reduce turbidity. 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 dredged are proposed to occur for 1-2 week periods during the 1 October – 31 March 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.

Implementation of the proposed project would require two separate Individual 401 Water Quality Certifications (WQCs), one for the USACE channels and one for the NPS channels. The required 401 will be obtained prior to dredging and all conditions of the 401 will be met. For USACE channels, WQC coverage would include placement onto Sandbag Island 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 401 authorization would cover placement onto previously authorized NPS soundside and oceanside beaches, and open water placement from Government plant sidecasting and special purpose hopper dredging.

Section 404 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 draft 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, Section 401 and 404 authorizations for USACE and NPS channel maintenance would be the same as Alternative 02.

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.

NPS Procedural Manual PM 77-1, Wetlands Protection, defines unvegetated wetlands to include beaches from mean lower low water (MLLW) to mean higher high water (MHHW). NPS-managed beaches receiving dredged material require a Wetlands Statement of Finding (WSOF). A WSOF has been issued for Lighthouse beach and a WSOF would be issued for the oceanside beach prior to placement activities.

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 Cape Lookout 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 an attainment area after having been a 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 National Ambient Air Quality Standards 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 National Ambient Air Quality Standards. 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 dredging operating 24 hours per day. Maintenance dredging in between regular pipeline events would be expected to be of shorter duration than the 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 - 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 Section 6-28 and Section 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 Sandbag 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 1 September – 31 March when placing on Sandbag Island and from 16 November - 30 April 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 year, however only during daylight hours. Sidecast and special purpose hopper dredging is expected to occur between 1 October – 31 March, 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 which 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 the 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 vitulaina*) 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, 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 1 October – 31 March, depending on shoaling, but only last 7-14 days and only during daytime hours.

All dredged material sampled, to date, is ≥ 90% sand and would be expected to fall out of 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 1 October – 31 March timeframe for Government Plant dredging

and 1 September – 31 March for pipeline dredging when placing material from Back Sound onto Sandbag Island and 16 November – 30 April for pipeline dredging when placing material on the 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 the 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 the 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 sea floor, 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 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 the 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 located within the project vicinity of Back Sound to Lookout Bight (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).

ESSENTIAL FISH HABITAT	**Present Near Project Vicinity**	**Present In Project Area**	**Effects of Dredging Activities**	**Effects of Sediment Placement Activities**
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
HABITAT AREAS OF PARTICULAR CONCERN	**Present Near Project Vicinity**	**Present In Project Area**	**Effects of Dredging Activities**	**Effects of Sediment Placement Activities**
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

Species	Adult	Juvenile	Neonatal	Spawning
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)

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. In addition, all coastal inlets, all 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). In addition, the Gulf Stream is an essential fish habitat, because it provides a mechanism to disperse coastal migratory pelagic larvae. For king and Spanish mackerel and cobia, essential fish habitat 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, essential fish habitat 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, Habitat Areas of Particular Concern (HAPC) were reviewed using the EFH Mapper to identify any HAPC located 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). HAPC include species of penaeid shrimp, within 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 the snapper-grouper complex, penaeid shrimp, and summer flounder.

5.6.5 Submerged Aquatic Vegetation (SAV) and Shellfish Beds.

SAV provide 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 are prolific in shallow estuaries of Back Sound and Lookout Bight as shown in NCDEQ's 2019-2020 SAV mapping data (Figure 12). SAV were 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. Currently, there are no SAV present within and immediately adjacent to USACE and NPS channels that would be affected by dredging activity. The nearest SAV is 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). Dredging would avoid known areas of SAV to the maximum extent 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 recommended timeframe of 1 October – 31 March to avoid the SAV growing season, thereby making impacts to SAV insignificant.

SAV are present to the south and southwest of Sandbag Island.

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 establish 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.

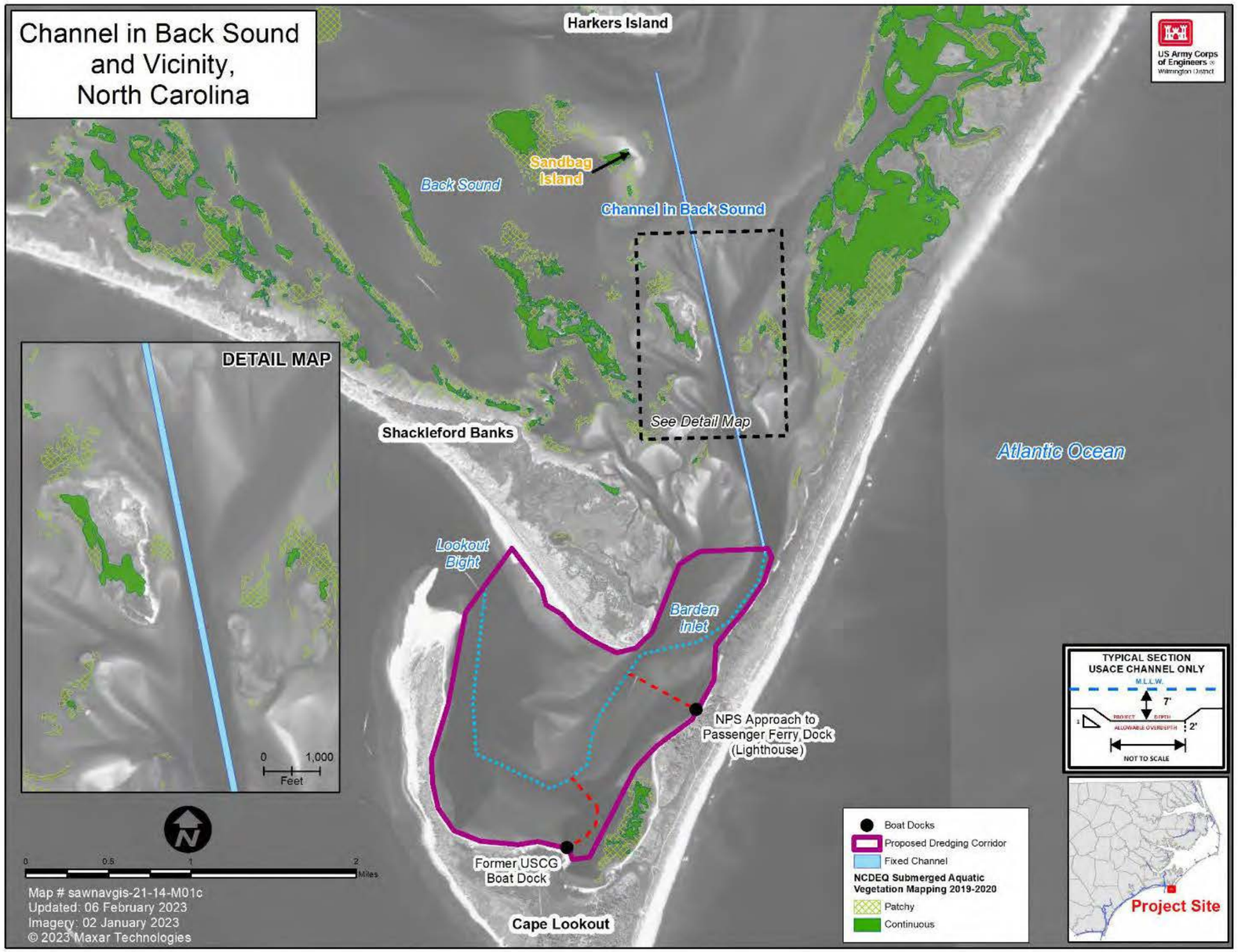

Figure 12. Location of Submerged Aquatic Vegetation (SAV), NCDEQ 2019-2020 SAV Mapper

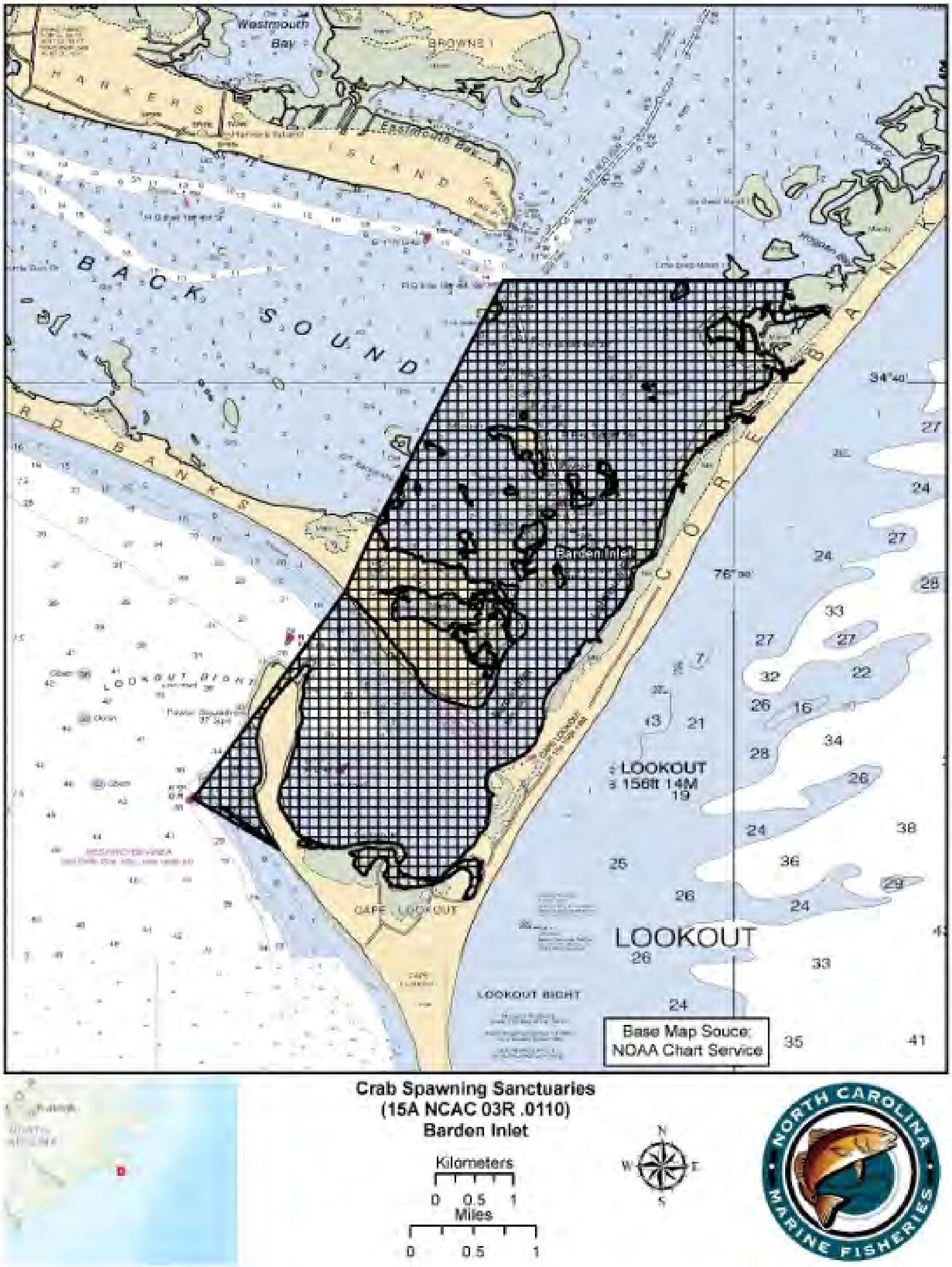

Figure 13. Barden Inlet Crab Spawning Sanctuary (CSS)

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 postlarval 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 Marine Fisheries Council and the Wildlife Resources Commission. 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 are 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 propellors impacts only the immediate area of the dredge, since sand material would fall out quickly (not remain in suspension).

Impacts from pipeline placement onto Sandbag Island and CALO beaches would occur where material settles out below mean low water (intertidal and shallow water habitat areas). In the fall of 2022, the areas surrounding Sandbag Island were ground-truthed for SAV. It was noted that, within the 25-acre footprint of the proposed placement area, SAV do not exist (what was identified was remnant sandbags from a previous project that were overgrown with algae). SAV were identified along the south and west sides of Sandbag Island, which would be avoided to the maximum extent practicable using geotubes, sandbags and berm construction to contain material (Sandbag Island Placement Plan, Appendix B).

Sandbag 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 due to the fact that the 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 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 recommended timeframe of 1 October – 31 March to avoid the SAV growing season, thereby making impacts to SAV insignificant.

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 measure listed below that the USACE has committed to follow:

- All Government Plant dredging would take place between 1 October – 31 March.
- Pipeline dredging and associated beach placement and bird island placement would only occur during the relevant timeframes for the protection of nesting sea turtles (16 November – 30 April) and birds (1 September – 31 March).
- 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 Island via control-of-effluent would utilize methodologies that will avoid impacts to SAV 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 resources 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.

Colonially 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.

Alternative 2 – Full Corridor:

Dredging the federal channel in Back Sound would provide a source of placement material for Sandbag Island, which has not received material for over two decades. Initial dredging of the channel would provide over 150,000 CYs and would triple the footprint of the island. Over multiple pipeline contracts (10-15 years), USACE proposes to expand the island up to a footprint of 25 acres, the maximum size recommended by resource agencies for nesting birds without possible predators inhabiting the island.

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 U.S. Fish and Wildlife Service (USFWS) and National Marine Fisheries Service (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

Species	**Status (T/E)**	**USFWS/NMFS**	**Present in the Project Area?**
Green sea turtle (*Chelonia mydas*)	T	Both	Yes
Loggerhead sea turtle (*Caretta caretta*)	T	Both	Yes
Leatherback sea turtle (*Dermochelys coriacea*)	E	Both	Rare
Kemp's ridley sea turtle (*Lepidochelys kempii*)	E	Both	Yes
Red knot (*Calidris canutus rufa*)	T	USFWS	Yes
Piping plover (*Charadrius melodus*); Critical Habitat	T	USFWS	Yes
Eastern Black Rail (*Laterallus jamaicensis*)	T	USFWS	No
Roseate tern (*Sterna dougallii dougallii*)	E	USFWS	No
Red-cockaded Woodpecker *(Picoides borealis)*	E	USFWS	No
Species	**Status (T/E)**	**USFWS/NMFS**	**Present?**
West Indian manatee (*Trichechus manatus*)	T	USFWS	Rare
Rough-leaved Loosestrife *(Lysimachia asperilaefolia)*	E	USFWS	No
Seabeach amaranth (*Amaranthus pumilus*)	T	USFWS	Yes
North Atlantic right whale (*Eubalaena glacialis*)	E	NMFS	No
Shortnose sturgeon (*Acipenser brevirostrum*)	E	NMFS	Rare
Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*)	E	NMFS	Yes
Giant manta ray (*Manta birostris*)	T	NMFS	Yes
Smalltooth sawfish (*Pistis pectinata*)	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; 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.

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.

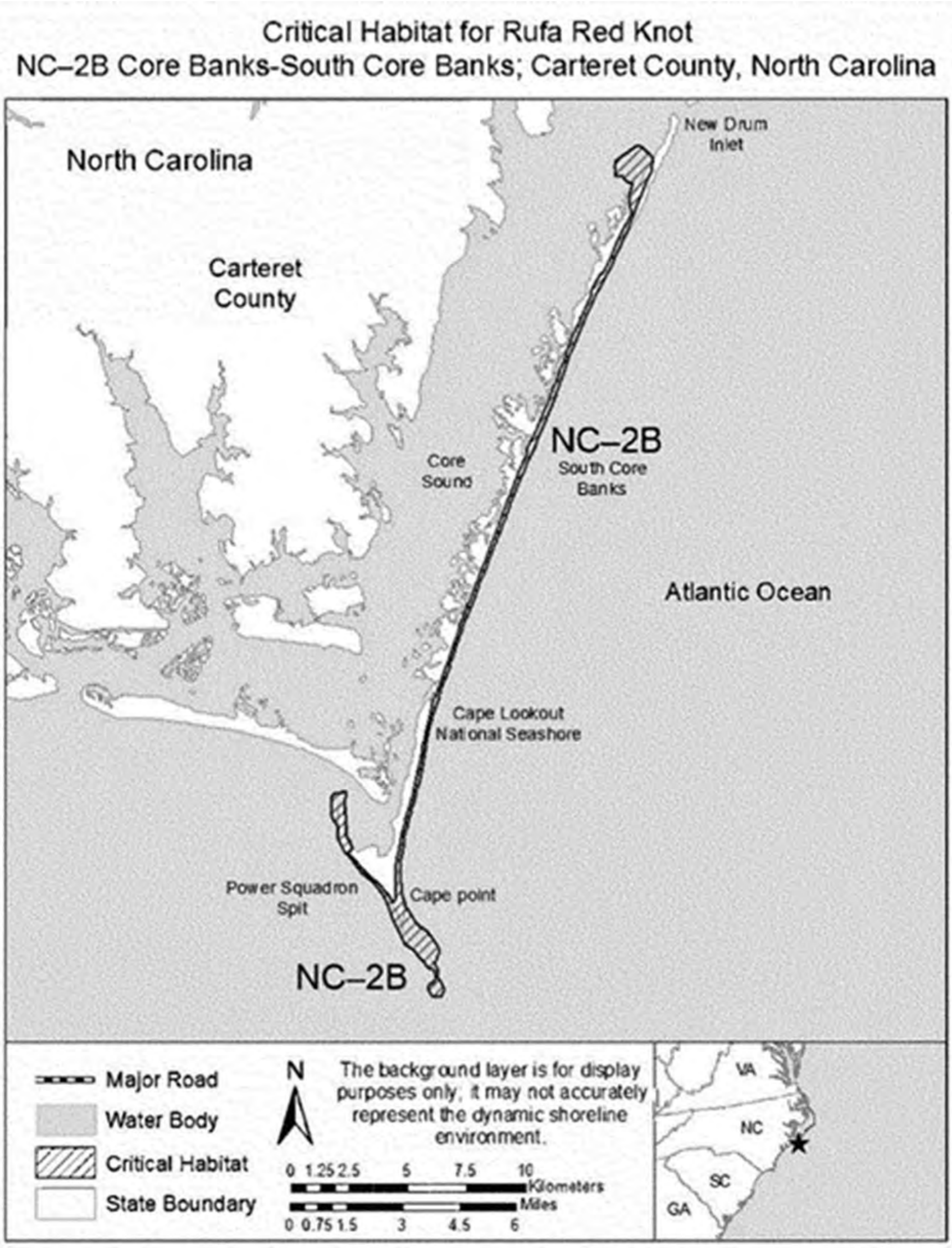

Figure 14. Rufa Red Knot Critical Habitat

Sea turtle nesting may occur on the ocean beachfronts of CALO where beach quality dredged material may be placed; however, placement would occur during 16 November to 31 March to avoid turtle nesting season. Likewise, beach placement and control of effluent practices on Sandbag bird island would adhere to the 1 September to 31 March timeframe, thereby protecting nesting piping plovers and visiting red knots. 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 roseate tern, 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 listed below may occur in the project area that are under the purview of NMFS Protected Resources Division (PRD) are covered by the South Atlantic Regional Biological Opinion (SARBO) for Dredging and Material Placement Activities in the Southeast United States issued by the NMFS 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 the NMFS 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. 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. This 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 revaluated 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 threatened and endangered species relative to Alternative 2 are expected to be negligible. Maintenance of the USACE and NPS channels would adhere to all the relevant PDCs of the NMFS 2020 SARBO and the USFWS 2017 SPBO for all dredging and placement activities. Incidental takes are not anticipated, lethal or non-lethal, 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 16 November – 31 March timeframe may have minor and temporary impacts on piping plover and red knot foraging, sheltering, and roosting habitat. It may impact the constituent elements for piping plover nesting and wintering habitat. Bird island placement of dredged material onto Sandbag Island 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). 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 rays) 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 the 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 19th 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).

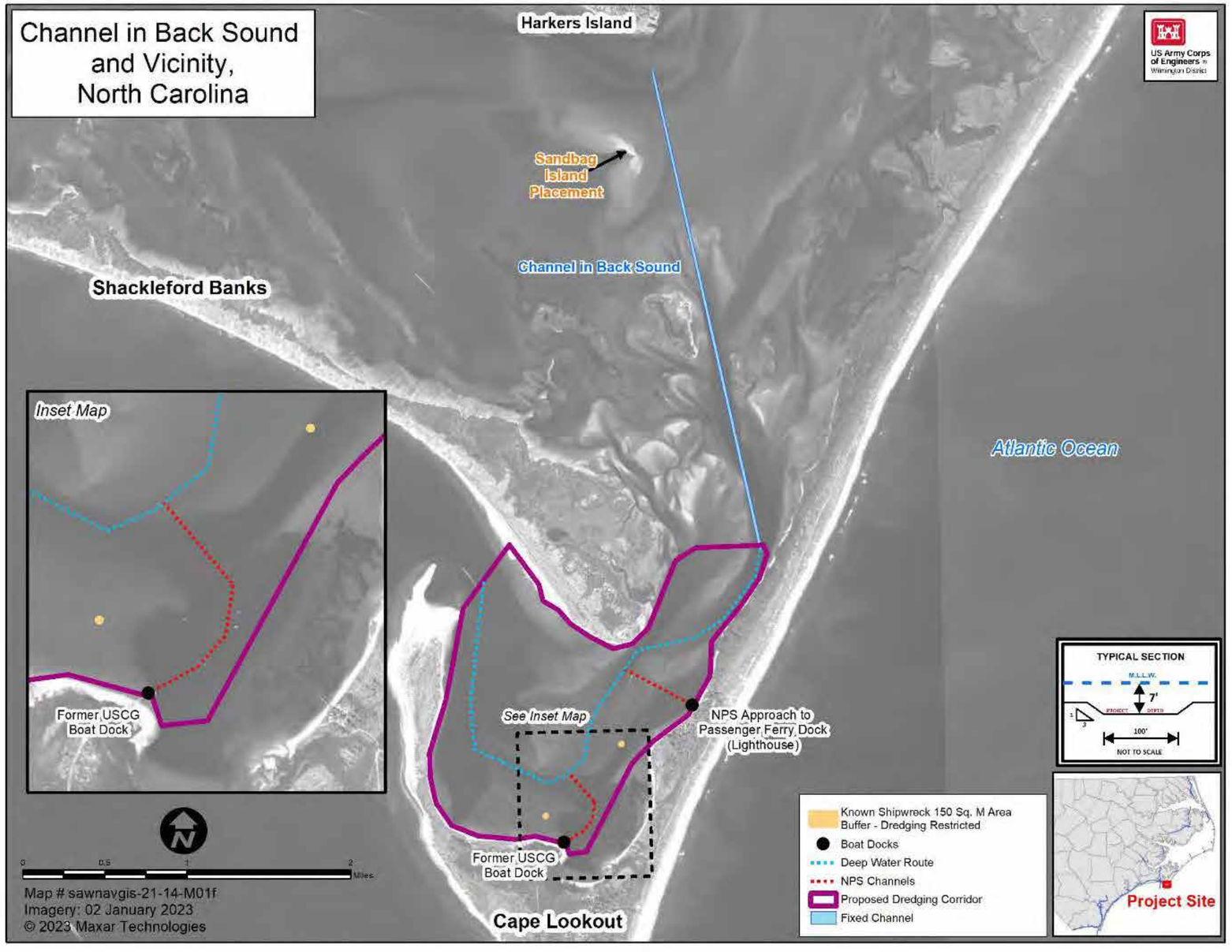

Figure 15. SHPO Identified Submerged Cultural Resources (Shipwrecks)

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 the 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 the 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.

<u>Alternative 1 – No Action:</u>
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 onto 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 rise 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, 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 the sea level is expected to rise up to 2.67 feet.

5.10.2 Greenhouse Gas (GHG) Emissions Analysis

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.

<u>Alternative 1 - No Action:</u>

There would be no increase in GHG emissions or affects 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.

<u>Alternative 2 – Full Corridor:</u>

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

Equipment Type	**Engine Size (HP)**	**Hours of Use Per Year (avg)**	**Equipment Events Over 10 Years (avg)**	**Total Hours of Emissions Over 10 Years**
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
Total		**4, 480**		**15,360**

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) is 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.

Socio-economic 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 U.S. National Park Service, 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 comms Jan 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 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 Shackleford 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.

Placement onto Light house 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.

5.12 Environmental Impact Comparison of Alternatives for USACE and NPS Channels

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**
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.

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
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.
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.

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
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.
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.

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

6.0 CUMULATIVE EFFECTS

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

This 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 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 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 1 October – 31 March 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 the UASCE 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 temporary. Resources that may be impacted include benthic invertebrates (sessile and mobile), nektonic species that feed and dwell on the seafloor, and marine reptiles and mammals such as sea turtles 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 a ~1 mile distance 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 3 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 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.

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 the 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 6 May 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 1 June 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 30-day public review and comment. All identified agency and stakeholder concerns will be 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 has submitted a federal consistency determination to the N.C. Division of Coastal Management in accordance with Section 307 (c) (l) of the Federal Coastal Zone Management Act of 1972, as amended (16 U.S.C. 1456(c)(1)(C)). NCDCM requests 60 days for review and response.

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, NC Division of Coastal Management (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 NC Division of Marine Fisheries (NCDMF) and the NC Wildlife Resources Commission (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 there under 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 dredging and dredged material placement activities in USACE and NPS channels. Implementation of the proposed project would require two separate Individual 401 Water Quality Certifications (WQCs), one for the USACE channels and one for the NPS channels. The required 401 will be obtained prior to dredging and all conditions of the 401 will be met. For USACE channels, WQC coverage would include placement onto Sandbag Island 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 401 authorization would cover placement onto previously authorized NPS soundside and oceanside beaches, and open water placement from Government plant sidecasting and special purpose hopper dredging.

Applications requesting WQC for both USACE and NPS channels will be submitted to NCDWR following the release of this Draft EA.

Section 404:
Pursuant to Section 404 of the Clean Water Act (33 C.F.R. § 335.7), the impacts associated with the discharge of fill material into waters of the United States are discussed in the Section 404(b)(1) (P.L. 95-217) Draft Guidelines Analysis in Appendix C. Discharges associated with dredging are considered incidental and therefore, are not being considered as being 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 will be submitted to USACE Regulatory for NPS channel maintenance and dredged material placement following the release of this Draft EA.

The preferred alternative will comply with Sections 404 and 401 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 U.S. Fish and Wildlife Service (USFWS) and National Marine Fisheries Service (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 the NPS boat dock channels.

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. This BO is expected to be updated for Red Knot Critical Habitat in the near future. 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 threatened and endangered 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 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.

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

Title of Public Law	**US CODE**	***Compliance Status**
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
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

Title of Public Law	US CODE	*Compliance Status
National Historic Preservation Act Amendments of 1980	16 USC 469a	Full Compliance
Native American Religious Freedom Act of 1978	42 USC 1996	Full Compliance

Executive Orders		*Compliance Status
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 National Park Service 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 Special Use Permit (SUP). Coordination with the NPS will occur prior to any placement activity within the CALO boundary.

7.8 Coordination of this Document

Prior to the release of the Draft EA and following the 1 June 2022 virtual scoping presentation, two meetings were held with state and federal resource agencies to resolve concerns raised during the scoping period. On 28 October 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 concerns raised by agencies.

The Preferred Alternative and the environmental impacts of the Preferred Alternative are thoroughly addressed in this EA. The Draft EA has been made available to an extensive list of 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.

The Draft EA 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 1 October – 31 March.
- Beach placement and bird island placement would only occur during the relevant timeframes for the protection of nesting sea turtles (16 November – 30 April) and birds (1 September – 31 March).
- 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 Island via control-of-effluent would utilize methodologies that will avoid impacts to SAV to the maximum extent practicable.
- A Wetlands Statement of Findings and a Special Use Permit will be obtained from the NPS prior to commencement of work on oceanfront beach.
- USACE will establish 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 in order 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 least environmentally damaging practicable alternative (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.

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APPENDIX A

GEOTECHNICAL ASSESSMENT

CHANNELS FROM BACK SOUND TO LOOKOUT BIGHT

CARTERET COUNTY, NC

APRIL 2023

Prepared by:

U.S. Army Corps of Engineers, Wilmington District

Geotechnical and Dam Safety Section

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1) General

The Back Sound to 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.

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 placement 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) Sandbag Island (red) and, 2) soundside beach placement (green).

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. Sandbag Island has not been used fro dredged material placement 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 bird nesting site, was last used in 1997. The island's footprint has changed numerous times due to sediments being reworked by wind, tides, and coastal storms. Old sandbags (dashed orange line) used to control the movement of material are 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[1].

[1] 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[2] , 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[3]) 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.

[2] If SP-SM is identified if the fines content is greater than 12% it was deemed unsuitable for beach placement.
[3] 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 $R_4/R_{200}>0.5$	GP	Poorly graded gravel	$F_{200}<5$; $C_u\geq4$, $1\leq C_z\leq3$
		SW	Well-graded sand	$F_{200}<5$; $C_u\geq6$, $1\leq C_z\leq3$
		SP	Poorly graded sand	$F_{200}<5$, Does not meet the SW criteria of C_u and C_z
	Sands $R_4/R_{200}\leq0.5$	SM	Silty Sand	$F_{200}>12$, PI<4
		SC	Clayey sand	$F_{200}>12$, PI>7
		SW-SM	Well-graded sand with silt	$5\leq F_{200}\leq12$, satisfies C_u and C_z criteria of SW and PI>7
		SP-SM	Poorly graded sand with silt	$5\leq F_{200}\leq12$, does not satisfy C_u and C_z criteria of SW and PI<4
		SP-SC	Poorly graded sand with clay	$5\leq F_{200}\leq12$, does not satisfy C_u and C_z criteria of SW and PI>7
	Silts and Clays LL≥50	MH	Sandy silt	≥30% plus No. 200, % sand ≥ % gravel
$F_{200}>50$		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 ≥ % 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 vibracore 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[4], Y values[5], 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[6]." 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-(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.

[4] X = [MEAN (PHI) BORROW – MEAN (PHI) NATIVE/STD. DEV. NATIVE (PHI)
[5] Y = STD. DEV. (PHI) BORROW / STD. DEV. (PHI) NATIVE
[6] The "initial overfill ratio" does not consider the applied silt correction factor.
[7] Percent silt denotes the percent of sediment passing the No. 200 sieve.

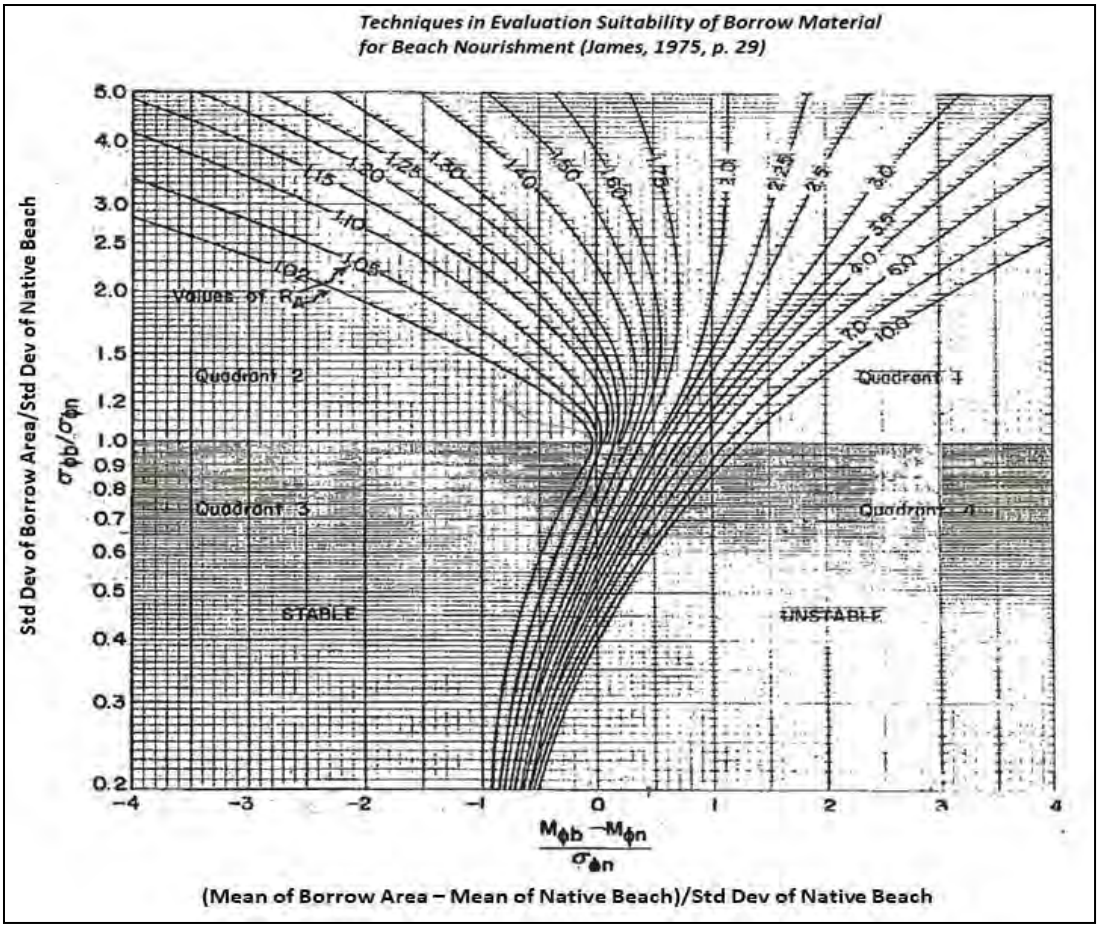

Figure 5. Adjusted Fill Factor Plot. After finding the cumulative mean X and Y values this graph was used to determine the "initial overfill ratio".

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.

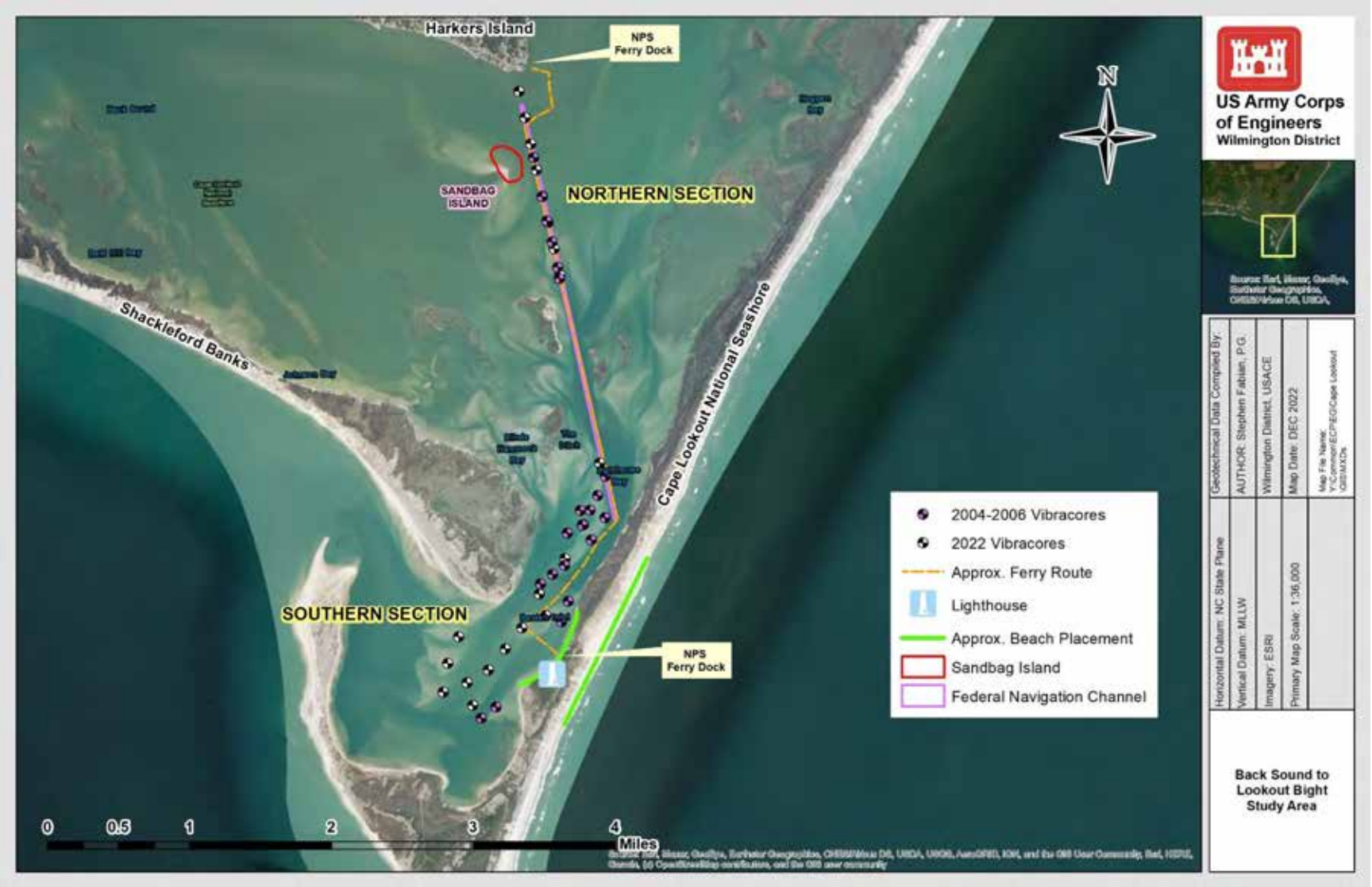

Figure 6. Vibracores collected throughout the study area during the 2004-2005 and 2022 drilling efforts.

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.

Native Grain Size (Sound-Side Beach)			
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-04-005) 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.

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

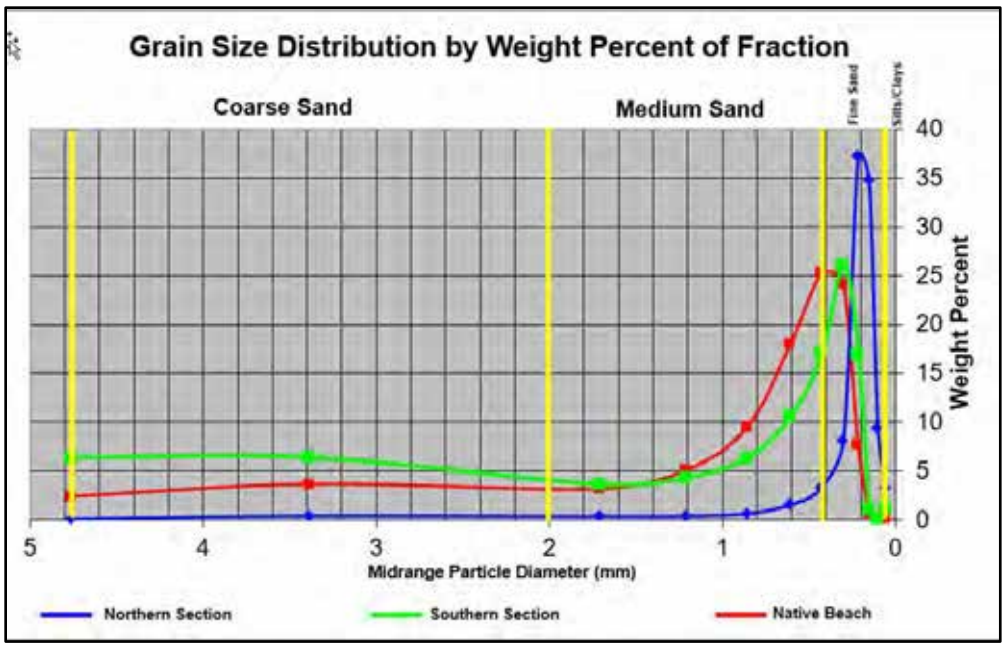

Figure 7. Grain size distribution curves showing the midrange particle diameter (mm) for the collected 2005-2006 vibracore data comparably to each location. The southern section and native beach curve closely resemble one another and straddle the fine to medium sand particle size. The northern section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

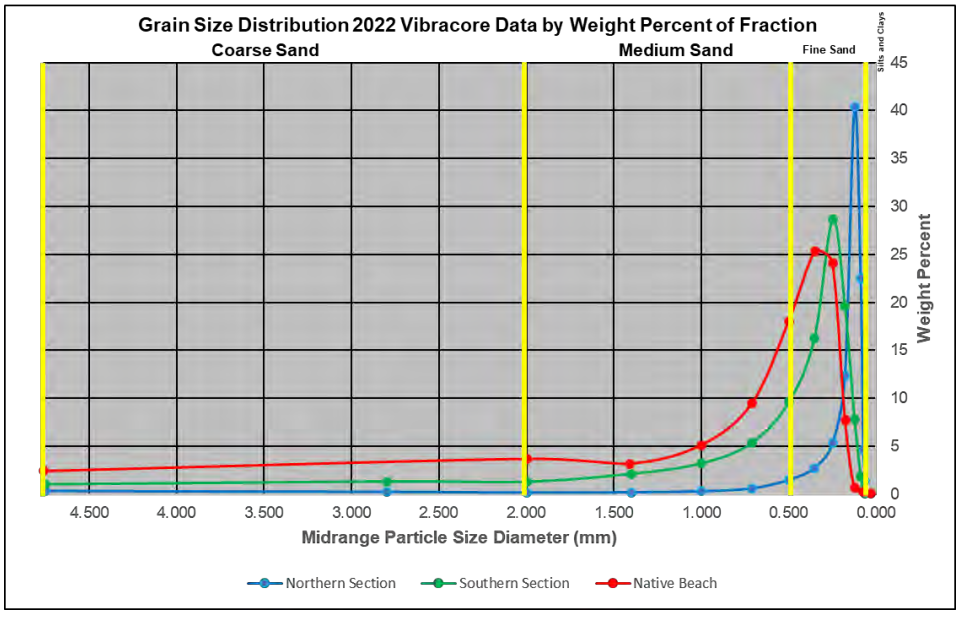

Figure 8. Grain size distribution curves showing the midrange particle diameter (mm) for the collected 2022 vibracore data comparably to each location. Shows similar results to the grain size curves created in 2005-2006.

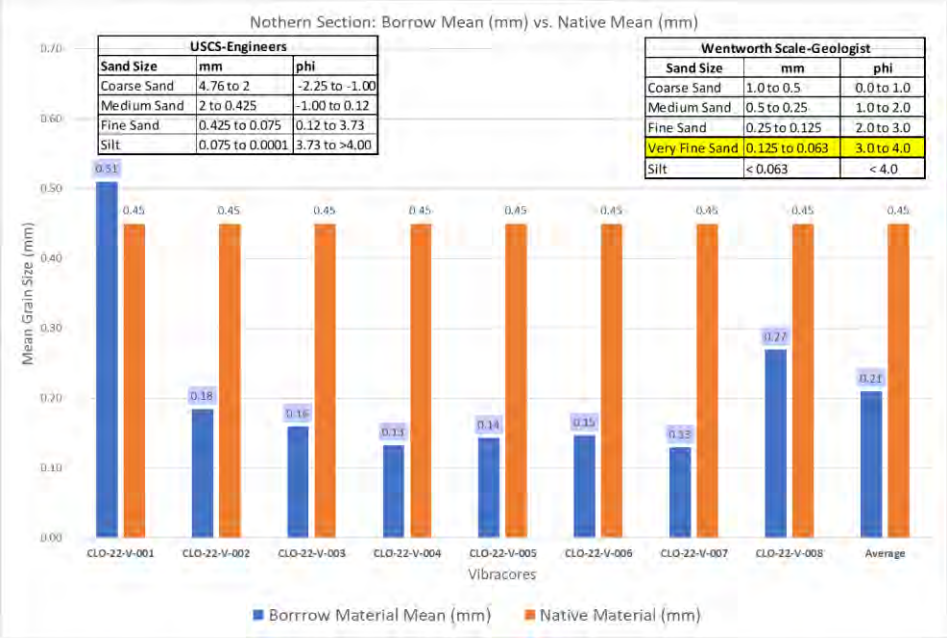

Figure 9. Vibracore data from 2022 collection showing the mean grain size comparison of the northern section vs. the native beach.

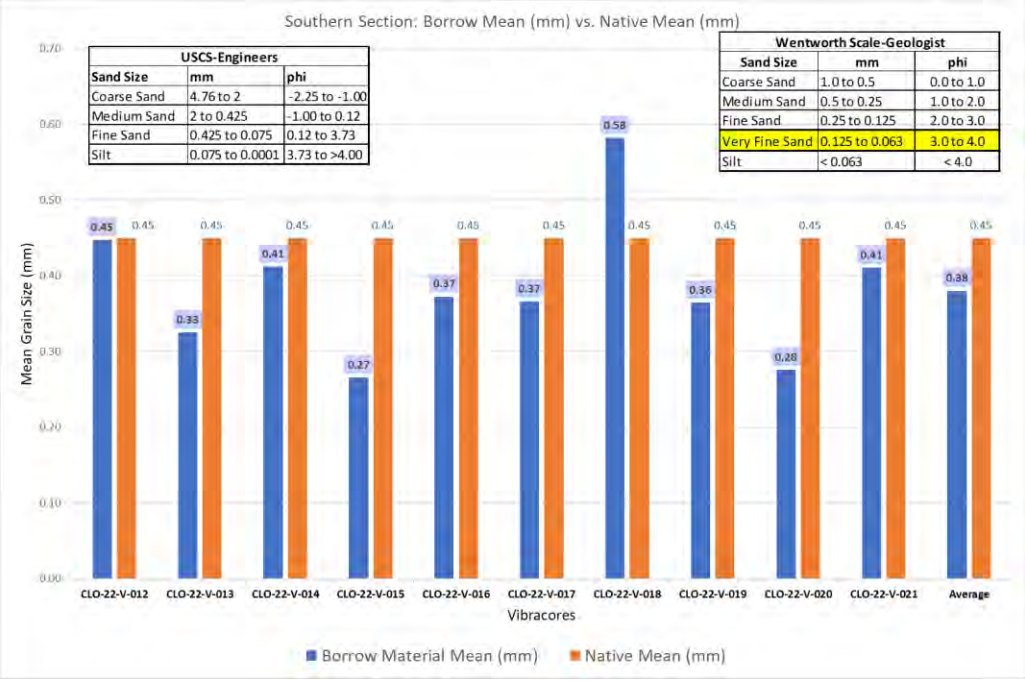

Figure 10. Vibracore data from 2022 collection showing the mean grain size comparison of the southern section vs. the native beach.

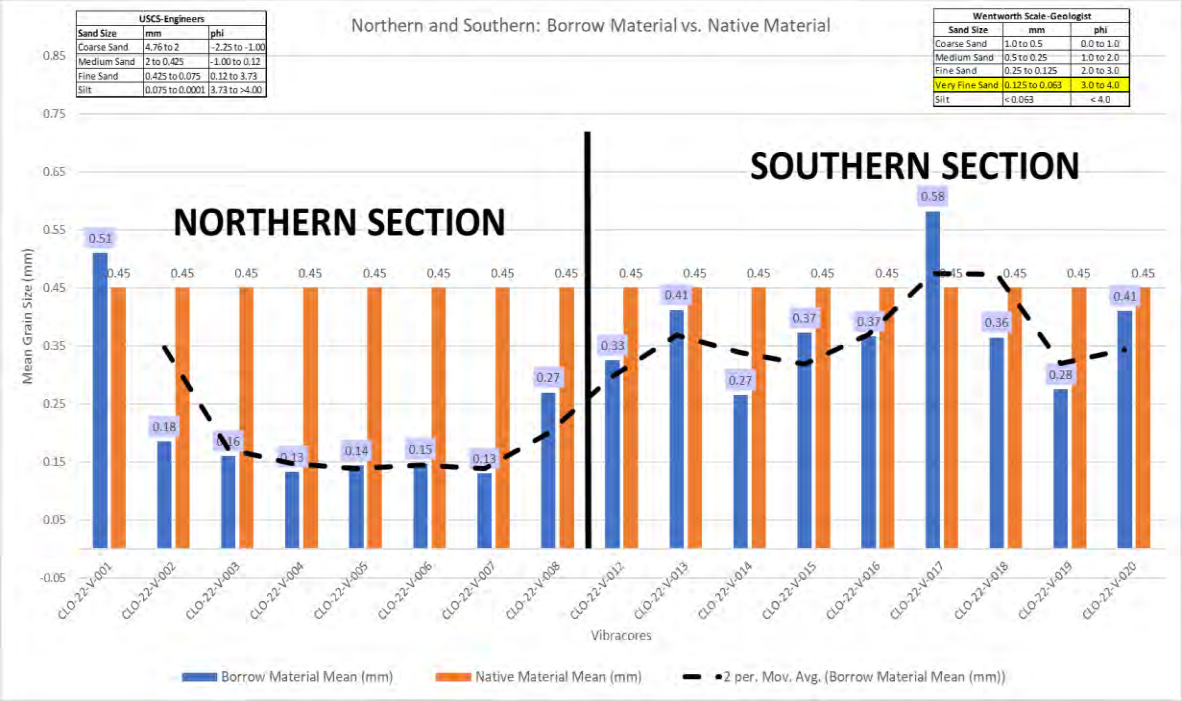

Figure 11. Vibracore data from 2022 collection showing the mean grain size comparison of the northern and southern section vs. the native beach.

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). From vibracores CLO-22-V-001 to CLO-22-V-003, dredge depths would be restricted to -7 MLLW with no allowable over depth. 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[8] to efficiently pump the material from the federal navigation channel to the sound-side beach. Therefore,

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

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 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).

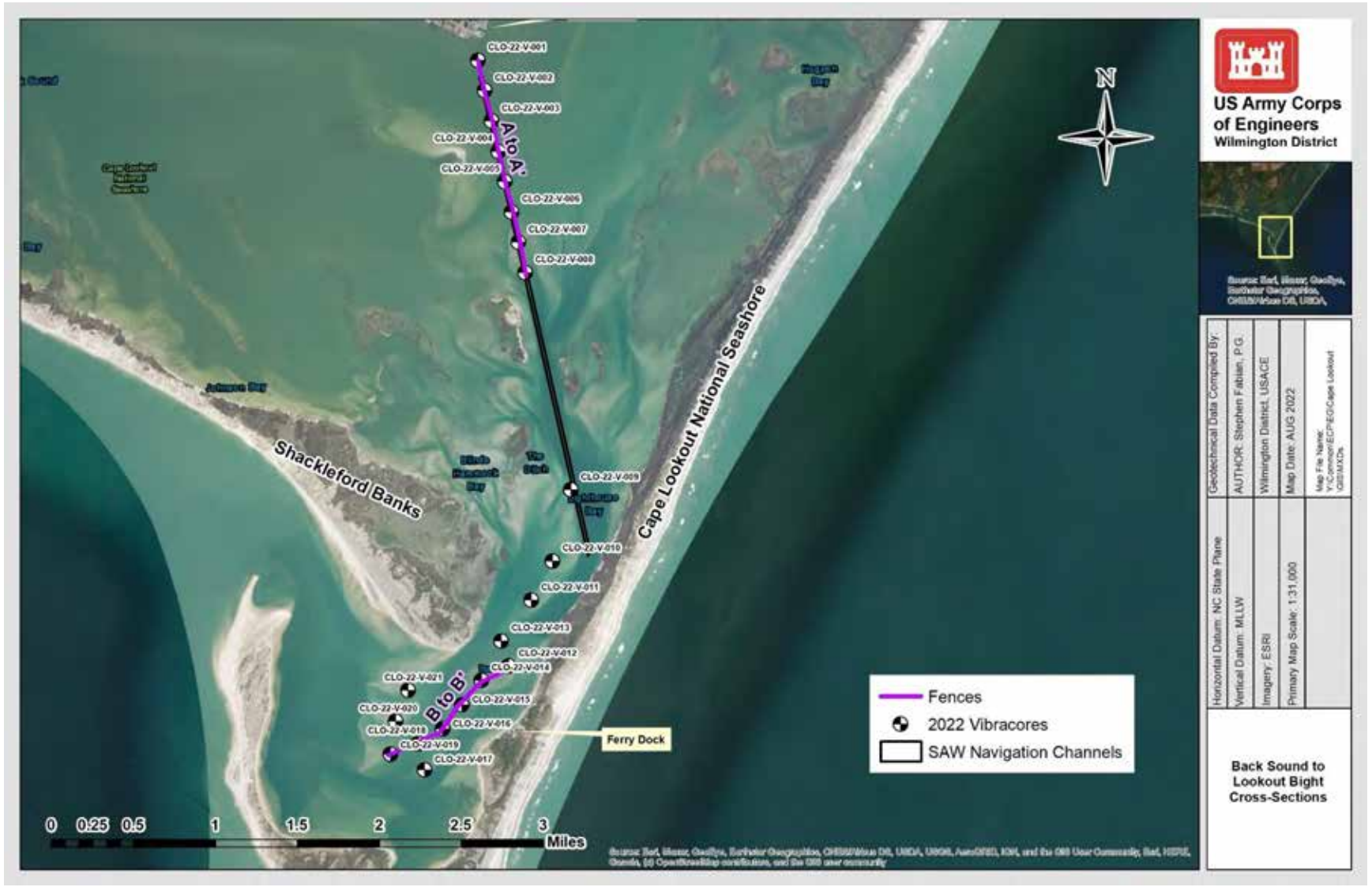

Figure 13. Layout of cross-sections across the study area. Two cross-sections were done, one in the northern section, A to A' and one in the southern section, B to B'.

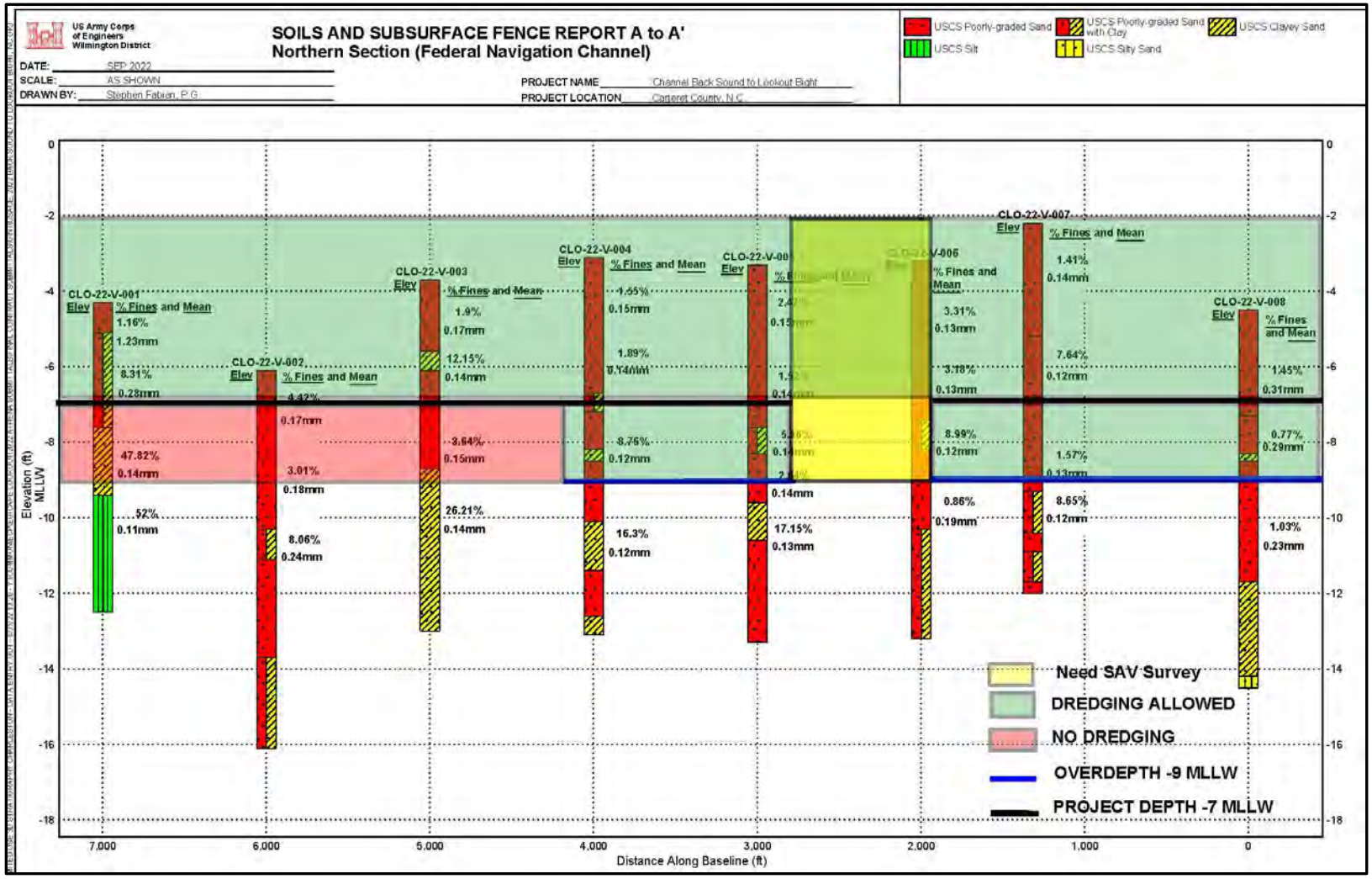

Figure 14. Cross section A to A' showing allowable dredge areas throughout the northern section.

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.

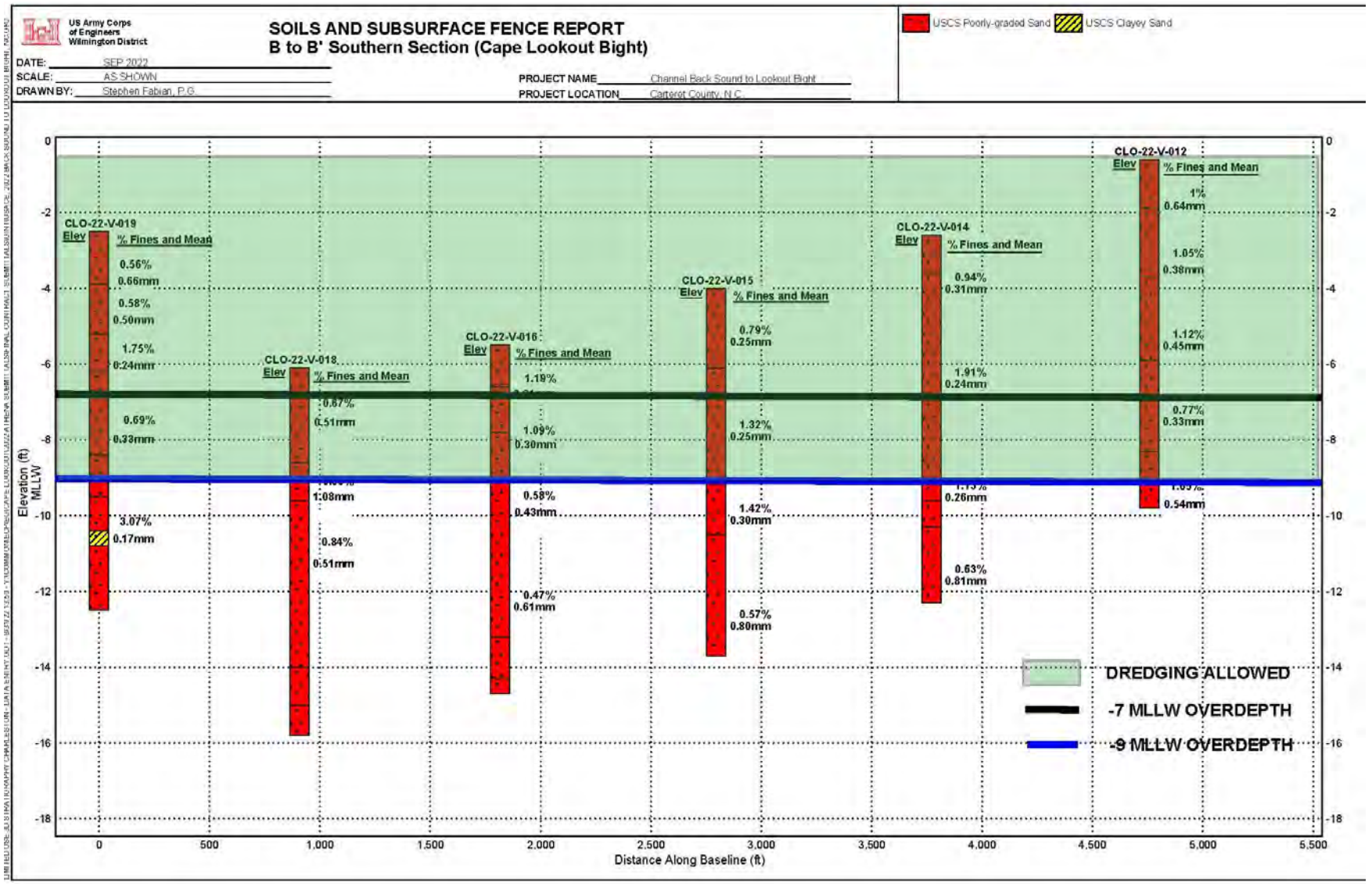

Figure 16. Cross section B to B’ showing allowable dredge areas throughout the southern section.

8) References

Dean. R.G., 1991, Equilibrium beach profiles: characteristics and applications, Journal of Coastal Research, vol. 7, pp. 53-84.

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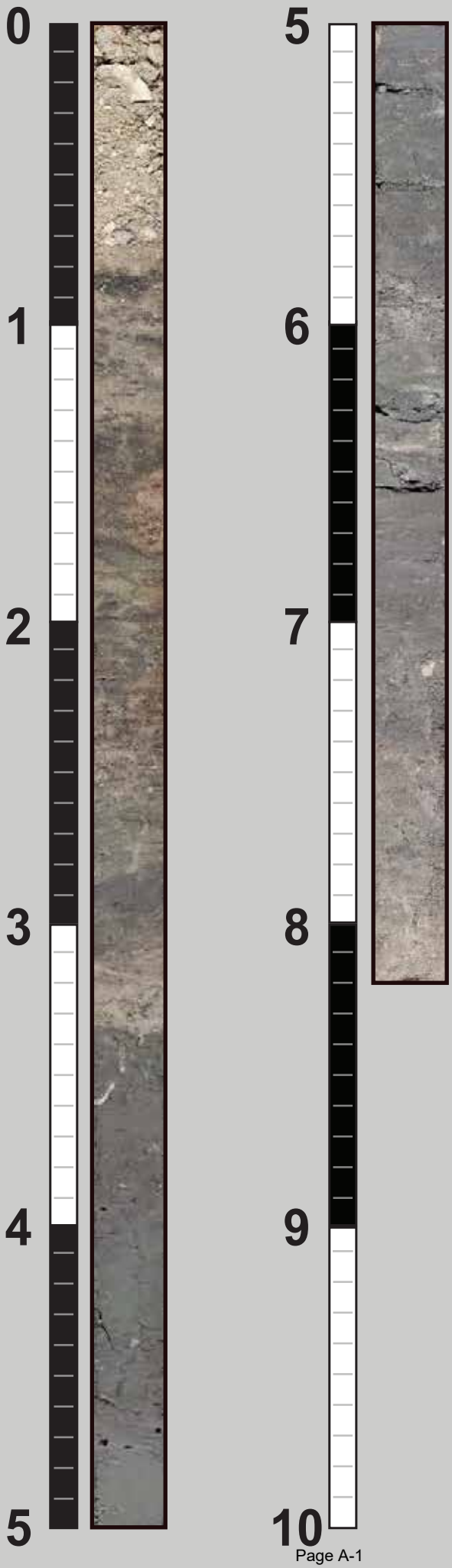
U.S. Army Corps of Engineers, 1995. Engineering and Design: Coastal Geology, Engineering Manual 1110-2-1810, 92 p.

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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(843) 887-3800

DRILLING LOG

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
	10. SIZE AND TYPE OF BIT: 3 Sample Barrel		
2. HOLE NUMBER: **CLO-22-V-001** — LOCATION COORDINATES: N 348622.35 E 2743461.49	11. MANUFACTURER'S DESIGNATION OF DRILL: Athena Technologies Vibracore System		
3. DRILLING AGENCY: Athena Technologies	12. TOTAL SAMPLES	DISTURBED: 1	UNDISTURBED: 0
4. NAME OF DRILLER: Palmer McClellan	13. TOTAL NUMBER CORE BOXES		
5. DIRECTION OF BORING: ☒ VERTICAL ☐ INCLINED — DEG FROM VERTICAL: --- — BEARING	14. ELEVATION GROUND WATER: See Remarks		
	15. DATE TIME GROUP OF BORING	STARTED: 6/28/22 @ 0810 hrs.	COMPLETED: 6/28/22 @ 0825 hrs.
6. THICKNESS OF OVERBURDEN	16. ELEVATION TOP OF BORING: -4.3' MLLW		
7. DEPTH DRILLED INTO ROCK: 0.0'	17. TOTAL CORE RECOVERY FOR BORING: 82%		
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 -4.3' 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 = +1.47 feet MLLW.
			OCEAN BOTTOM AT -4.3' MLLW			
-4.3	0.0		**SP**: Gray, poorly graded sand, fine to medium -grained, some fine to coarse gravel-sized shell fragments, loose, subangular.		0.5' **S-1**	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.
-5.1			**SP-SC**: Very dark gray mottled with gray, poorly graded sand with clay, fine -grained, few organic/inorganic clay in matrix & burrows throughout, trace fine to coarse sand-sized shells in matrix, loose, subrounded, bioturbated.	Core Run 10.0' Recovery 82.0%	2.0' **S-2**	**VIBRACORE BORING** From: 0.0' to 10.0' Ran: 10.0' Rec: 8.2'
-7.6	2.0		**SC**: Black, clayey sand, fine -grained, some organic/inorganic clay in matrix throughout, clean sand in occasional burrows, trace fine sand-sized shells, loose/soft, bioturbated.		4.0' **S-3**	**LAB CLASSIFICATION**
-9.4	4.0		**ML**: Black grades to dark olive gray, sandy silt, fine -grained, some grading to little organic/inorganic silt in matrix, few organic/inorganic clay in layers, occasional shells fragments, loose/soft, bioturbated.		5.4' **S-4**	
-12.5	6.0					
	8.0					
	10.0		BOTTOM OF BOREHOLE AT 10.0 ft SOILS ARE FIELD VISUALLY CLASSIFIED IN ACCORDANCE WITH THE UNIFIED SOIL CLASSIFICATION SYSTEM			

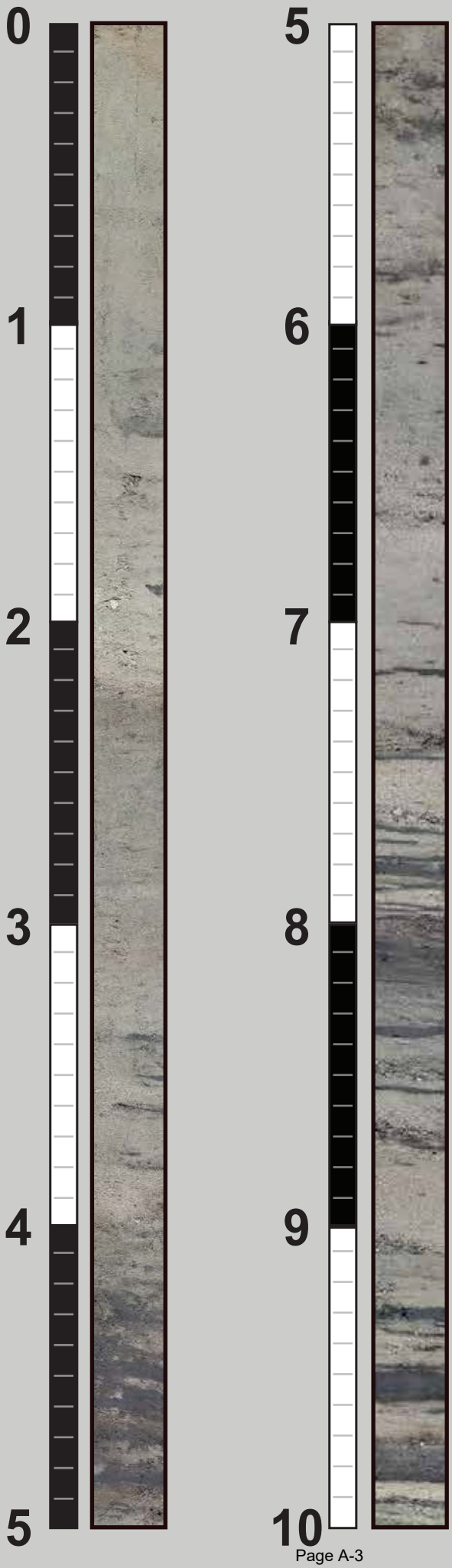
Sample ID	Lab Class.	% Content Shell	% Content #200 Fines	% Content Rock
S-1	SP	32.54	1.16	0
S-2	SP-SM	0	8.31	0
S-3	SM	0	47.82	0
S-4	MH	0	52	0

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.

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-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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McClellanville, SC 29458
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DRILLING LOG

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
	10. SIZE AND TYPE OF BIT: 3 Sample Barrel		
2. HOLE NUMBER: **CLO-22-V-002** — LOCATION COORDINATES: N 347647.21 E 2743676.97	11. MANUFACTURER'S DESIGNATION OF DRILL: Athena Technologies Vibracore System		
3. DRILLING AGENCY: Athena Technologies	12. TOTAL SAMPLES	DISTURBED: 1	UNDISTURBED: 0
4. NAME OF DRILLER: Palmer McClellan	13. TOTAL NUMBER CORE BOXES		
5. DIRECTION OF BORING: ☒ VERTICAL ☐ INCLINED — DEG FROM VERTICAL: --- — BEARING:	14. ELEVATION GROUND WATER: See Remarks		
	15. DATE TIME GROUP OF BORING	STARTED: 6/28/22 @ 0833 hrs.	COMPLETED: 6/28/22 @ 0845 hrs.
6. THICKNESS OF OVERBURDEN	16. ELEVATION TOP OF BORING: -6.1' MLLW		
7. DEPTH DRILLED INTO ROCK: 0.0'	17. TOTAL CORE RECOVERY FOR BORING: 94%		
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
			0.0' TO -6.1' WATER		
			OCEAN BOTTOM AT -6.1' MLLW		
-6.1	0.0		**SP**: 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.	Core Run 14.0' Recovery 94.3%	1.0' **S-1**
-8.4	2.0		**SP**: Olive gray, poorly graded sand, fine -grained, trace inorganic clay in matrix & burrows, organic material/fibers at 3.6', loose, subrounded.		3.0' **S-2**
-10.3	4.0		**SP-SC**: 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' **S-3**
-11.1			**SP**: 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.		
-13.7	6.0		**SP-SC**: 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.		
-16.1	8.0				
	10.0		BOTTOM OF BOREHOLE AT 10.0 ft SOILS ARE FIELD VISUALLY CLASSIFIED IN ACCORDANCE WITH THE UNIFIED SOIL CLASSIFICATION SYSTEM		

REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g

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.

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.

VIBRACORE BORING
From: 0.0' to 14.0'
Ran: 14.0' Rec: 13.2'

LAB CLASSIFICATION

Sample ID	Lab Class.	% Content 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

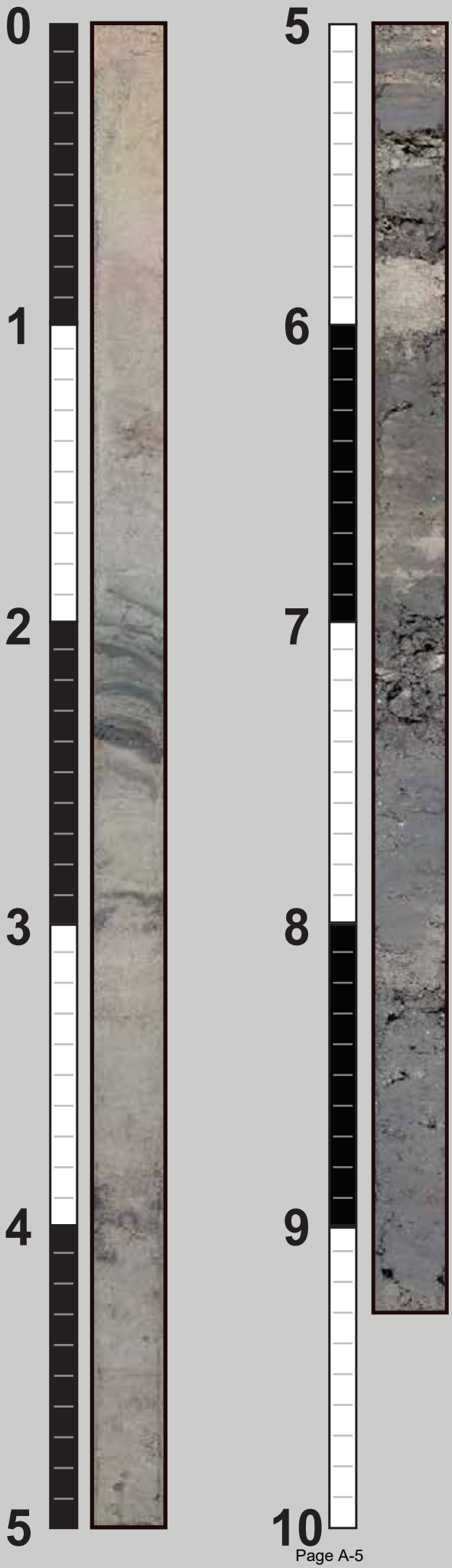
NOTE 3: Soils are Visually Lab Classified in Accordance with ASTM-D2487. Percent Passing #200 Sieve and Percent Shell are Determined in Accordance with ASTM-D6913. See NOTE 2.
NOTE 4: Shell and/or rock percentages were derived based on the percentage of shell and/or rock retained on the 1-inch, 3/8-inch, 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-)Top 10 feet of core retained for processing.

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-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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McClellanville, SC 29458
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(843) 887-3800

DRILLING LOG

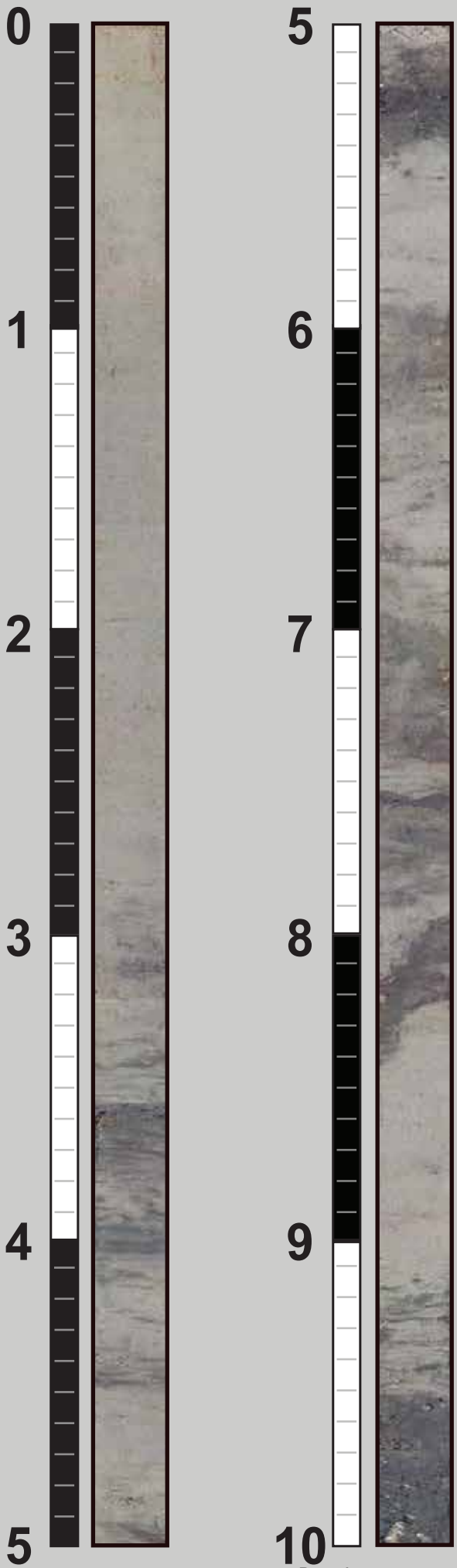
DIVISION: South Atlantic Division	INSTALLATION: Wilmington District	SHEET 1 OF 1 SHEETS	
1. PROJECT: 2022 Back Sound to Lookout Bight (W912PM22P0042) Carteret County, North Carolina	9. COORDINATE SYSTEM: NC State Plane	HORIZONTAL: NAD83	VERTICAL: MLLW
	10. SIZE AND TYPE OF BIT: 3 Sample Barrel		
2. HOLE NUMBER: **CLO-22-V-003** — LOCATION COORDINATES: N 346671.43 E 2743891.59	11. MANUFACTURER'S DESIGNATION OF DRILL: Athena Technologies Vibracore System		
3. DRILLING AGENCY: Athena Technologies	12. TOTAL SAMPLES	DISTURBED: 1	UNDISTURBED: 0
4. NAME OF DRILLER: Palmer McClellan	13. TOTAL NUMBER CORE BOXES		
5. DIRECTION OF BORING: ☒ VERTICAL ☐ INCLINED — DEG FROM VERTICAL: --- — BEARING	14. ELEVATION GROUND WATER: See Remarks		
	15. DATE TIME GROUP OF BORING	STARTED: 6/28/22 @ 0853 hrs.	COMPLETED: 6/28/22 @ 0905 hrs.
6. THICKNESS OF OVERBURDEN	16. ELEVATION TOP OF BORING: -3.7' MLLW		
7. DEPTH DRILLED INTO ROCK: 0.0'	17. TOTAL CORE RECOVERY FOR BORING: 89%		
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 -3.7' 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 = +1.52 feet MLLW.
			OCEAN BOTTOM AT -3.7' MLLW			
-3.7	0.0		**SP**: Olive gray grades to gray, poorly graded sand, fine -grained, trace inorganic clay in occasional burrows, loose, subrounded.	Core Run 10.5'	1.0' **S-1**	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.
-5.6						
-6.1	2.0		**SC**: Gray and very dark greenish gray, clayey sand, fine -grained, little inorganic clay in laminations & layers, loose, subrounded, interbedded.	Recovery 88.6%	2.2' **S-2**	**VIBRACORE BORING** From: 0.0' to 10.5' Ran: 10.5' Rec: 9.3'
			SP: Gray, poorly graded sand, fine -grained, trace inorganic clay in burrows at 2.8' & between 3.8-4.1', loose, subrounded.			**LAB CLASSIFICATION**
	4.0				4.5' **S-3**	Sample ID / Lab Class. / % Content Shell / #200 Fines / Rock: S-1 SP 0 1.9 0 S-2 SM 0 12.15 0 S-3 SP 0 3.64 0 S-4 SM 0 26.21 0
-8.7						
			SC: Very dark greenish gray and gray, clayey sand, fine -grained, some inorganic clay in matrix throughout, clean sand in burrows, laminations & in layers below 5.8', few fine sand to fine gravel-sized shells, loose/soft, bioturbated.		6.4' **S-4**	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.
	6.0					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.
	8.0					* = Laboratory results not interpreted to be representative of the broader interval from which the sub-sample was extracted. Initial USCS designation unchanged.
-13.0						
	10.0		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-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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DRILLING LOG

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
10. SIZE AND TYPE OF BIT	3 Sample Barrel
2. HOLE NUMBER	**CLO-22-V-004**
LOCATION COORDINATES	N 345694.08 E 2744112.38
11. MANUFACTURER'S DESIGNATION OF DRILL	Athena Technologies Vibracore System
3. DRILLING AGENCY	Athena Technologies
12. TOTAL SAMPLES	
DISTURBED	1
UNDISTURBED	0
4. NAME OF DRILLER	Palmer McClellan
13. TOTAL NUMBER CORE BOXES	
5. DIRECTION OF BORING	☒ VERTICAL ☐ INCLINED
DEG FROM VERTICAL	---
BEARING	
14. ELEVATION GROUND WATER	See Remarks
15. DATE TIME GROUP OF BORING	STARTED 6/28/22 @ 0914 hrs. COMPLETED 6/28/22 @ 0925 hrs.
6. THICKNESS OF OVERBURDEN	
16. ELEVATION TOP OF BORING	-3.1' MLLW
7. DEPTH DRILLED INTO ROCK	0.0'
17. TOTAL CORE RECOVERY FOR BORING	94%
8. TOTAL DEPTH OF BORING	10.0'
18. SIGNATURE AND TITLE OF INSPECTOR	Adam Freeze, Geologist

ELEV (MLLW) a	DEPTH (feet) b	FIELD CLASSIFICATION OF MATERIALS (Description) d	% CORE REC e	BOX OR SAMPLE # f
		0.0' TO -3.1' WATER		
-3.1	0.0	OCEAN BOTTOM AT -3.1' MLLW		
		SP: Gray, poorly graded sand, fine -grained, trace inorganic clay in occasional burrows below 2.8', loose, subrounded.	Core Run 12.0' Recovery 94.2%	1.0' **S-1**
	2.0			2.5' **S-2**
-6.7				
-7.2	4.0	**SP-SC**: Dark gray, poorly graded sand with clay, fine -grained, few inorganic clay in laminations & burrows, loose, subrounded, bioturbated.		
-8.2		**SP**: Gray, poorly graded sand, fine -grained, trace inorganic clay in burrows & laminations, trace organic material in clay intervals, loose, subrounded, bioturbated.		4.5' **S-3***
-8.5				
	6.0	**SC**: Very dark gray, clayey sand, fine -grained, little inorganic clay in matrix, trace fine to coarse sand-sized shells in matrix, loose, subrounded, bioturbated.		
-10.1		**SP**: Gray and dark gray, poorly graded sand, fine -grained, trace inorganic clay in burrows, loose, subrounded.		7.2' **S-4**
-11.4	8.0	**SC**: Very dark gray mottled with gray, clayey sand, fine -grained, little inorganic clay in matrix, burrows & layers, trace organic silt, loose, subrounded, bioturbated.		
-12.6		**SP**: Gray, poorly graded sand, fine -grained, trace inorganic clay in burrows & laminations below 9.1', loose, subrounded.		
-13.1	10.0	**SC**: 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		

REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g

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.

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.

VIBRACORE BORING
From: 0.0' to 12.0'
Ran: 12.0' Rec: 11.3'

LAB CLASSIFICATION

Sample ID	Lab Class.	% Content 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

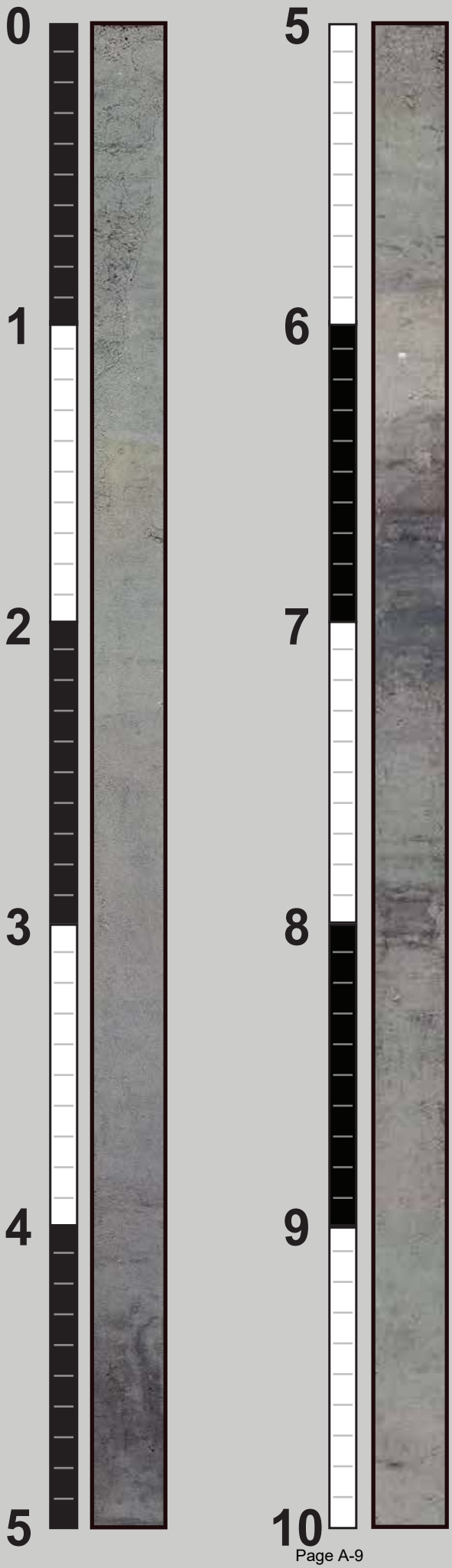
NOTE 3: Soils are Visually Lab Classified in Accordance with ASTM-D2487. Percent Passing #200 Sieve and Percent Shell are Determined in Accordance with ASTM-D6913. See NOTE 2.
NOTE 4: Shell and/or rock percentages were derived based on the percentage of shell and/or rock retained on the 1-inch, 3/8-inch, 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-)Top 10 feet of core retained for processing.

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-005

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

Notes:
- Photo Mosaic Image
- Photo Scale in Feet

ATHENA TECHNOLOGIES, INC.

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

DRILLING LOG

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
10. SIZE AND TYPE OF BIT	3 Sample Barrel
2. HOLE NUMBER	**CLO-22-V-005**
LOCATION COORDINATES	N 344720.15 E 2744328.93
11. MANUFACTURER'S DESIGNATION OF DRILL	Athena Technologies Vibracore System
3. DRILLING AGENCY	Athena Technologies
12. TOTAL SAMPLES	
DISTURBED	1
UNDISTURBED	0
4. NAME OF DRILLER	Palmer McClellan
13. TOTAL NUMBER CORE BOXES	
5. DIRECTION OF BORING	☒ VERTICAL ☐ INCLINED
DEG FROM VERTICAL	---
BEARING	
14. ELEVATION GROUND WATER	See Remarks
15. DATE TIME GROUP OF BORING	STARTED 6/28/22 @ 0929 hrs. COMPLETED 6/28/22 @ 0945 hrs.
6. THICKNESS OF OVERBURDEN	
16. ELEVATION TOP OF BORING	-3.3' MLLW
7. DEPTH DRILLED INTO ROCK	0.0'
17. TOTAL CORE RECOVERY FOR BORING	89%
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 -3.3' 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 = +1.64 feet MLLW.
-3.3	0.0		OCEAN BOTTOM AT -3.3' MLLW			
			SP: Gray, poorly graded sand, fine -grained, trace inorganic clay in occasional burrows below 3.5', occasional fine to coarse sand-sized shells, loose, subrounded.	Core Run 14.0' Recovery 88.6%	1.0' **S-1**	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				3.0' **S-2**	**VIBRACORE BORING** From: 0.0' to 14.0' Ran: 14.0' Rec: 12.4'
-7.6	4.0					**LAB CLASSIFICATION**
-8.3			**SP-SC**: Gray mottled with very dark greenish gray, poorly graded sand with clay, fine -grained, few inorganic clay in matrix & burrows, loose, subrounded, bioturbated.		4.5' **S-3**	
-9.6	6.0		**SP**: Gray, poorly graded sand, fine -grained, trace fine to coarse sand-sized shells, trace inorganic clay in occasional burrows, loose, subrounded.		5.5' **S-4**	
-10.6			**SC**: Very dark greenish gray mottled with dark gray, clayey sand, fine -grained, little inorganic clay, trace fine to coarse sand-sized shells, loose, subrounded, bioturbated.		7.0' **S-5**	
	8.0		**SP**: Gray, poorly graded sand, fine -grained, trace inorganic clay in laminations to 8.1', loose, subrounded.			
-13.3	10.0					
			BOTTOM OF BOREHOLE AT 10.0 ft			(10-)Top 10 feet of core retained for processing.
			SOILS ARE FIELD VISUALLY CLASSIFIED IN ACCORDANCE WITH THE UNIFIED SOIL CLASSIFICATION SYSTEM			

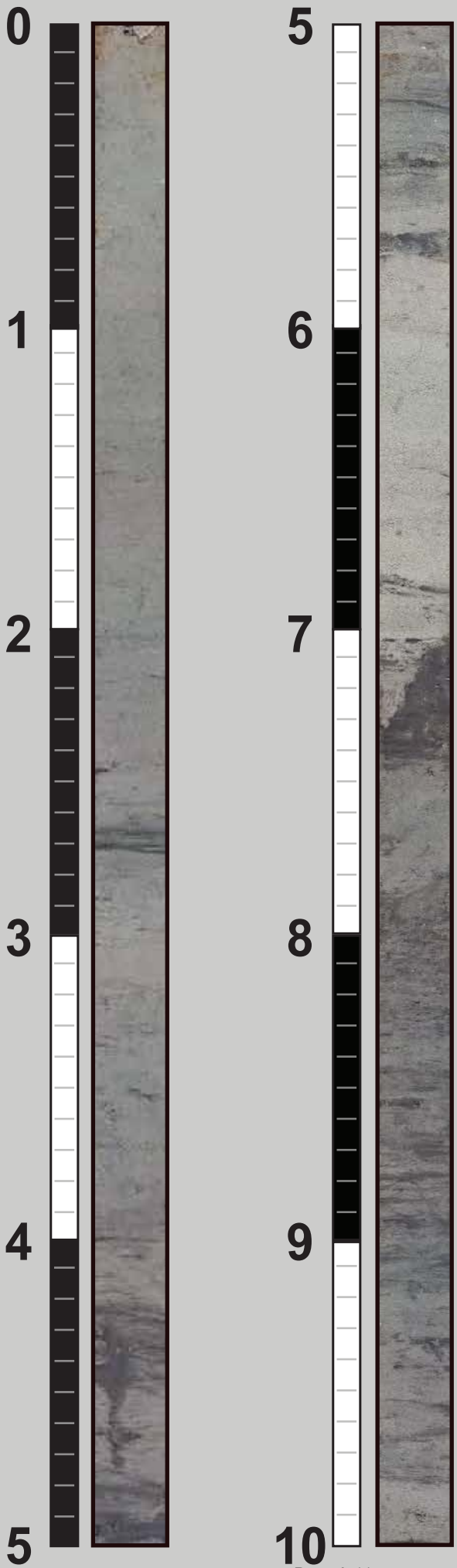
Sample ID	Lab Class.	% Content Shell	% Content #200 Fines	% Content Rock
S-1	SP	0.04	2.47	0
S-2	SP	0	1.52	0
S-3	SP-SM	0	5.36	0
S-4	SP	0.54	2.64	0
S-5	SM	0	17.15	0

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.

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-006

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

Notes:
- Photo Mosaic Image
- Photo Scale in Feet

ATHENA TECHNOLOGIES, INC.

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DRILLING LOG

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
	10. SIZE AND TYPE OF BIT: 3 Sample Barrel		
2. HOLE NUMBER: **CLO-22-V-006** — LOCATION COORDINATES: N 343741.73 E 2744546.35	11. MANUFACTURER'S DESIGNATION OF DRILL: Athena Technologies Vibracore System		
3. DRILLING AGENCY: Athena Technologies	12. TOTAL SAMPLES	DISTURBED: 1	UNDISTURBED: 0
4. NAME OF DRILLER: Palmer McClellan	13. TOTAL NUMBER CORE BOXES		
5. DIRECTION OF BORING: ☒ VERTICAL ☐ INCLINED — DEG FROM VERTICAL: --- — BEARING	14. ELEVATION GROUND WATER: See Remarks		
	15. DATE TIME GROUP OF BORING	STARTED: 6/28/22 @ 0955 hrs.	COMPLETED: 6/28/22 @ 1005 hrs.
6. THICKNESS OF OVERBURDEN	16. ELEVATION TOP OF BORING: -3.2' MLLW		
7. DEPTH DRILLED INTO ROCK: 0.0'	17. TOTAL CORE RECOVERY FOR BORING: 84%		
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 -3.2' 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 = +1.52 feet MLLW.
			OCEAN BOTTOM AT -3.2' MLLW			
-3.2	0.0		**SP**: Gray, poorly graded sand, fine -grained, trace inorganic clay in occasional burrows below 1.5' & in laminations at 2.7', loose, subrounded.	Core Run 12.0' Recovery 84.2%	1.0' **S-1**	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				3.0' **S-2**	**VIBRACORE BORING** From: 0.0' to 12.0' Ran: 12.0' Rec: 10.1'
-7.4	4.0		**SP-SC**: Gray and very dark greenish gray, poorly graded sand with clay, fine -grained, few inorganic clay in burrows & layers, loose, subrounded, bioturbated.		4.4' **S-3**	**LAB CLASSIFICATION**
-8.2			**SP**: Gray, poorly graded sand, fine -grained, trace inorganic clay in burrows & laminations, trace fine to coarse sand-sized shells, loose, subrounded.			
-9.0	6.0		**SP**: Gray, poorly graded sand, fine -grained, trace inorganic clay in occasional burrows below 6.8', loose, subrounded.		6.2' **S-4**	
-10.3			**SP-SC**: Gray mottled with very dark greenish gray, poorly graded sand with clay, fine -grained, few inorganic clay in layer at top & in matrix, burrows & laminations below 7.5', loose, subrounded, bioturbated.			
-13.2	8.0					
	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.

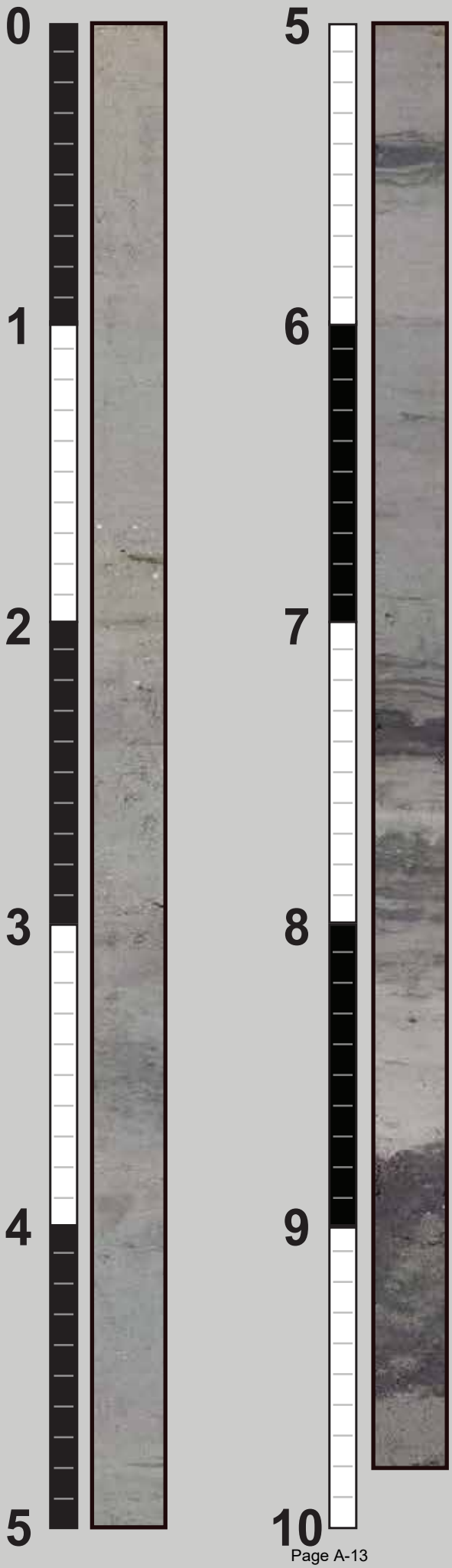
Sample ID	Lab Class.	% Content Shell	% Content #200 Fines	% Content Rock
S-1	SP	0	3.31	0
S-2	SP	0	3.18	0
S-3	SP-SM	0	8.99	0
S-4	SP	0	0.86	0

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.

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-007

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

Notes:
- Photo Mosaic Image
- Photo Scale in Feet

ATHENA TECHNOLOGIES, INC.

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McClellanville, SC 29458
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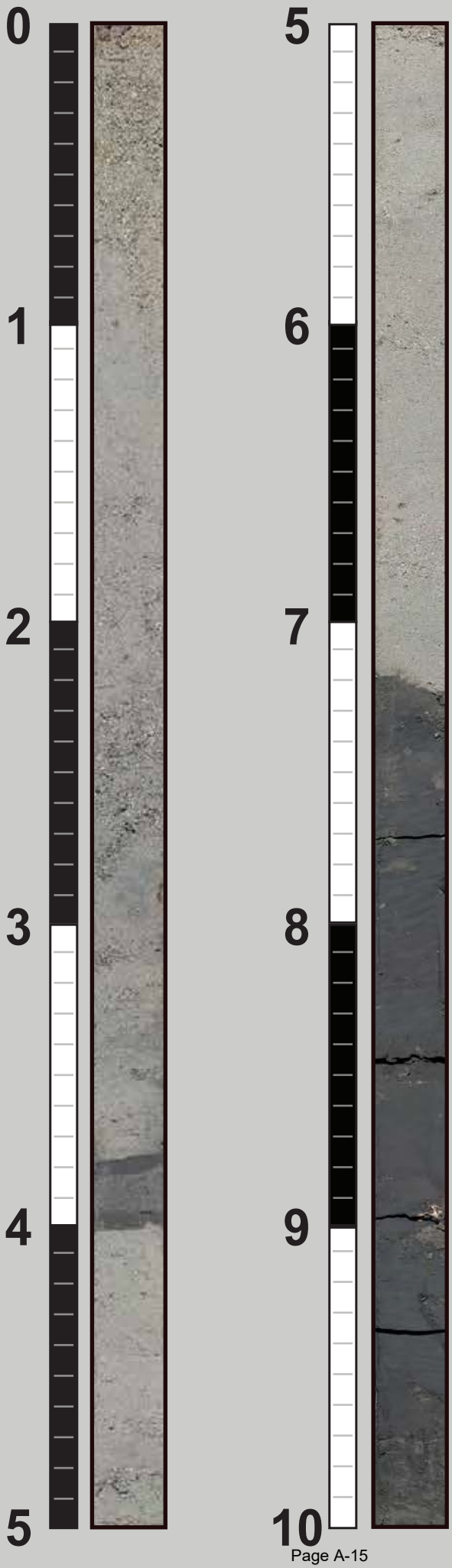
DRILLING LOG

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
10. SIZE AND TYPE OF BIT	3 Sample Barrel
2. HOLE NUMBER	CLO-22-V-007
LOCATION COORDINATES	N 343076.5 E 2744693.92
11. MANUFACTURER'S DESIGNATION OF DRILL	Athena Technologies Vibracore System
3. DRILLING AGENCY	Athena Technologies
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	☒ VERTICAL ☐ INCLINED
DEG FROM VERTICAL	---
BEARING	
15. DATE TIME GROUP OF BORING	STARTED 6/28/22 @ 1012 hrs. COMPLETED 6/28/22 @ 1030 hrs.
6. THICKNESS OF OVERBURDEN	
16. ELEVATION TOP OF BORING	-2.2' MLLW
7. DEPTH DRILLED INTO ROCK	0.0'
17. TOTAL CORE RECOVERY FOR BORING	93%
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 -2.2' 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 = +1.62 feet MLLW.
			OCEAN BOTTOM AT -2.2' MLLW			
-2.2	0.0		**SP**: Gray, poorly graded sand, fine -grained, trace medium sand to fine gravel-sized shells below 1.6', trace inorganic clay in occasional burrows below 1.7', loose, subrounded.	Core Run 10.5' Recovery 93.3%	1.0' **S-1**	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. **VIBRACORE BORING** From: 0.0' to 10.5' Ran: 10.5' Rec: 9.8'
	2.0					
-5.2			**SP**: Gray, poorly graded sand, fine -grained, trace inorganic clay in burrows & in layer at 5.4-5.5', loose, subrounded.		3.5' **S-2***	**LAB CLASSIFICATION**
	4.0					Sample ID / Lab Class. / % Content (Shell, #200 Fines, Rock): S-1 SP 0 1.41 0; S-2* SP-SM 0 7.64 0; S-3 SP 0 1.57 0; S-4 SP-SM 0 8.65 0
	6.0				6.0' **S-3**	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.
-9.3					7.2' **S-4**	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.
-10.4	8.0		**SP-SC**: Gray and very dark greenish gray, poorly graded sand with clay, fine -grained, few inorganic clay in laminations & layers, loose, subrounded, minor bioturbation.			
-10.9			**SP**: Gray, poorly graded sand, fine -grained, trace inorganic clay in occasional burrows, loose, subrounded.			
-11.7						
-12.0	10.0		**SP-SC**: Very dark greenish gray mottled with gray, poorly graded sand with clay, fine -grained, few inorganic clay in matrix & layers, few fine to coarse sand-sized shells, loose, subrounded, bioturbated.			
			SP: Gray, poorly graded sand, fine -grained, trace fine to coarse sand-sized shells, loose, subrounded.			
			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

Wilmington District Geotechnical Section



US Army Corps of Engineers, Wilmington District

2022 Back Sound to Lookout Bight, Subsurface Investigation and Geotechnical Laboratory Testing
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

ATHENA TECHNOLOGIES, INC.

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DRILLING LOG

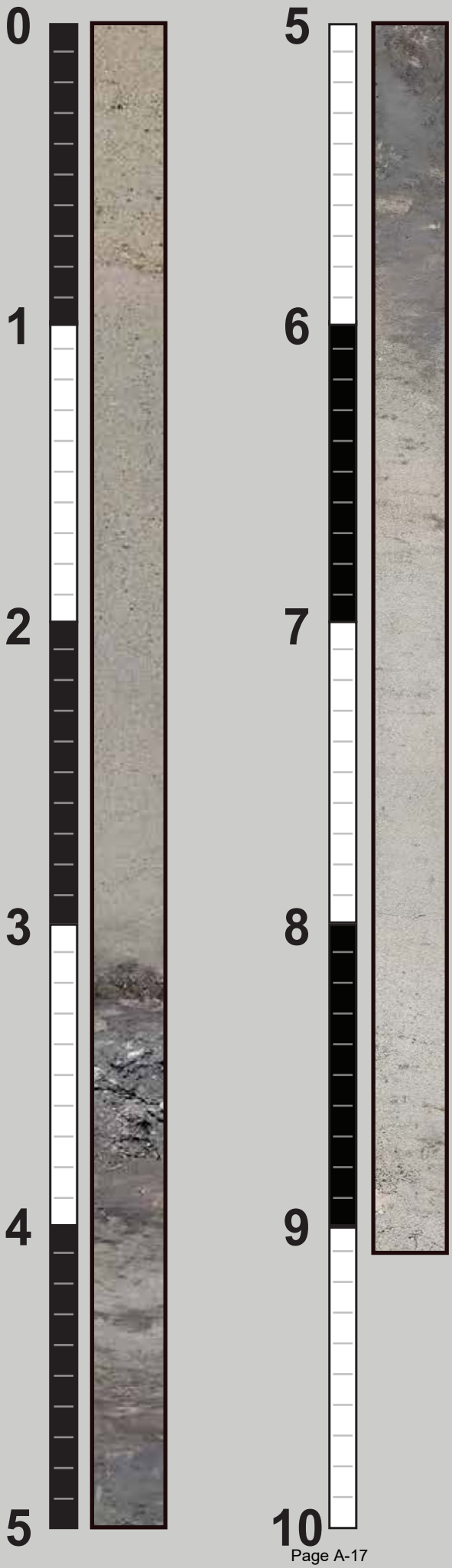
DIVISION: South Atlantic Division	INSTALLATION: Wilmington District	SHEET 1 OF 1 SHEETS	
1. PROJECT: 2022 Back Sound to Lookout Bight (W912PM22P0042) Carteret County, North Carolina	9. COORDINATE SYSTEM: NC State Plane	HORIZONTAL: NAD83	VERTICAL: MLLW
	10. SIZE AND TYPE OF BIT: 3 Sample Barrel		
2. HOLE NUMBER: **CLO-22-V-008** — LOCATION COORDINATES: N 341791.57 E 2744978.55	11. MANUFACTURER'S DESIGNATION OF DRILL: Athena Technologies Vibracore System		
3. DRILLING AGENCY: Athena Technologies	12. TOTAL SAMPLES	DISTURBED: 1	UNDISTURBED: 0
4. NAME OF DRILLER: Palmer McClellan	13. TOTAL NUMBER CORE BOXES		
5. DIRECTION OF BORING: ☒ VERTICAL ☐ INCLINED — DEG FROM VERTICAL: --- — BEARING	14. ELEVATION GROUND WATER: See Remarks		
	15. DATE TIME GROUP OF BORING	STARTED: 6/28/22 @ 1036 hrs.	COMPLETED: 6/28/22 @ 1100 hrs.
6. THICKNESS OF OVERBURDEN	16. ELEVATION TOP OF BORING: -4.5' MLLW		
7. DEPTH DRILLED INTO ROCK: 0.0'	17. TOTAL CORE RECOVERY FOR BORING: 97%		
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 -4.5' 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 = +1.49 feet MLLW.
	0.0		OCEAN BOTTOM AT -4.5' MLLW			
-4.5			**SP**: Gray, poorly graded sand, fine to medium -grained, few fine sand to fine gravel-sized shells in matrix (notable at top & at base), loose, subrounded.	Core Run 13.0' Recovery 96.9%	1.5' **S-1**	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. **VIBRACORE BORING** From: 0.0' to 13.0' Ran: 13.0' Rec: 12.6'
	2.0					
-7.3			**SP**: Gray, poorly graded sand, fine -grained, trace fine to coarse sand-sized shells, loose, subrounded.		3.0' **S-2**	**LAB CLASSIFICATION**
-8.3						
-8.5	4.0		**SC**: Very dark greenish gray and dark gray, clayey sand, fine -grained, little inorganic clay in layers at top & at base.			Sample ID / Lab Class. / % Content Shell / % Content #200 Fines / % Content 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
			SP: Gray, poorly graded sand, fine -grained, trace fine to coarse sand-sized shells in matrix, loose, subrounded.			
	6.0				6.0' **S-3**	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.
-11.7						
	8.0		**SC**: Black, clayey sand, fine -grained, some inorganic clay in matrix throughout, clean sand in burrows, trace fine to coarse sand-sized shells in matrix, gravel-sized shell at 9.0', loose/soft, bioturbated.			
-14.2						
-14.5	10.0		**SM**: Dark olive gray, silty sand, fine -grained, little inorganic silt in matrix & burrows, loose, subrounded, bioturbated.			(10-)Top 10 feet of core retained for processing.
			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-009

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

Notes:
- Photo Mosaic Image
- Photo Scale in Feet

ATHENA TECHNOLOGIES, INC.

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DRILLING LOG

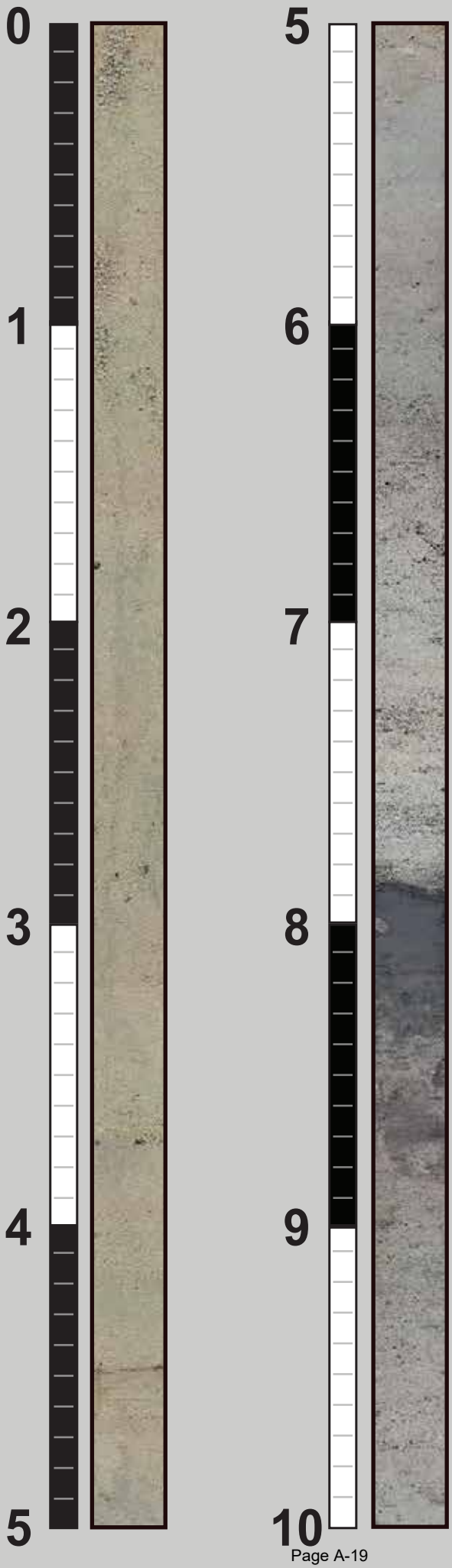
DIVISION: South Atlantic Division	INSTALLATION: Wilmington District	SHEET 1 OF 1 SHEETS	
1. PROJECT: 2022 Back Sound to Lookout Bight (W912PM22P0042) Carteret County, North Carolina	9. COORDINATE SYSTEM: NC State Plane	HORIZONTAL: NAD83	VERTICAL: MLLW
	10. SIZE AND TYPE OF BIT: 3 Sample Barrel		
2. HOLE NUMBER: **CLO-22-V-009** — LOCATION COORDINATES: N 334797.94 E 2746455.39	11. MANUFACTURER'S DESIGNATION OF DRILL: Athena Technologies Vibracore System		
3. DRILLING AGENCY: Athena Technologies	12. TOTAL SAMPLES	DISTURBED: 1	UNDISTURBED: 0
4. NAME OF DRILLER: Palmer McClellan	13. TOTAL NUMBER CORE BOXES		
5. DIRECTION OF BORING: ☒ VERTICAL ☐ INCLINED — DEG FROM VERTICAL: --- — BEARING:	14. ELEVATION GROUND WATER: See Remarks		
	15. DATE TIME GROUP OF BORING	STARTED: 6/28/22 @ 1109 hrs.	COMPLETED: 6/28/22 @ 1130 hrs.
6. THICKNESS OF OVERBURDEN	16. ELEVATION TOP OF BORING: -0.1' MLLW		
7. DEPTH DRILLED INTO ROCK: 0.0'	17. TOTAL CORE RECOVERY FOR BORING: 81%		
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 -0.1' 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 = +1.69 feet MLLW.
-0.1	0.0		OCEAN BOTTOM AT -0.1' MLLW			
			SP: Olive gray, poorly graded sand, fine -grained, trace fine to coarse sand-sized shells in matrix, loose, subrounded.	Core Run 11.3' Recovery 80.5%	2.0' **S-1**	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. **VIBRACORE BORING** From: 0.0' to 11.3' Ran: 11.3' Rec: 9.1'
	2.0					
-3.3						
-3.9			**SC**: Very dark greenish gray mottled with dark gray, clayey sand, fine -grained, little inorganic clay, little medium sand to coarse gravel-sized shells, loose/soft.		3.5' **S-2**	**LAB CLASSIFICATION**
	4.0					Sample ID / Lab Class. / % Content Shell / #200 Fines / Rock: S-1 SP 0 0.77 0; S-2 SM 17.83 24.94 0.18; S-3 SM 0 38.94 0; S-4 SP 0.56 1.41 0
-4.8			**SP-SC**: Gray mottled with very dark greenish gray, poorly graded sand with clay, fine -grained, few inorganic clay in matrix, burrows & laminations, loose, subrounded, bioturbated.		5.2' **S-3**	
-6.2	6.0		**SC**: Very dark greenish gray mottled with gray, clayey sand, fine -grained, some grading to little inorganic clay, clean sand in burrows, sand-sized shells at base, clay % decreases with depth, loose/soft, bioturbated.			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.
	8.0		**SP**: Gray, poorly graded sand, fine -grained, trace fine to medium sand-sized shells in matrix, trace inorganic clay in occasional burrows, gravel-sized shell at 8.9', loose, subrounded.		8.5' **S-4**	
-9.2						
	10.0		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-010

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

Notes:
- Photo Mosaic Image
- Photo Scale in Feet

ATHENA TECHNOLOGIES, INC.

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

DRILLING LOG

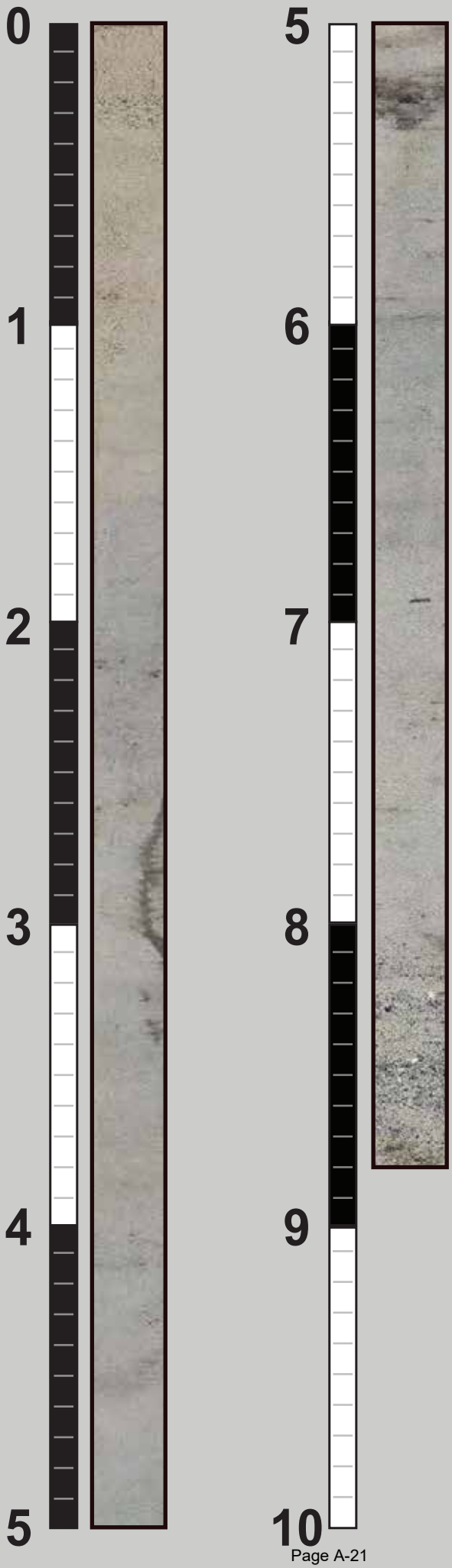
DIVISION: South Atlantic Division	INSTALLATION: Wilmington District	SHEET 1 OF 1 SHEETS	
1. PROJECT: 2022 Back Sound to Lookout Bight (W912PM22P0042) Carteret County, North Carolina	9. COORDINATE SYSTEM: NC State Plane	HORIZONTAL: NAD83	VERTICAL: MLLW
	10. SIZE AND TYPE OF BIT: 3 Sample Barrel		
2. HOLE NUMBER: **CLO-22-V-010** — LOCATION COORDINATES: N 332506.87 E 2745856.78	11. MANUFACTURER'S DESIGNATION OF DRILL: Athena Technologies Vibracore System		
3. DRILLING AGENCY: Athena Technologies	12. TOTAL SAMPLES	DISTURBED: 1	UNDISTURBED: 0
4. NAME OF DRILLER: Palmer McClellan	13. TOTAL NUMBER CORE BOXES		
5. DIRECTION OF BORING: ☒ VERTICAL ☐ INCLINED — DEG FROM VERTICAL: --- — BEARING:	14. ELEVATION GROUND WATER: See Remarks		
	15. DATE TIME GROUP OF BORING	STARTED: 6/28/22 @ 1142 hrs.	COMPLETED: 6/28/22 @ 1215 hrs.
6. THICKNESS OF OVERBURDEN	16. ELEVATION TOP OF BORING: -5' MLLW		
7. DEPTH DRILLED INTO ROCK: 0.0'	17. TOTAL CORE RECOVERY FOR BORING: 90%		
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 -5.0' 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 = +1.61 feet MLLW.
			OCEAN BOTTOM AT -5.0' MLLW			
-5	0.0		**SP**: Olive gray grades to gray, poorly graded sand, fine -grained, trace fine sand to fine gravel-sized shells in matrix to 1.9' & in layers at 3.7' & 5.2', inorganic clay in lamination at 4.5', color changes at 5.2', loose, subrounded.	Core Run 12.5' Recovery 90.4%	1.0' **S-1**	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					**VIBRACORE BORING** From: 0.0' to 12.5' Ran: 12.5' Rec: 11.3'
	4.0				3.0' **S-2**	**LAB CLASSIFICATION**
					5.0' **S-3**	Sample ID / Lab Class. / % Content (Shell, #200 Fines, Rock): S-1 SP 0.06 1.18 0; S-2 SP 0 0.91 0; S-3 SP 0 1.22 0
-11.3	6.0		**SP**: Gray, poorly graded sand, fine to medium -grained, few fine to coarse sand-sized shells in matrix & layers, gravel-sized shells present between 6.3-6.8', 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.
-12.9						
-13.8	8.0		**SC**: Very dark greenish gray and gray, clayey sand, fine -grained, little inorganic clay in matrix & burrows, trace fine to coarse sand-sized shells, clay % decreases with depth below 8.3', loose/soft, bioturbated.			
-15.0	10.0		**SP**: Gray, poorly graded sand, fine -grained, trace fine to coarse sand-sized shells in matrix, trace inorganic clay in occasional burrows, loose, subrounded.			(10-)Top 10 feet of core retained for processing.
			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-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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DRILLING LOG

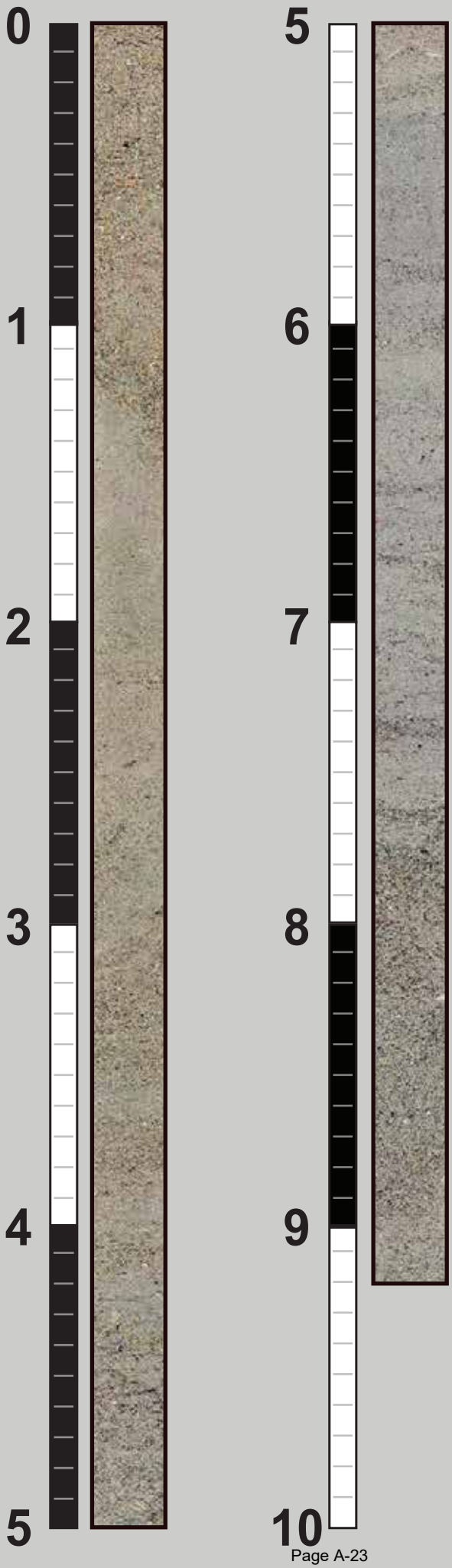
DIVISION: South Atlantic Division	INSTALLATION: Wilmington District	SHEET 1 OF 1 SHEETS	
1. PROJECT: 2022 Back Sound to Lookout Bight (W912PM22P0042) Carteret County, North Carolina	9. COORDINATE SYSTEM: NC State Plane	HORIZONTAL: NAD83	VERTICAL: MLLW
	10. SIZE AND TYPE OF BIT: 3 Sample Barrel		
2. HOLE NUMBER: **CLO-22-V-011** — LOCATION COORDINATES: N 331246.73 E 2745172.11	11. MANUFACTURER'S DESIGNATION OF DRILL: Athena Technologies Vibracore System		
3. DRILLING AGENCY: Athena Technologies	12. TOTAL SAMPLES	DISTURBED: 1	UNDISTURBED: 0
4. NAME OF DRILLER: Palmer McClellan	13. TOTAL NUMBER CORE BOXES		
5. DIRECTION OF BORING: ☒ VERTICAL ☐ INCLINED — DEG FROM VERTICAL: --- — BEARING:	14. ELEVATION GROUND WATER: See Remarks		
	15. DATE TIME GROUP OF BORING	STARTED: 6/28/22 @ 1226 hrs.	COMPLETED: 6/28/22 @ 1250 hrs.
6. THICKNESS OF OVERBURDEN	16. ELEVATION TOP OF BORING: -2.1' 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 -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.
	0.0		OCEAN BOTTOM AT -2.1' MLLW			
-2.1			**SP**: Olive gray, poorly graded sand, fine -grained, loose, subrounded.		1.0' **S-1**	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.
-3.7			**SP**: 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' **S-2**	**VIBRACORE BORING** From: 0.0' to 10.0' Ran: 10.0' Rec: 8.8'
	2.0					**LAB CLASSIFICATION**
	4.0					Sample ID / Lab Class. / % Content (Shell, #200 Fines, Rock): S-1 SP 0 0.88 0; S-2 SP 0 2.93 0; S-3 SP 0 1.7 0; S-4 SP 0 0.76 0
	6.0				6.0' **S-3**	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.
-10.2	8.0				7.5' **S-4**	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.
-10.9			**SP**: Gray, poorly graded sand, fine -grained, few fine sand to fine gravel-sized shells, loose, subrounded.			* = 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			

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-012

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

Notes:
- Photo Mosaic Image
- Photo Scale in Feet

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DRILLING LOG

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
	10. SIZE AND TYPE OF BIT: 3 Sample Barrel		
2. HOLE NUMBER: **CLO-22-V-012** — LOCATION COORDINATES: N 329132.52 E 2744458.1	11. MANUFACTURER'S DESIGNATION OF DRILL: Athena Technologies Vibracore System		
3. DRILLING AGENCY: Athena Technologies	12. TOTAL SAMPLES	DISTURBED: 1	UNDISTURBED: 0
4. NAME OF DRILLER: Palmer McClellan	13. TOTAL NUMBER CORE BOXES		
5. DIRECTION OF BORING: ☒ VERTICAL ☐ INCLINED — DEG FROM VERTICAL: --- — BEARING	14. ELEVATION GROUND WATER: See Remarks		
	15. DATE TIME GROUP OF BORING	STARTED: 6/28/22 @ 1724 hrs.	COMPLETED: 6/28/22 @ 1750 hrs.
6. THICKNESS OF OVERBURDEN	16. ELEVATION TOP OF BORING: -0.6' MLLW		
7. DEPTH DRILLED INTO ROCK: 0.0'	17. TOTAL CORE RECOVERY FOR BORING: 92%		
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
			0.0' TO -0.6' WATER		
	0.0		OCEAN BOTTOM AT -0.6' MLLW		
-0.6			**SP**: Light brownish gray, poorly graded sand, fine to medium -grained, few fine sand to fine gravel-sized shells in matrix, loose, subrounded.		0.5' **S-1**
-1.9					
	2.0		**SP**: Light brownish gray, poorly graded sand, fine -grained, trace fine to coarse sand-sized shells in matrix, loose, subrounded.	Core Run 10.0' Recovery 92.0%	2.0' **S-2**
-3.7					
	4.0		**SP**: 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.		4.0' **S-3**
-5.9					
	6.0		**SP**: Gray, poorly graded sand, fine -grained, trace fine to coarse sand-sized shells in matrix & layers, loose, subrounded.		6.0' **S-4**
-8.3					
	8.0		**SP**: Gray, poorly graded sand, fine to medium -grained, few fine to coarse sand-sized shells, occasional gravel-sized shells, loose, subrounded.		8.5' **S-5**
-9.8					
	10.0		BOTTOM OF BOREHOLE AT 10.0 ft SOILS ARE FIELD VISUALLY CLASSIFIED IN ACCORDANCE WITH THE UNIFIED SOIL CLASSIFICATION SYSTEM		

REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g

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.

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.

VIBRACORE BORING
From: 0.0' to 10.0'
Ran: 10.0' Rec: 9.2'

LAB CLASSIFICATION

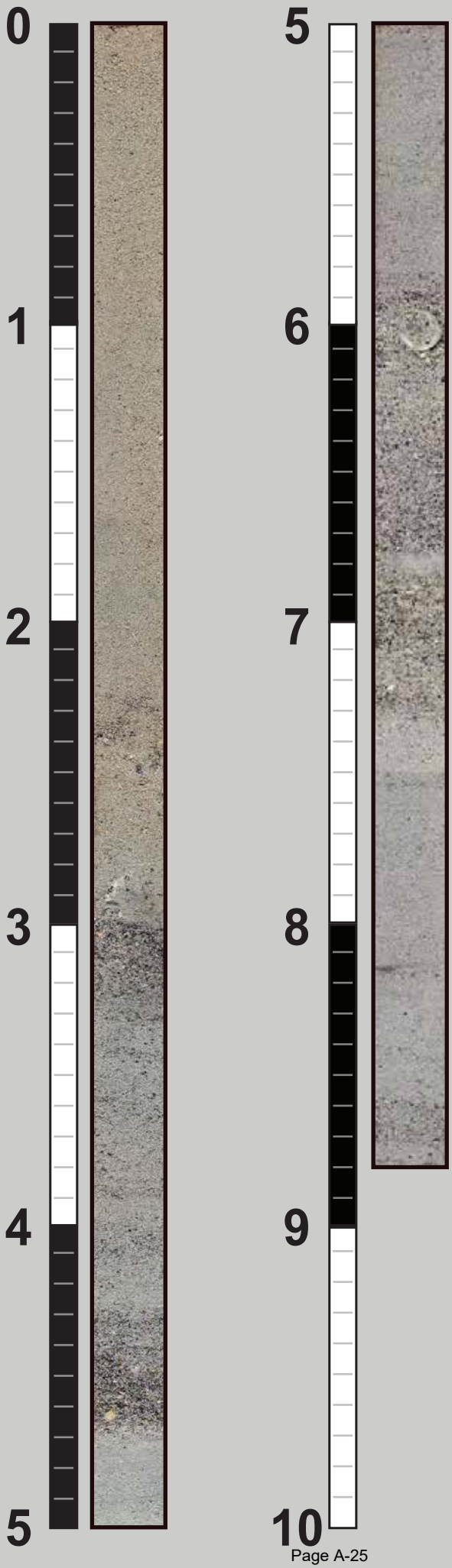
Sample ID	Lab Class.	% Content Shell	#200 Fines	Rock
S-1	SP	1.12	1	0
S-2	SP	0.57	1.05	0
S-3	SP	1.89	1.12	0
S-4	SP	0	0.77	0
S-5	SP	3.06	1.05	0

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.

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-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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DRILLING LOG

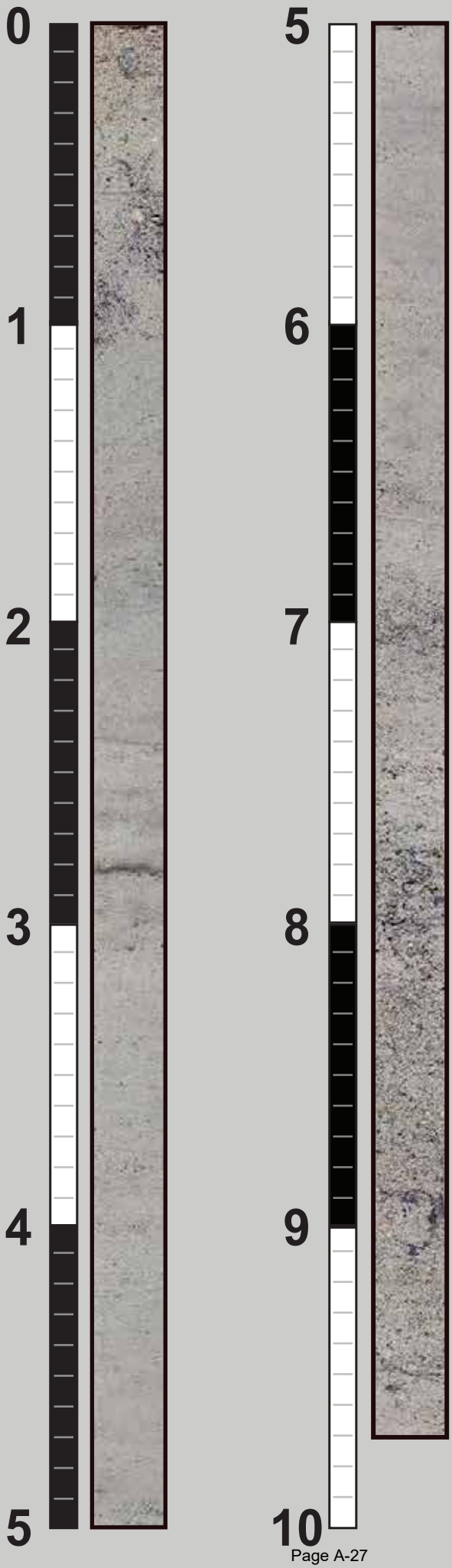
DIVISION: South Atlantic Division
INSTALLATION: Wilmington District
SHEET 1 OF 1 SHEETS

1. PROJECT: 2022 Back Sound to Lookout Bight (W912PM22P0042) Carteret County, North Carolina
9. COORDINATE SYSTEM: NC State Plane | HORIZONTAL: NAD83 | VERTICAL: MLLW
10. SIZE AND TYPE OF BIT: 3 Sample Barrel
2. HOLE NUMBER: **CLO-22-V-013** | LOCATION COORDINATES: N 329931.9 E 2744208.96
11. MANUFACTURER'S DESIGNATION OF DRILL: Athena Technologies Vibracore System
3. DRILLING AGENCY: Athena Technologies
12. TOTAL SAMPLES | DISTURBED: 1 | UNDISTURBED: 0
4. NAME OF DRILLER: Palmer McClellan
13. TOTAL NUMBER CORE BOXES
5. DIRECTION OF BORING: ☒ VERTICAL ☐ INCLINED | DEG FROM VERTICAL: --- | BEARING
14. ELEVATION GROUND WATER: See Remarks
15. DATE TIME GROUP OF BORING | STARTED: 6/28/22 @ 1301 hrs. | COMPLETED: 6/28/22 @ 1340 hrs.
6. THICKNESS OF OVERBURDEN
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.
			OCEAN BOTTOM AT -8.0' MLLW			
-8	0.0		**SP**: Light brownish gray, poorly graded sand, fine -grained, trace fine to coarse sand-sized shells in matrix, gravel-sized shells at base, loose, subrounded.	Core Run 10.0' Recovery 88.0%	0.5' S-1	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				2.0' S-2	**VIBRACORE BORING** From: 0.0' to 10.0' Ran: 10.0' Rec: 8.8'
-10.9			**SP**: 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.			**LAB CLASSIFICATION**
	4.0				4.0' S-3	Sample ID / Lab Class. / % Content 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
-12.7			**SP**: Gray, poorly graded sand, fine -grained, trace fine to medium sand-sized shells in matrix, loose, subrounded.			
-13.9	6.0		**SP**: Gray, poorly graded sand, fine to medium -grained, little fine to coarse sand-sized shells in matrix, gravel-sized shell at top, loose, subrounded.			
-15.3			**SP**: 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.
-16.8	8.0					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			

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-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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DRILLING LOG

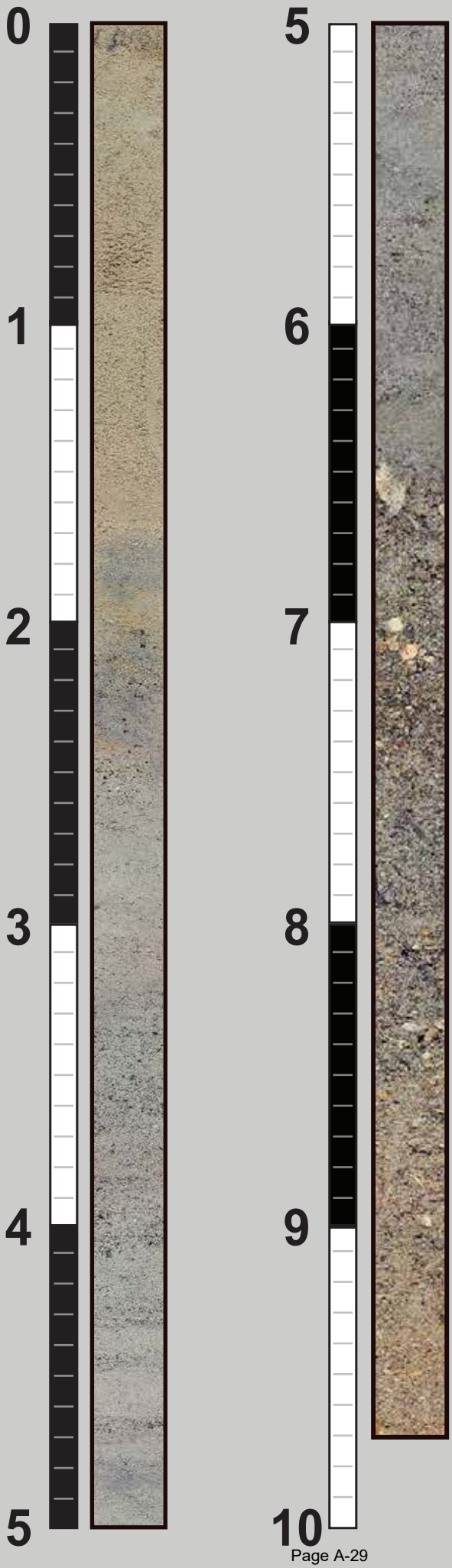
DIVISION: South Atlantic Division	INSTALLATION: Wilmington District	SHEET 1 OF 1 SHEETS	
1. PROJECT: 2022 Back Sound to Lookout Bight (W912PM22P0042) Carteret County, North Carolina	9. COORDINATE SYSTEM: NC State Plane	HORIZONTAL: NAD83	VERTICAL: MLLW
	10. SIZE AND TYPE OF BIT: 3 Sample Barrel		
2. HOLE NUMBER: **CLO-22-V-014** — LOCATION COORDINATES: N 328665.14 E 2743568.22	11. MANUFACTURER'S DESIGNATION OF DRILL: Athena Technologies Vibracore System		
3. DRILLING AGENCY: Athena Technologies	12. TOTAL SAMPLES	DISTURBED: 1	UNDISTURBED: 0
4. NAME OF DRILLER: Palmer McClellan	13. TOTAL NUMBER CORE BOXES		
5. DIRECTION OF BORING: ☒ VERTICAL ☐ INCLINED — DEG FROM VERTICAL: --- — BEARING	14. ELEVATION GROUND WATER: See Remarks		
	15. DATE TIME GROUP OF BORING	STARTED: 6/28/22 @ 1350 hrs.	COMPLETED: 6/28/22 @ 1405 hrs.
6. THICKNESS OF OVERBURDEN	16. ELEVATION TOP OF BORING: -2.6' MLLW		
7. DEPTH DRILLED INTO ROCK: 0.0'	17. TOTAL CORE RECOVERY FOR BORING: 97%		
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 -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.
			OCEAN BOTTOM AT -2.6' MLLW			
-2.6	0.0		**SP**: Gray, poorly graded sand, fine to medium -grained, few fine sand to fine gravel-sized shells in matrix, loose, subrounded.		0.5' **S-1**	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' Recovery 97.0%		**VIBRACORE BORING** From: 0.0' to 10.0' Ran: 10.0' Rec: 9.7'
	2.0				3.0' **S-2**	**LAB CLASSIFICATION**
	4.0					Sample ID / Lab Class. / % Content (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
	6.0				6.0' **S-3**	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.
-9.6						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.
-10.3			**SP**: Gray, poorly graded sand, fine to medium -grained, few fine to coarse sand-sized shells, loose, subrounded.			* = Laboratory results not interpreted to be representative of the broader interval from which the sub-sample was extracted. Initial USCS designation unchanged.
	8.0		**SP**: Gray, poorly graded sand, medium -grained, little fine sand to fine gravel-sized shells, occasional coarse gravel-sized shells, loose, subrounded.		8.2' **S-4**	
-12.3						
	10.0		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-015

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

Notes:
- Photo Mosaic Image
- Photo Scale in Feet

ATHENA TECHNOLOGIES, INC.

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

DRILLING LOG

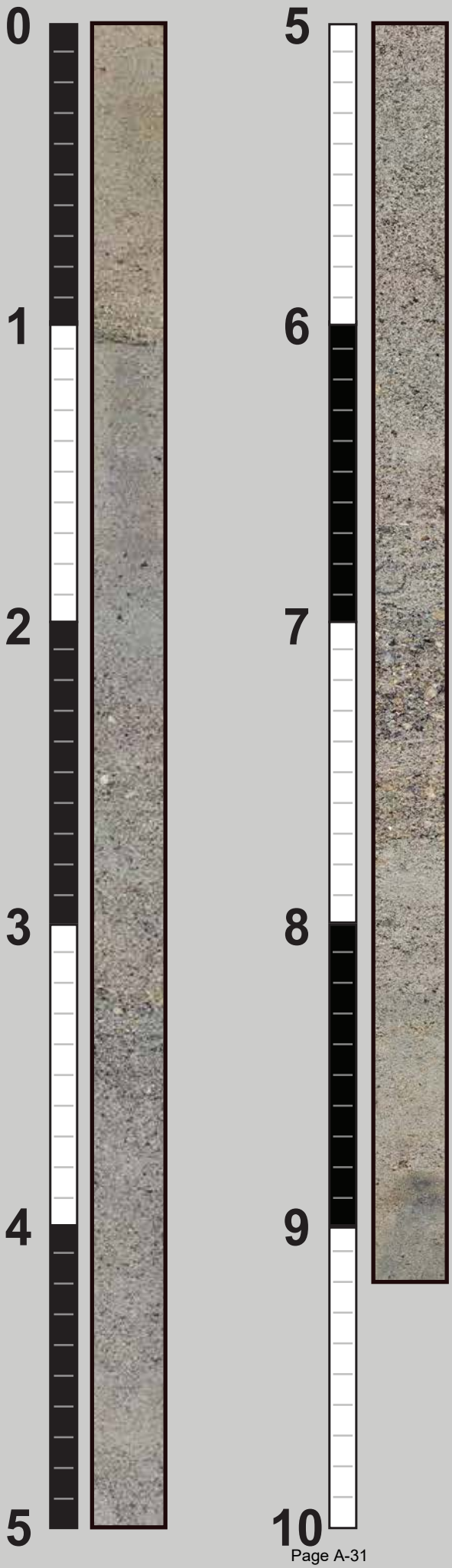
DIVISION: South Atlantic Division	INSTALLATION: Wilmington District	SHEET 1 OF 1 SHEETS	
1. PROJECT: 2022 Back Sound to Lookout Bight (W912PM22P0042) Carteret County, North Carolina	9. COORDINATE SYSTEM: NC State Plane	HORIZONTAL: NAD83	VERTICAL: MLLW
	10. SIZE AND TYPE OF BIT: 3 Sample Barrel		
2. HOLE NUMBER: **CLO-22-V-015** — LOCATION COORDINATES: N 327884.68 E 2742944.84	11. MANUFACTURER'S DESIGNATION OF DRILL: Athena Technologies Vibracore System		
3. DRILLING AGENCY: Athena Technologies	12. TOTAL SAMPLES	DISTURBED: 1	UNDISTURBED: 0
4. NAME OF DRILLER: Palmer McClellan	13. TOTAL NUMBER CORE BOXES		
5. DIRECTION OF BORING: ☒ VERTICAL ☐ INCLINED — DEG FROM VERTICAL: --- — BEARING	14. ELEVATION GROUND WATER: See Remarks		
	15. DATE TIME GROUP OF BORING	STARTED: 6/28/22 @ 1415 hrs.	COMPLETED: 6/28/22 @ 1435 hrs.
6. THICKNESS OF OVERBURDEN	16. ELEVATION TOP OF BORING: -4' MLLW		
7. DEPTH DRILLED INTO ROCK: 0.0'	17. TOTAL CORE RECOVERY FOR BORING: 97%		
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 -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.
			OCEAN BOTTOM AT -4.0' MLLW			
-4	0.0		**SP**: Light brownish gray, poorly graded sand, fine -grained, trace fine to medium sand-sized shells in matrix, loose, subrounded.		0.5' **S-1**	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.
-6.1	2.0		**SP**: 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' **S-2**	**VIBRACORE BORING** From: 0.0' to 10.0' Ran: 10.0' Rec: 9.7'
	4.0					**LAB CLASSIFICATION**
	6.0				5.2' **S-3**	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
-10.5			**SP**: 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.			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				8.0' **S-4**	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.
-13.7						* = 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			

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-016

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

Notes:
- Photo Mosaic Image
- Photo Scale in Feet

ATHENA TECHNOLOGIES, INC.

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DRILLING LOG

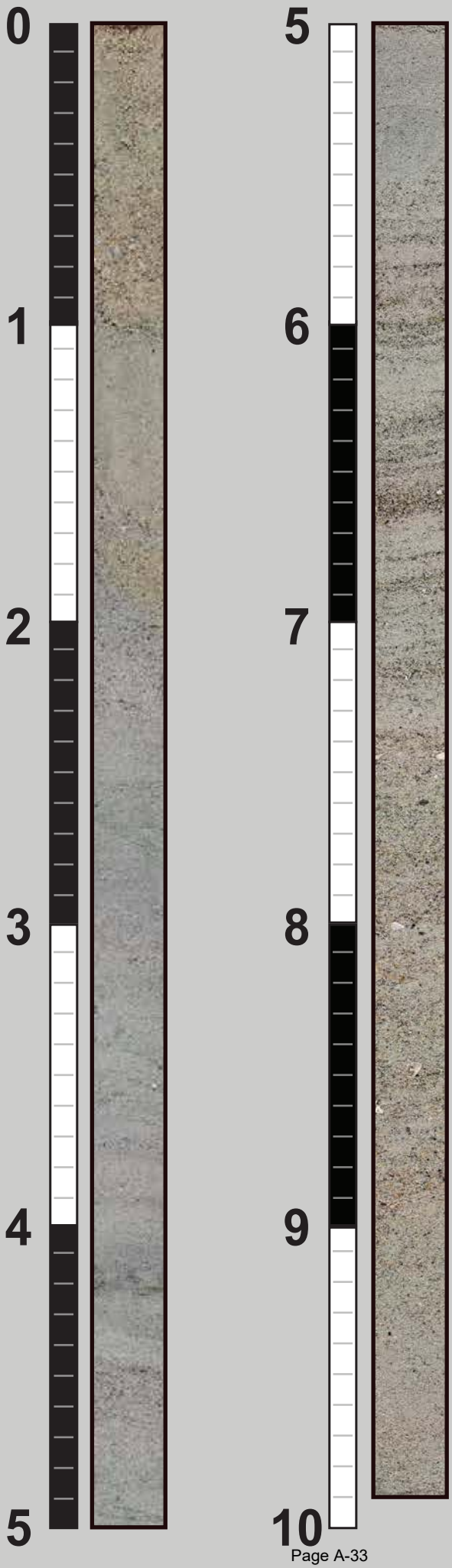
DIVISION	South Atlantic Division
INSTALLATION	Wilmington District
SHEET	1 OF 1 SHEETS
1. PROJECT	2022 Back Sound to Lookout Bight (W912PM22P0042) Carteret County, North Carolina
9. COORDINATE SYSTEM	NC State Plane
HORIZONTAL	NAD83
VERTICAL	MLLW
10. SIZE AND TYPE OF BIT	3 Sample Barrel
2. HOLE NUMBER	**CLO-22-V-016**
LOCATION COORDINATES	N 327106.42 E 2742314.74
11. MANUFACTURER'S DESIGNATION OF DRILL	Athena Technologies Vibracore System
3. DRILLING AGENCY	Athena Technologies
12. TOTAL SAMPLES	
DISTURBED	1
UNDISTURBED	0
4. NAME OF DRILLER	Palmer McClellan
13. TOTAL NUMBER CORE BOXES	
5. DIRECTION OF BORING	☒ VERTICAL ☐ INCLINED
DEG FROM VERTICAL	---
BEARING	
14. ELEVATION GROUND WATER	See Remarks
15. DATE TIME GROUP OF BORING	STARTED 6/28/22 @ 1444 hrs. COMPLETED 6/28/22 @ 1510 hrs.
6. THICKNESS OF OVERBURDEN	
16. ELEVATION TOP OF BORING	-5.5' MLLW
7. DEPTH DRILLED INTO ROCK	0.0'
17. TOTAL CORE RECOVERY FOR BORING	92%
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 -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.
			OCEAN BOTTOM AT -5.5' MLLW			
-5.5	0.0		**SP**: 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' **S-1**	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			**SP**: Gray, poorly graded sand, fine -grained, trace fine to coarse sand-sized shells in matrix, loose, subrounded.	Core Run 10.0' Recovery 92.0%	2.0' **S-2**	**VIBRACORE BORING** From: 0.0' to 10.0' Ran: 10.0' Rec: 9.2'
-7.8	2.0		**SP**: 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.			**LAB CLASSIFICATION**
	4.0				4.0' **S-3**	Sample ID / Lab Class. / % Content (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
	6.0				6.0' **S-4**	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.
-13.2						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.
	8.0		**SP**: Gray, poorly graded sand, fine to medium -grained, trace fine to coarse sand-sized shells in matrix, loose, subrounded.			* = Laboratory results not interpreted to be representative of the broader interval from which the sub-sample was extracted. Initial USCS designation unchanged.
-14.3						
-14.7			**SP**: Olive gray, poorly graded sand, fine -grained, trace inorganic clay/silt in matrix, trace fine to medium sand-sized shells, loose, subrounded.			
	10.0		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-017

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

Notes:
- Photo Mosaic Image
- Photo Scale in Feet

ATHENA TECHNOLOGIES, INC.

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McClellanville, SC 29458
www.athenatechnologies.com
(843) 887-3800

DRILLING LOG

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
	10. SIZE AND TYPE OF BIT: 3 Sample Barrel		
2. HOLE NUMBER: **CLO-22-V-017** — LOCATION COORDINATES: N 325790.45 E 2741740.47	11. MANUFACTURER'S DESIGNATION OF DRILL: Athena Technologies Vibracore System		
3. DRILLING AGENCY: Athena Technologies	12. TOTAL SAMPLES	DISTURBED: 1	UNDISTURBED: 0
4. NAME OF DRILLER: Palmer McClellan	13. TOTAL NUMBER CORE BOXES		
5. DIRECTION OF BORING: ☒ VERTICAL ☐ INCLINED — DEG FROM VERTICAL: --- — BEARING:	14. ELEVATION GROUND WATER: See Remarks		
	15. DATE TIME GROUP OF BORING	STARTED: 6/28/22 @ 1519 hrs.	COMPLETED: 6/28/22 @ 1530 hrs.
6. THICKNESS OF OVERBURDEN	16. ELEVATION TOP OF BORING: -2.5' MLLW		
7. DEPTH DRILLED INTO ROCK: 0.0'	17. TOTAL CORE RECOVERY FOR BORING: 90%		
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 -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 = +1.44 feet MLLW.
			OCEAN BOTTOM AT -2.5' MLLW			
-2.5	0.0		**SP**: Grayish brown, poorly graded sand, fine to medium -grained, few fine sand to fine gravel-sized shells, loose, subrounded.		0.5' **S-1**	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.
-3.5			**SP**: Grayish brown grades to gray, poorly graded sand, fine -grained, trace fine to coarse sand-sized shells in matrix, trace inorganic clay in small burrows at 4.2', loose, subrounded.	Core Run 11.0' Recovery 90.0%		**VIBRACORE BORING** From: 0.0' to 11.0' Ran: 11.0' Rec: 9.9'
	2.0				3.0' **S-2**	
	4.0				4.5' **S-3**	**LAB CLASSIFICATION**
-8.0			**SP**: Gray, poorly graded sand, fine to medium -grained, few fine sand to fine gravel-sized shells in matrix, laminations & layers, shell % decreases with depth below 8.9', loose, subrounded.			
	6.0				7.0' **S-4**	
	8.0					
-12.4	10.0		BOTTOM OF BOREHOLE AT 10.0 ft			
			SOILS ARE FIELD VISUALLY CLASSIFIED IN ACCORDANCE WITH THE UNIFIED SOIL CLASSIFICATION SYSTEM			

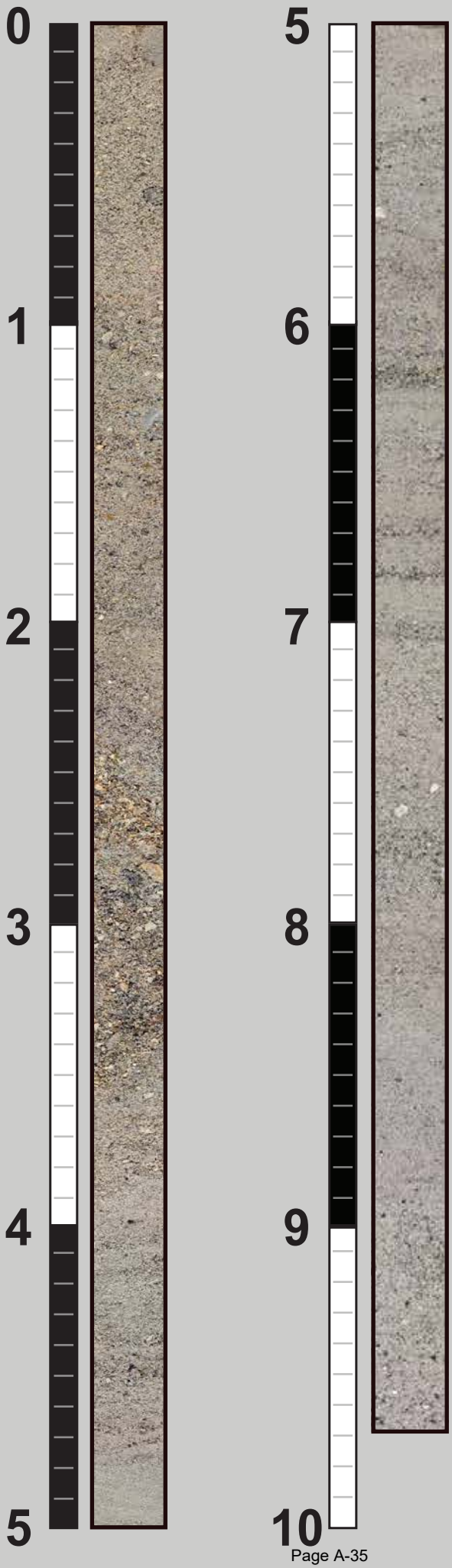
Sample ID	Lab Class.	% Content Shell	% Content #200 Fines	% Content Rock
S-1	SP	0.11	1.83	0
S-2	SP	1.11	1.07	0
S-3	SP	0	0.69	0
S-4	SP	0.65	0.73	0

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.

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

ATHENA TECHNOLOGIES, INC.

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(843) 887-3800

DRILLING LOG

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
10. SIZE AND TYPE OF BIT	3 Sample Barrel
2. HOLE NUMBER	**CLO-22-V-018**
LOCATION COORDINATES	N 326626.71 E 2741532.4
11. MANUFACTURER'S DESIGNATION OF DRILL	Athena Technologies Vibracore System
3. DRILLING AGENCY	Athena Technologies
12. TOTAL SAMPLES	
DISTURBED	1
UNDISTURBED	0
4. NAME OF DRILLER	Palmer McClellan
13. TOTAL NUMBER CORE BOXES	
5. DIRECTION OF BORING	☒ VERTICAL ☐ INCLINED
DEG FROM VERTICAL	---
BEARING	
14. ELEVATION GROUND WATER	See Remarks
15. DATE TIME GROUP OF BORING	STARTED 6/28/22 @ 1540 hrs. COMPLETED 6/28/22 @ 1550 hrs.
6. THICKNESS OF OVERBURDEN	
16. ELEVATION TOP OF BORING	-6.1' MLLW
7. DEPTH DRILLED INTO ROCK	0.0'
17. TOTAL CORE RECOVERY FOR BORING	97%
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
			0.0' TO -6.1' WATER		
			OCEAN BOTTOM AT -6.1' MLLW		
-6.1	0.0		**SP**: 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' Recovery 97.0%	1.0' **S-1**
-8.6	2.0		**SP**: Grayish brown, poorly graded sand, medium -grained, some fine sand to fine gravel-sized shells in matrix, loose, subrounded.		3.0' **S-2**
-9.6	4.0		**SP**: 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' **S-3**
-14.0	6.0				
-15.0	8.0		**SP**: Gray, poorly graded sand, fine -grained, trace fine to medium sand-sized shells in matrix, loose, subrounded.		
-15.8			**SP**: 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		

REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g

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.

VIBRACORE BORING
From: 0.0' to 10.0'
Ran: 10.0' Rec: 9.7'

LAB CLASSIFICATION

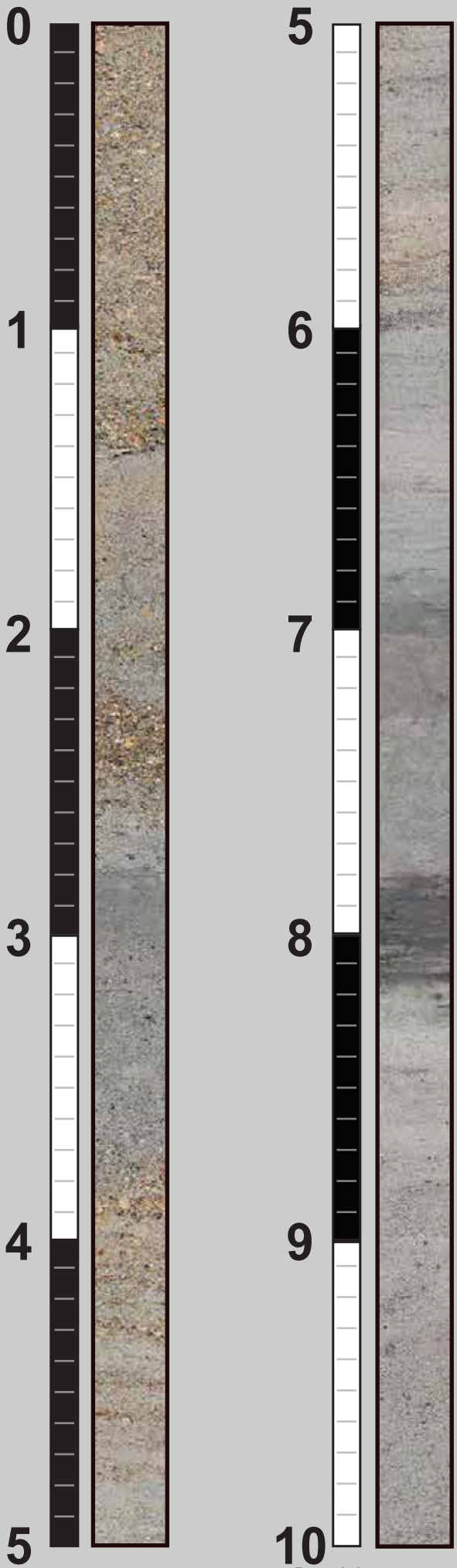
Sample ID	Lab Class.	% Content Shell	% Content #200 Fines	% Content Rock
S-1	SP	2.11	0.67	0
S-2	SP	14	0.95	0
S-3	SP	1.26	0.84	0

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.

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-019

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

Notes:
- Photo Mosaic Image
- Photo Scale in Feet

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DRILLING LOG

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
	10. SIZE AND TYPE OF BIT: 3 Sample Barrel		
2. HOLE NUMBER: **CLO-22-V-019** — LOCATION COORDINATES: N 326292.76 E 2740636.8	11. MANUFACTURER'S DESIGNATION OF DRILL: Athena Technologies Vibracore System		
3. DRILLING AGENCY: Athena Technologies	12. TOTAL SAMPLES	DISTURBED: 1	UNDISTURBED: 0
4. NAME OF DRILLER: Palmer McClellan	13. TOTAL NUMBER CORE BOXES		
5. DIRECTION OF BORING: ☒ VERTICAL ☐ INCLINED — DEG FROM VERTICAL: --- — BEARING:	14. ELEVATION GROUND WATER: See Remarks		
	15. DATE TIME GROUP OF BORING	STARTED: 6/28/22 @ 1559 hrs.	COMPLETED: 6/28/22 @ 1620 hrs.
6. THICKNESS OF OVERBURDEN	16. ELEVATION TOP OF BORING: -2.5' MLLW		
7. DEPTH DRILLED INTO ROCK: 0.0'	17. TOTAL CORE RECOVERY FOR BORING: 94%		
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
			0.0' TO -2.5' WATER		
			OCEAN BOTTOM AT -2.5' MLLW		
-2.5	0.0		**SP**: Light brownish gray, poorly graded sand, medium -grained, little fine sand to fine gravel-sized shells throughout, loose, subrounded.		1.0' **S-1**
-3.9			**SP**: 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' Recovery 93.6%	2.0' **S-2**
-5.2	2.0		**SP**: Dark gray grades to gray, poorly graded sand, fine -grained, trace fine to coarse sand-sized shells in matrix, loose, subrounded.		3.0' **S-3**
-6.2			**SP**: Gray, poorly graded sand, fine to medium -grained, few fine to coarse sand-sized shells in laminations & layers, shell % decreases with depth, loose, subrounded.		
-8.4	4.0		**SP**: Gray, poorly graded sand, fine -grained, trace fine sand-sized shells in laminations, trace heavy minerals in laminations, loose, subrounded.		5.2' **S-4**
-9.5	6.0		**SP**: Dark gray, poorly graded sand, fine -grained, trace inorganic clay in matrix & burrows, loose, subrounded, bioturbated.		7.2' **S-5**
-10.4			**SC**: Very dark greenish gray, clayey sand, fine -grained, little inorganic clay, loose/soft, bioturbated.		
-10.8	8.0		**SP**: Gray, poorly graded sand, fine -grained, trace fine to coarse sand-sized shells in matrix, loose, subrounded.		
-12.5	10.0		BOTTOM OF BOREHOLE AT 10.0 ft		
			SOILS ARE FIELD VISUALLY CLASSIFIED IN ACCORDANCE WITH THE UNIFIED SOIL CLASSIFICATION SYSTEM		

REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g

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.

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.

VIBRACORE BORING
From: 0.0' to 11.0'
Ran: 11.0' Rec: 10.3'

LAB CLASSIFICATION

Sample ID	Lab Class.	% Content Shell	% Content #200 Fines	% Content 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

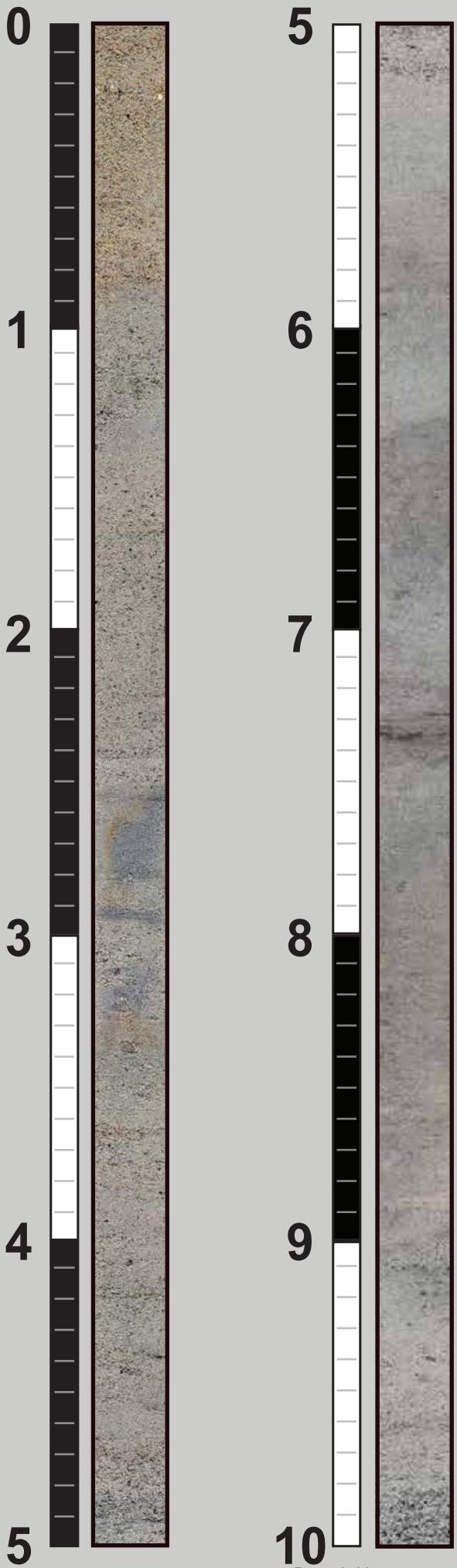
NOTE 3: Soils are Visually Lab Classified in Accordance with ASTM-D2487. Percent Passing #200 Sieve and Percent Shell are Determined in Accordance with ASTM-D6913. See NOTE 2.
NOTE 4: Shell and/or rock percentages were derived based on the percentage of shell and/or rock retained on the 1-inch, 3/8-inch, 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-)Top 10 feet of core retained for processing.

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-020

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

Notes:
- Photo Mosaic Image
- Photo Scale in Feet

ATHENA TECHNOLOGIES, INC.

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

DRILLING LOG

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
	10. SIZE AND TYPE OF BIT: 3 Sample Barrel		
2. HOLE NUMBER: **CLO-22-V-020** — LOCATION COORDINATES: N 327341.72 E 2740812.64	11. MANUFACTURER'S DESIGNATION OF DRILL: Athena Technologies Vibracore System		
3. DRILLING AGENCY: Athena Technologies	12. TOTAL SAMPLES	DISTURBED: 1	UNDISTURBED: 0
4. NAME OF DRILLER: Palmer McClellan	13. TOTAL NUMBER CORE BOXES		
5. DIRECTION OF BORING: ☒ VERTICAL ☐ INCLINED — DEG FROM VERTICAL: --- — BEARING:	14. ELEVATION GROUND WATER: See Remarks		
	15. DATE TIME GROUP OF BORING	STARTED: 6/28/22 @ 1655 hrs.	COMPLETED: 6/28/22 @ 1715 hrs.
6. THICKNESS OF OVERBURDEN	16. ELEVATION TOP OF BORING: 0.6' MLLW		
7. DEPTH DRILLED INTO ROCK: 0.0'	17. TOTAL CORE RECOVERY FOR BORING: 92%		
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
			0.0' TO 0.6' WATER		
	0.0		OCEAN BOTTOM AT 0.6' MLLW		
0.6					
-0.2			**SP**: Light brownish gray, poorly graded sand, fine to medium -grained, few fine to medium sand-sized shells, occasional fine gravel-sized shells, loose, subrounded.		
			SP: 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' Recovery 91.7%	2.0' **S-1**
	2.0				
	4.0				4.0' **S-2**
-4.6					
			SP: Gray, poorly graded sand, fine -grained, trace inorganic clay in occasional burrows, trace fine sand-sized shells, loose, subrounded.		
	6.0				6.0' **S-3**
	8.0				8.0' **S-4**
-8.4					
			SP: 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.		9.0' **S-5**
-9.4	10.0				
			BOTTOM OF BOREHOLE AT 10.0 ft		
			SOILS ARE FIELD VISUALLY CLASSIFIED IN ACCORDANCE WITH THE UNIFIED SOIL CLASSIFICATION SYSTEM		

REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g

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.

VIBRACORE BORING
From: 0.0' to 12.0'
Ran: 12.0' Rec: 11.0'

LAB CLASSIFICATION

Sample ID	Lab Class.	% Content Shell	% Content #200 Fines	% Content 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

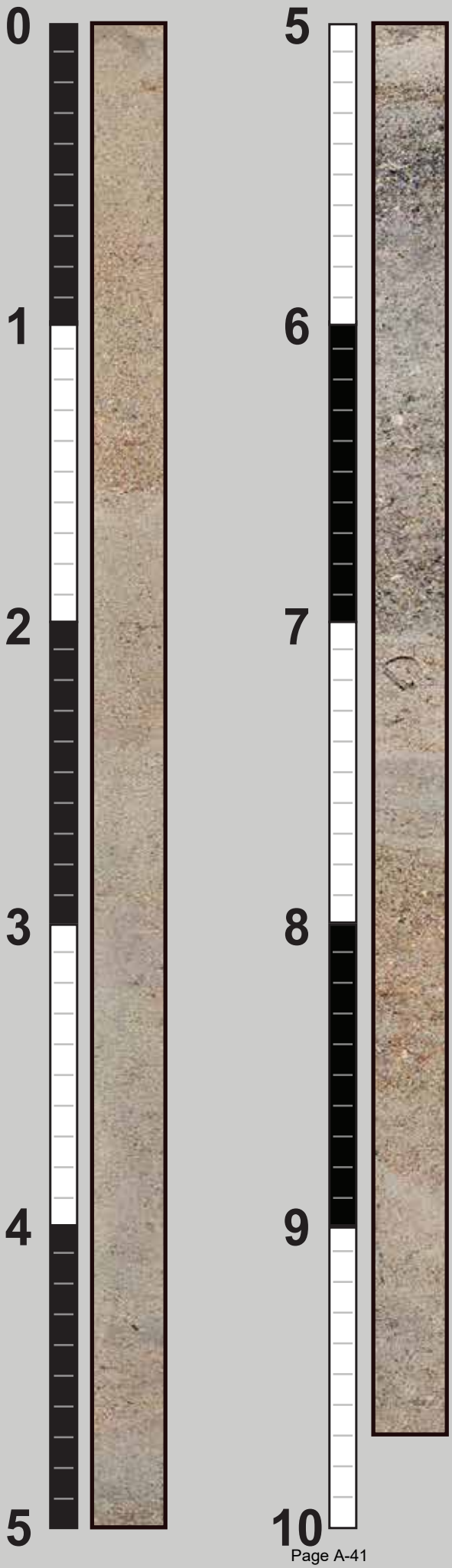
NOTE 3: Soils are Visually Lab Classified in Accordance with ASTM-D2487. Percent Passing #200 Sieve and Percent Shell are Determined in Accordance with ASTM-D6913. See NOTE 2.
NOTE 4: Shell and/or rock percentages were derived based on the percentage of shell and/or rock retained on the 1-inch, 3/8-inch, 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-)Top 10 feet of core retained for processing.

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-021

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

Notes:
- Photo Mosaic Image
- Photo Scale in Feet

ATHENA TECHNOLOGIES, INC.

Athena Technologies, Inc.
1293 Graham Farm Road
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DRILLING LOG

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
10. SIZE AND TYPE OF BIT	3 Sample Barrel
2. HOLE NUMBER	**CLO-22-V-021**
LOCATION COORDINATES	N 328338.33 E 2741211.56
11. MANUFACTURER'S DESIGNATION OF DRILL	Athena Technologies Vibracore System
3. DRILLING AGENCY	Athena Technologies
12. TOTAL SAMPLES	
DISTURBED	1
UNDISTURBED	0
4. NAME OF DRILLER	Palmer McClellan
13. TOTAL NUMBER CORE BOXES	
5. DIRECTION OF BORING	☒ VERTICAL ☐ INCLINED
DEG FROM VERTICAL	---
BEARING	
14. ELEVATION GROUND WATER	See Remarks
15. DATE TIME GROUP OF BORING	STARTED 6/28/22 @ 1627 hrs. COMPLETED 6/28/22 @ 1645 hrs.
6. THICKNESS OF OVERBURDEN	
16. ELEVATION TOP OF BORING	0.2' MLLW
7. DEPTH DRILLED INTO ROCK	0.0'
17. TOTAL CORE RECOVERY FOR BORING	97%
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
			0.0' TO 0.2' WATER		
			OCEAN BOTTOM AT 0.2' MLLW		
0.2	0.0		**SP**: 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.		1.0' **S-1**
-1.4				Core Run 10.0' Recovery 97.0%	
	2.0		**SP**: 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.		3.0' **S-2**
	4.0				
-5.1			**SP**: Gray, poorly graded sand, medium -grained, little fine sand to fine gravel-sized shells in matrix & in layers at top & at base, loose, subrounded.		6.0' **S-3**
	6.0				
-6.8			**SP**: Gray, poorly graded sand, fine -grained, trace fine to medium sand-sized shells, gravel-sized shell at top, loose, subrounded.		
-7.6					
	8.0		**SP**: Light brownish gray, poorly graded sand, fine to medium -grained, few fine sand to fine gravel-sized shells in matrix, loose, subrounded.		8.0' **S-4**
-8.4					
-9.5			**SP**: Gray, poorly graded sand, fine to medium -grained, trace fine to coarse sand-sized shells in matrix, occasional gravel-sized shell, loose, subrounded.		9.0' **S-5**
	10.0				

BOTTOM OF BOREHOLE AT 10.0 ft

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

REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g

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.

VIBRACORE BORING
From: 0.0' to 10.0'
Ran: 10.0' Rec: 9.7'

LAB CLASSIFICATION

Sample ID	Lab Class.	% Content 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.

Wilmington District Geotechnical Section

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

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

Hole No. CL-04-V-1

DRILLING LOG	DIVISION	INSTALLATION	SHEET
	SOUTH ATLANTIC	WILMINGTON DISTRICT	1 OF 2 SHEETS

1. PROJECT: CAPE LOOKOUT NATIONAL SEASHORE
2. LOCATION (Coordinates or Station): E 2744960.80 N 341662.97
3. DRILLING AGENCY: WILMINGTON DISTRICT
4. HOLE NO.: CL-04-V-1
5. NAME OF DRILLER: LESTER GAUGHF
6. DIRECTION OF HOLE: [X] VERTICAL [ ] INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: N/A (3.9' OF WATER)
8. DEPTH DRILLED INTO ROCK: 0.0'
9. TOTAL DEPTH OF HOLE: 23.9'
10. SIZE AND TYPE OF BIT: 4" DIA VIBRACORE
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): MLLW
12. MANUFACTURER'S DESIGNATION OF DRILL: SNELL
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 4; UNDISTURBED 0
14. TOTAL NUMBER CORE BOXES: N/A
15. ELEVATION GROUND WATER: N/A
16. DATE HOLE: STARTED 7/12/04; COMPLETED 7/12/04
17. ELEVATION TOP OF HOLE: 0.0' MLLW
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 3.9' WATER			Time begin vibracoring: 12:38 hrs. Soils described by Larry Benjamin, Civil Engr Tech.
-3.9	3.9		RIVER BOTTOM @3.9'		3.9'	NOTE: Scale changed @4.0'.
	4.0		SP Grayish tan, coarse, poorly graded sand.		1	
					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.
	6.0					VIBRACORE BORING: From 0.0' To 20.0' Ran 20.0' Rec 12.0'
	8.0				8.0'	
					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
					8.5'	
-9.9			9.9'		9.9'	
	10.0		MH Dark gray elastic silt, T/large shell fragments.		3	
					10.4'	
	12.0					LAB CLASSIFICATION: JAR NUMBER 1 — SP; JAR NUMBER 2 — SP
			13.6'		13.6'	
			SP-SM Gray, fine, poorly graded silty sand.		4	
	14.0				14.1'	
			15.9'			
	16.0		ASSUMED NOT RECOVERED			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-1

PROJECT: CAPE LOOKOUT NATIONAL SEASHORE | INSTALLATION: WILMINGTON DISTRICT | SHEET 2 OF 2 SHEETS

ELEVATION (NGVD) a	DEPTH (feet) 18.0	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) 0 20 40 g 60 80 100
			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			

Hole No. CL-04-V-2

DRILLING LOG	DIVISION	INSTALLATION	SHEET
	SOUTH ATLANTIC	WILMINGTON DISTRICT	1 OF 2 SHEETS

1. PROJECT: CAPE LOOKOUT NATIONAL SEASHORE
2. LOCATION (Coordinates or Station): E 2744687.17 N 343021.84
3. DRILLING AGENCY: WILMINGTON DISTRICT
4. HOLE NO.: CL-04-V-2
5. NAME OF DRILLER: LESTER GAUGHF
6. DIRECTION OF HOLE: [X] VERTICAL [ ] INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: N/A (4.7' OF WATER)
8. DEPTH DRILLED INTO ROCK: 0.0'
9. TOTAL DEPTH OF HOLE: 24.7'
10. SIZE AND TYPE OF BIT: 4" DIA VIBRACORE
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): MLLW
12. MANUFACTURER'S DESIGNATION OF DRILL: SNELL
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 4; UNDISTURBED 0
14. TOTAL NUMBER CORE BOXES: N/A
15. ELEVATION GROUND WATER: N/A
16. DATE HOLE: STARTED 7/12/04; COMPLETED 7/12/04
17. ELEVATION TOP OF HOLE: 0.0' MLLW
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. NOTE: Scale changed @4.0'.
	4.0					
-4.7	4.7		RIVER 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.
			SP Grayish tan, medium, poorly graded sand.		1	
	6.0				5.2'	
	8.0				8.7'	VIBRACORE BORING From 0.0' To 20.0' Ran 20.0' Rec 13.6' 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
					2	
					9.2'	
	10.0					
			11.7'		11.7'	
-11.7	12.0		MH Dark gray, elastic silt.		3	LAB CLASSIFICATION: JAR NUMBER 1 SP; 2 SP
					12.2'	
	14.0					
			16.1'		16.1'	NOTE: HOLE TERMINATED AT PREDETERMINED DEPTH AT 20.0'
	16.0		SP-SM Gray, fine, poorly graded silty sand, T/shell fragments.		4	
					16.6'	
-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-2

PROJECT
CAPE LOOKOUT NATIONAL SEASHORE

INSTALLATION
WILMINGTON DISTRICT

SHEET 2 OF 2 SHEETS

ELEVATION (NGVD) a	DEPTH (feet) 18.0	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) 0 20 40 g 60 80 100
	18.0		SP-SM CONT'D		DRIVE	
			18.3'			
			ASSUMED NOT RECOVERED			
	20.0					
	22.0					
	24.0					
-24.7	24.7		BOTTOM OF HOLE @24.7'			
			SOILS ARE FIELD VISUALLY CLASSIFIED IN ACCORDANCE WITH THE UNIFIED SOIL CLASSIFICATION SYSTEM			

Hole No. CL-04-V-2A

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: DISTURBED 3; UNDISTURBED 0
5. NAME OF DRILLER LESTER GAUGHF	14. TOTAL NUMBER CORE BOXES N/A
6. DIRECTION OF HOLE [X] VERTICAL [ ] 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 RECOVERY (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. Soils described by Larry Benjamin, Civil Engr Tech.
			RIVER BOTTOM @3.2'		3.2'	
-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'	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 9.0'
			7.2'		7.2'	
			MH Dark gray, elastic silt.		2	
	8.0		8.6'		7.7'	
			SP-SM Gray, fine, poorly graded, silty sand, T/shell fragments.		8.6'	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
	10.0				3	
					9.1'	
	12.0		12.2'			
12.2			ASSUMED NOT RECOVERED			LAB CLASSIFICATION: JAR NUMBER 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) 18.0	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) 0 20 40 g 60 80 100
			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			

Hole No. CL-04-V-3

DRILLING LOG	DIVISION SOUTH ATLANTIC	INSTALLATION WILMINGTON DISTRICT	SHEET 1 OF 2 SHEETS

1. PROJECT: CAPE LOOKOUT NATIONAL SEASHORE
2. E 2744490.2 N 343810
3. DRILLING AGENCY: WILMINGTON DISTRICT
4. HOLE NO.: CL-04-V-3
5. NAME OF DRILLER: LESTER GAUGHF
6. DIRECTION OF HOLE: [X] VERTICAL [ ] INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: N/A (4.4' OF WATER)
8. DEPTH DRILLED INTO ROCK: 0.0'
9. TOTAL DEPTH OF HOLE: 24.4'
10. SIZE AND TYPE OF BIT: 4" DIA VIBRACORE
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): MLLW
12. MANUFACTURER'S DESIGNATION OF DRILL: SNELL
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 3; UNDISTURBED 0
14. TOTAL NUMBER CORE BOXES: N/A
15. ELEVATION GROUND WATER: N/A
16. DATE HOLE: STARTED 7/12/04; COMPLETED 7/12/04
17. ELEVATION TOP OF HOLE: 0.0' MLLW
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 4.4' WATER			Time begin vibracoring: 1645 hrs. Soils described by Larry Benjamin, Civil Engr Tech. NOTE: Scale changed @4.0'.
	4.0					
-4.4	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.
			SP-SM Gray, fine, poorly graded sand.		1	
					4.9'	
	6.0					VIBRACORE BORING From 0.0' To 20.0' Ran 20.0' Rec 9.3'
	8.0				8.8'	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
					2	
	10.0				9.3'	
	12.0					LAB CLASSIFICATION JAR NUMBER 1 SP; 2 SP
					13.0'	
					3	
-13.7			13.7'		13.5'	
	14.0		ASSUMED NOT RECOVERED			
	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-3

PROJECT: CAPE LOOKOUT NATIONAL SEASHORE | INSTALLATION: WILMINGTON DISTRICT | SHEET 2 OF 2 SHEETS

ELEVATION (NGVD) a	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
	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			

Hole No. CL-04-V-4

DRILLING LOG	DIVISION	INSTALLATION	SHEET
	SOUTH ATLANTIC	WILMINGTON DISTRICT	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: [X] VERTICAL [ ] 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

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 3.4' WATER			Time begin vibracoring: 1626 hrs. Soils described by Larry Benjamin, Civil Engr Tech.
-3.4	3.4		RIVER BOTTOM @3.4'		3.4'	
			SP Gray, medium, poorly graded sand.		1	NOTE: Scale changed @4.0'.
	4.0				3.9'	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 11.4'
			7.3'		7.3'	
			SM Gray, fine, silty sand, with shell fragments.		2	
	8.0				7.8'	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
	10.0					
-10.9			10.9'		10.9'	
			SP-SM Grayish tan.		3	
	12.0				11.4'	LAB CLASSIFICATION: JAR NUMBER 1 SP; 2 SP
					13.9'	
	14.0				4	
			14.8'		14.4'	
			ASSUMED NOT RECOVERED			
	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-4

PROJECT: CAPE LOOKOUT NATIONAL SEASHORE | INSTALLATION: WILMINGTON DISTRICT | SHEET 2 OF 2 SHEETS

ELEVATION (NGVD) a	DEPTH (feet) 18.0	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) 0 20 40 60 80 100 g
			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			

Hole No. CL-04-V-5

DRILLING LOG	DIVISION SOUTH ATLANTIC	INSTALLATION WILMINGTON DISTRICT	SHEET 1 OF 2 SHEETS

1. PROJECT: CAPE LOOKOUT NATIONAL SEASHORE
2. E 2744007.0 N 346155
3. DRILLING AGENCY: WILMINGTON DISTRICT
4. HOLE NO.: CL-04-V-5
5. NAME OF DRILLER: LESTER GAUGHF
6. DIRECTION OF HOLE: [X] VERTICAL [ ] INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: N/A (3.8' OF WATER)
8. DEPTH DRILLED INTO ROCK: 0.0'
9. TOTAL DEPTH OF HOLE: 23.8'
10. SIZE AND TYPE OF BIT: 4" DIA VIBRACORE
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): MLLW
12. MANUFACTURER'S DESIGNATION OF DRILL: SNELL
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 4; UNDISTURBED 0
14. TOTAL NUMBER CORE BOXES: N/A
15. ELEVATION GROUND WATER: N/A
16. DATE HOLE: STARTED 7/12/04; COMPLETED 7/12/04
17. ELEVATION TOP OF HOLE: 0.0' MLLW
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 3.8' WATER			Time begin vibracoring: 1359 hrs. Soils described by Larry Benjamin, Civil Engr Tech.
-3.8	3.8		RIVER 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'		7.3'	
			SM Gray, fine, silty sand.		2	
	8.0				7.8'	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
	10.0					
	12.0		12.3'		12.3'	LAB CLASSIFICATION: JAR NUMBER 1 — SP; 2 — SP-SM
-12.3			SP-SM Grayish tan, medium, poorly graded, silty sand, T/shell fragments.		3	
	14.0				12.8'	
					15.4'	
			15.9'		4	NOTE: HOLE TERMINATED AT PREDETERMINED DEPTH AT 20.0'
	16.0		ASSUMED NOT RECOVERED		15.9'	
-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-5

PROJECT: CAPE LOOKOUT NATIONAL SEASHORE | INSTALLATION: WILMINGTON DISTRICT | SHEET 2 OF 2 SHEETS

ELEVATION (NGVD) a	DEPTH (feet) 18.0	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) 0 20 40 g 60 80 100
			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			

HOLE NO. CLO-05-V-1

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 (TBM or MSL): 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-BURDEN SAMPLES TAKEN: DISTURBED 6 / UNDISTURBED 0
5. NAME OF DRILLER: LESTER GAUGHF CRANE OPERATOR	14. TOTAL NUMBER CORE BOXES: N/A
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.	15. ELEVATION GROUND WATER: N/A
7. THICKNESS OF OVERBURDEN: N/A (4.7' 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: 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'	VIBRACORE BORING From 0.0' to 12.0' Ran 12.0' Rec: 9.8'
					6.5'	
	7.0				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.
					7.0'	
			8.1'		8.1'	
			MH Dark green elastic silt.		3	
			8.7'	8.7'	8.6'	
	9.0		SP Grayish tan, coarse, poorly graded sand w/shell fragments.		4	
					9.2'	NOTE: Soils Commercial lab classified in accordance with ASTM D2487.
			10.6' tan, no shell fragments			
	11.0				11.0'	LAB CLASSIFICATION
			11.9' w/shell fragments.		5	Jar Number / Classification: 1 SP; 2 SP; 3 ML; 4 SP
					11.5'	
	13.0					
					14.0'	
			14.5'		6	NOTE: HOLE TERMINATED AT VIBRACORE REFUSAL AT 12.0'
	15.0		ASSUMED NOT RECOVERED		14.5'	
-16.7	16.7		BOTTOM OF HOLE AT 16.7'			
			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. E2744698.75 N330669.10 (NAD 83)	11. DATUM FOR ELEVATION SHOWN (TBM or MSL): 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-2	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 6 / UNDISTURBED 0
5. NAME OF DRILLER: LESTER GAUGHF CRANE OPERATOR	14. TOTAL NUMBER CORE BOXES: N/A
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.	15. ELEVATION GROUND WATER: N/A
7. THICKNESS OF OVERBURDEN: N/A (5.1' 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: 16.1'	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 5.1' WATER			Time begin vibracoring: 1226 hrs. Soils described by Larry Benjamin, Civil Engr. Tech.
	5.0		TOP OF CHANNEL @ 5.1'		5.1'	
-5.1	5.1		SP Grayish tan, medium to coarse, poorly graded sand.		1	
					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				7.0'	
					2	
					7.5'	VIBRACORE BORING From 0.0' to 11.0' Ran 11.0' Rec: 9.5'
			8.0' w/shell fragments			
	9.0				9.0'	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.
					3	
					9.5'	
	11.0				11.0'	
					4	NOTE: Soils Commercial lab classified in accordance with ASTM D2487.
					11.5'	
	13.0				13.0'	LAB CLASSIFICATION
					5	Jar Number / Classification: 1 SP; 2 SP; 3 SP
					13.5'	
					14.1'	
			14.6'		6	
-14.6	14.6				14.6'	
	15.0		ASSUMED NOT RECOVERED			
-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 SHOWN (TBM or MSL): 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 5 / UNDISTURBED 0
5. NAME OF DRILLER: LESTER GAUGHF CRANE OPERATOR	14. TOTAL NUMBER CORE BOXES: N/A
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.	15. ELEVATION GROUND WATER: N/A
7. THICKNESS OF OVERBURDEN: N/A (3.0' 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: 15.0'	18. TOTAL CORE RECOVERY FOR BORING: N/A %
	19. SIGNATURE OF INSPECTOR: LARRY BENJAMIN & DIANE GREENE

ELEVATION MLW	DEPTH feet	LEGEND	CLASSIFICATION OF MATERIALS (Description)	% CORE RECOVERY	BOX OR SAMPLE NO.	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant)
	0		0.0' TO 3.0' WATER			Time begin vibracoring: 1308 hrs. Soils described by Larry Benjamin, Civil Engr. Tech.
			TOP OF CHANNEL @ 3.0'		3.0'	
-3.0	3.0		SP Tan, coarse, poorly sand, w/shell fragments.		1	
					3.5'	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				5.0'	
					2	
					5.5'	VIBRACORE BORING From 0.0' to 12.0' Ran 12.0' Rec: 9.0'
	7.0				7.0'	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.
					3	
					7.5'	
	9.0		9.0'		9.0'	
			grayish tan w/shell fragments		4	NOTE: Soils Commercial lab classified in accordance with ASTM D2487.
					9.5'	
	11.0				11.0'	LAB CLASSIFICATION
			11.5'		5	Jar Number / Classification: 1 SP; 2 SP; 3 SP; 4 SP
-11.5	11.5		ASSUMED NOT RECOVERED		11.5'	
	13.0					
-15.0	15.0		BOTTOM OF HOLE AT 15.0'			NOTE: HOLE TERMINATED AT VIBRACORE REFUSAL AT 12.0'
			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. E2745285.60 N329661.38 (NAD 83)	11. DATUM FOR ELEVATION SHOWN (TBM or MSL): 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-5	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 5 / UNDISTURBED 0
5. NAME OF DRILLER: LESTER GAUGHF CRANE OPERATOR	14. TOTAL NUMBER CORE BOXES: N/A
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.	15. ELEVATION GROUND WATER: N/A
7. THICKNESS OF OVERBURDEN: N/A (1.6' 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: 15.6'	18. TOTAL CORE RECOVERY FOR BORING: N/A %
	19. SIGNATURE OF INSPECTOR: LARRY BENJAMIN & DIANE GREENE

ELEVATION MLW	DEPTH feet	LEGEND	CLASSIFICATION OF MATERIALS (Description)	% CORE RECOVERY	BOX OR SAMPLE NO.	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant)
	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 / 2.1'	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				4.0' / 2 / 4.5'	VIBRACORE BORING From 0.0' to 14.00' Ran 14.0' Rec: 8.0'
			4.6' w/shell fragments			
	6.0				6.0' / 3 / 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.
	8.0				8.0' / 4 / 8.5' / 9.1' / 5	NOTE: Soils Commercial lab classified in accordance with ASTM D2487.
			9.6'			
	10.0		ASSUMED NOT RECOVERED		9.6'	LAB CLASSIFICATION Jar Number / Classification 1 SP 2 SP 3 SP 4 SP
	12.0					
	14.0					NOTE: HOLE TERMINATED AT VIBRACORE REFUSAL AT 14.0'
-15.6	15.6		BOTTOM OF HOLE AT 15.6'			
			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. E2745028.53 N328897.46 (NAD 83)	11. DATUM FOR ELEVATION SHOWN (TBM or MSL): 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-07	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 5 / UNDISTURBED 0
5. NAME OF DRILLER: LESTER GAUGHF CRANE OPERATOR	14. TOTAL NUMBER CORE BOXES: N/A
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.	15. ELEVATION GROUND WATER: N/A
7. THICKNESS OF OVERBURDEN: N/A (1.3' of Water)	16. DATE HOLE: STARTED 01/04/05 / COMPLETED 01/04/05
8. DEPTH DRILLED INTO ROCK: 0.0'	17. ELEVATION TOP OF HOLE: 0.0' MLW
9. TOTAL DEPTH OF HOLE: 14.3'	18. TOTAL CORE RECOVERY FOR BORING: N/A %
	19. SIGNATURE OF INSPECTOR: LARRY BENJAMIN & DIANE GREENE

ELEVATION MLW	DEPTH feet	LEGEND	CLASSIFICATION OF MATERIALS (Description)	% CORE RECOVERY	BOX OR SAMPLE NO.	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant)
	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'	
			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.
	2.0				1.8'	
					3.3'	VIBRACORE BORING
					2	From 0.0' to 13.0'
	4.0				3.8'	Ran 13.0' Rec: 8.0'
					5.0'	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.
					3	
	6.0				5.5'	
					7.0'	
					4	NOTE: Soils Commercial lab classified in accordance with ASTM D2487.
	8.0				7.5'	
					8.8'	LAB CLASSIFICATION
				9.3'	5	Jar Number / Classification: 1 SP; 2 SP; 3 SP; 4 SP
			ASSUMED NOT RECOVERED		9.3'	
	10.0					
	12.0					NOTE: HOLE TERMINATED AT VIBRACORE REFUSAL AT 13.0'
-14.3	14.3		BOTTOM OF HOLE AT 14.3'			
	15.0					
			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. E2754827.26 N328433.50 (NAD 83)	11. DATUM FOR ELEVATION SHOWN (TBM or MSL): 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: DISTURBED 5 / UNDISTURBED 0
5. NAME OF DRILLER: LESTER GAUGHF CRANE OPERATOR	14. TOTAL NUMBER CORE BOXES: N/A
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ 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	CLASSIFICATION OF MATERIALS (Description)	% CORE RECOVERY	BOX OR SAMPLE NO.	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant)
	0		0.0' TO 2.4' WATER			Time begin vibracoring: 1434 hrs. Soils described by Larry Benjamin, Civil Engr. Tech.
	2.0		TOP OF CHANNEL @ 2.4'		2.4'	
-2.4	2.4		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.
					2.9'	
	4.0				4.4'	VIBRACORE BORING From 0.0' to 15.5' Ran 15.5' Rec: 8.8'
					2	
					4.9'	
	6.0		6.4' grayish tan		6.4'	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.
					3	
					6.9'	
	8.0		8.2' tan		8.2'	NOTE: Soils Commercial lab classified in accordance with ASTM D2487.
					4	
					8.6'	
	10.0				10.0'	LAB CLASSIFICATION: Jar Number 1 SP; 2 SP; 3 SP; 4 SP
					5	
					10.5'	
-11.2	11.2		11.2' ASSUMED NOT RECOVERED			
	12.0					
	14.0					
	16.0					NOTE: HOLE TERMINATED AT VIBRACORE REFUSAL AT 15.5'
-17.9	17.9		BOTTOM OF HOLE AT 17.9' 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. E2746153.11 N331945.31 (NAD 83)	11. DATUM FOR ELEVATION SHOWN (TBM or MSL): 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 5 — UNDISTURBED 0
5. NAME OF DRILLER: LESTER GAUGHF — CRANE OPERATOR	14. TOTAL NUMBER CORE BOXES: N/A
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.	15. ELEVATION GROUND WATER: N/A
7. THICKNESS OF OVERBURDEN: N/A (0.0' 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: 14.1'	18. TOTAL CORE RECOVERY FOR BORING: N/A %
	19. SIGNATURE OF INSPECTOR: LARRY BENJAMIN & DIANE GREENE

ELEVATION MLW	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'		SP-SM Grayish tan, fine, poorly silty sand.		1	Time begin vibracoring: 1339 hrs. Soils described by Larry Benjamin, Civil Engr. Tech.
					0.5'	
	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.
					2	
					3.5'	
	4.0					
					5.0'	VIBRACORE BORING From 0.0' to 15.0' Ran 15.0' Rec: 11.2'
					3	
					5.5'	
	6.0					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.
			7.5' coarse-grain sizes		7.5'	
					4	
	8.0				8.0'	NOTE: Soils Commercial lab classified in accordance with ASTM D2487.
					9.8'	LAB CLASSIFICATION: Jar Number 1 SP; 2 SP; 3 SP; 4 SP
	10.0		10.3'		5	
-11.3	11.3		ASSUMED NOT RECOVERED		10.3'	
	12.0					
	14.0					
-14.1	14.1		BOTTOM OF HOLE AT 14.1'			NOTE: HOLE TERMINATED AT VIBRACORE REFUSAL AT 15.0'

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. E2746649.66 N332770.64 (NAD 83)	11. DATUM FOR ELEVATION SHOWN (TBM or MSL): 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: ☒ VERTICAL ☐ 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		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	0.5		SP Grayish tan, fine to medium poorly graded sand.		1	
					1.0'	
	2.0				2.0'	
					2	
					2.5'	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				4.0'	
					3	
					4.5'	
			5.0'		5.0'	VIBRACORE BORING From 0.0' to 15.5' Ran 15.5' Rec: 11.5'
			SP-SM Grayish tan, fine poorly graded silty sand.		4	
	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.
			7.7'		7.7'	
	8.0		SP Grayish tan, coarse, poorly graded sand.		5	
					8.2'	NOTE: Soils Commercial lab classified in accordance with ASTM D2487.
	10.0				10.0'	LAB CLASSIFICATION Jar Number — Classification 1 SP 2 SP 3 4 SP 5 SP
					6	
					10.5'	
					11.5'	
			12.0'		7	
	12.0		ASSUMED NOT RECOVERED		12.0'	
	14.0					
-15.5	15.5		BOTTOM OF HOLE AT 15.5'			NOTE: HOLE TERMINATED AT VIBRACORE REFUSAL AT 15.5'
	17.0		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. E2746664.31 N334306.05 (NAD 83)	11. DATUM FOR ELEVATION SHOWN (TBM or MSL): 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: DISTURBED 3 / UNDISTURBED 0
5. NAME OF DRILLER: LESTER GAUGHF — CRANE OPERATOR	14. TOTAL NUMBER CORE BOXES: N/A
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ 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.
			TOP OF CHANNEL @ 1.3'		1.3'	
-1.3	1.3		SP Grayish tan, coarse, poorly graded sand.		1	
	2.0				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.
	4.0				4.0'	
					2	VIBRACORE BORING From 0.0' to 12.0' Ran 12.0' Rec: 5.0'
					4.5'	
	6.0				6.0'	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.
					3	
			7.3'		6.5'	
			ASSUMED NOT RECOVERED			
	8.0					NOTE: Soils Commercial lab classified in accordance with ASTM D2487.
	10.0					LAB CLASSIFICATION
						Jar Number / Classification: 1 SP; 2 SP; 3 SP
	12.0					
-13.3	13.3		BOTTOM OF HOLE AT 13.3'			
			SOILS ARE FIELD VISUALLY CLASSIFIED IN ACCORDANCE WITH THE UNIFIED SOIL CLASSIFICATION SYSTEM			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 (TBM or MSL): <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 5; UNDISTURBED
5. NAME OF DRILLER: LESTER GAUGHF CRANE OPERATOR	14. TOTAL NUMBER CORE BOXES: N/A
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.	15. ELEVATION GROUND WATER: N/A
7. THICKNESS OF OVERBURDEN: N/A (0.0' 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: 10.4'	18. TOTAL CORE RECOVERY FOR BORING: N/A %
	19. SIGNATURE OF INSPECTOR: LARRY BENJAMIN & DIANE GREENE 0

ELEVATION MLW	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'				0.0'	
			SP Grayish tan, coarse, poorly graded sand, T/shell fragments.		1	Time begin vibracoring: 1133 hrs. Soils described by Larry Benjamin, Civil Engr. Tech.
					0.5'	
	2.0				2.0'	
					2	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.
					2.5'	
	4.0				4.0'	
					3	VIBRACORE BORING From 0.0' to 11.0' Ran 11.0' Rec: 8.2' 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.
					4.5'	
			5.0'		5.0'	
			SM Gray, fine, silty sand.		4	
	6.0				5.5'	
					7.0'	
-7.6	7.6		7.6'		5	
			ASSUMED NOT RECOVERED		7.5'	NOTE: Soils Commercial lab classified in accordance with ASTM D2487.
	8.0					
	10.0					LAB CLASSIFICATION: Jar Number 1 — SP; 2 — SP; 4 — SP; 5 — SP-SM
-10.4	10.4		BOTTOM OF HOLE AT 10.4'			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>
2. LOCATION (Coordinates or Station): NC Coord. E2742049.69 N325312.46 (NAD 83)
3. DRILLING AGENCY: WILMINGTON DISTRICT
4. HOLE NO. (As shown on drawing title and file number): CLO-05-V-15
5. NAME OF DRILLER: LESTER GAUGHF CRANE OPERATOR
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: N/A (2.8' of Water)
8. DEPTH DRILLED INTO ROCK: 0.0'
9. TOTAL DEPTH OF HOLE: 14.8'
10. SIZE AND TYPE OF BIT: 4" Dia. Vibracore
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): MLW
12. MANUFACTURER'S DESIGNATION OF DRILL: VIBRA CORE SNELL
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 4; UNDISTURBED 0
14. TOTAL NUMBER CORE BOXES: N/A
15. ELEVATION GROUND WATER: N/A
16. DATE HOLE: STARTED 01/03/05; COMPLETED 01/03/05
17. ELEVATION TOP OF HOLE: 0.0' MLW
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.
			TOP OF CHANNEL @ 2.8'		2.8'	
-2.8	2.8		SP Tan, coarse, poorly graded sand.		1	
	3.0				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.
	5.0				4.8'	
					2	
					5.3'	VIBRACORE BORING From 0.0' to 12.0' Ran 12.0' Rec: 10.0'
					6.8'	
	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.
			7.8'		7.3' 7.8'	
			SP-SM Grayish tan, fine, poorly graded silty sand, w/shell fragments.		4	
					8.3' 8.8'	
	9.0		SP Tan, coarse, poorly graded sand.		5	
					9.3'	NOTE: Soils Commercial lab classified in accordance with ASTM D2487.
					10.8'	LAB CLASSIFICATION
	11.0				6	Jar Number / Classification: 1 SP; 3 SP; 4 SP; 5 SP
					11.3'	
					12.3'	
			12.8'		7	
	13.0		ASSUMED NOT RECOVERED		12.8'	
						NOTE: HOLE TERMINATED AT VIBRACORE REFUSAL AT 12.0'
-14.8	14.8		BOTTOM OF HOLE AT 14.8'			
			SOILS ARE FIELD VISUALLY CLASSIFIED IN ACCORDANCE WITH THE UNIFIED SOIL CLASSIFICATION SYSTEM			

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-05-01
	DRILLER: Tom Landis		
NORTHING: 332198	EASTING: 2745258	CREW: Ben Ashba	ELEV.: -3.1ft.
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: 15:10	SURF. WATER DEPTH: 3.8

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

COMMENTS:
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 - C:\DOCUMENTS AND SETTINGS\BEN ASHBA\MY DOCUMENTS\HARKERS ISLAND\GPJ\ CATLIN.GDT 12/30/05

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 DRILLER: Tom Landis	BORING ID. CLOBA-05-02
NORTHING: 332486	EASTING: 2745819	CREW: Ben Ashba	ELEV.: -3.6ft.
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.)	

COMMENTS:
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

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
	DRILLER: Tom Landis		
NORTHING: 333033	EASTING: 2745738	CREW: Ben Ashba	ELEV.: -0.6ft.
SYSTEM: NCSP NAD 83 (USft)	BORING LOCATION: Channel in Back Sound - Borrow Area A		DEPTH: 5.4ft.
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: 09:45	SURF. WATER DEPTH: 3.1

DEPTH	ELEV	ENV. SAMP. ELEV.	ENV. SAMP. ID.	GEOTECH SAMPLE	USCS	LOG	SEDIMENT DESCRIPTION	DEPTH	ELEVATION
								0.0	-0.6
0.0	-0.6						SEDIMENT SURFACE		
				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	-6.0
							Boring Terminated at Elevation -6.0 ft (M.L.W.)		

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 - 205-HARKERS ISLAND.GPJ CATLIN.GDT 12/30/05

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
	DRILLER: Tom Landis		
NORTHING: 333047	EASTING: 2746104	CREW: Ben Ashba	ELEV.: -0.1ft.
SYSTEM: NCSP NAD 83 (USft)	BORING LOCATION: Channel in Back Sound - Borrow Area A		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	USCS	LOG	DEPTH	SEDIMENT DESCRIPTION	ELEVATION
							0.0	SEDIMENT SURFACE	-0.1
0.0	-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.)	

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

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	DRILLER: Tom Landis	BORING ID. CLOBA-05-05
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						3.2		-3.6
				05-B	SP			Olive gray, f. SAND w/few shell fragments.	
4.6	-5.0						4.6		-5.0
								Boring Terminated at Elevation -5.3 ft (M.L.W.)	

COMMENTS:
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

Grain Tables and Curves Data

Granularmetric Report

Depths and elevations based on measured values

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

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

Easting (ft):	Northing (ft):	Coordinate System:	Elevation (ft):
2,743,461	348,622	NC State Plane, Zone 3200	-4.8 MLLW

USCS:	Munsell:	Comments:
SP	Moist - 2.5Y-5/2	Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

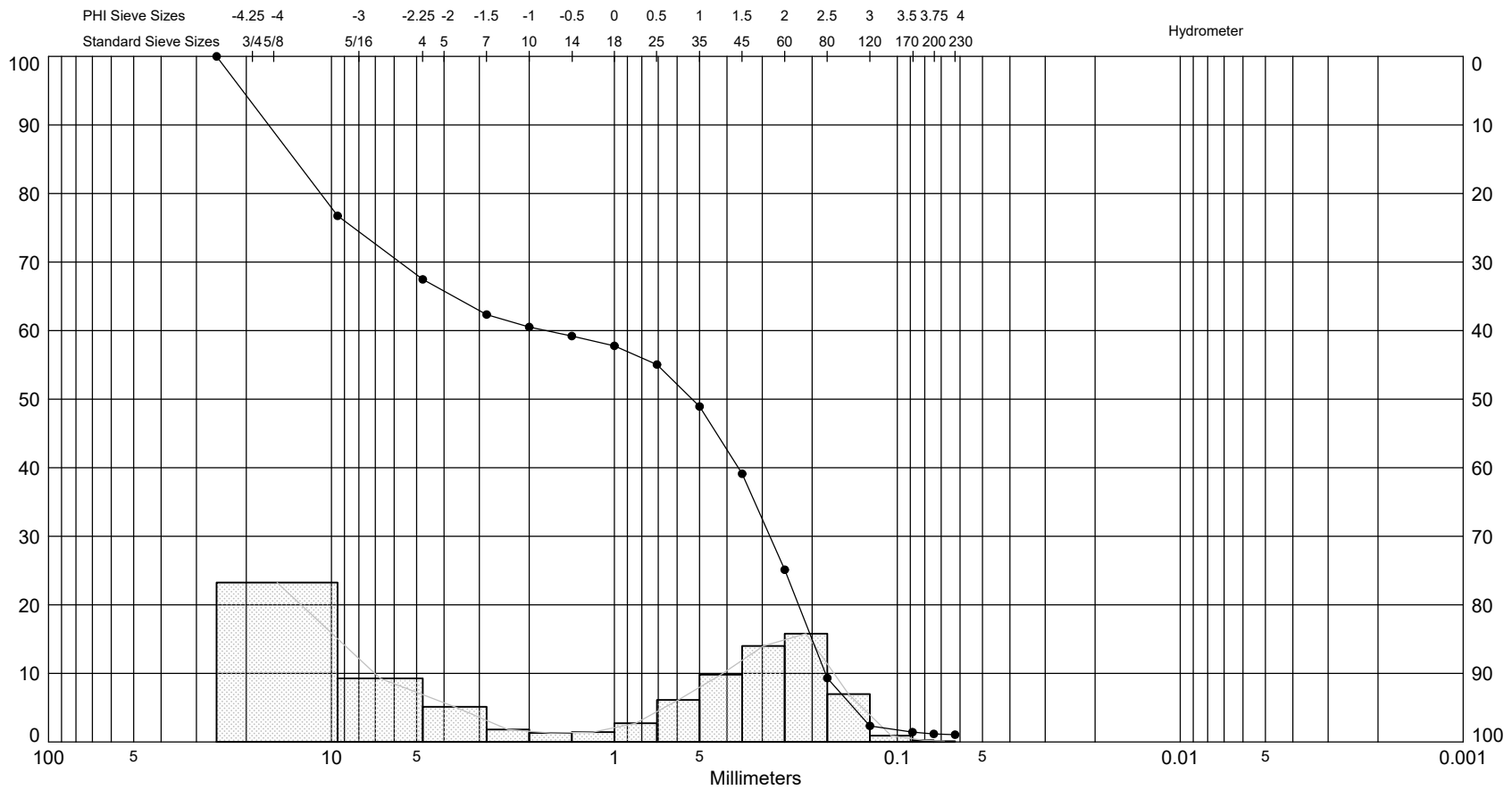
Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shells (%):
211.34	209.12			#200 - 1.17 #230 - 1.06			

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

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

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



Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort
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

Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

Depths and elevations based on measured values

Sample Information	
Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Analysis Date:	07-29-22
Analyzed By:	CRM
Easting (X, ft):	2,743,461
Northing (Y, ft):	348,622
Horizontal System:	NAD 1983
Vertical System:	MLLW

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

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

Granularmetric Report

Depths and elevations based on measured values

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

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

Easting (ft):	Northing (ft):	Coordinate System:	Elevation (ft):
2,743,461	348,622	NC State Plane, Zone 3200	-6.3 MLLW

USCS:	Munsell:	Comments:
SP-SM	Moist - 2.5Y-4/2	Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

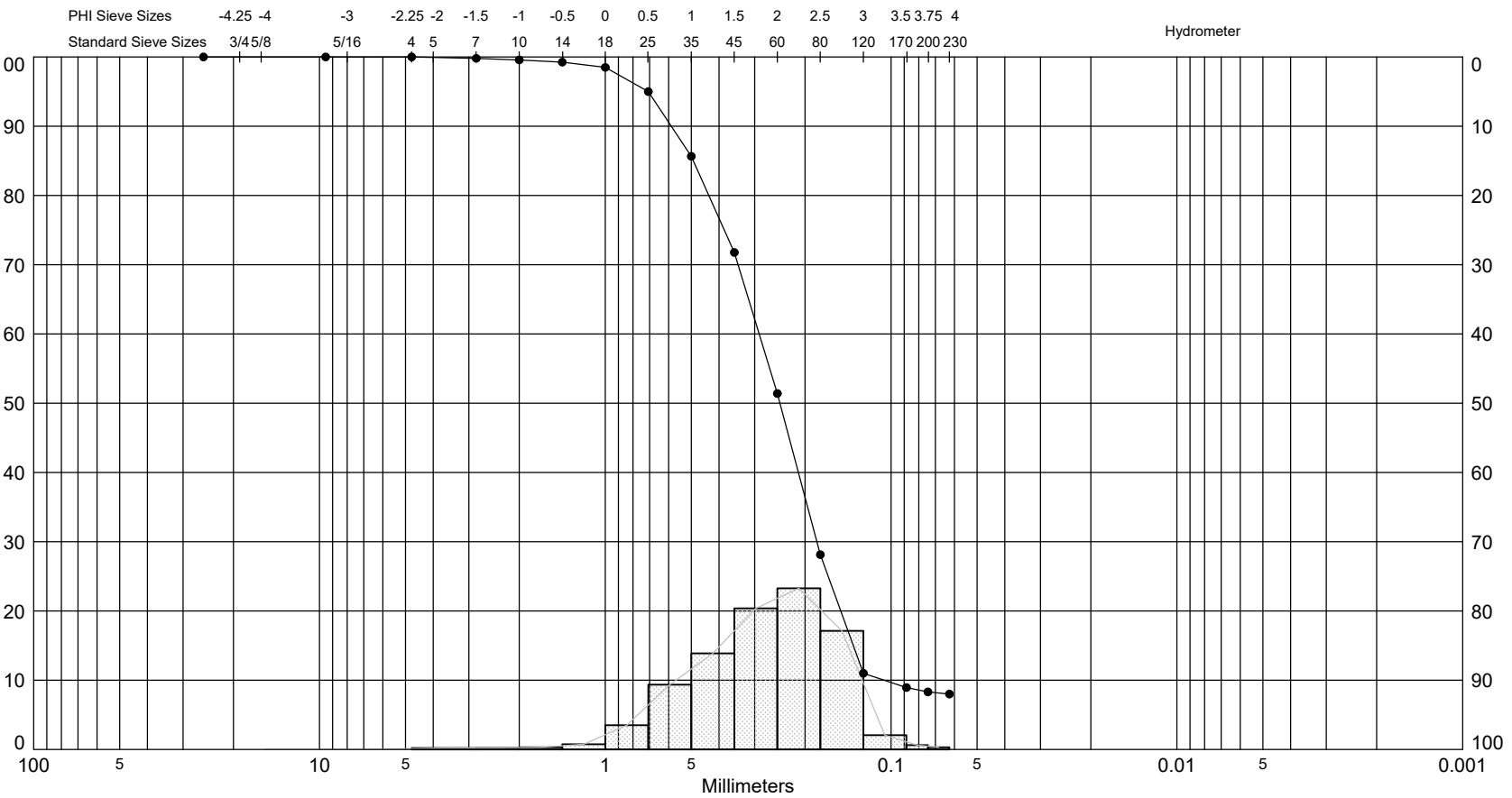
Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shells (%):
176.43	162.32			#200 - 8.31 #230 - 8.00			

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

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
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

Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

Depths and elevations based on measured values

Sample Information	
Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Analysis Date:	07-29-22
Analyzed By:	CRM
Easting (X, ft):	2,743,461
Northing (Y, ft):	348,622
Horizontal System:	NAD 1983
Vertical System:	MLLW

ATHENA TECHNOLOGIES, INC.

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

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

Granularmetric Report

Depths and elevations based on measured values

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

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

Easting (ft):	Northing (ft):	Coordinate System:	Elevation (ft):
2,743,461	348,622	NC State Plane, Zone 3200	-8.3 MLLW

USCS:	Munsell:	Comments:
SM	Moist - 2.5Y-2.5/1	Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

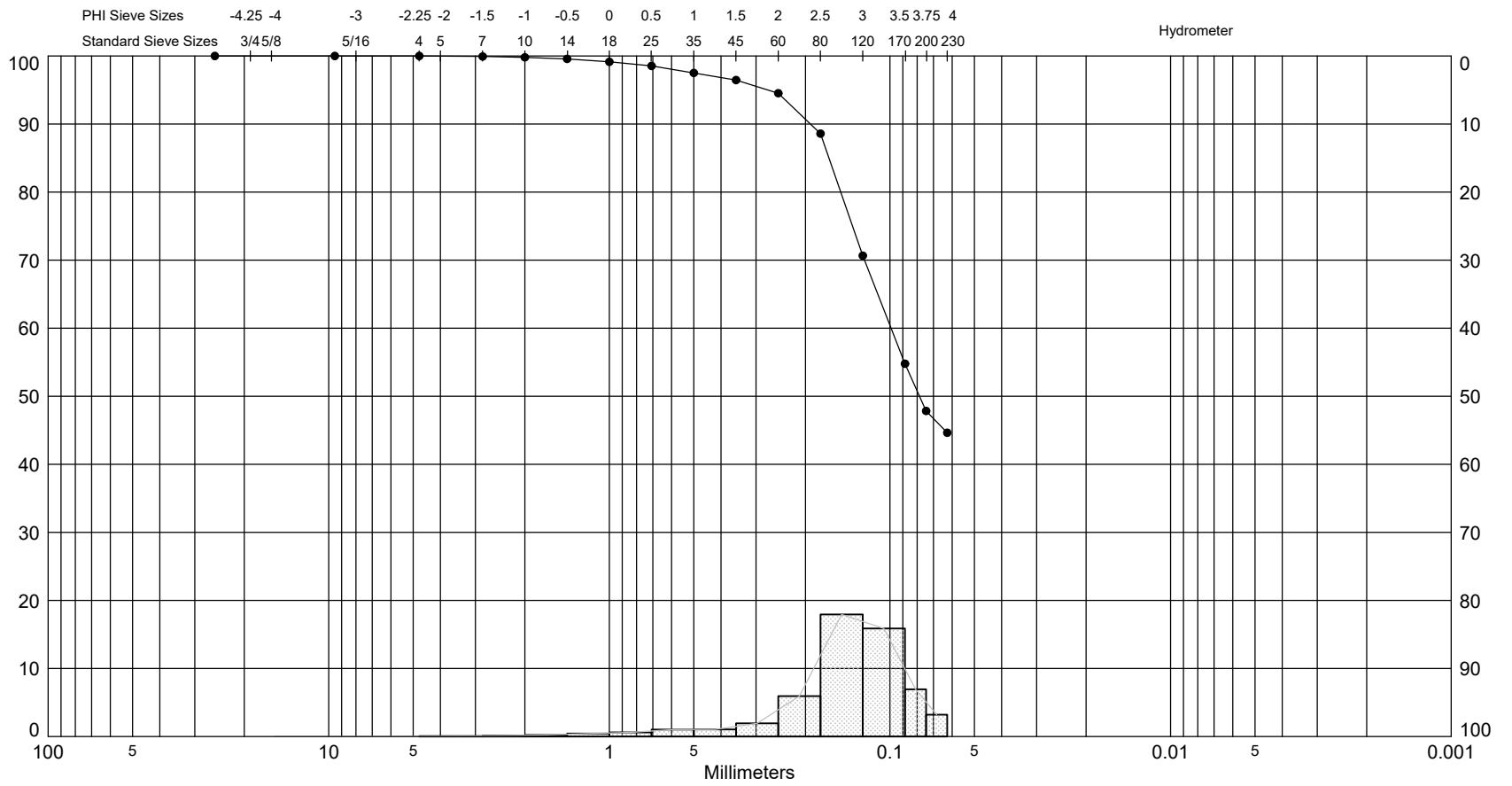
Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shells (%):
128.03	70.91			#200 - 47.84 #230 - 44.64			

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



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort
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

Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

Depths and elevations based on measured values

Sample Information	
Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Analysis Date:	07-29-22
Analyzed By:	CRM
Easting (X, ft):	2,743,461
Northing (Y, ft):	348,622
Horizontal System:	NAD 1983
Vertical System:	MLLW

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

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

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):	Northing (ft):	Coordinate System:	Elevation (ft):
2,743,461	348,622	NC State Plane, Zone 3200	-9.7 MLLW

USCS:	Munsell:	Comments:
MH	Moist - 2.5Y-4/1	Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

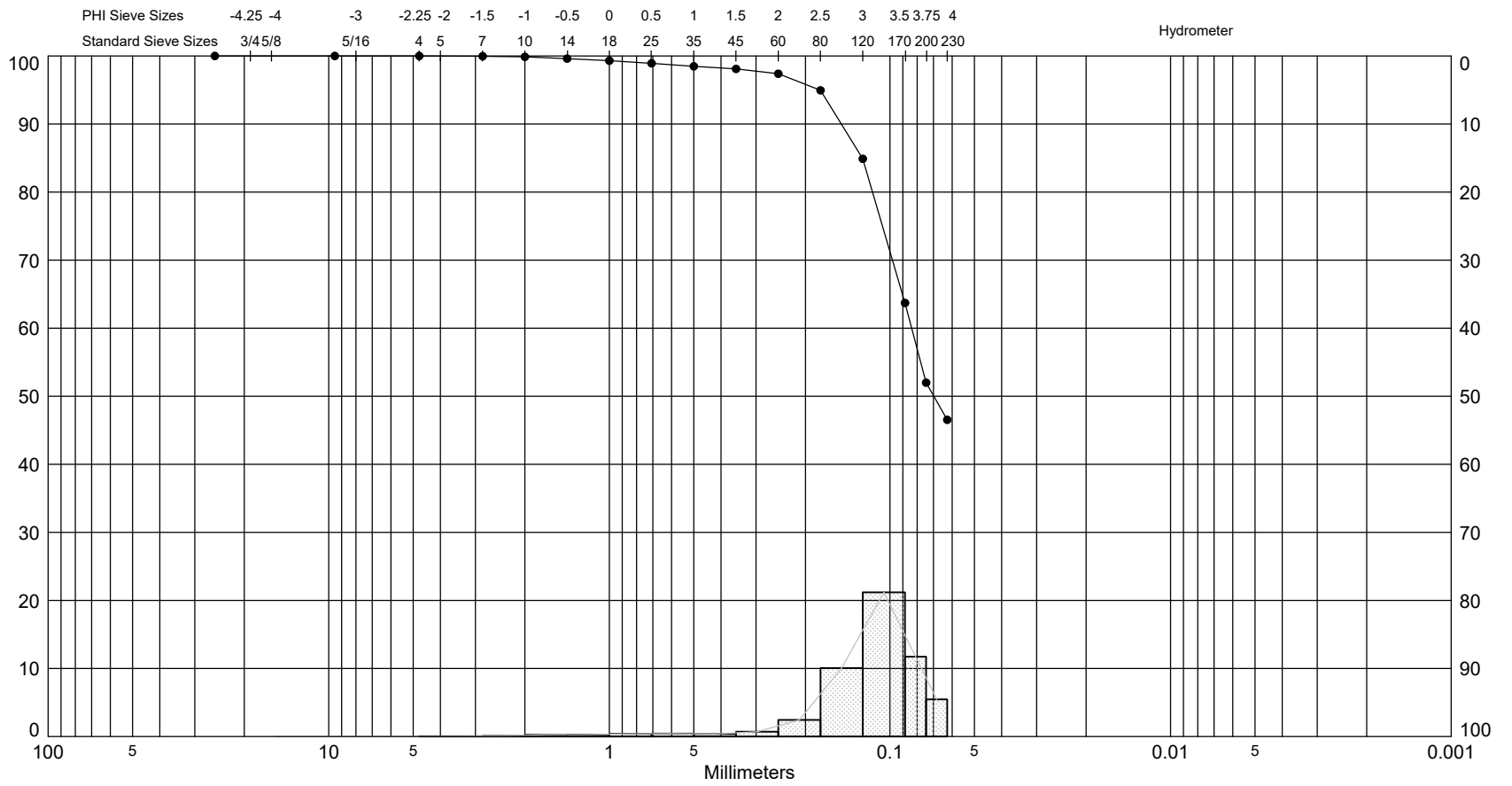
Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shells (%):
137.84	73.68			#200 - 51.99 #230 - 46.54			

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

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



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort
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

Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

Depths and elevations based on measured values

Sample Information	
Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Analysis Date:	07-29-22
Analyzed By:	CRM
Easting (X, ft):	2,743,461
Northing (Y, ft):	348,622
Horizontal System:	NAD 1983
Vertical System:	MLLW

Athena Technologies, Inc.
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McClellanville, SC 29458
Office: 843-887-3800

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

Granularmetric Report

Depths and elevations based on measured values

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

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

Easting (ft):	Northing (ft):	Coordinate System:	Elevation (ft):
2,743,677	347,647	NC State Plane, Zone 3200	-7.1 MLLW

USCS:	Munsell:	Comments:
SP	Moist - 5Y-5/2	Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

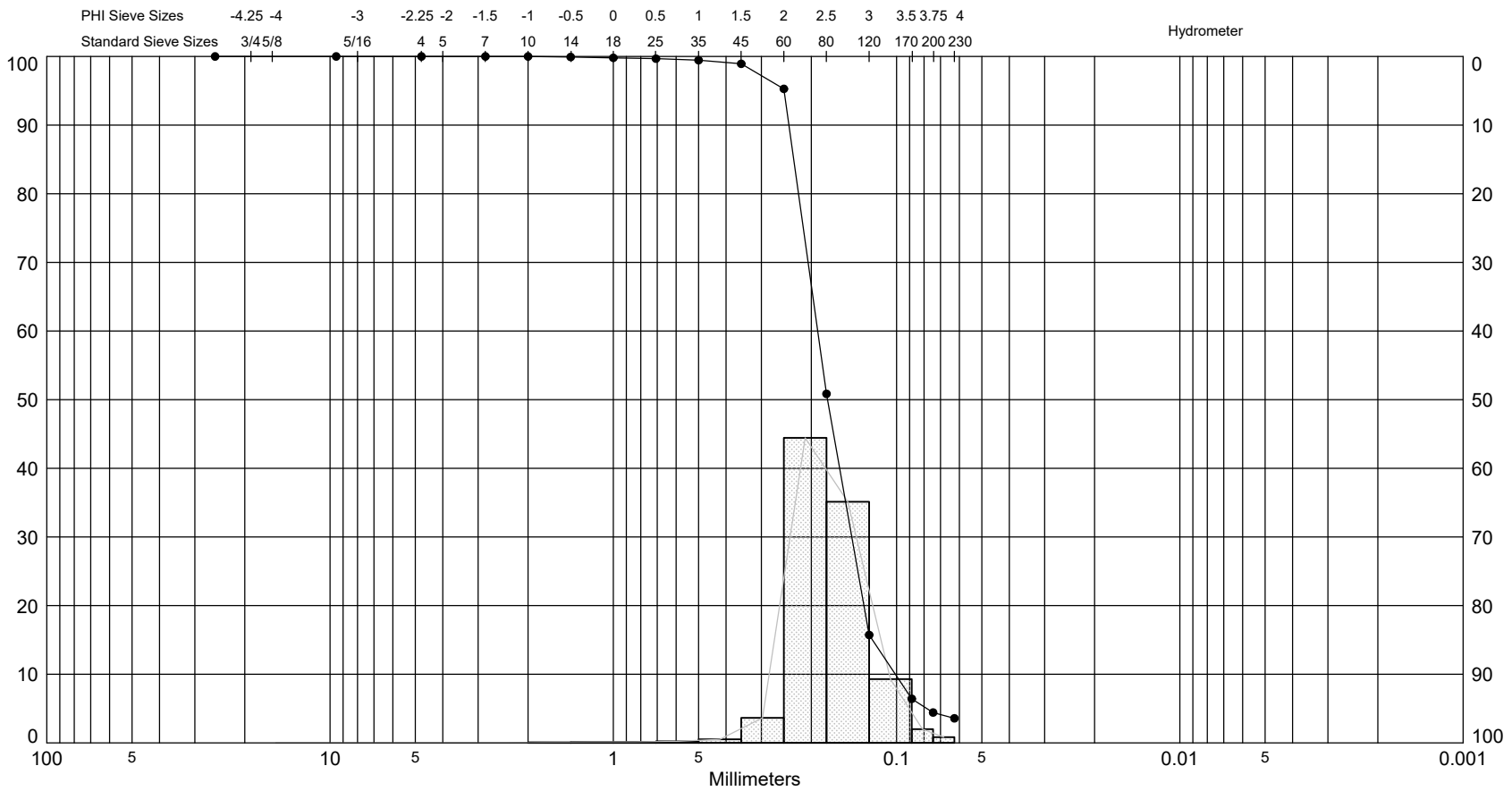
Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shells (%):
141.76	136.68			#200 - 4.42 #230 - 3.58			

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

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



Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort
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

Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

Depths and elevations based on measured values

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

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

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-2			
Analysis Date: 07-29-22			
Analyzed By: CRM			
Easting (ft): 2,743,677	Northing (ft): 347,647	Coordinate System: NC State Plane, Zone 3200	Elevation (ft): -9.1 MLLW
USCS: SP	Munsell: Moist - 5Y-4/1	Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL	

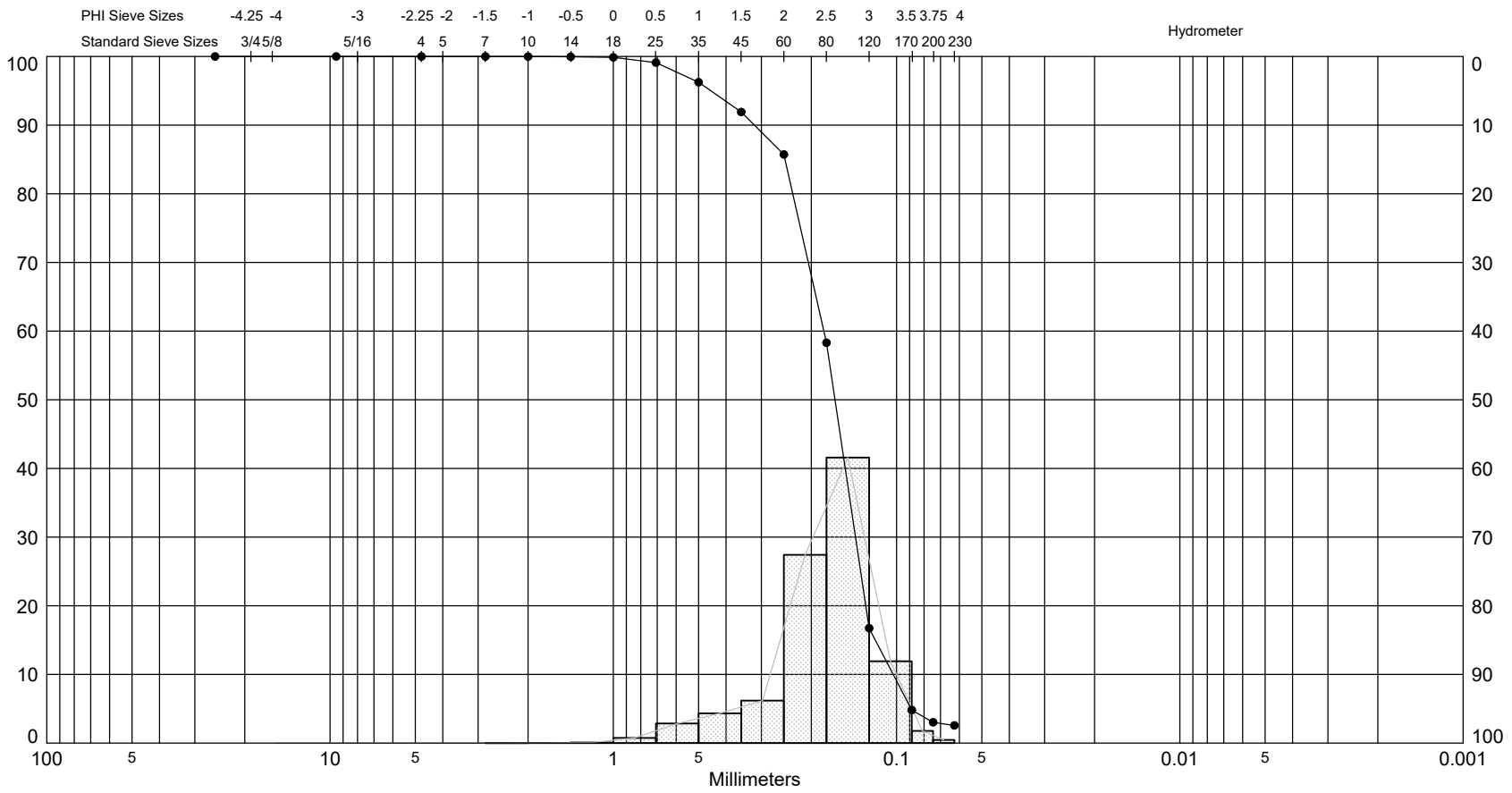
Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shells (%):
141.81	138.19			#200 - 3.03 #230 - 2.57			

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

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

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



Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort
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

Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

Depths and elevations based on measured values

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

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

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

Granularmetric Report

Depths and elevations based on measured values

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

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

Easting (ft):	Northing (ft):	Coordinate System:	Elevation (ft):
2,743,677	347,647	NC State Plane, Zone 3200	-10.5 MLLW

USCS:	Munsell:	Comments:
SP-SM	Moist - 2.5Y-5/2	Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

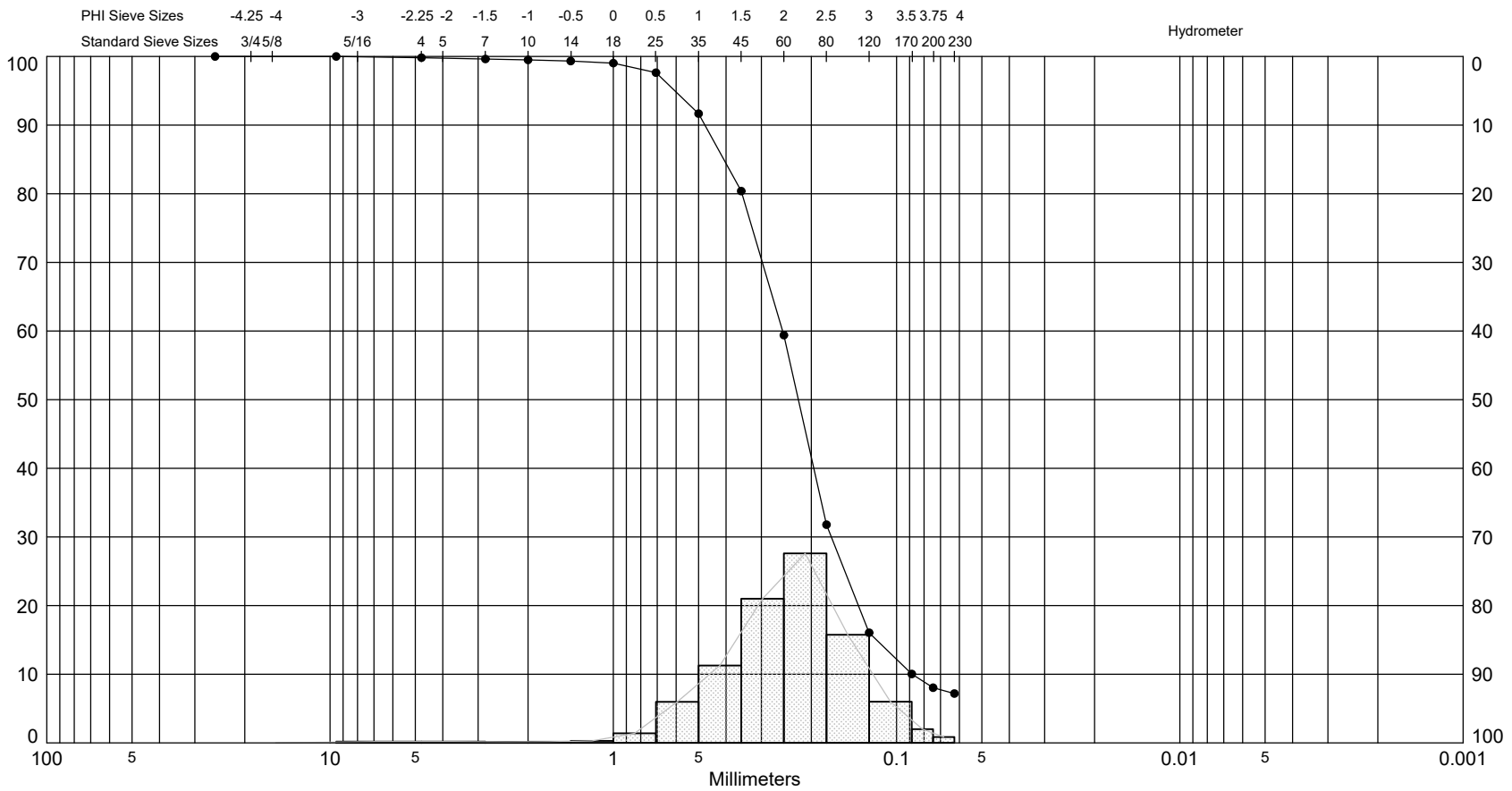
Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shells (%):
142.76	132.47			#200 - 8.04 #230 - 7.19			

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

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
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

Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

Depths and elevations based on measured values

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

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

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

Granularmetric Report

Depths and elevations based on measured values

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

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

Easting (ft):	Northing (ft):	Coordinate System:	Elevation (ft):
2,743,892	346,671	NC State Plane, Zone 3200	-4.7 MLLW

USCS:	Munsell:	Comments:
SP	Moist - 5Y-6/2	Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

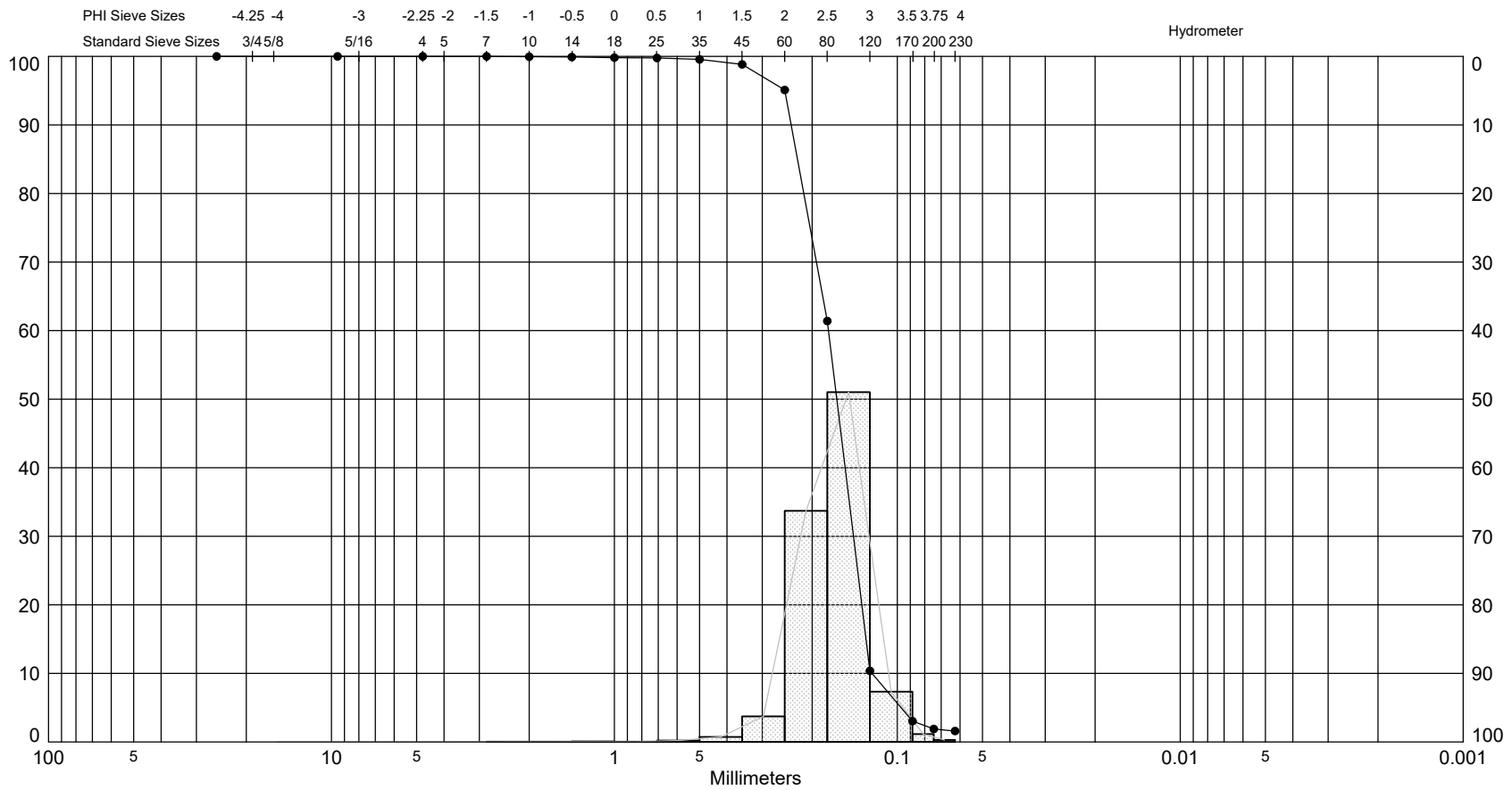
Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shells (%):
144.34	142.03			#200 - 1.89 #230 - 1.59			

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

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



Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort
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

Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

Depths and elevations based on measured values

Sample Information	
Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Analysis Date:	07-29-22
Analyzed By:	CRM
Easting (X, ft):	2,743,892
Northing (Y, ft):	346,671
Horizontal System:	NAD 1983
Vertical System:	MLLW

ATHENA TECHNOLOGIES, INC.

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

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

Granularmetric Report

Depths and elevations based on measured values

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

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

Easting (ft):	Northing (ft):	Coordinate System:	Elevation (ft):
2,743,892	346,671	NC State Plane, Zone 3200	-5.9 MLLW

USCS:	Munsell:	Comments:
SM	Moist - 2.5Y-4/1	Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

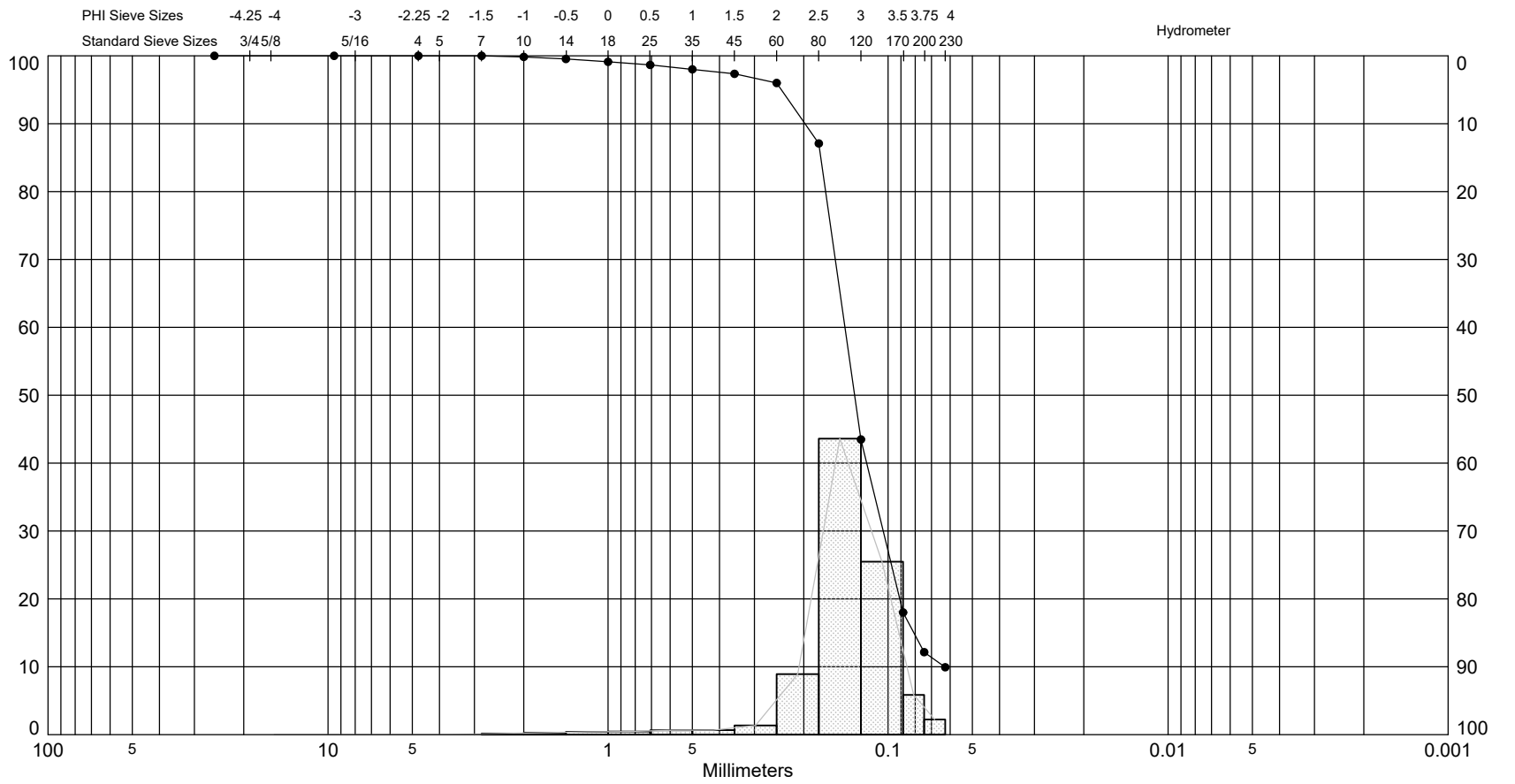
Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shells (%):
131.54	118.48			#200 - 12.15 #230 - 9.93			

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

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



Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort
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

Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

Depths and elevations based on measured values

Sample Information	
Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Analysis Date:	07-29-22
Analyzed By:	CRM
Easting (X, ft):	2,743,892
Northing (Y, ft):	346,671
Horizontal System:	NAD 1983
Vertical System:	MLLW

ATHENA TECHNOLOGIES, INC.

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

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

Granularmetric Report

Depths and elevations based on measured values

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

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

Easting (ft):	Northing (ft):	Coordinate System:	Elevation (ft):
2,743,892	346,671	NC State Plane, Zone 3200	-8.2 MLLW

USCS:	Munsell:	Comments:
SP	Moist - 5Y-5/2	Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

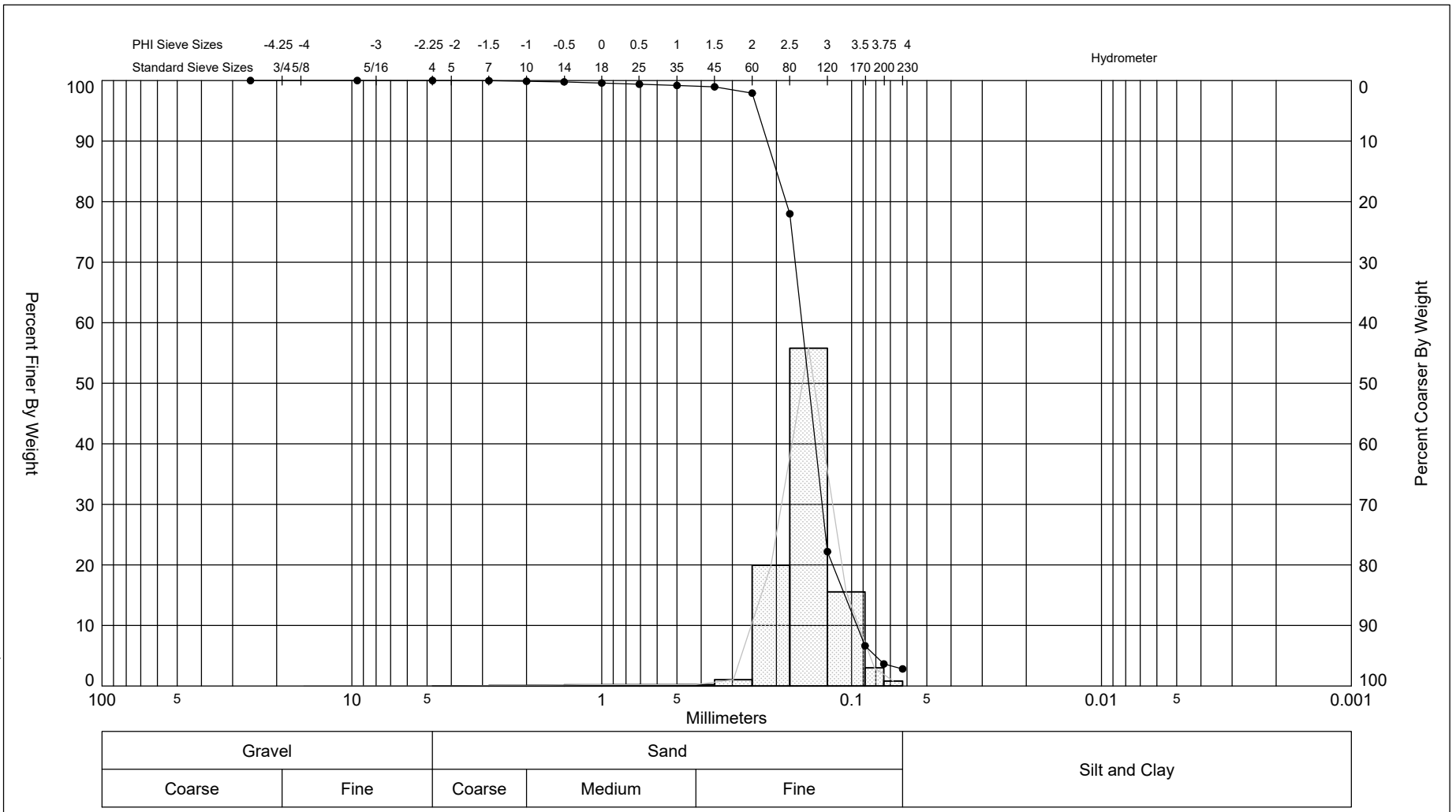
Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shells (%):
153.79	149.45			#200 - 3.64 #230 - 2.82			

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

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



Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort
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

Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

Depths and elevations based on measured values

Sample Information	
Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Analysis Date:	07-29-22
Analyzed By:	CRM
Easting (X, ft):	2,743,892
Northing (Y, ft):	346,671
Horizontal System:	NAD 1983
Vertical System:	MLLW

ATHENA TECHNOLOGIES, INC.

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

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

Granularmetric Report

Depths and elevations based on measured values

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

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

Easting (ft):	Northing (ft):	Coordinate System:	Elevation (ft):
2,743,892	346,671	NC State Plane, Zone 3200	-10.1 MLLW

USCS:	Munsell:	Comments:
SM	Moist - 5Y-4/1	Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

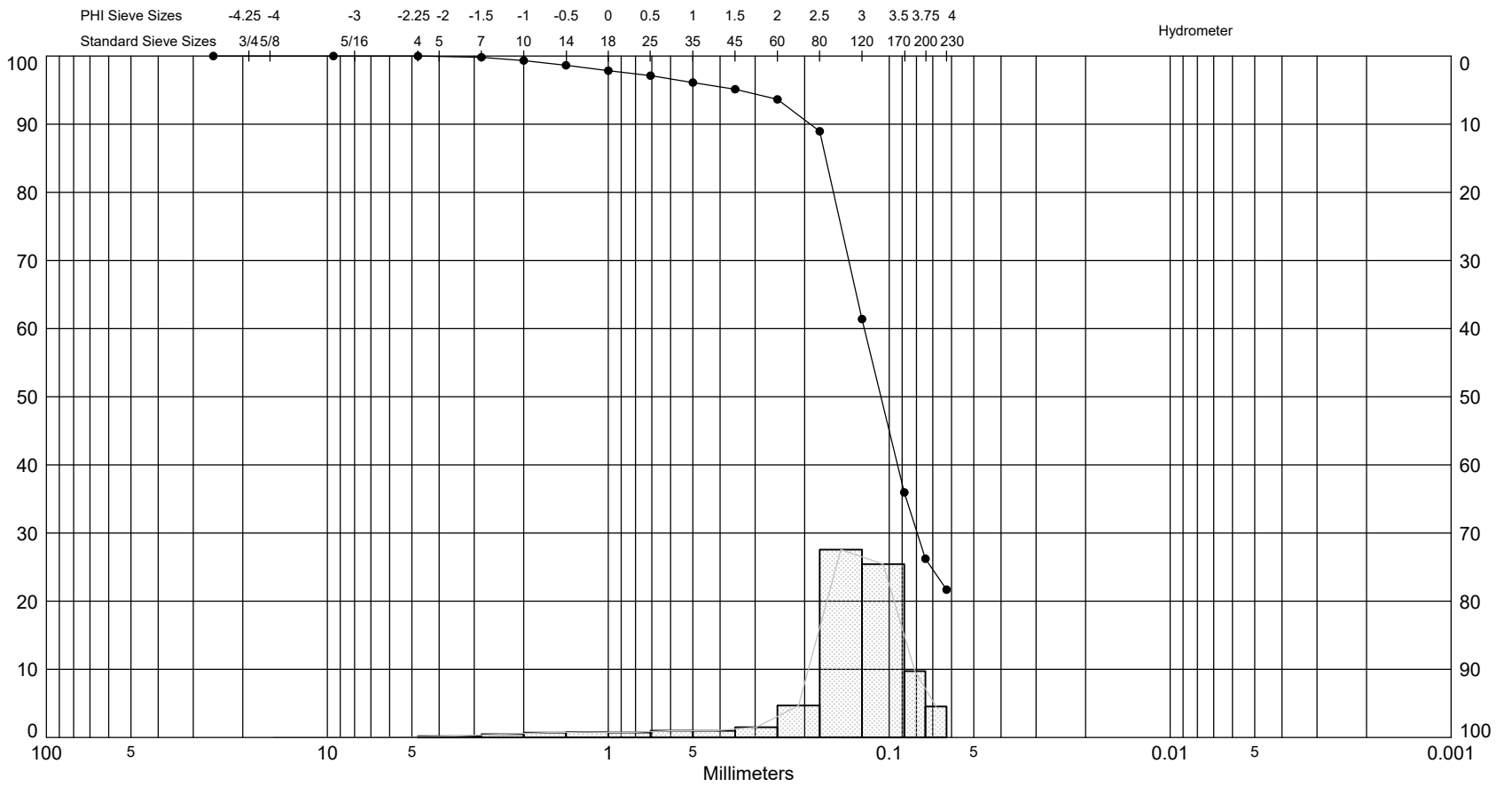
Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shells (%):
136.21	106.69			#200 - 26.23 #230 - 21.69			

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



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort
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

Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

Depths and elevations based on measured values

Sample Information	
Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Analysis Date:	07-29-22
Analyzed By:	CRM
Easting (X, ft):	2,743,892
Northing (Y, ft):	346,671
Horizontal System:	NAD 1983
Vertical System:	MLLW

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

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

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):	Northing (ft):	Coordinate System:	Elevation (ft):
2,744,112	345,694	NC State Plane, Zone 3200	-4.1 MLLW

USCS:	Munsell:	Comments:
SP	Moist - 5Y-6/1	Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

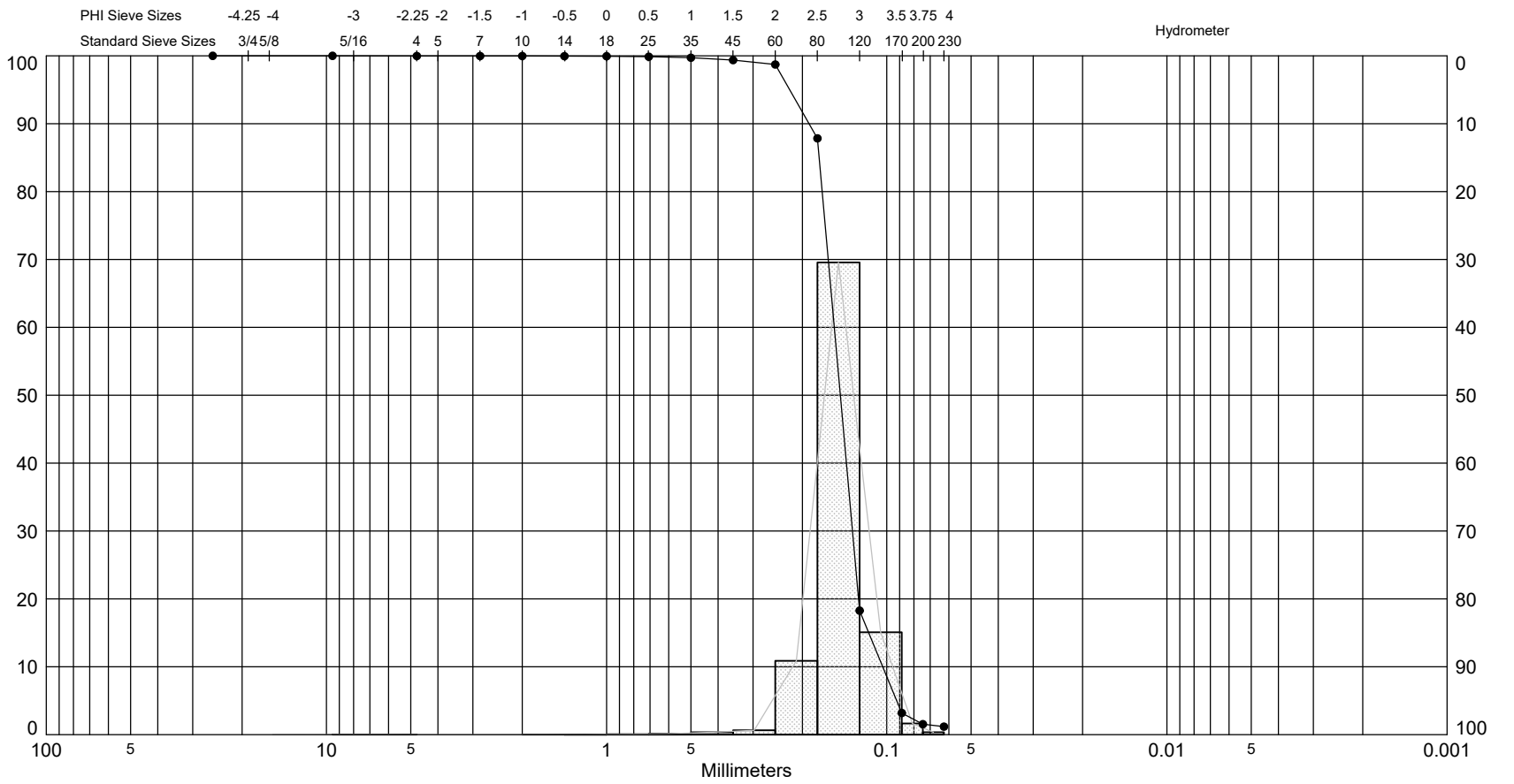
Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shells (%):
153.00	151.18			#200 - 1.54 #230 - 1.18			

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

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



Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort
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

Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

Depths and elevations based on measured values

Sample Information	
Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Analysis Date:	07-29-22
Analyzed By:	CRM
Easting (X, ft):	2,744,112
Northing (Y, ft):	345,694
Horizontal System:	NAD 1983
Vertical System:	MLLW

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

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

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):	Northing (ft):	Coordinate System:	Elevation (ft):
2,744,112	345,694	NC State Plane, Zone 3200	-5.6 MLLW

USCS:	Munsell:	Comments:
SP	Moist - 5Y-5/1	Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

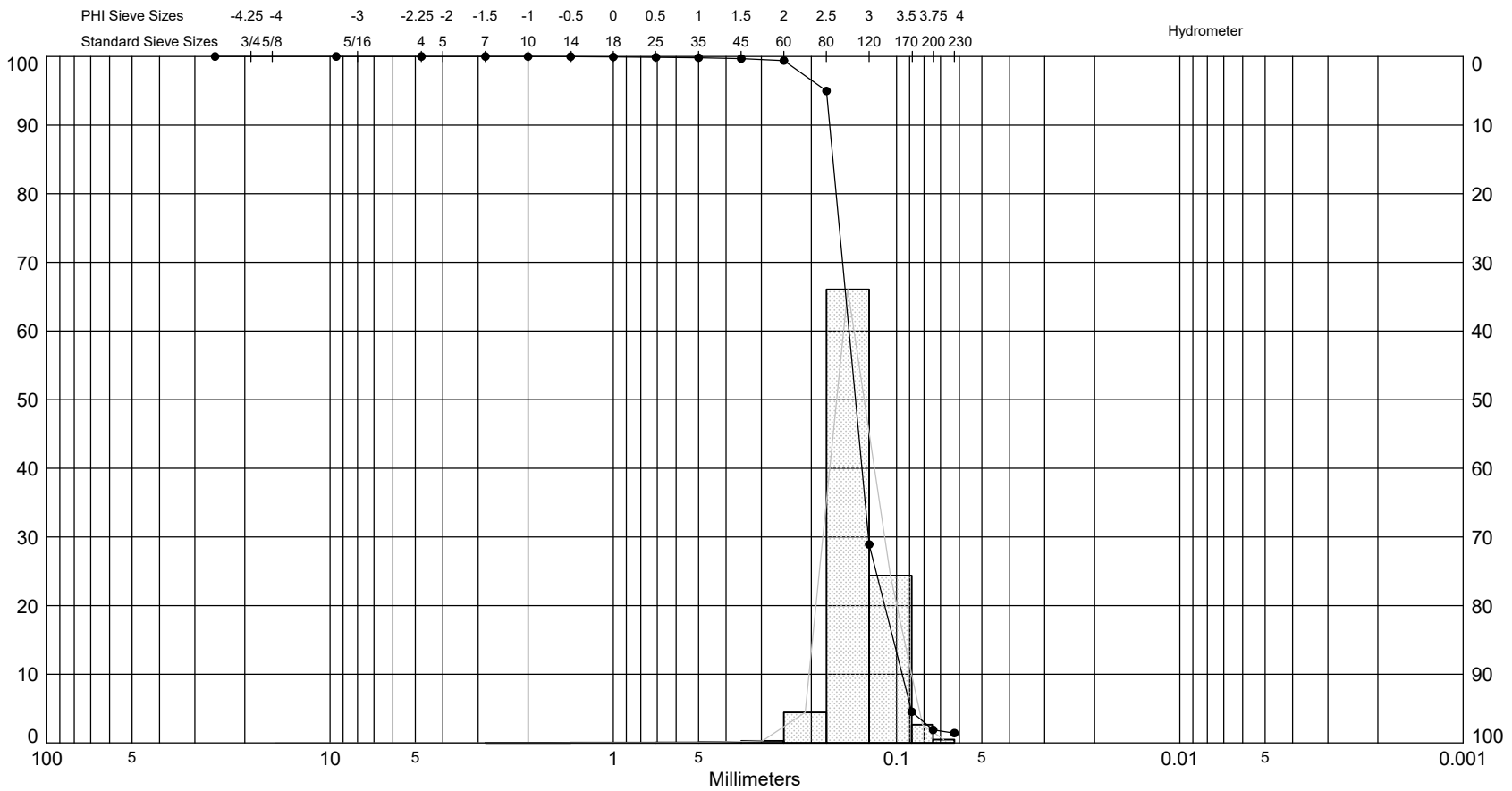
Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shells (%):
148.30	146.20			#200 - 1.89 #230 - 1.42			

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

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



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort
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

Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

Depths and elevations based on measured values

Sample Information	
Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Analysis Date:	07-29-22
Analyzed By:	CRM
Easting (X, ft):	2,744,112
Northing (Y, ft):	345,694
Horizontal System:	NAD 1983
Vertical System:	MLLW

ATHENA TECHNOLOGIES, INC.

Athena Technologies, Inc.
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Office: 843-887-3800

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

Granularmetric Report

Depths and elevations based on measured values

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

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

Easting (ft):	Northing (ft):	Coordinate System:	Elevation (ft):
2,744,112	345,694	NC State Plane, Zone 3200	-7.6 MLLW

USCS:	Munsell:	Comments:
SP-SM	Moist - 5Y-5/1	Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

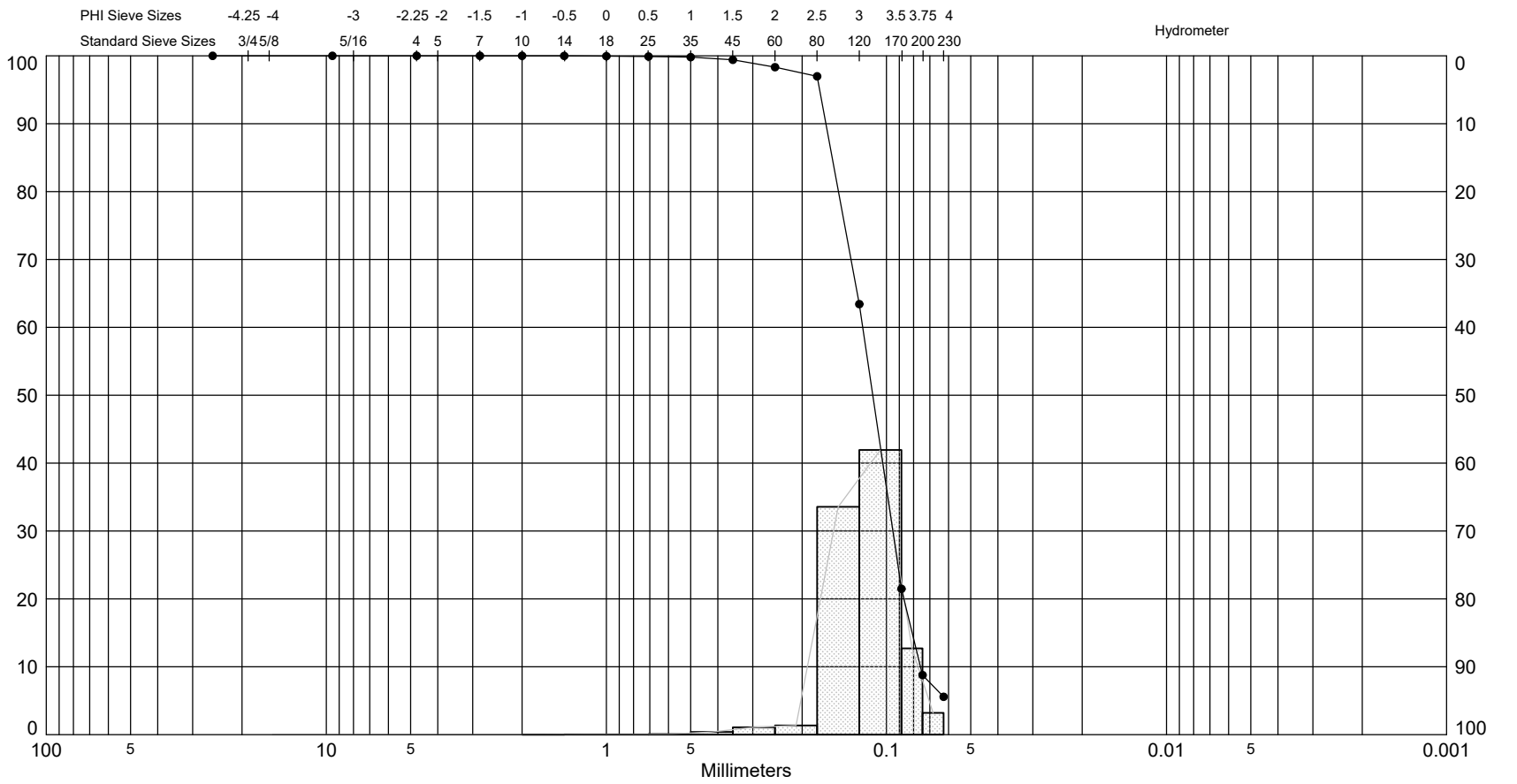
Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shells (%):
141.13	133.28			#200 - 8.78 #230 - 5.58			

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

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	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
Statistics	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



Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort
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

Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

Depths and elevations based on measured values

Sample Information	
Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Analysis Date:	07-29-22
Analyzed By:	CRM
Easting (X, ft):	2,744,112
Northing (Y, ft):	345,694
Horizontal System:	NAD 1983
Vertical System:	MLLW

ATHENA TECHNOLOGIES, INC.

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

Granularmetric Report

Depths and elevations based on measured values

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

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

Easting (ft):	Northing (ft):	Coordinate System:	Elevation (ft):
2,744,112	345,694	NC State Plane, Zone 3200	-10.3 MLLW

USCS:	Munsell:	Comments:
SM	Moist - 5Y-5/1	Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

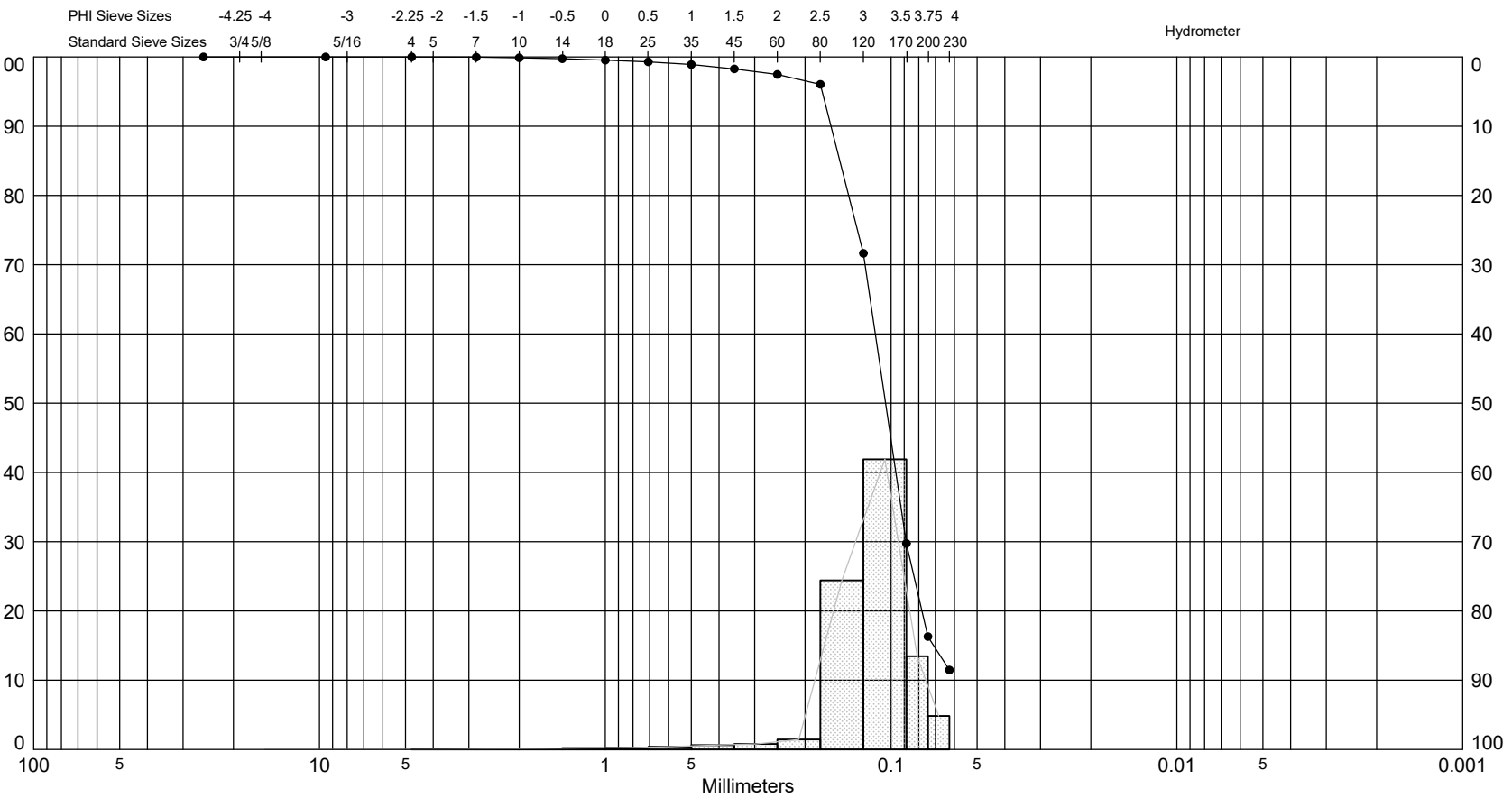
Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shells (%):
149.43	132.29			#200 - 16.30 #230 - 11.47			

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

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	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
Statistics	3.12	0.12	0.54	-3	19.79

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



Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort
CLO-22-V-004 #S-4	—●—	-10.3	SM	#200 - 16.30 #230 - 11.47			3.26	3.12	-3	19.79	0.54

Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

Depths and elevations based on measured values

Sample Information	
Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Analysis Date:	07-29-22
Analyzed By:	CRM
Easting (X, ft):	2,744,112
Northing (Y, ft):	345,694
Horizontal System:	NAD 1983
Vertical System:	MLLW

ATHENA TECHNOLOGIES, INC.

Athena Technologies, Inc.
1293 Graham Farm Road
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SIEVE ANALYSIS USACE, 2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT 8/12/22

Granularmetric Report

Depths and elevations based on measured values

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

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

Easting (ft):	Northing (ft):	Coordinate System:	Elevation (ft):
2,744,329	344,720	NC State Plane, Zone 3200	-4.3 MLLW

USCS:	Munsell:	Comments:
SP	Moist - 5Y-5/1	Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

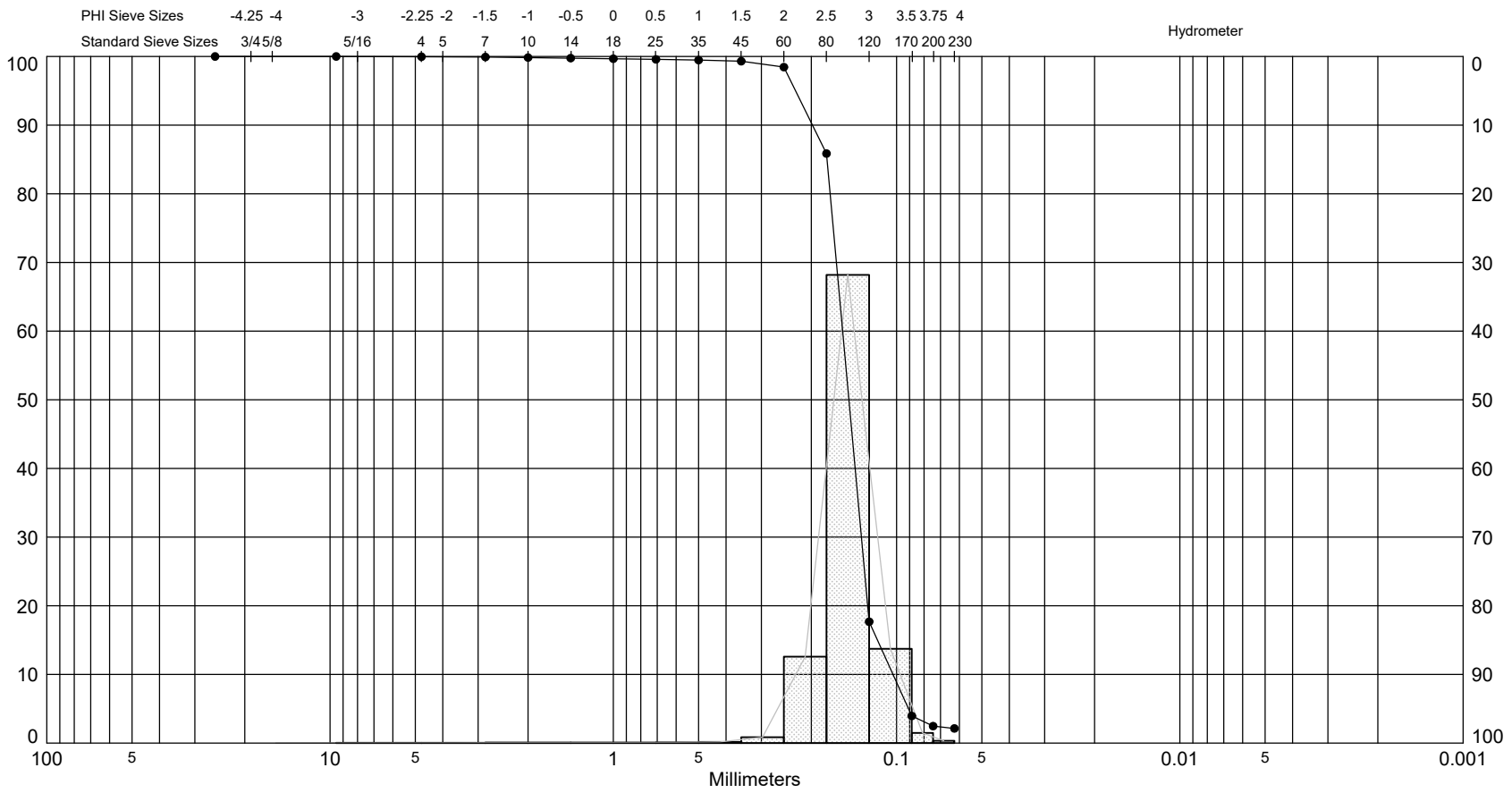
Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shells (%):
151.53	148.30			#200 - 2.47 #230 - 2.13			

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



Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort
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

Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

Depths and elevations based on measured values

Sample Information	
Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Analysis Date:	07-29-22
Analyzed By:	CRM
Easting (X, ft):	2,744,329
Northing (Y, ft):	344,720
Horizontal System:	NAD 1983
Vertical System:	MLLW

ATHENA TECHNOLOGIES, INC.

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Office: 843-887-3800

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

Granularmetric Report

Depths and elevations based on measured values

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

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

Easting (ft):	Northing (ft):	Coordinate System:	Elevation (ft):
2,744,329	344,720	NC State Plane, Zone 3200	-6.3 MLLW

USCS:	Munsell:	Comments:
SP	Moist - 5Y-5/1	Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

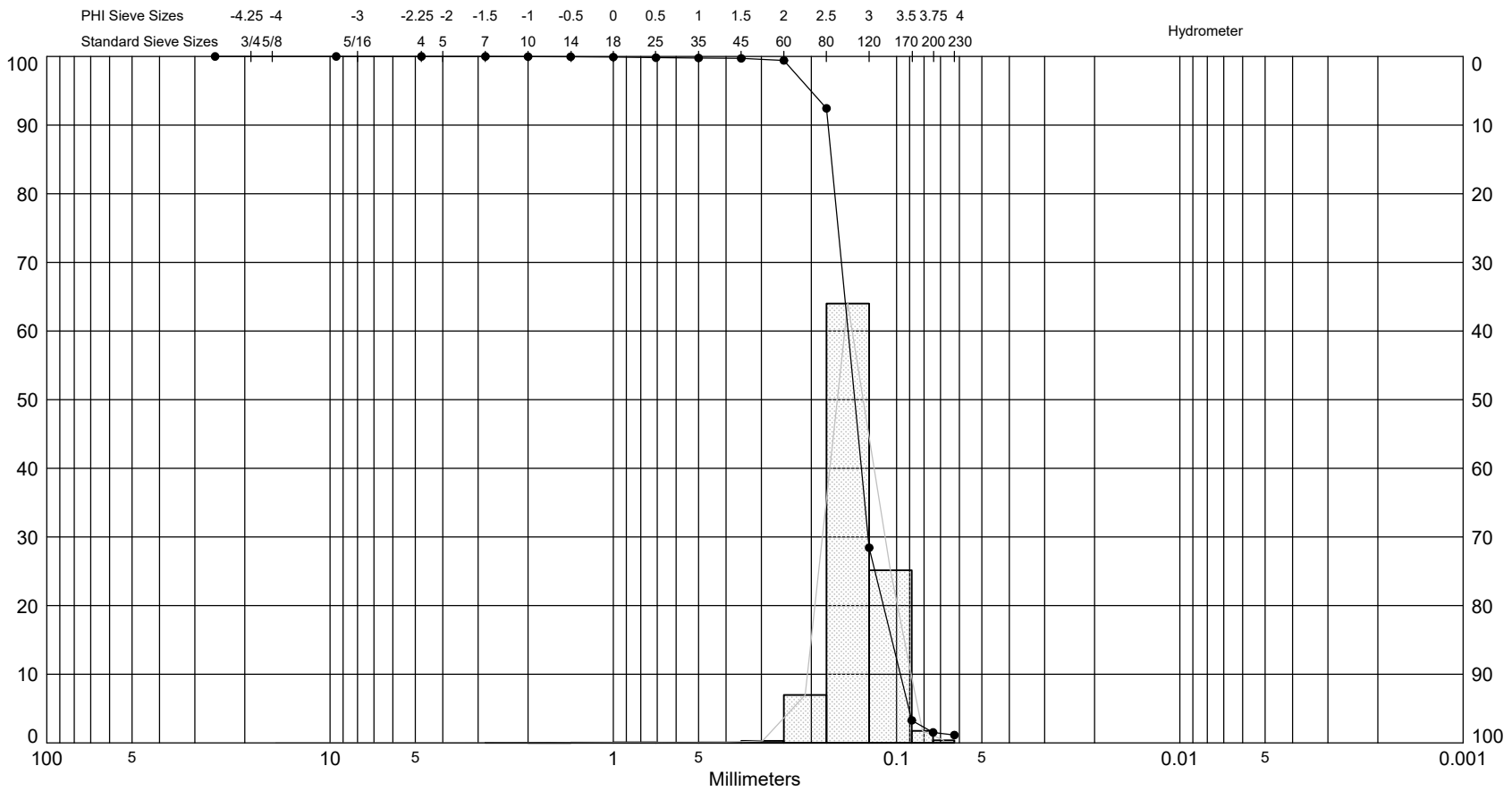
Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shells (%):
146.21	144.55			#200 - 1.52 #230 - 1.14			

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

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

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
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

Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

Depths and elevations based on measured values

Sample Information	
Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Analysis Date:	07-29-22
Analyzed By:	CRM
Easting (X, ft):	2,744,329
Northing (Y, ft):	344,720
Horizontal System:	NAD 1983
Vertical System:	MLLW

ATHENA TECHNOLOGIES, INC.

Athena Technologies, Inc.
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McClellanville, SC 29458
Office: 843-887-3800

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

Granularmetric Report

Depths and elevations based on measured values

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

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

Easting (ft):	Northing (ft):	Coordinate System:	Elevation (ft):
2,744,329	344,720	NC State Plane, Zone 3200	-7.8 MLLW

USCS:	Munsell:	Comments:
SP-SM	Moist - 5Y-6/1	Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

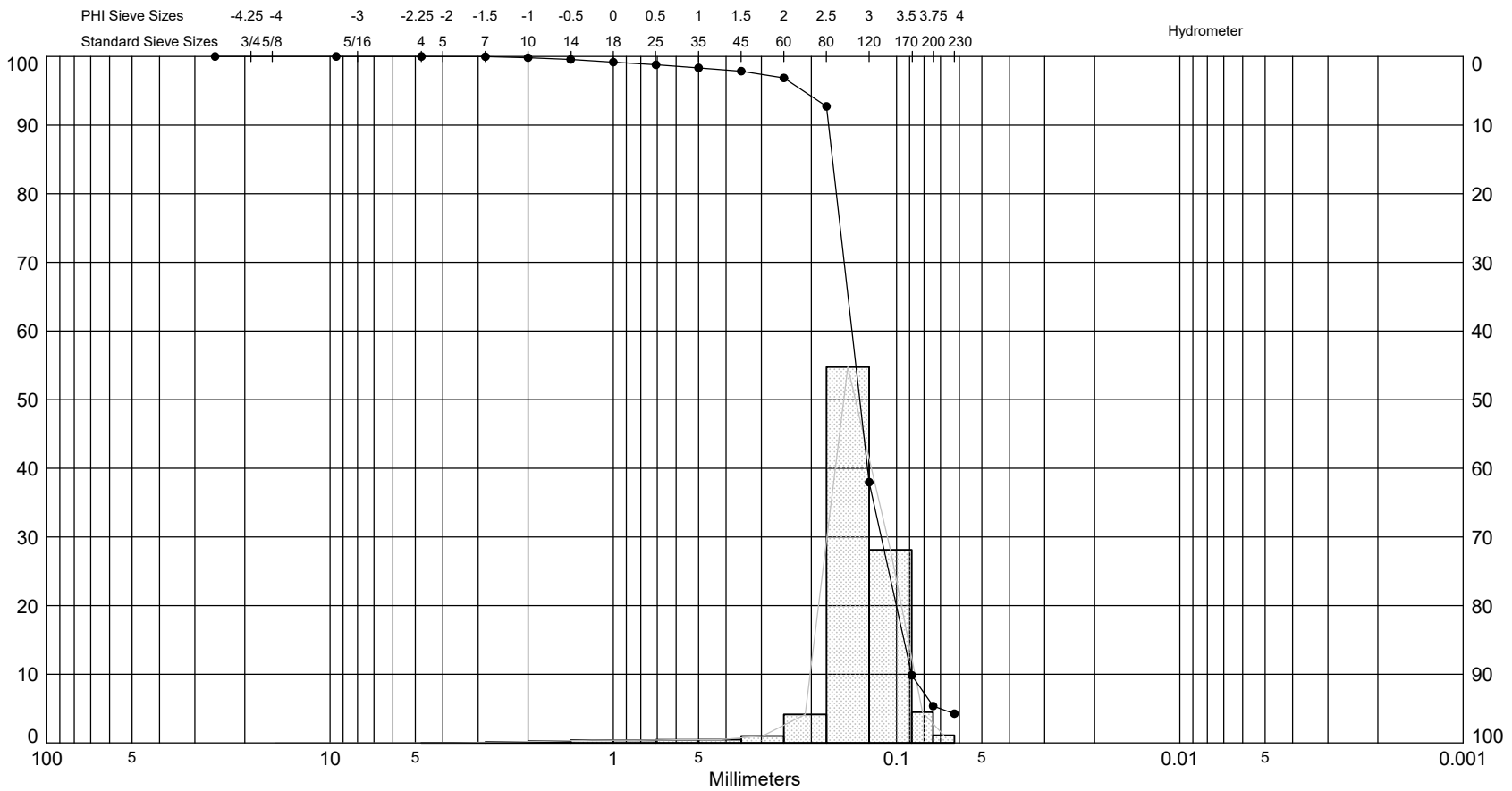
Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shells (%):
142.90	136.82			#200 - 5.37 #230 - 4.26			

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

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

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



Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort
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

Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

Depths and elevations based on measured values

Sample Information	
Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Analysis Date:	07-29-22
Analyzed By:	CRM
Easting (X, ft):	2,744,329
Northing (Y, ft):	344,720
Horizontal System:	NAD 1983
Vertical System:	MLLW

ATHENA TECHNOLOGIES, INC.

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

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

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-4			
Analysis Date: 07-29-22			
Analyzed By: CRM			
Easting (ft): 2,744,329	Northing (ft): 344,720	Coordinate System: NC State Plane, Zone 3200	Elevation (ft): -8.8 MLLW
USCS: SP	Munsell: Moist - 5Y-6/1	Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL	

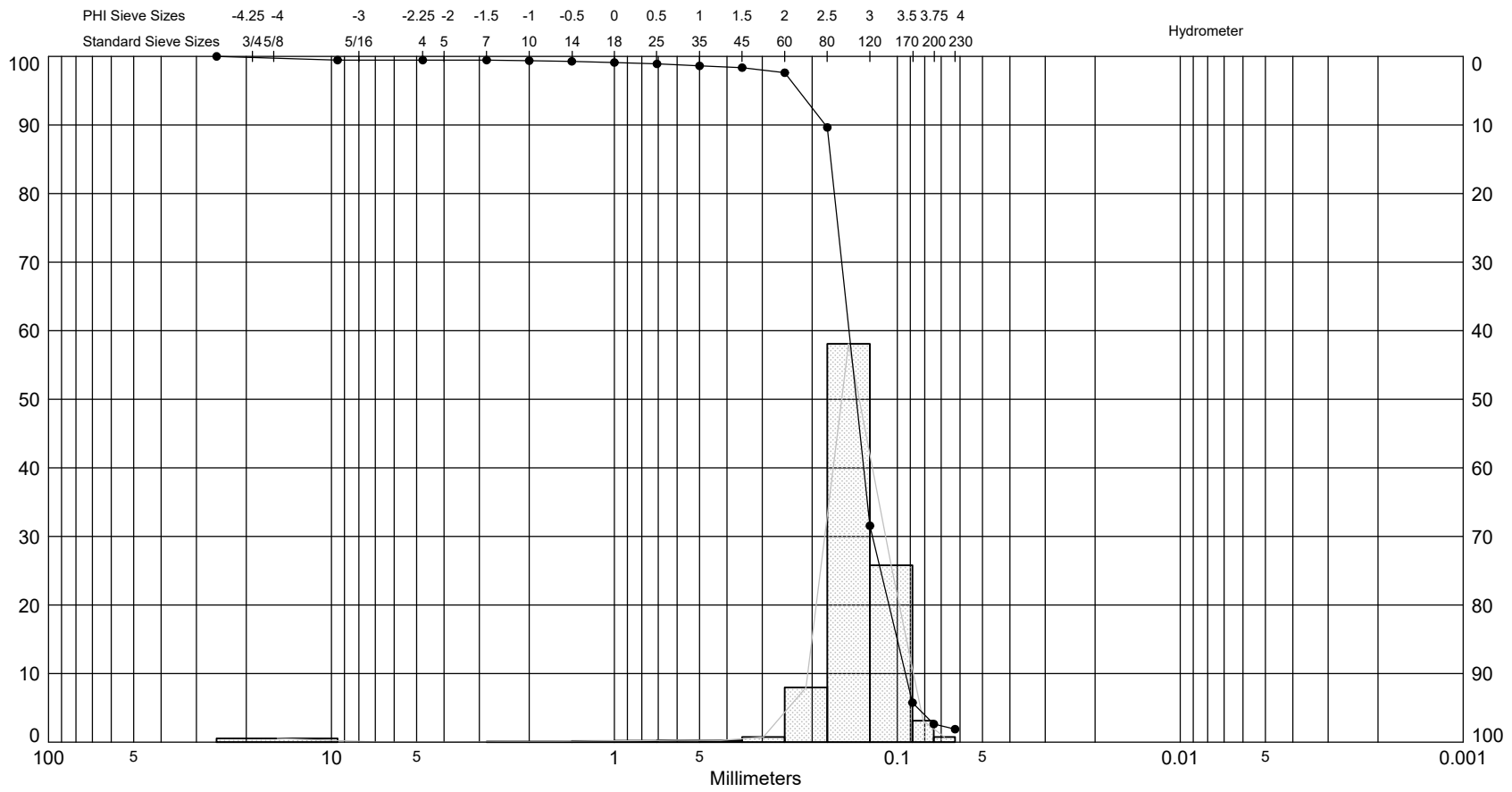
Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shells (%):
157.24	154.27			#200 - 2.64 #230 - 1.89			

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

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

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



Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort
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

Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

Depths and elevations based on measured values

Sample Information	
Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Analysis Date:	07-29-22
Analyzed By:	CRM
Easting (X, ft):	2,744,329
Northing (Y, ft):	344,720
Horizontal System:	NAD 1983
Vertical System:	MLLW

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

Granularmetric Report

Depths and elevations based on measured values

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

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

Easting (ft):	Northing (ft):	Coordinate System:	Elevation (ft):
2,744,329	344,720	NC State Plane, Zone 3200	-10.3 MLLW

USCS:	Munsell:	Comments:
SM	Moist - 5Y-4/1	Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

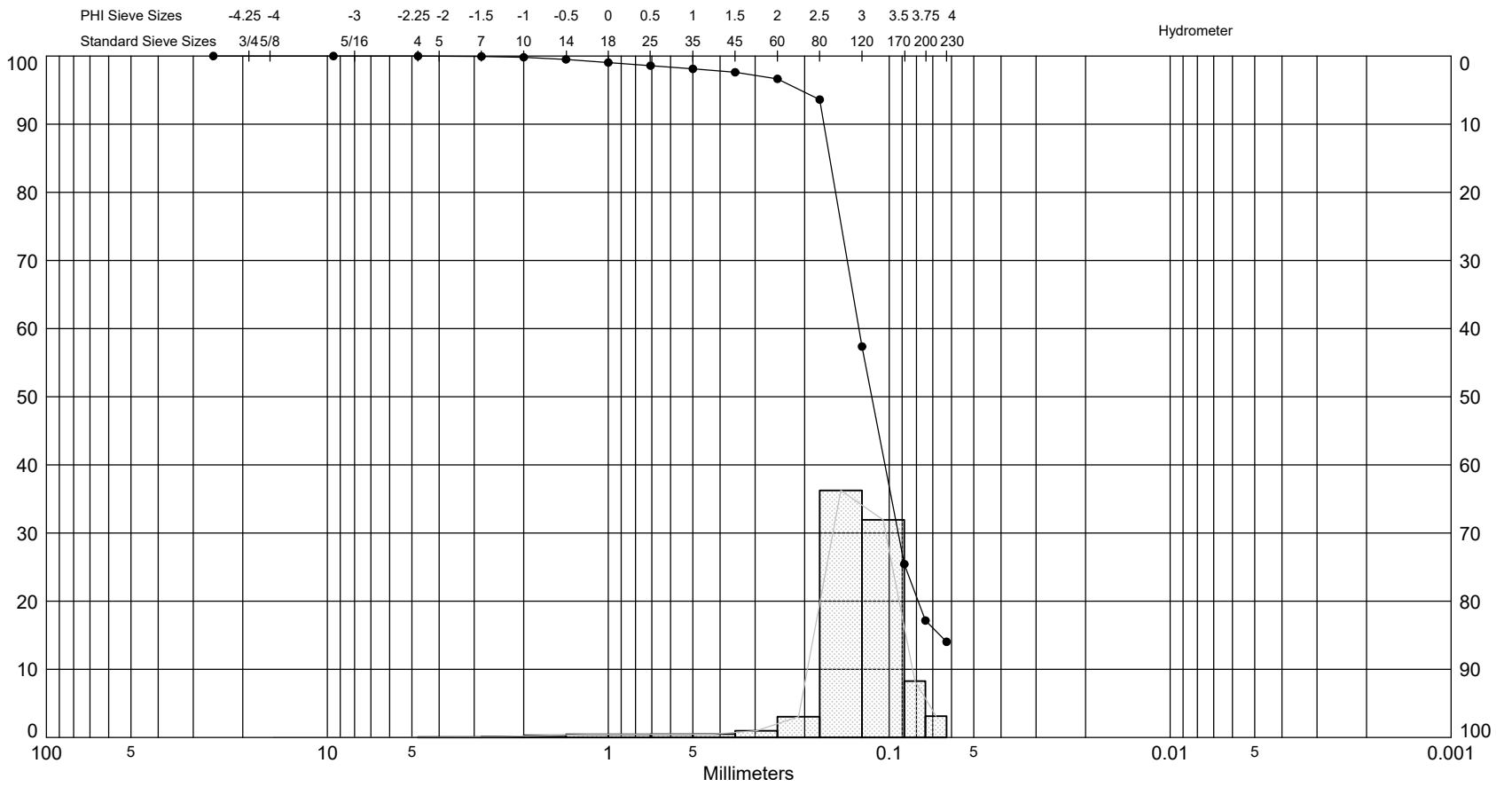
Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shells (%):
103.44	88.93			#200 - 17.16 #230 - 14.04			

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

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	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
Statistics	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



Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort
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

Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

Depths and elevations based on measured values

Sample Information	
Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Analysis Date:	07-29-22
Analyzed By:	CRM
Easting (X, ft):	2,744,329
Northing (Y, ft):	344,720
Horizontal System:	NAD 1983
Vertical System:	MLLW

ATHENA TECHNOLOGIES, INC.

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

Granularmetric Report

Depths and elevations based on measured values

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

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

Easting (ft):	Northing (ft):	Coordinate System:	Elevation (ft):
2,744,546	343,742	NC State Plane, Zone 3200	-4.2 MLLW

USCS:	Munsell:	Comments:
SP	Moist - 5Y-6/1	Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

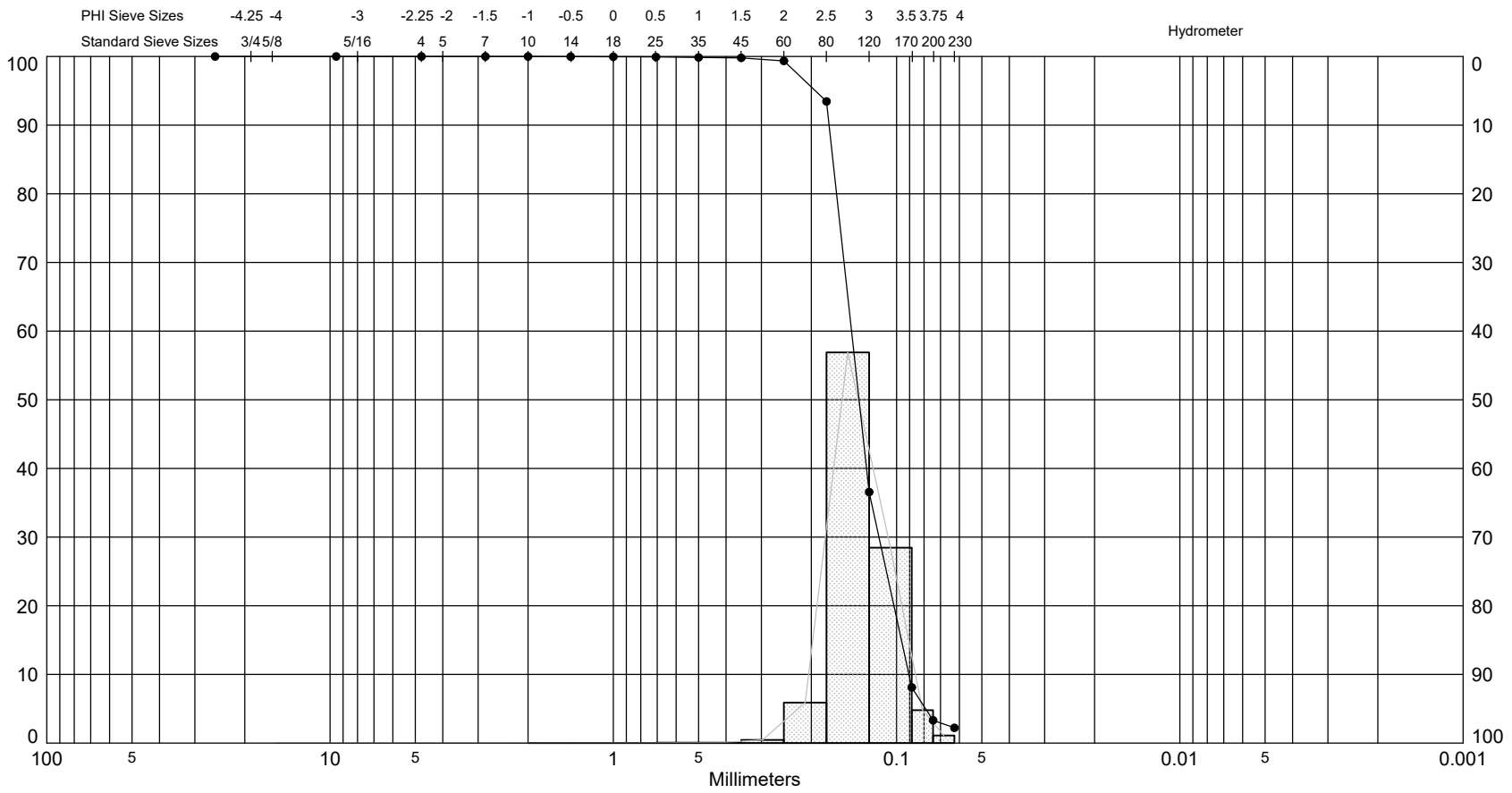
Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shells (%):
99.60	97.40			#200 - 3.32 #230 - 2.22			

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

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

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



Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort
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

Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

Depths and elevations based on measured values

Sample Information	
Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Analysis Date:	07-29-22
Analyzed By:	CRM
Easting (X, ft):	2,744,546
Northing (Y, ft):	343,742
Horizontal System:	NAD 1983
Vertical System:	MLLW

ATHENA TECHNOLOGIES, INC.

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McClellanville, SC 29458
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SIEVE ANALYSIS USACE, 2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT 8/12/22

Granularmetric Report

Depths and elevations based on measured values

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

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

Easting (ft):	Northing (ft):	Coordinate System:	Elevation (ft):
2,744,546	343,742	NC State Plane, Zone 3200	-6.2 MLLW

USCS:	Munsell:	Comments:
SP	Moist - 5Y-6/1	Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

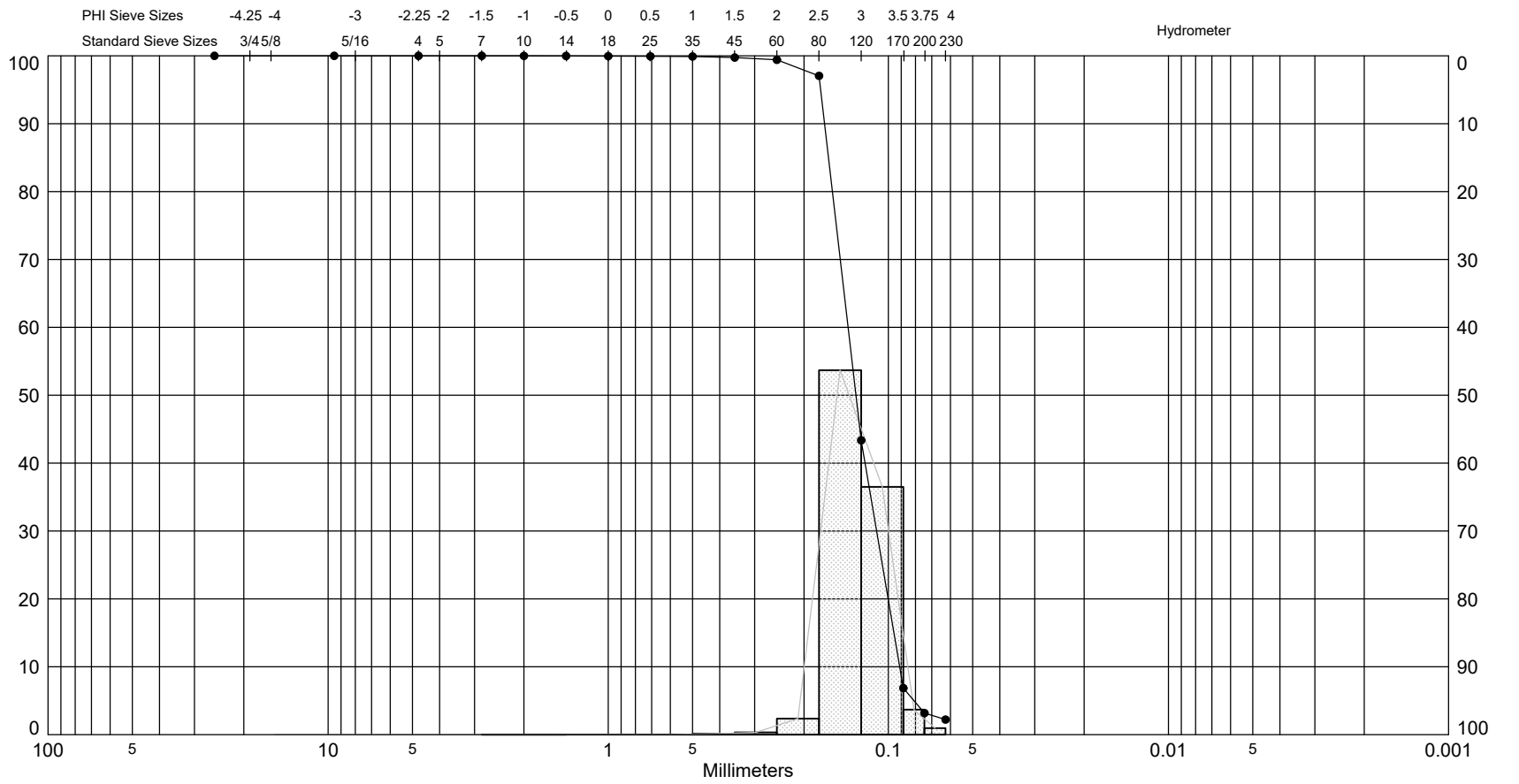
Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shells (%):
100.65	98.42			#200 - 3.18 #230 - 2.22			

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

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



Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort
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

Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

Depths and elevations based on measured values

Sample Information	
Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Analysis Date:	07-29-22
Analyzed By:	CRM
Easting (X, ft):	2,744,546
Northing (Y, ft):	343,742
Horizontal System:	NAD 1983
Vertical System:	MLLW

Athena Technologies, Inc.
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McClellanville, SC 29458
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SIEVE ANALYSIS USACE, 2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT 8/12/22

Granularmetric Report

Depths and elevations based on measured values

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

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

Easting (ft):	Northing (ft):	Coordinate System:	Elevation (ft):
2,744,546	343,742	NC State Plane, Zone 3200	-7.6 MLLW

USCS:	Munsell:	Comments:
SP-SM	Moist - 5Y-6/1	Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

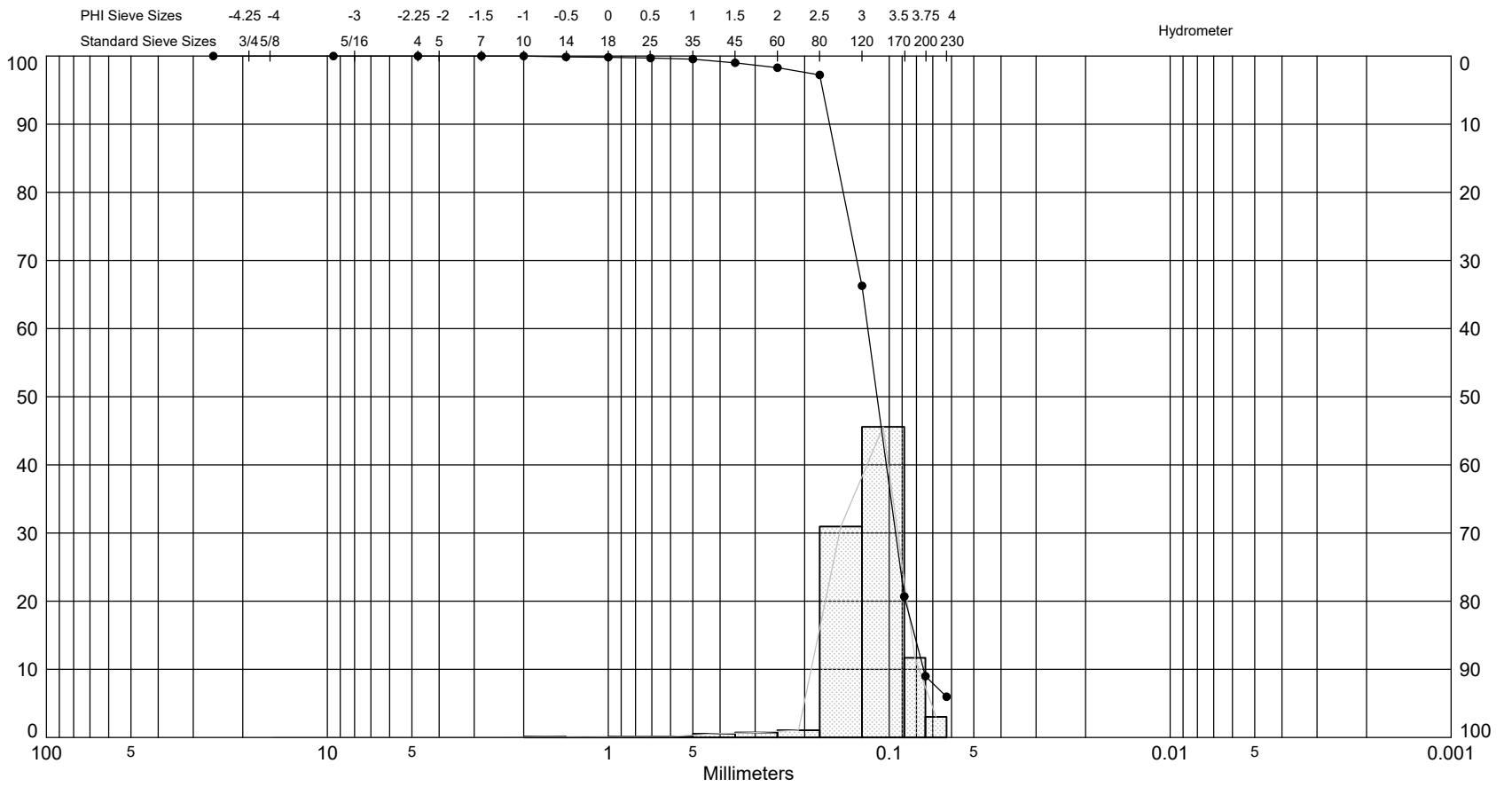
Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shells (%):
98.96	93.05			#200 - 9.00 #230 - 5.98			

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

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

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



Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort
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

Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

Depths and elevations based on measured values

Sample Information	
Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Analysis Date:	07-29-22
Analyzed By:	CRM
Easting (X, ft):	2,744,546
Northing (Y, ft):	343,742
Horizontal System:	NAD 1983
Vertical System:	MLLW

ATHENA TECHNOLOGIES, INC.

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

Granularmetric Report

Depths and elevations based on measured values

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

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

Easting (ft):	Northing (ft):	Coordinate System:	Elevation (ft):
2,744,546	343,742	NC State Plane, Zone 3200	-9.4 MLLW

USCS:	Munsell:	Comments:
SP	Moist - 5Y-7/1	Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

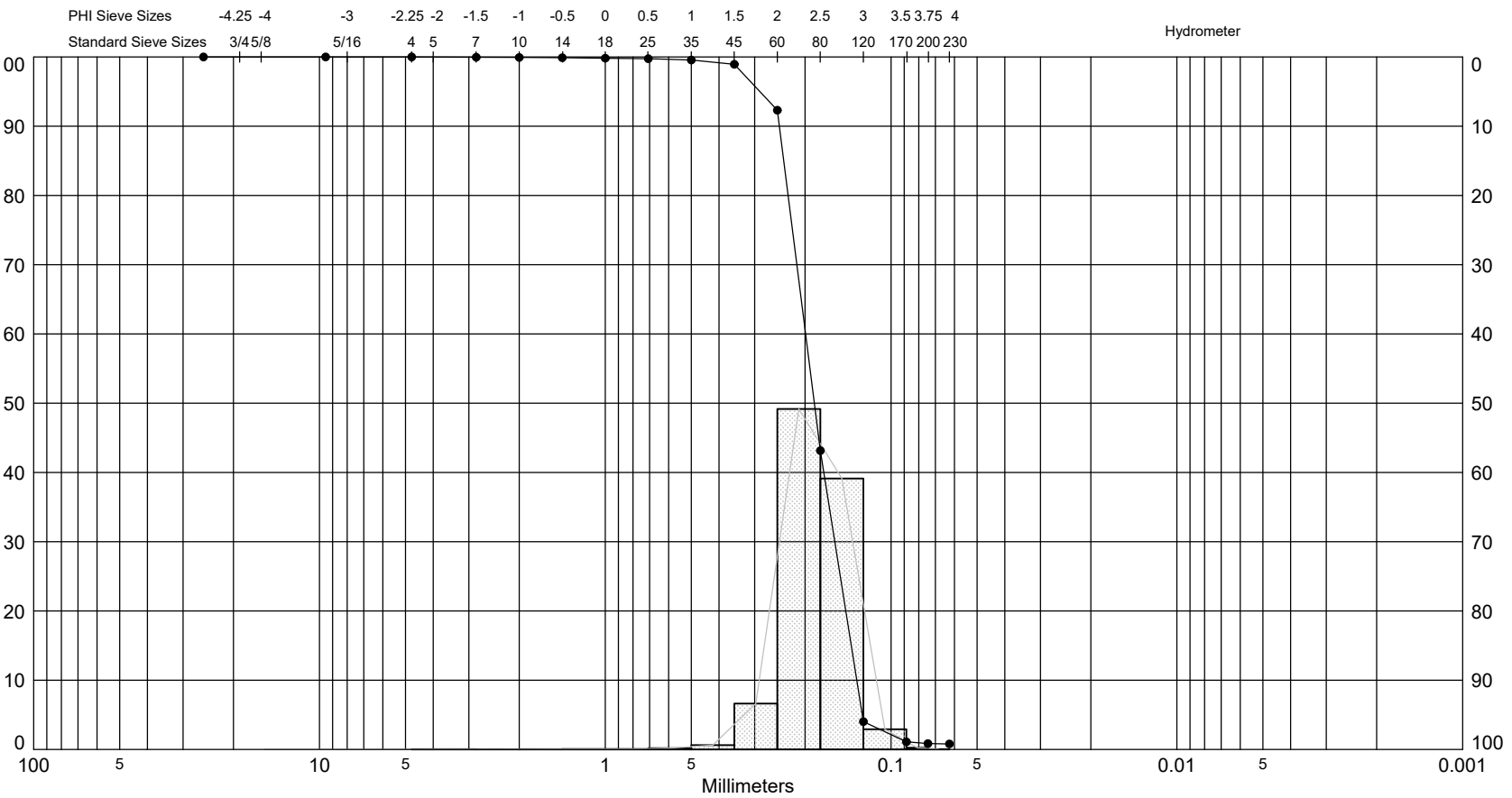
Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shells (%):
137.12	136.01			#200 - 0.85 #230 - 0.80			

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

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

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
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

Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

Depths and elevations based on measured values

Sample Information	
Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Analysis Date:	07-29-22
Analyzed By:	CRM
Easting (X, ft):	2,744,546
Northing (Y, ft):	343,742
Horizontal System:	NAD 1983
Vertical System:	MLLW

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

Granularmetric Report

Depths and elevations based on measured values

Athena Technologies, Inc.
1293 Graham Farm Road
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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):	Northing (ft):	Coordinate System:	Elevation (ft):
2,744,694	343,077	NC State Plane, Zone 3200	-3.2 MLLW

USCS:	Munsell:	Comments:
SP	Moist - 5Y-6/1	Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

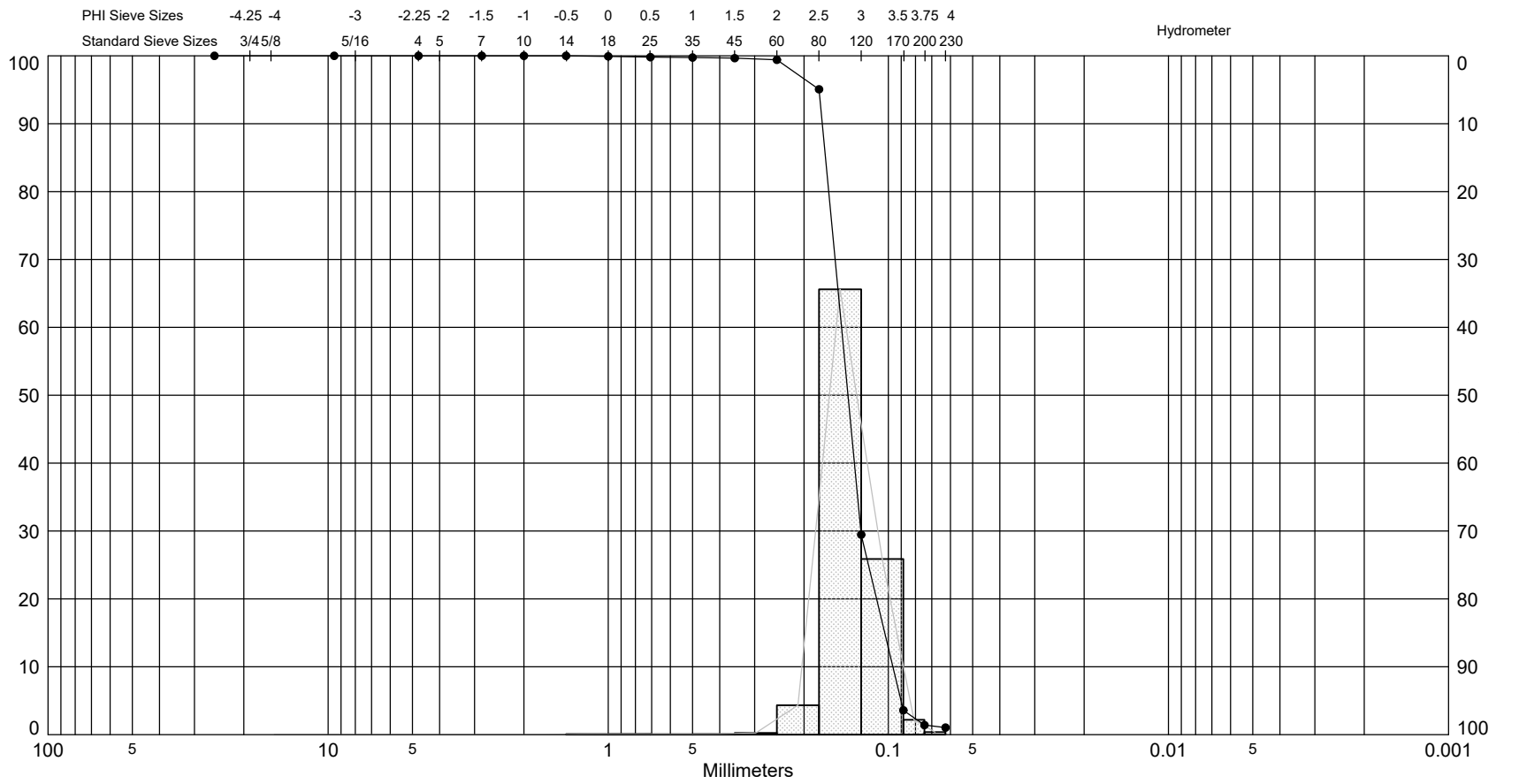
Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shells (%):
144.63	143.12			#200 - 1.41 #230 - 1.04			

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



Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort
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

Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

Depths and elevations based on measured values

Sample Information	
Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Analysis Date:	07-29-22
Analyzed By:	CRM
Easting (X, ft):	2,744,694
Northing (Y, ft):	343,077
Horizontal System:	NAD 1983
Vertical System:	MLLW

ATHENA TECHNOLOGIES, INC.

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

Granularmetric Report

Depths and elevations based on measured values

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

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

Easting (ft):	Northing (ft):	Coordinate System:	Elevation (ft):
2,744,694	343,077	NC State Plane, Zone 3200	-5.7 MLLW

USCS:	Munsell:	Comments:
SP-SM	Moist - 5Y-5/1	Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

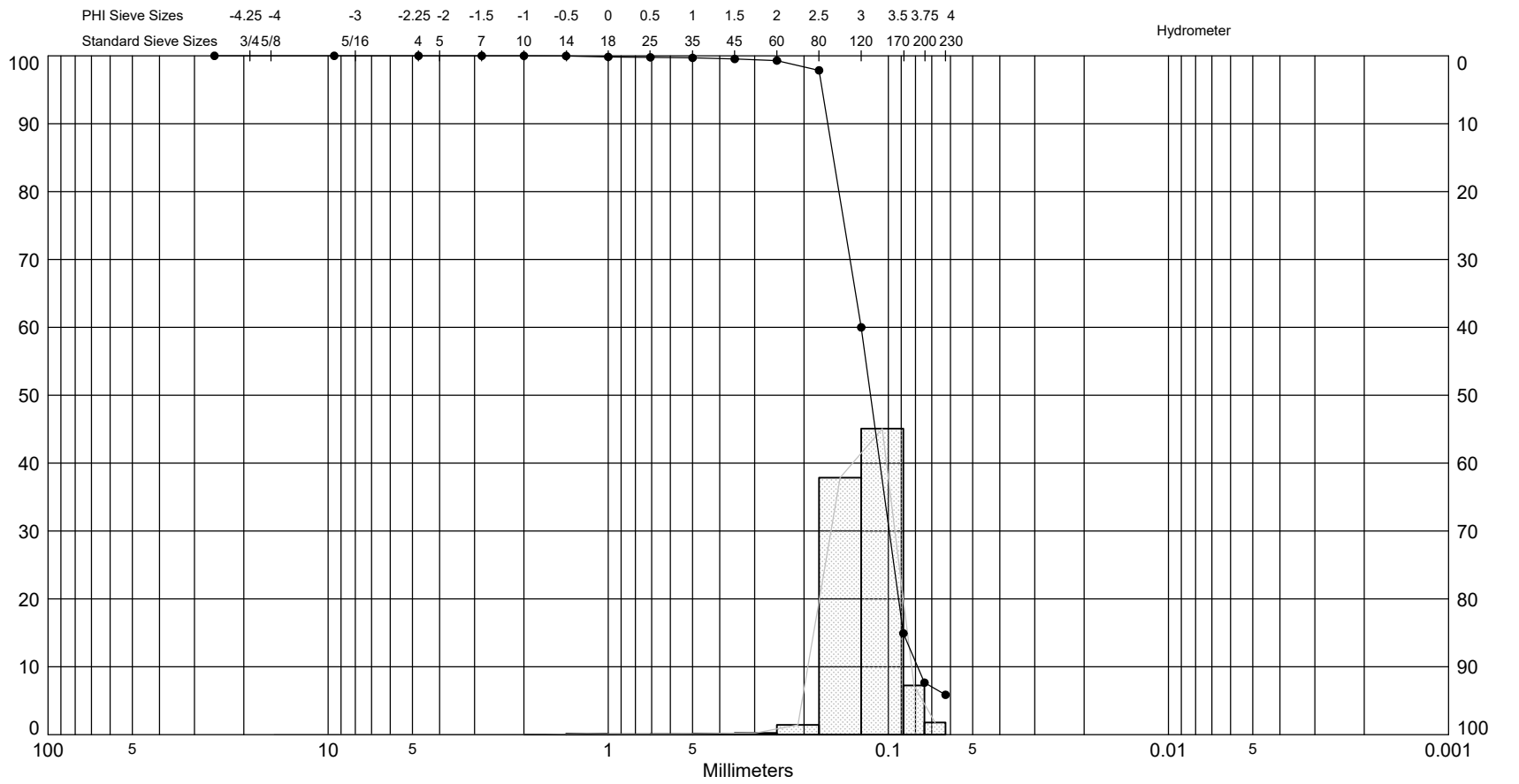
Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shells (%):
110.80	104.31			#200 - 7.66 #230 - 5.87			

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

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	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
Statistics	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



Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort
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

Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

Depths and elevations based on measured values

Sample Information	
Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Analysis Date:	07-29-22
Analyzed By:	CRM
Easting (X, ft):	2,744,694
Northing (Y, ft):	343,077
Horizontal System:	NAD 1983
Vertical System:	MLLW

ATHENA TECHNOLOGIES, INC.

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

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-3

Analysis Date: 07-29-22

Analyzed By: CRM

Easting (ft):	Northing (ft):	Coordinate System:	Elevation (ft):
2,744,694	343,077	NC State Plane, Zone 3200	-8.2 MLLW

USCS:	Munsell:	Comments:
SP	Moist - 5Y-6/1	Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

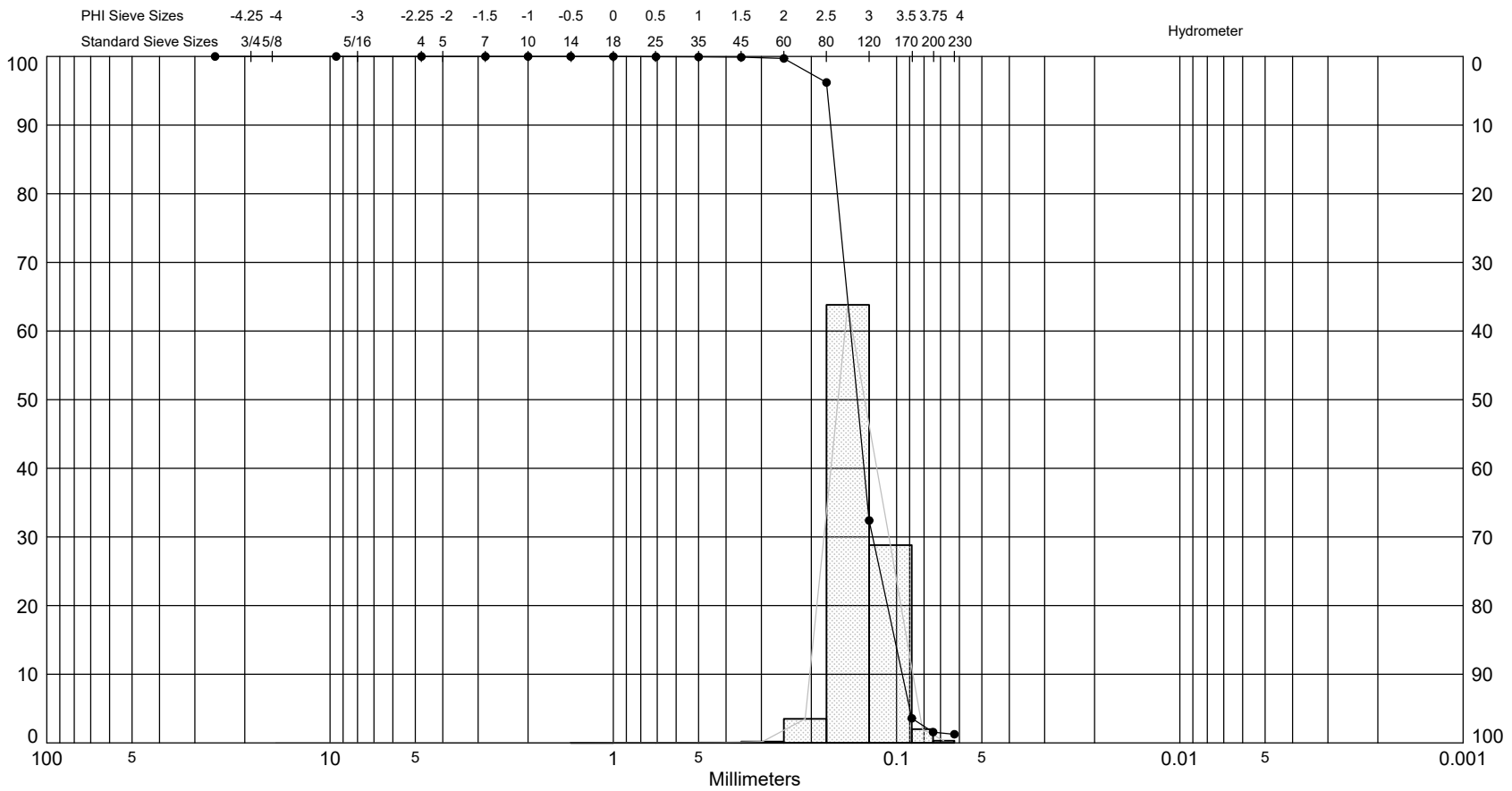
Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shells (%):
114.16	112.72			#200 - 1.57 #230 - 1.26			

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

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

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



Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort
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

Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

Depths and elevations based on measured values

Sample Information	
Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Analysis Date:	07-29-22
Analyzed By:	CRM
Easting (X, ft):	2,744,694
Northing (Y, ft):	343,077
Horizontal System:	NAD 1983
Vertical System:	MLLW

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

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-4

Analysis Date: 07-29-22

Analyzed By: CRM

Easting (ft):	Northing (ft):	Coordinate System:	Elevation (ft):
2,744,694	343,077	NC State Plane, Zone 3200	-9.4 MLLW

USCS:	Munsell:	Comments:
SP-SM	Moist - 5Y-6/1	Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

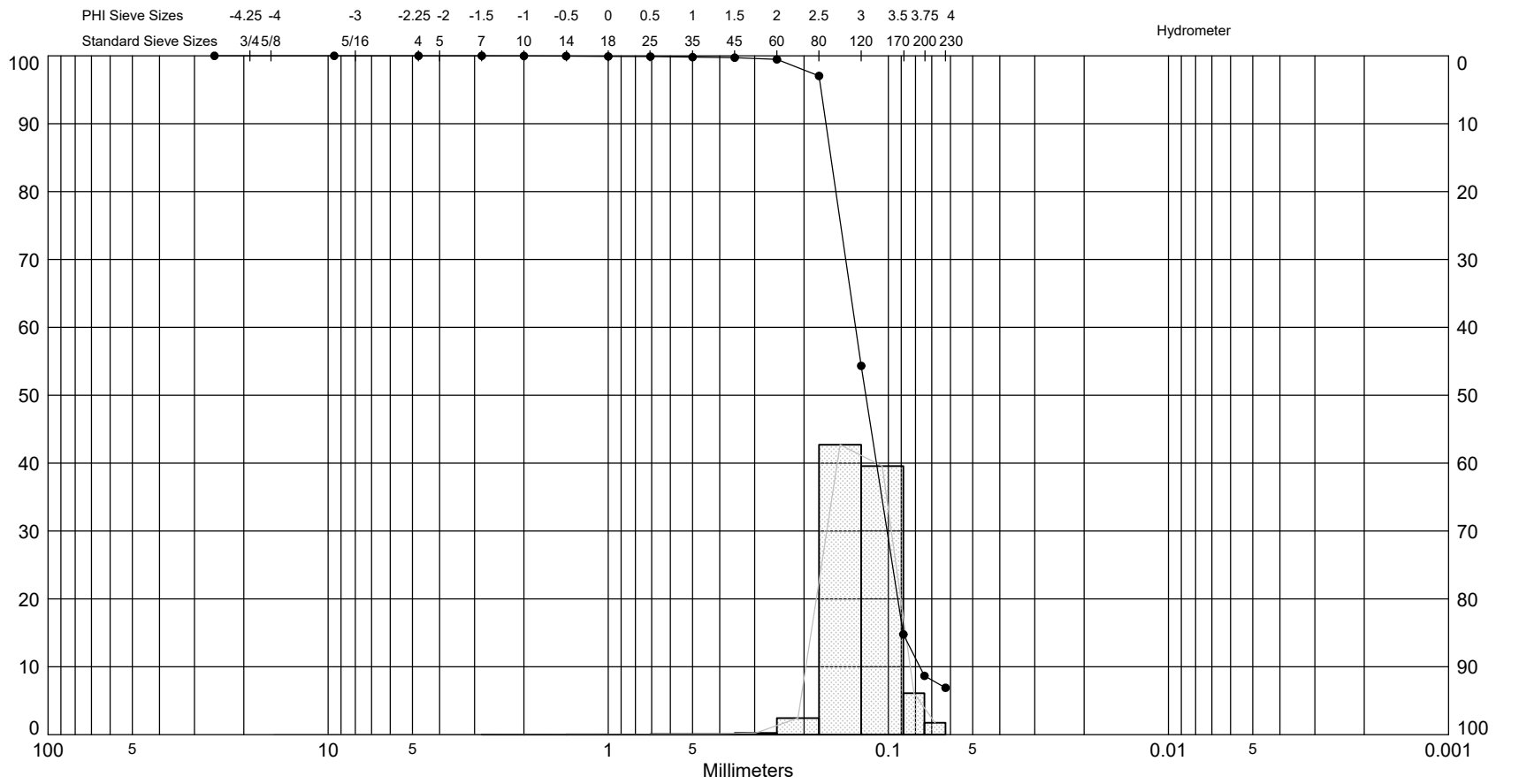
Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shells (%):
126.74	118.01			#200 - 8.66 #230 - 6.90			

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

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

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



Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort
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

Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

Depths and elevations based on measured values

Sample Information	
Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Analysis Date:	07-29-22
Analyzed By:	CRM
Easting (X, ft):	2,744,694
Northing (Y, ft):	343,077
Horizontal System:	NAD 1983
Vertical System:	MLLW

ATHENA TECHNOLOGIES, INC.

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

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-1

Analysis Date: 07-29-22

Analyzed By: CRM

Easting (ft):	Northing (ft):	Coordinate System:	Elevation (ft):
2,744,979	341,792	NC State Plane, Zone 3200	-6.0 MLLW

USCS:	Munsell:	Comments:
SP	Moist - 5Y-6/1	Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

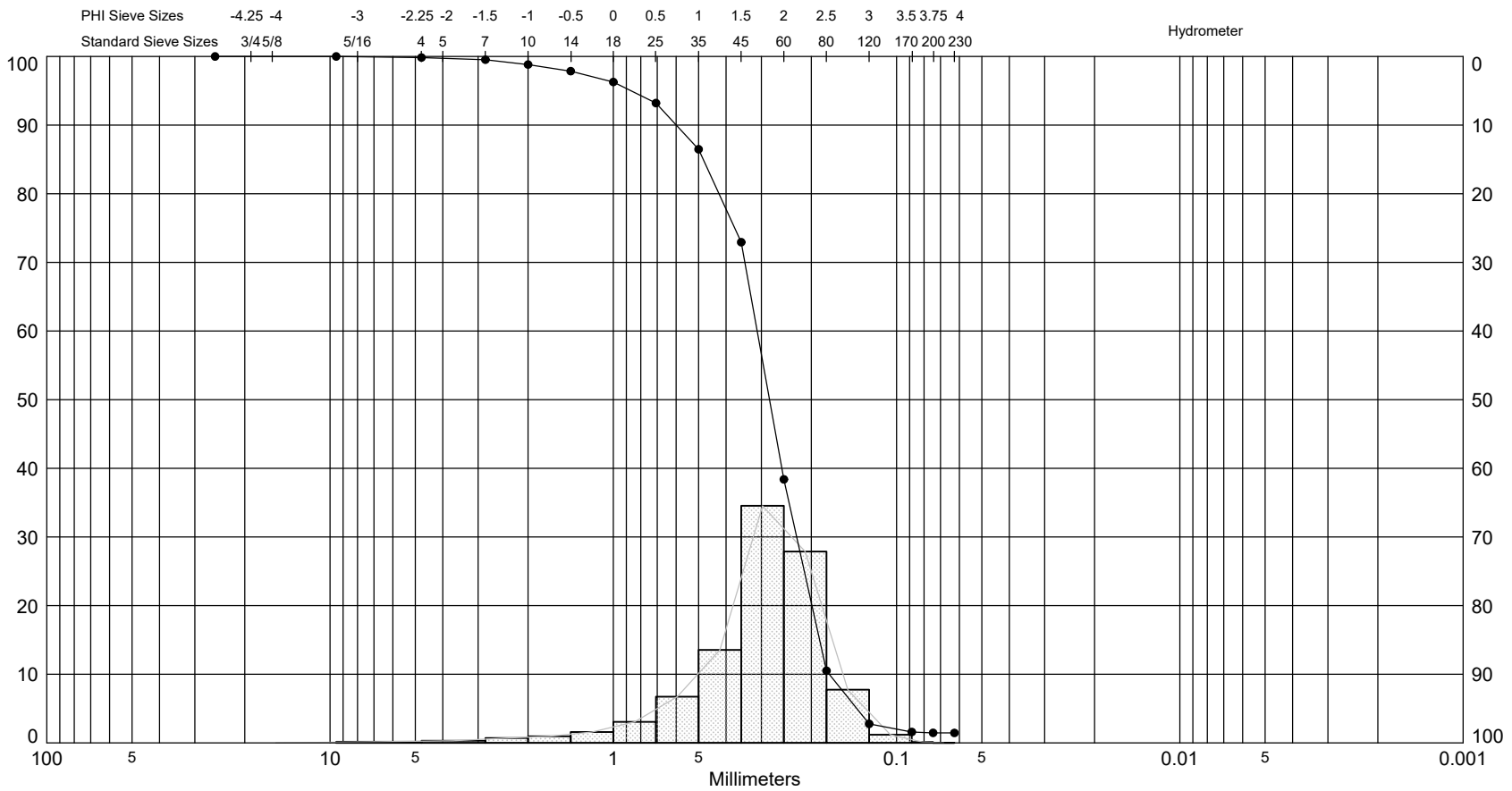
Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shells (%):
140.22	138.20			#200 - 1.46 #230 - 1.45			

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

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

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
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

Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

Depths and elevations based on measured values

Sample Information	
Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Analysis Date:	07-29-22
Analyzed By:	CRM
Easting (X, ft):	2,744,979
Northing (Y, ft):	341,792
Horizontal System:	NAD 1983
Vertical System:	MLLW

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McClellanville, SC 29458
Office: 843-887-3800

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

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):	Northing (ft):	Coordinate System:	Elevation (ft):
2,744,979	341,792	NC State Plane, Zone 3200	-7.5 MLLW

USCS:	Munsell:	Comments:
SP	Moist - 5Y-6/1	Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

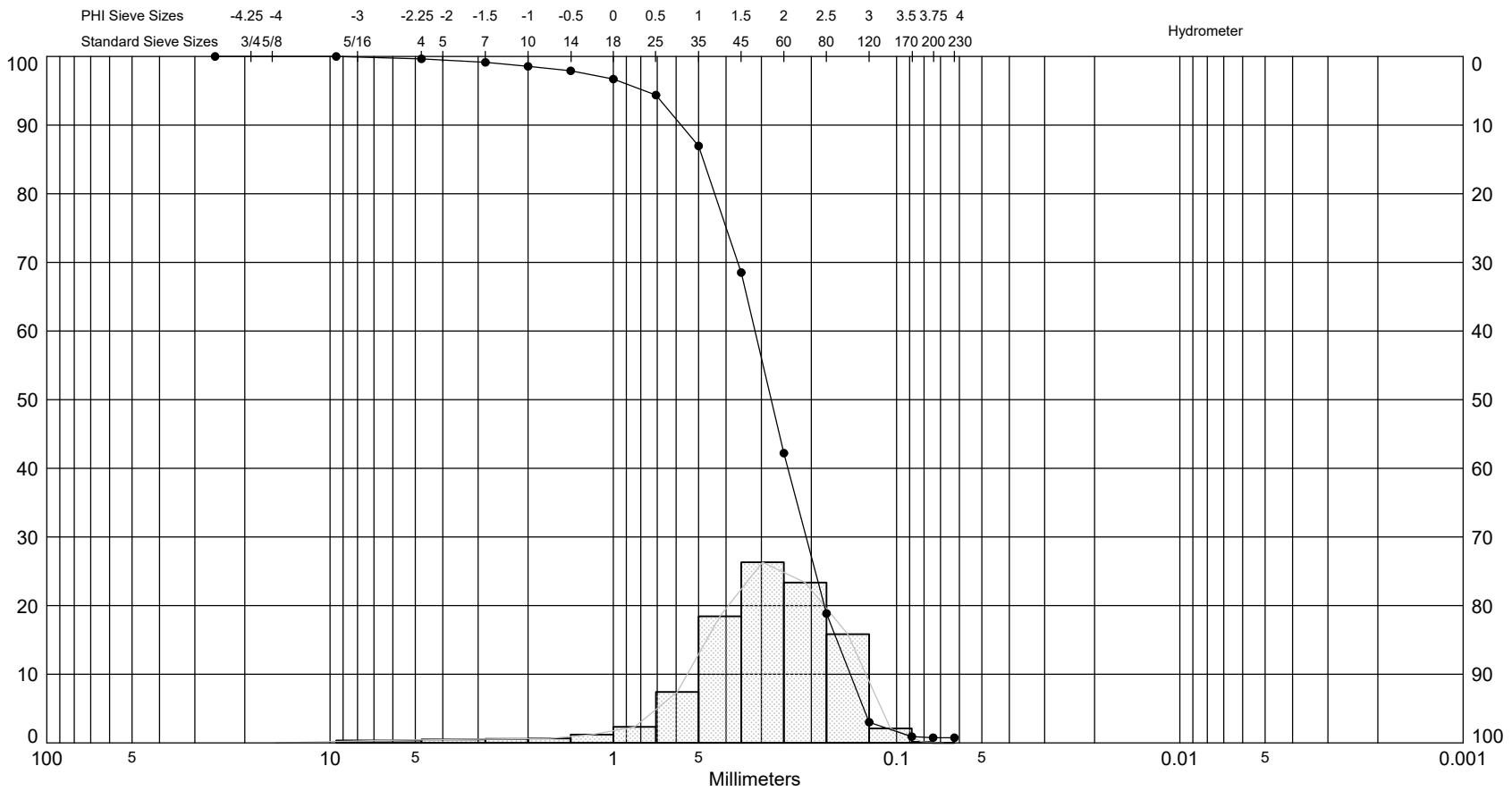
Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shells (%):
138.41	137.37			#200 - 0.76 #230 - 0.75			

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

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



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort
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

Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

Depths and elevations based on measured values

Sample Information	
Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Analysis Date:	07-29-22
Analyzed By:	CRM
Easting (X, ft):	2,744,979
Northing (Y, ft):	341,792
Horizontal System:	NAD 1983
Vertical System:	MLLW

Athena Technologies, Inc.
1293 Graham Farm Road
McClellanville, SC 29458
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SIEVE ANALYSIS USACE, 2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT 8/12/22

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-3

Analysis Date: 07-29-22

Analyzed By: CRM

Easting (ft):	Northing (ft):	Coordinate System:	Elevation (ft):
2,744,979	341,792	NC State Plane, Zone 3200	-10.5 MLLW

USCS:	Munsell:	Comments:
SP	Moist - 5Y-6/1	Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

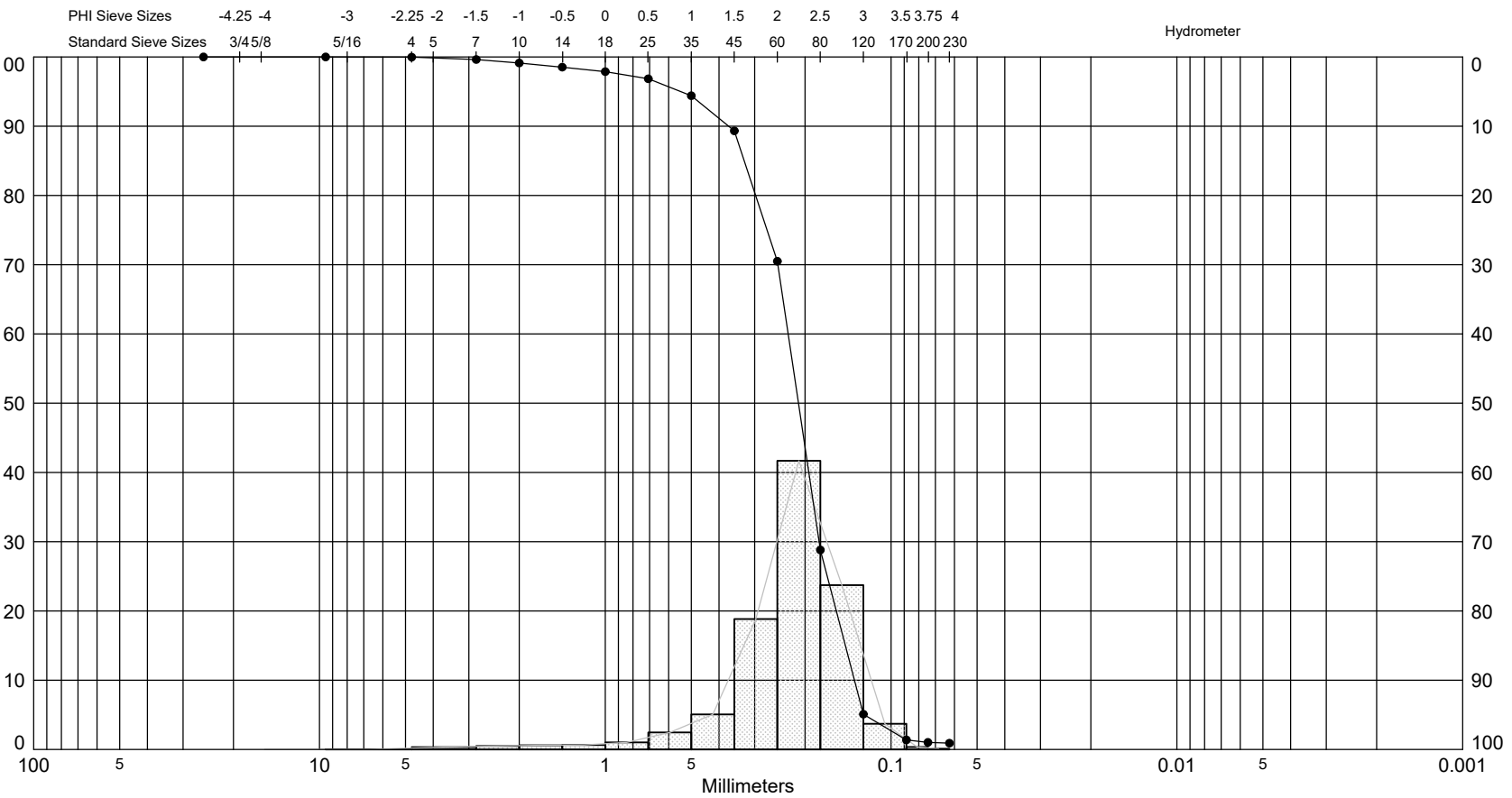
Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shells (%):
138.96	137.68			#200 - 1.02 #230 - 0.91			

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

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

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
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

Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

Depths and elevations based on measured values

Sample Information	
Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Analysis Date:	07-29-22
Analyzed By:	CRM
Easting (X, ft):	2,744,979
Northing (Y, ft):	341,792
Horizontal System:	NAD 1983
Vertical System:	MLLW

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

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):	Northing (ft):	Coordinate System:	Elevation (ft):
2,746,455	334,798	NC State Plane, Zone 3200	-2.1 MLLW

USCS:	Munsell:	Comments:
SP	Moist - 5Y-7/1	Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

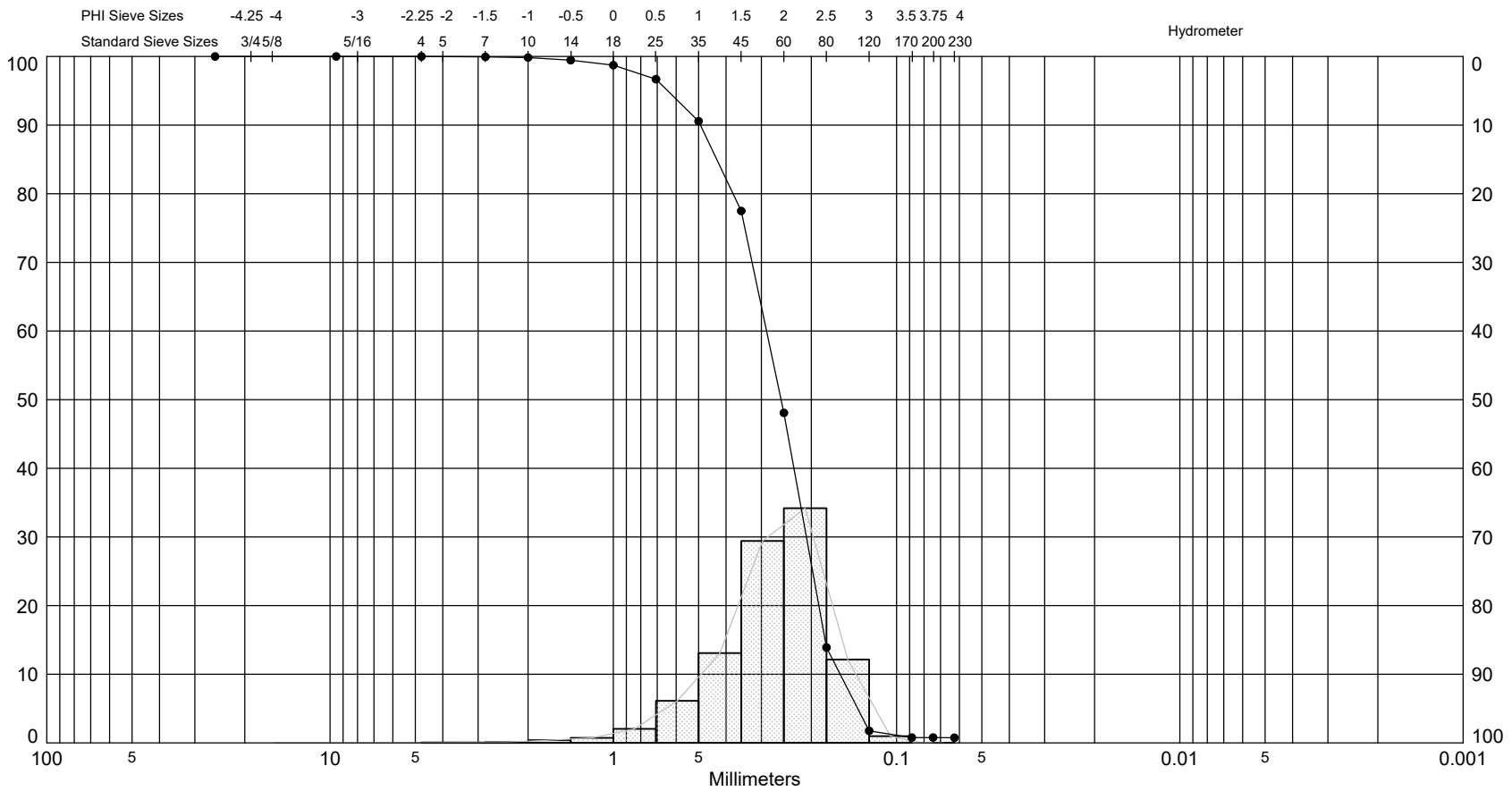
Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shells (%):
141.47	140.42			#200 - 0.78 #230 - 0.75			

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

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



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort
CLO-22-V-009 #S-1	—●—	-2.1	SP	#200 - 0.78 #230 - 0.75			1.97	1.87	-0.99	5.02	0.65

Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

Depths and elevations based on measured values

Sample Information	
Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Analysis Date:	07-29-22
Analyzed By:	CRM
Easting (X, ft):	2,746,455
Northing (Y, ft):	334,798
Horizontal System:	NAD 1983
Vertical System:	MLLW

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

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

Granularmetric Report

Depths and elevations based on measured values

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

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

Easting (ft):	Northing (ft):	Coordinate System:	Elevation (ft):
2,746,455	334,798	NC State Plane, Zone 3200	-3.6 MLLW

USCS:	Munsell:	Comments:
SM	Moist - 5Y-4/1	Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

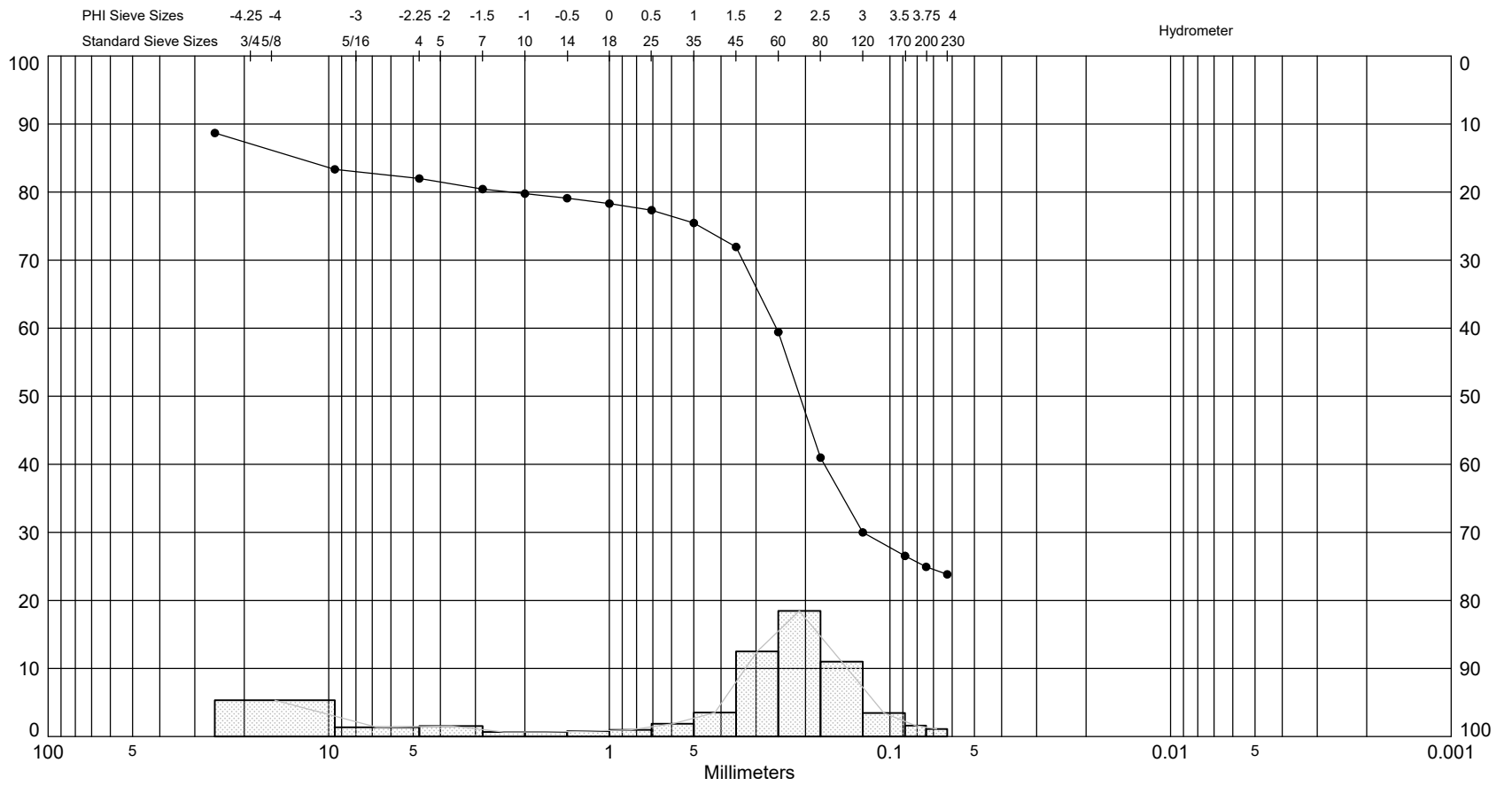
Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shells (%):
168.17	128.07			#200 - 24.93 #230 - 23.83			

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



Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort
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

Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

Depths and elevations based on measured values

Sample Information	
Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Analysis Date:	07-29-22
Analyzed By:	CRM
Easting (X, ft):	2,746,455
Northing (Y, ft):	334,798
Horizontal System:	NAD 1983
Vertical System:	MLLW

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

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

Granularmetric Report

Depths and elevations based on measured values

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

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

Easting (ft):	Northing (ft):	Coordinate System:	Elevation (ft):
2,746,455	334,798	NC State Plane, Zone 3200	-5.3 MLLW

USCS:	Munsell:	Comments:
SM	Moist - 5Y-5/1	Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

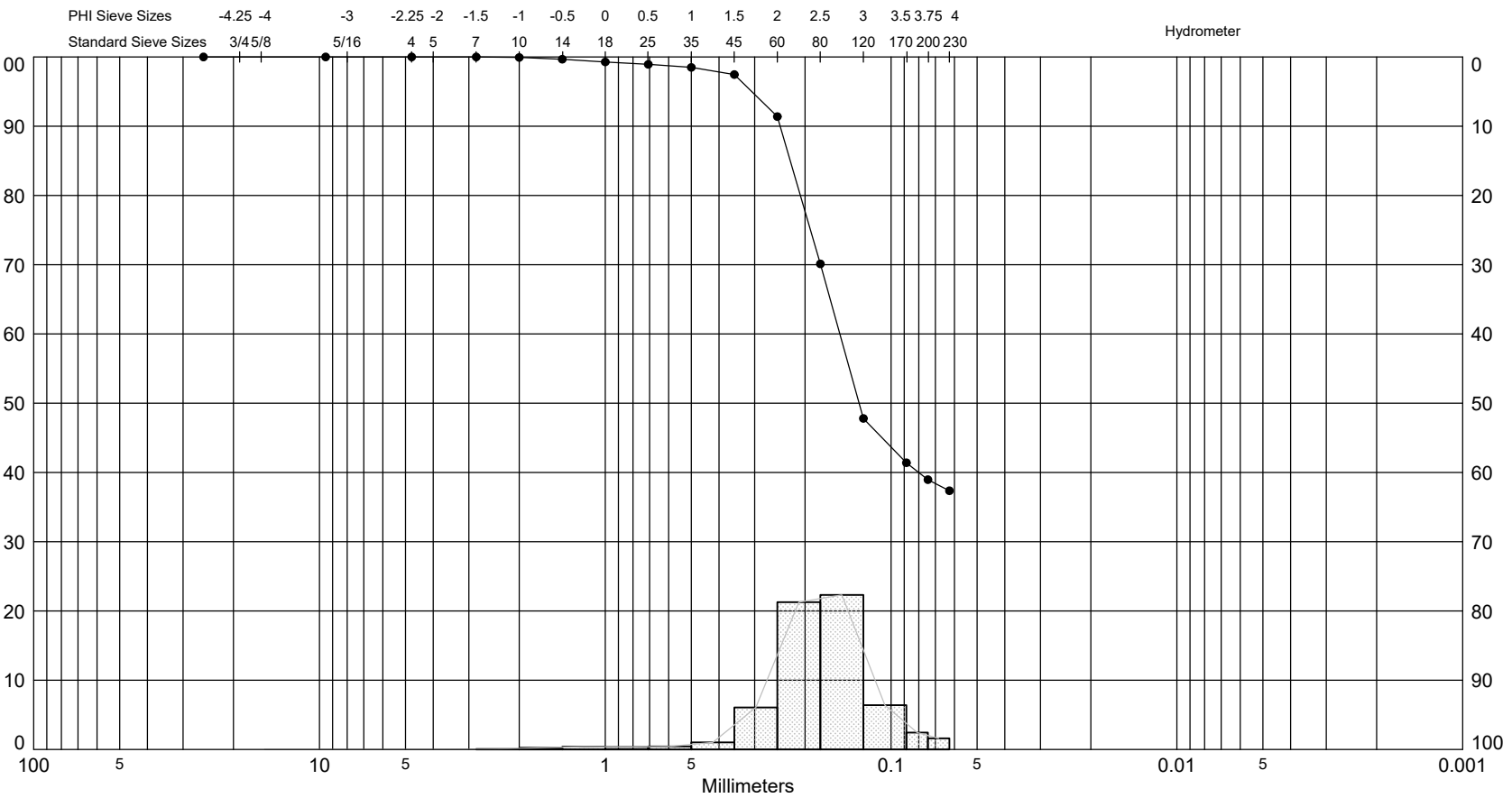
Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shells (%):
144.07	90.27			#200 - 38.96 #230 - 37.36			

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

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
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

Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

Depths and elevations based on measured values

Sample Information	
Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Analysis Date:	07-29-22
Analyzed By:	CRM
Easting (X, ft):	2,746,455
Northing (Y, ft):	334,798
Horizontal System:	NAD 1983
Vertical System:	MLLW

Athena Technologies, Inc.
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McClellanville, SC 29458
Office: 843-887-3800

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

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-4

Analysis Date: 07-29-22

Analyzed By: CRM

Easting (ft):	Northing (ft):	Coordinate System:	Elevation (ft):
2,746,455	334,798	NC State Plane, Zone 3200	-8.6 MLLW

USCS:	Munsell:	Comments:
SP	Moist - 5Y-6/1	Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

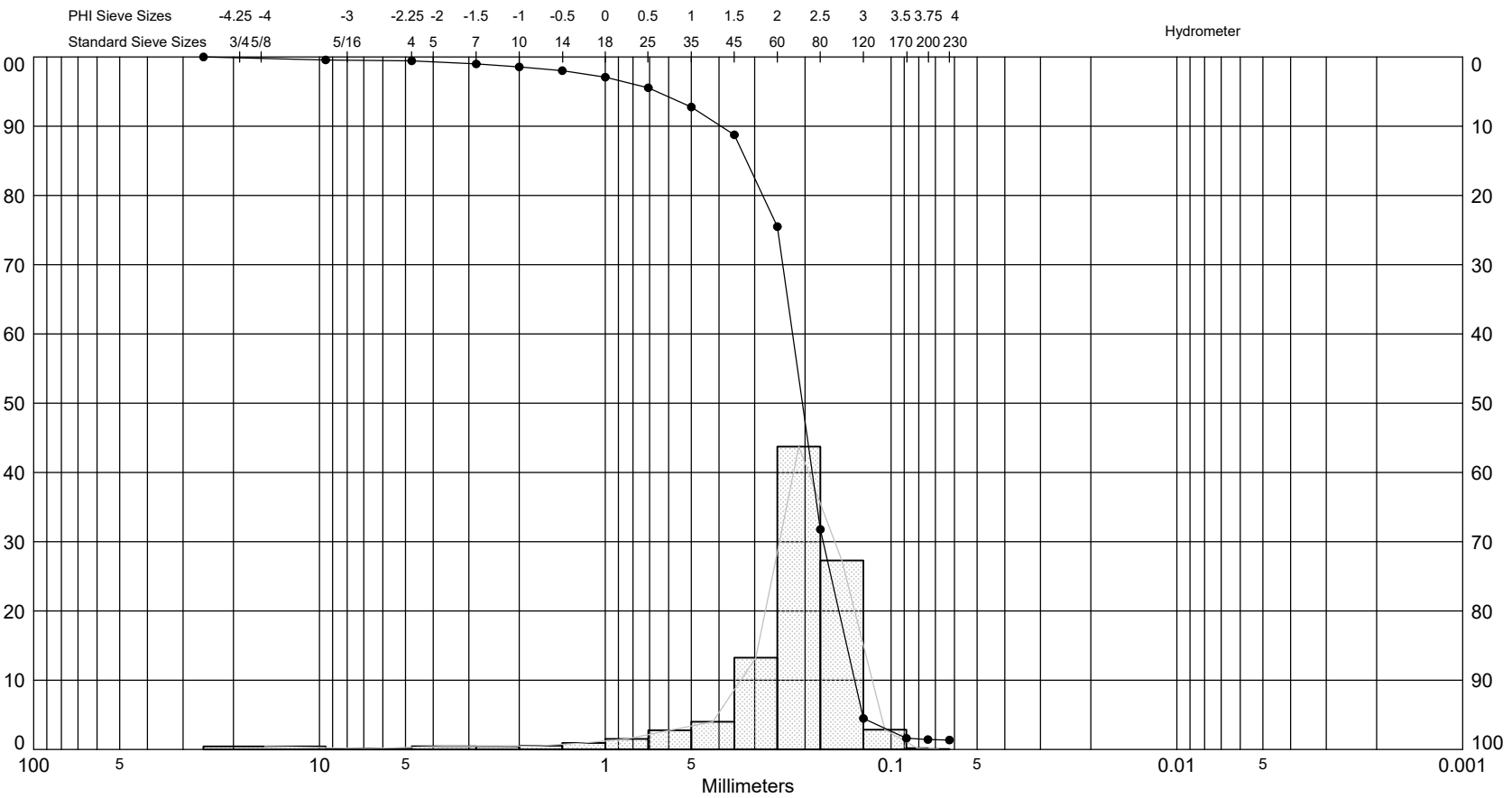
Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shells (%):
134.55	132.75			#200 - 1.43 #230 - 1.36			

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

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



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort
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

Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

Depths and elevations based on measured values

Sample Information	
Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Analysis Date:	07-29-22
Analyzed By:	CRM
Easting (X, ft):	2,746,455
Northing (Y, ft):	334,798
Horizontal System:	NAD 1983
Vertical System:	MLLW

ATHENA TECHNOLOGIES, INC.

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

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

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-1

Analysis Date: 07-29-22

Analyzed By: CRM

Easting (ft):	Northing (ft):	Coordinate System:	Elevation (ft):
2,745,857	332,507	NC State Plane, Zone 3200	-6.0 MLLW

USCS:	Munsell:	Comments:
SP	Moist - 5Y-6/2	Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

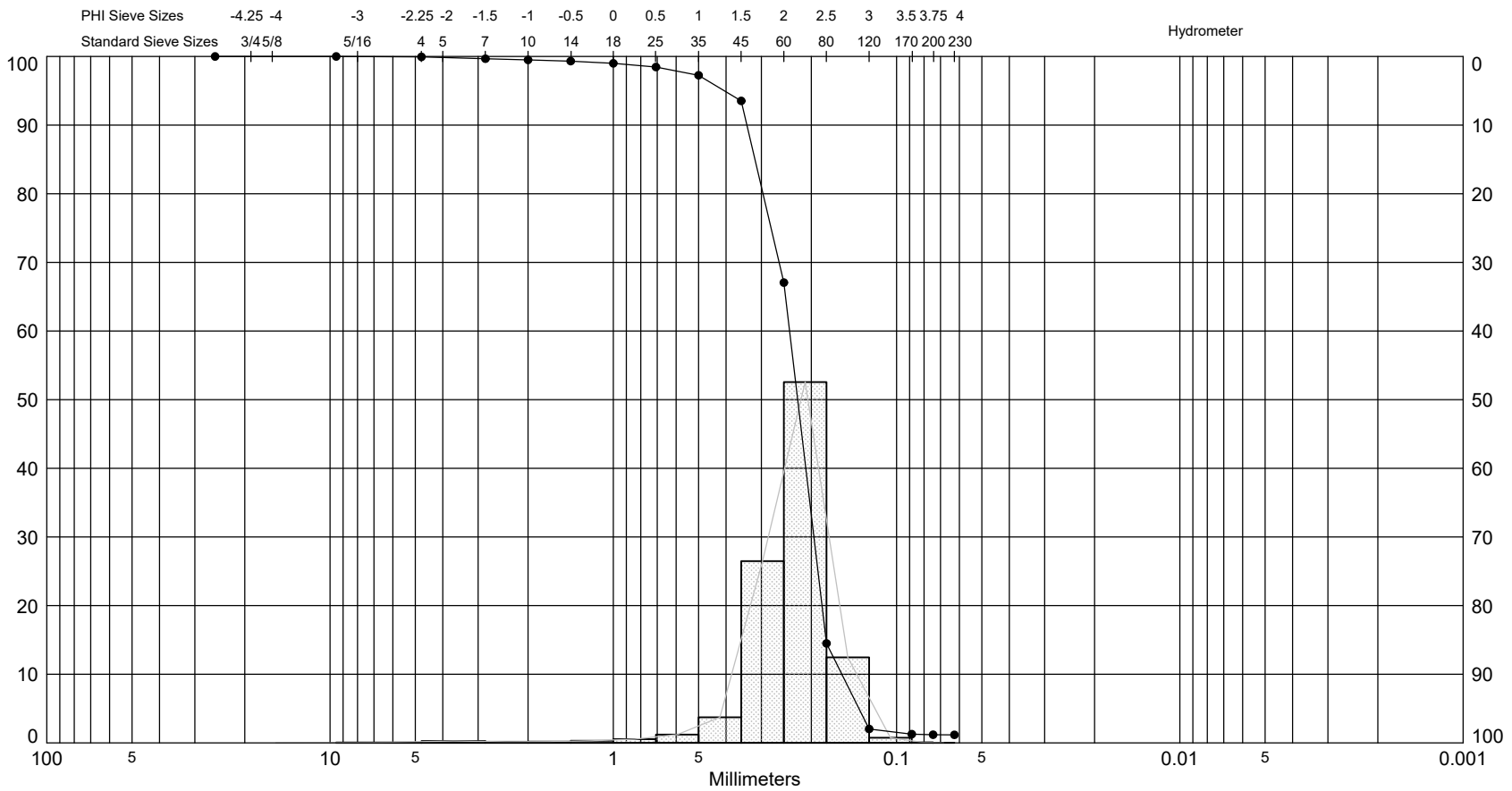
Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shells (%):
123.31	121.87			#200 - 1.19 #230 - 1.17			

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

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



Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort
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

Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

Depths and elevations based on measured values

Sample Information	
Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Analysis Date:	07-29-22
Analyzed By:	CRM
Easting (X, ft):	2,745,857
Northing (Y, ft):	332,507
Horizontal System:	NAD 1983
Vertical System:	MLLW

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

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

Granularmetric Report

Depths and elevations based on measured values

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

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

Easting (ft):	Northing (ft):	Coordinate System:	Elevation (ft):
2,745,857	332,507	NC State Plane, Zone 3200	-8.0 MLLW

USCS:	Munsell:	Comments:
SP	Moist - 5Y-7/1	Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

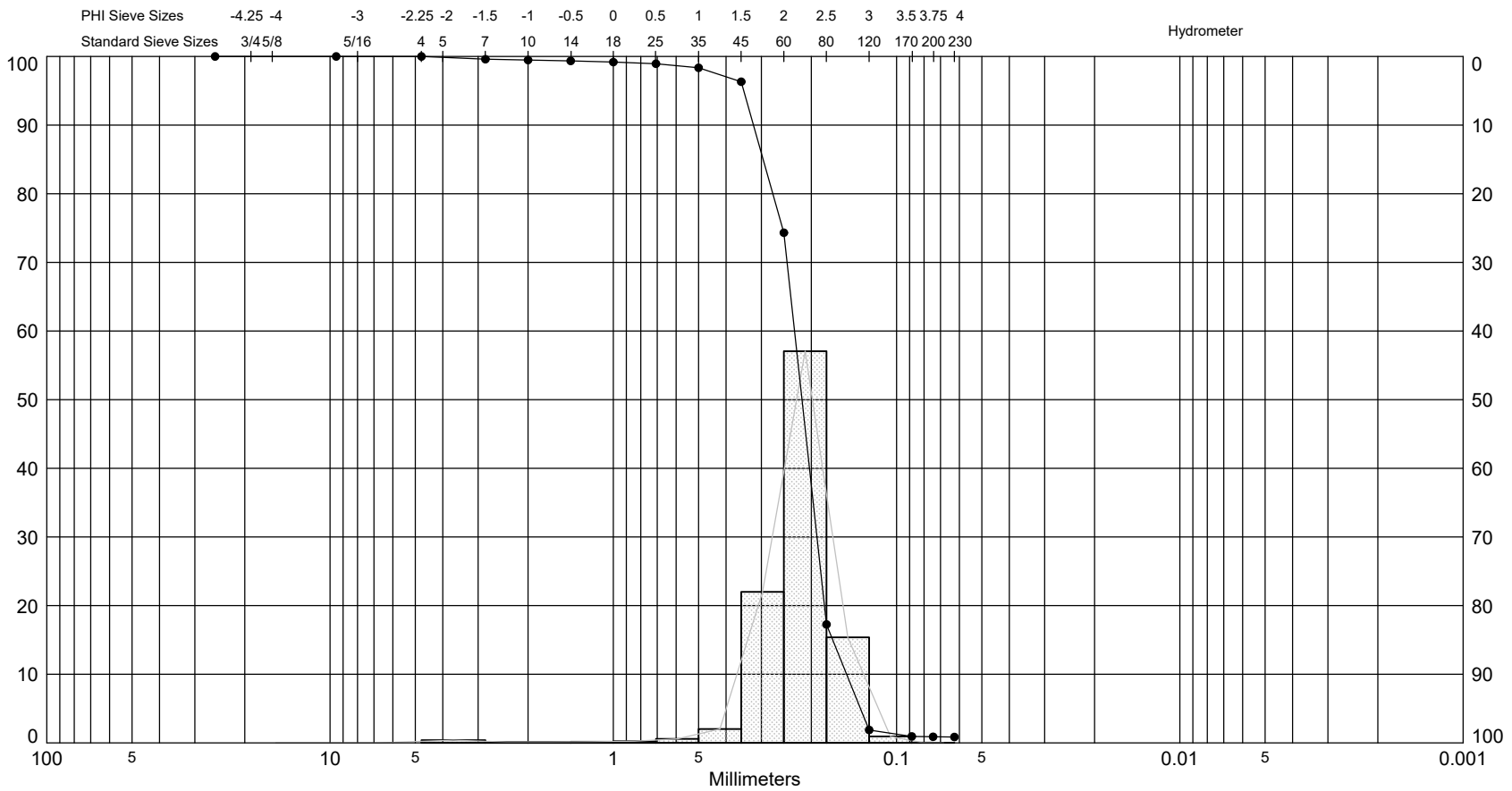
Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shells (%):
143.84	142.57			#200 - 0.89 #230 - 0.86			

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

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



Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort
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

Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

Depths and elevations based on measured values

Sample Information	
Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Analysis Date:	07-29-22
Analyzed By:	CRM
Easting (X, ft):	2,745,857
Northing (Y, ft):	332,507
Horizontal System:	NAD 1983
Vertical System:	MLLW

Athena Technologies, Inc.
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McClellanville, SC 29458
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SIEVE ANALYSIS USACE, 2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT 8/12/22

Granularmetric Report

Depths and elevations based on measured values

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

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

Easting (ft):	Northing (ft):	Coordinate System:	Elevation (ft):
2,745,857	332,507	NC State Plane, Zone 3200	-10.0 MLLW

USCS:	Munsell:	Comments:
SP	Moist - 5Y-7/1	Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

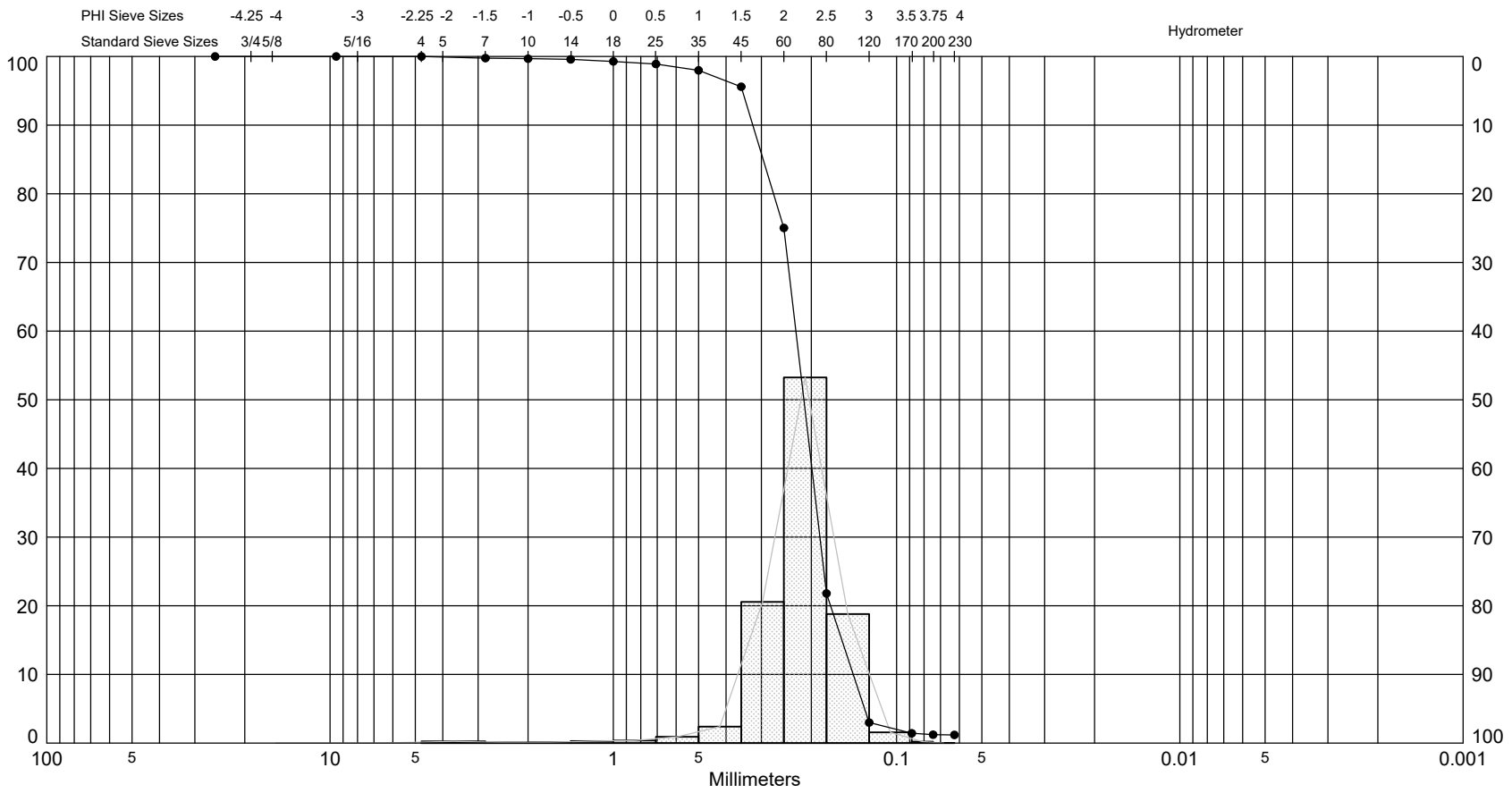
Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shells (%):
90.96	89.88			#200 - 1.22 #230 - 1.19			

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



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort
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

Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

Depths and elevations based on measured values

Sample Information	
Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Analysis Date:	07-29-22
Analyzed By:	CRM
Easting (X, ft):	2,745,857
Northing (Y, ft):	332,507
Horizontal System:	NAD 1983
Vertical System:	MLLW

ATHENA TECHNOLOGIES, INC.

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

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

Granularmetric Report

Depths and elevations based on measured values

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

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

Easting (ft):	Northing (ft):	Coordinate System:	Elevation (ft):
2,745,172	331,247	NC State Plane, Zone 3200	-3.1 MLLW

USCS:	Munsell:	Comments:
SP	Moist - 5Y-6/1	Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

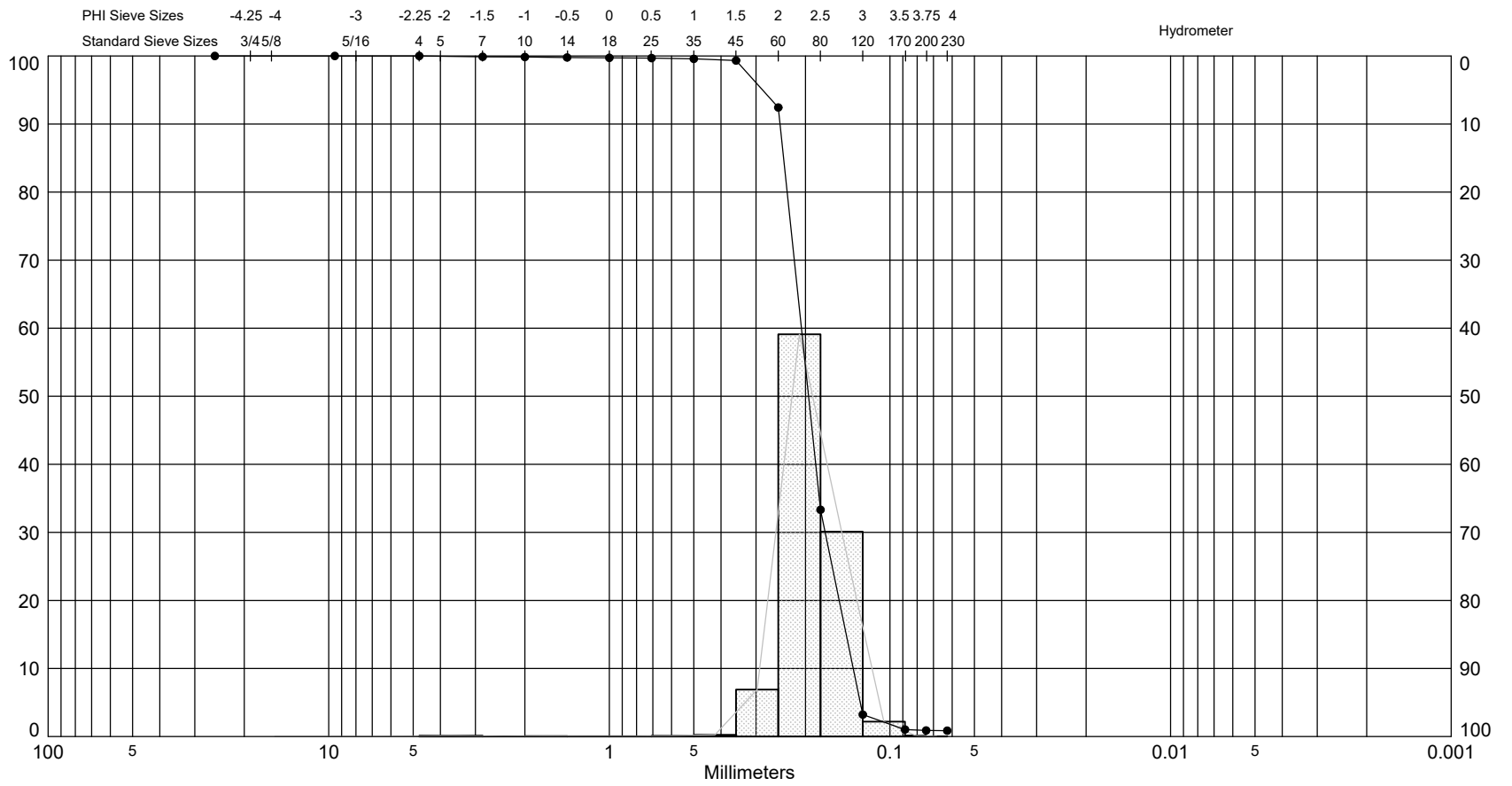
Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shells (%):
115.53	114.55			#200 - 0.89 #230 - 0.86			

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

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

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
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

Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

Depths and elevations based on measured values

Sample Information	
Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Analysis Date:	07-29-22
Analyzed By:	CRM
Easting (X, ft):	2,745,172
Northing (Y, ft):	331,247
Horizontal System:	NAD 1983
Vertical System:	MLLW

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

Granularmetric Report

Depths and elevations based on measured values

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

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

Easting (ft):	Northing (ft):	Coordinate System:	Elevation (ft):
2,745,172	331,247	NC State Plane, Zone 3200	-5.1 MLLW

USCS:	Munsell:	Comments:
SP	Moist - 5Y-6/1	Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

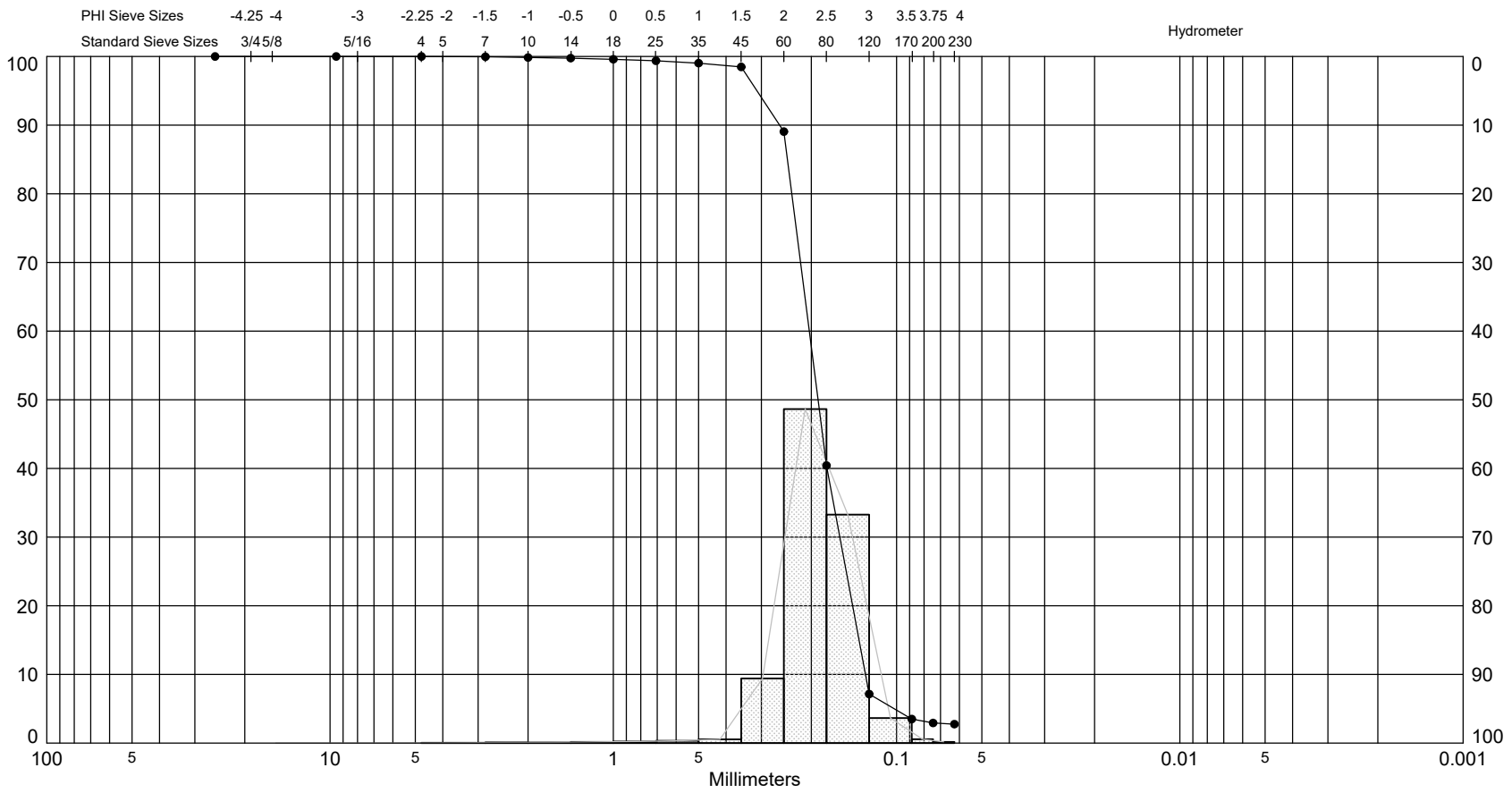
Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shells (%):
162.39	157.90			#200 - 2.93 #230 - 2.76			

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

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

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



Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort
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

Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

Depths and elevations based on measured values

Sample Information	
Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Analysis Date:	07-29-22
Analyzed By:	CRM
Easting (X, ft):	2,745,172
Northing (Y, ft):	331,247
Horizontal System:	NAD 1983
Vertical System:	MLLW

ATHENA TECHNOLOGIES, INC.

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McClellanville, SC 29458
Office: 843-887-3800

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

Granularmetric Report

Depths and elevations based on measured values

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

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

Easting (ft):	Northing (ft):	Coordinate System:	Elevation (ft):
2,745,172	331,247	NC State Plane, Zone 3200	-8.1 MLLW

USCS:	Munsell:	Comments:
SP	Moist - 5Y-6/1	Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

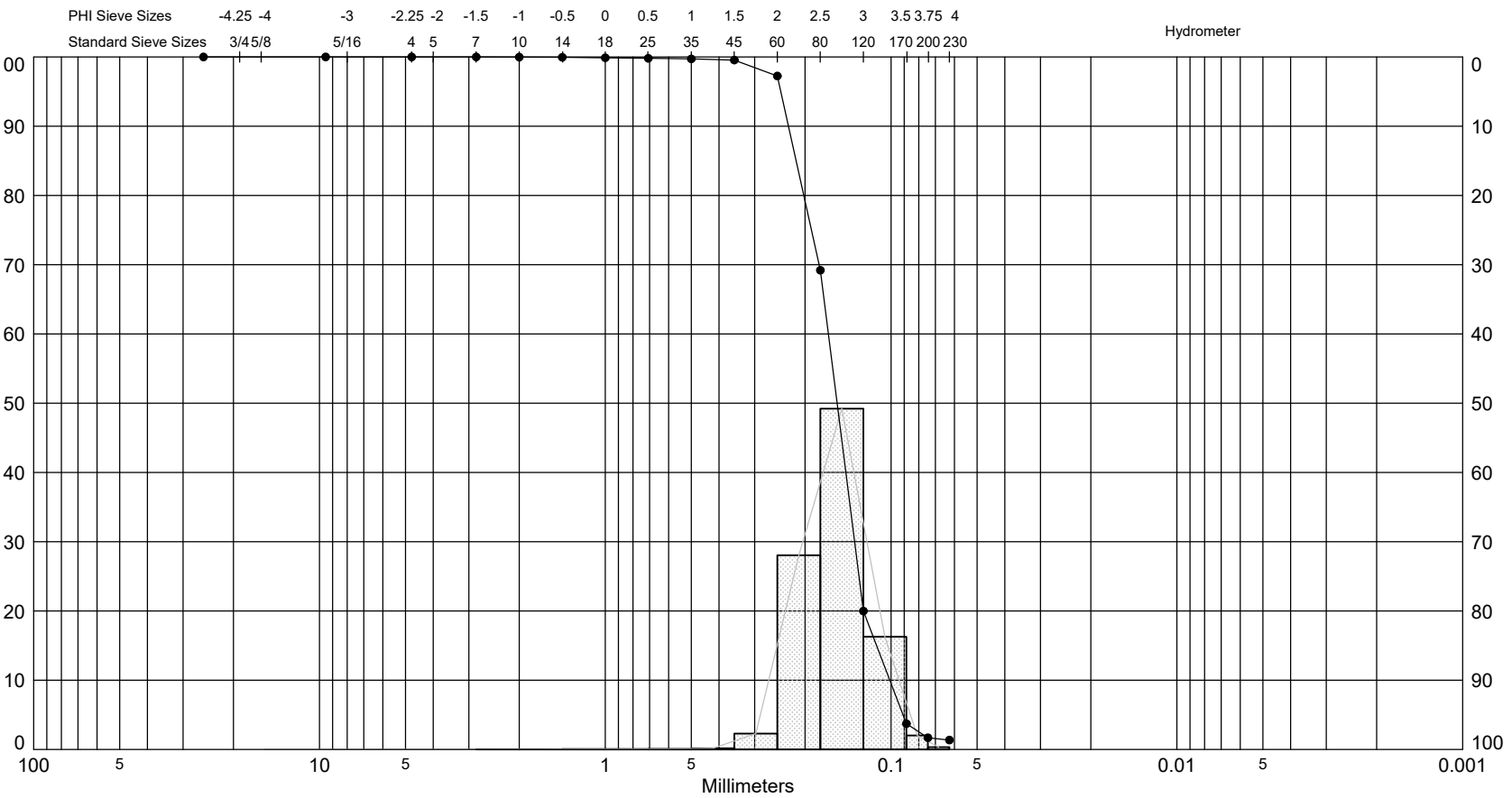
Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shells (%):
150.41	148.35			#200 - 1.69 #230 - 1.36			

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

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

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



Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort
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

Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

Depths and elevations based on measured values

Sample Information	
Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Analysis Date:	08-01-22
Analyzed By:	CRM
Easting (X, ft):	2,745,172
Northing (Y, ft):	331,247
Horizontal System:	NAD 1983
Vertical System:	MLLW

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

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

Granularmetric Report

Depths and elevations based on measured values

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

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

Easting (ft):	Northing (ft):	Coordinate System:	Elevation (ft):
2,745,172	331,247	NC State Plane, Zone 3200	-9.6 MLLW

USCS:	Munsell:	Comments:
SP	Moist - 5Y-7/1	Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

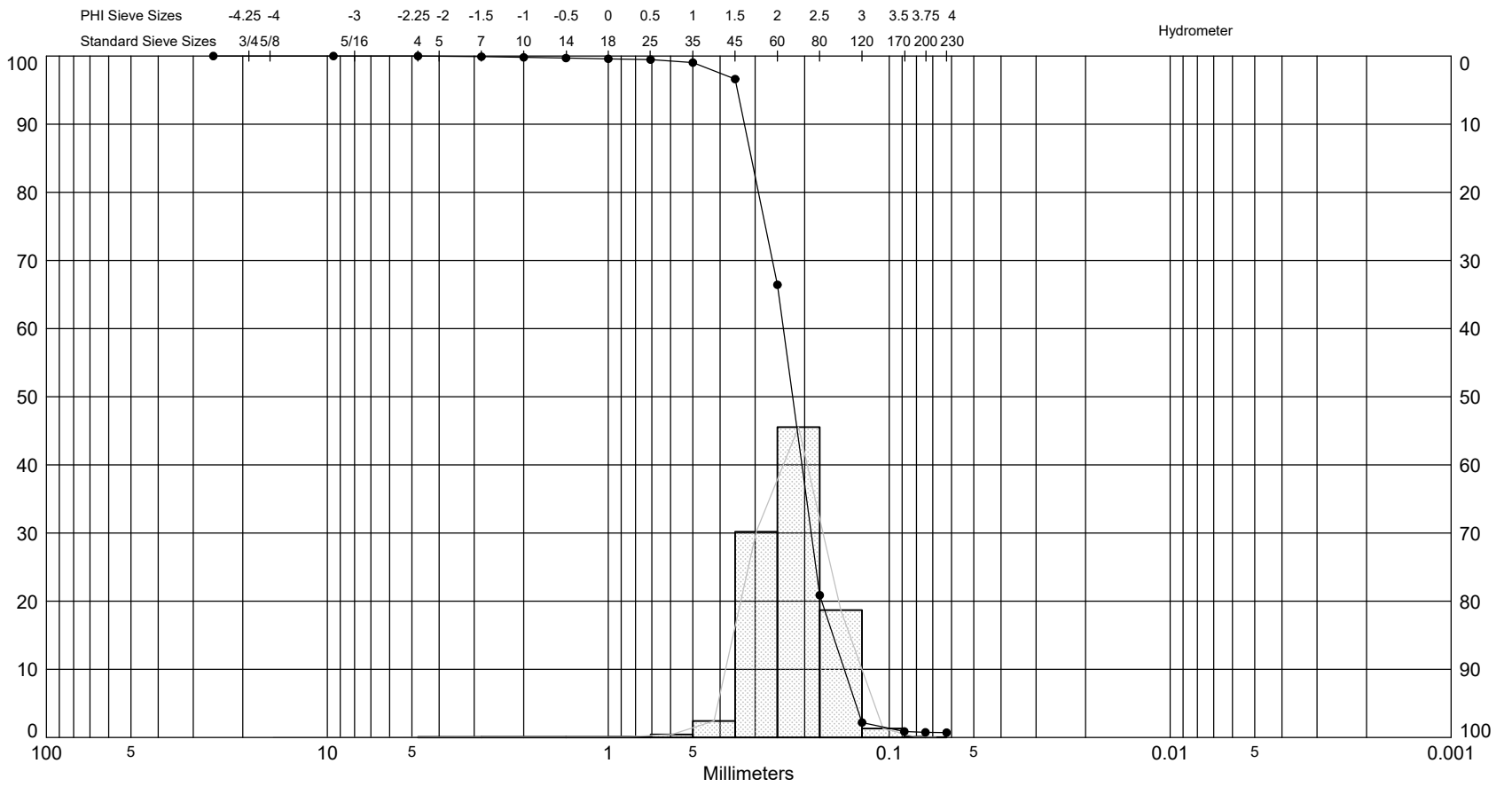
Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shells (%):
134.70	133.74			#200 - 0.75 #230 - 0.71			

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

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



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort
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

Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

Depths and elevations based on measured values

Sample Information	
Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Analysis Date:	08-01-22
Analyzed By:	CRM
Easting (X, ft):	2,745,172
Northing (Y, ft):	331,247
Horizontal System:	NAD 1983
Vertical System:	MLLW

ATHENA TECHNOLOGIES, INC.

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

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

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-012 #S-1

Analysis Date: 08-01-22

Analyzed By: CRM

Easting (ft):	Northing (ft):	Coordinate System:	Elevation (ft):
2,744,458	329,133	NC State Plane, Zone 3200	-1.1 MLLW

USCS:	Munsell:	Comments:
SP	Moist - 5Y-6/1	Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

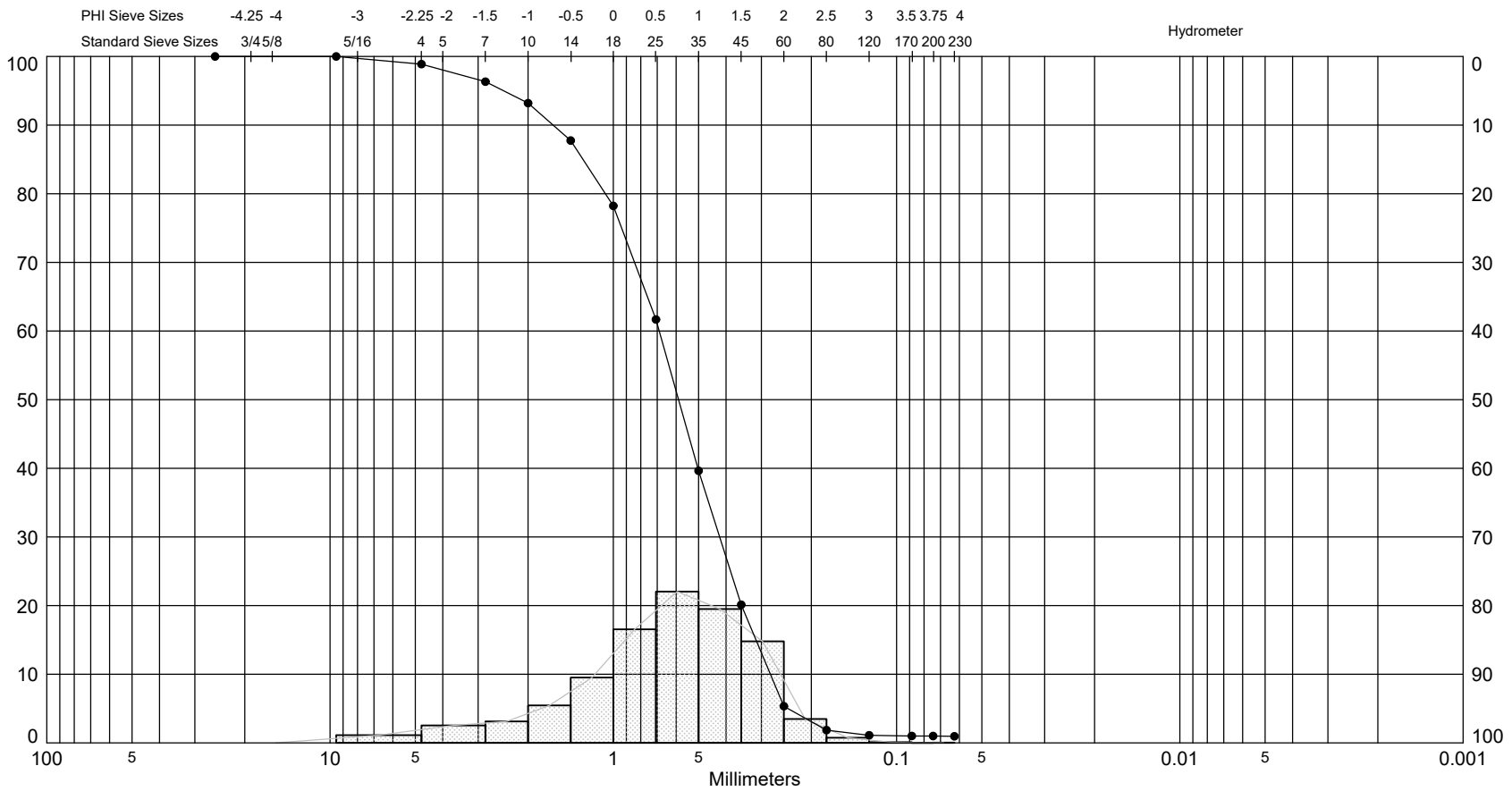
Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shells (%):
121.54	120.38			#200 - 1.00 #230 - 0.96			

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

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

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
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

Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

Depths and elevations based on measured values

Sample Information	
Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Analysis Date:	08-01-22
Analyzed By:	CRM
Easting (X, ft):	2,744,458
Northing (Y, ft):	329,133
Horizontal System:	NAD 1983
Vertical System:	MLLW

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

Granularmetric Report

Depths and elevations based on measured values

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

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

Easting (ft):	Northing (ft):	Coordinate System:	Elevation (ft):
2,744,458	329,133	NC State Plane, Zone 3200	-2.6 MLLW

USCS:	Munsell:	Comments:
SP	Moist - 5Y-7/1	Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

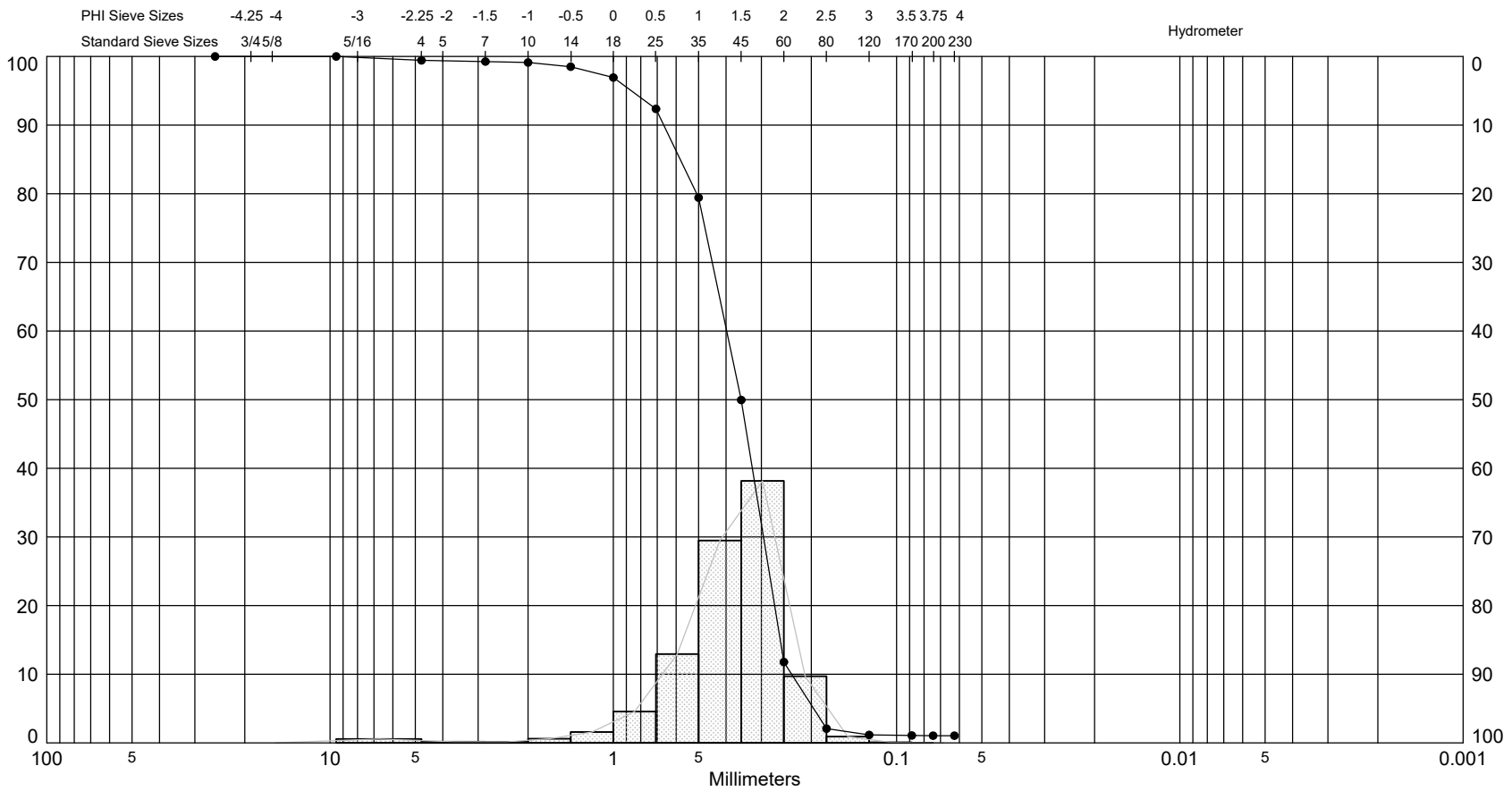
Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shells (%):
144.52	143.00			#200 - 1.05 #230 - 1.05			

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

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



Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort
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

Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

Depths and elevations based on measured values

Sample Information	
Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Analysis Date:	08-01-22
Analyzed By:	CRM
Easting (X, ft):	2,744,458
Northing (Y, ft):	329,133
Horizontal System:	NAD 1983
Vertical System:	MLLW

ATHENA TECHNOLOGIES, INC.

Athena Technologies, Inc.
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McClellanville, SC 29458
Office: 843-887-3800

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

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-012 #S-3

Analysis Date: 08-01-22

Analyzed By: CRM

Easting (ft):	Northing (ft):	Coordinate System:	Elevation (ft):
2,744,458	329,133	NC State Plane, Zone 3200	-4.6 MLLW

USCS:	Munsell:	Comments:
SP	Moist - 5Y-7/1	Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

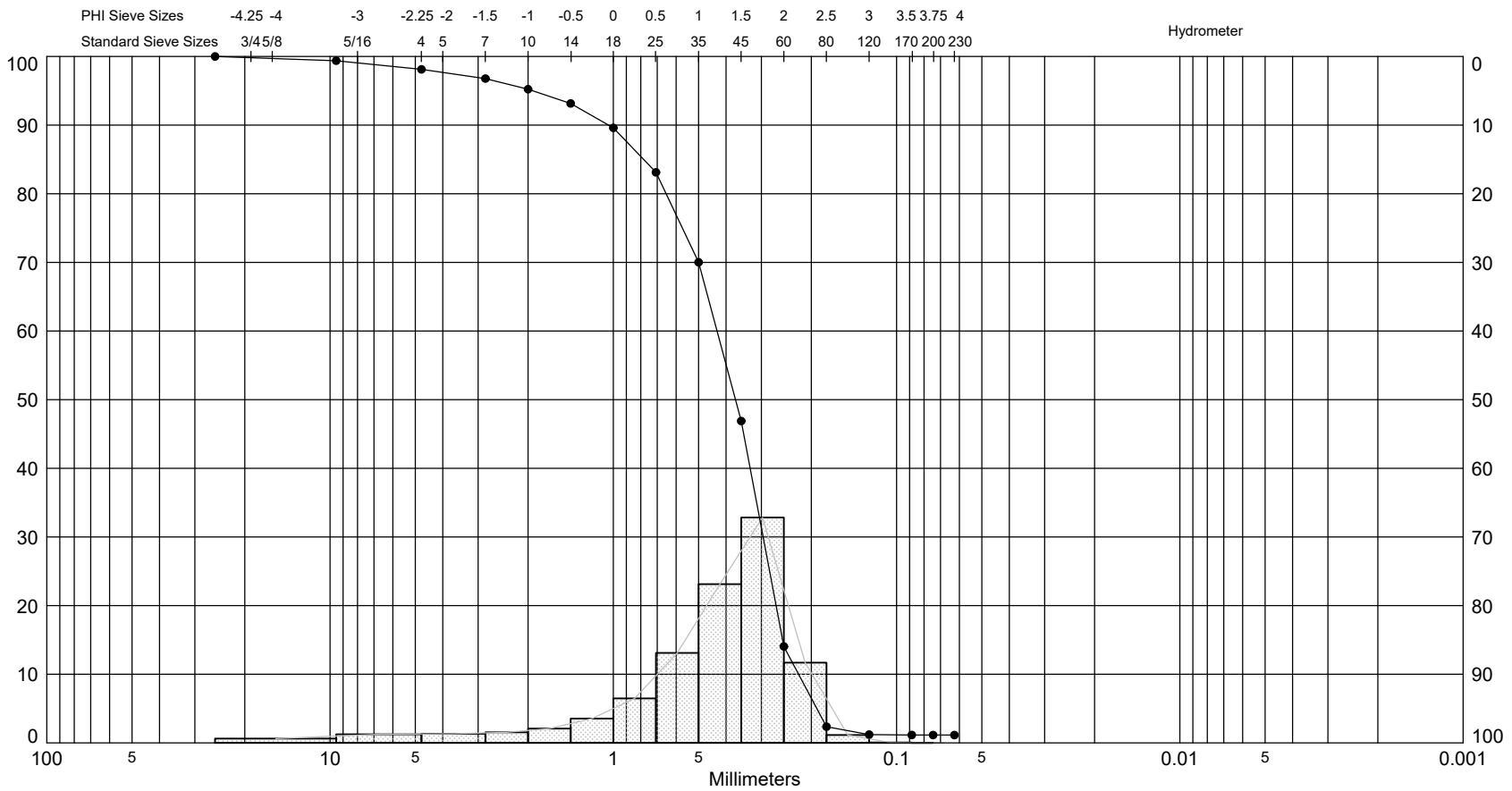
Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shells (%):
112.26	111.00			#200 - 1.14 #230 - 1.14			

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



Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort
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

Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

Depths and elevations based on measured values

Sample Information	
Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Analysis Date:	08-01-22
Analyzed By:	CRM
Easting (X, ft):	2,744,458
Northing (Y, ft):	329,133
Horizontal System:	NAD 1983
Vertical System:	MLLW

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

Granularmetric Report

Depths and elevations based on measured values

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

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

Easting (ft):	Northing (ft):	Coordinate System:	Elevation (ft):
2,744,458	329,133	NC State Plane, Zone 3200	-6.6 MLLW

USCS:	Munsell:	Comments:
SP	Moist - 5Y-6/1	Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

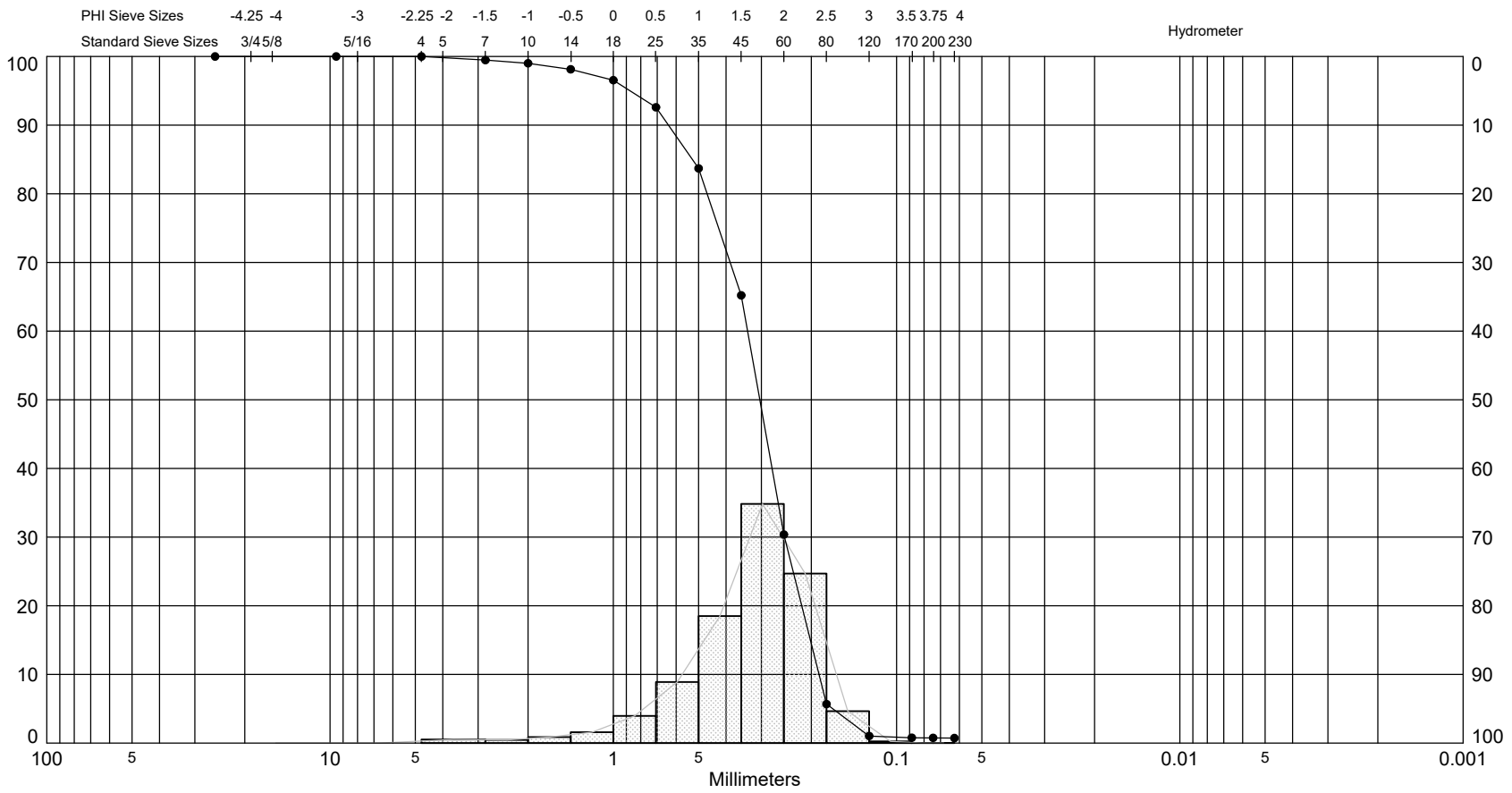
Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shells (%):
109.42	108.61			#200 - 0.76 #230 - 0.73			

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

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

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



Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort
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

Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

Depths and elevations based on measured values

Sample Information	
Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Analysis Date:	08-01-22
Analyzed By:	CRM
Easting (X, ft):	2,744,458
Northing (Y, ft):	329,133
Horizontal System:	NAD 1983
Vertical System:	MLLW

Athena Technologies, Inc.
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McClellanville, SC 29458
Office: 843-887-3800

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

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-012 #S-5

Analysis Date: 08-01-22

Analyzed By: CRM

Easting (ft):	Northing (ft):	Coordinate System:	Elevation (ft):
2,744,458	329,133	NC State Plane, Zone 3200	-9.1 MLLW

USCS:	Munsell:	Comments:
SP	Moist - 5Y-6/1	Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

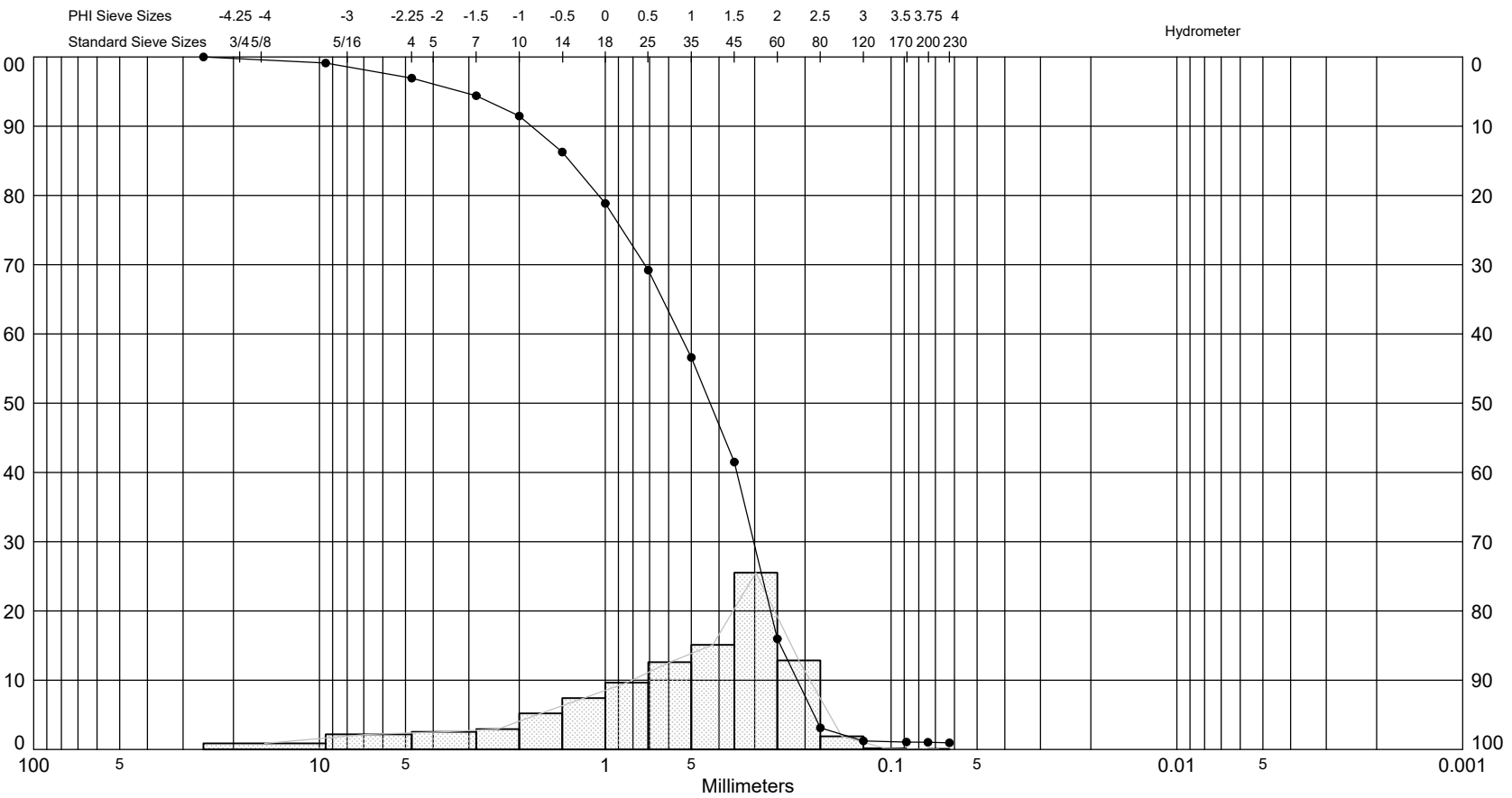
Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shells (%):
115.10	113.98			#200 - 1.04 #230 - 0.96			

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

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

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
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

Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

Depths and elevations based on measured values

Sample Information	
Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Analysis Date:	08-01-22
Analyzed By:	CRM
Easting (X, ft):	2,744,458
Northing (Y, ft):	329,133
Horizontal System:	NAD 1983
Vertical System:	MLLW

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

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

Granularmetric Report

Depths and elevations based on measured values

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

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

Easting (ft):	Northing (ft):	Coordinate System:	Elevation (ft):
2,744,209	329,932	NC State Plane, Zone 3200	-8.5 MLLW

USCS:	Munsell:	Comments:
SP	Moist - 5Y-7/2	Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

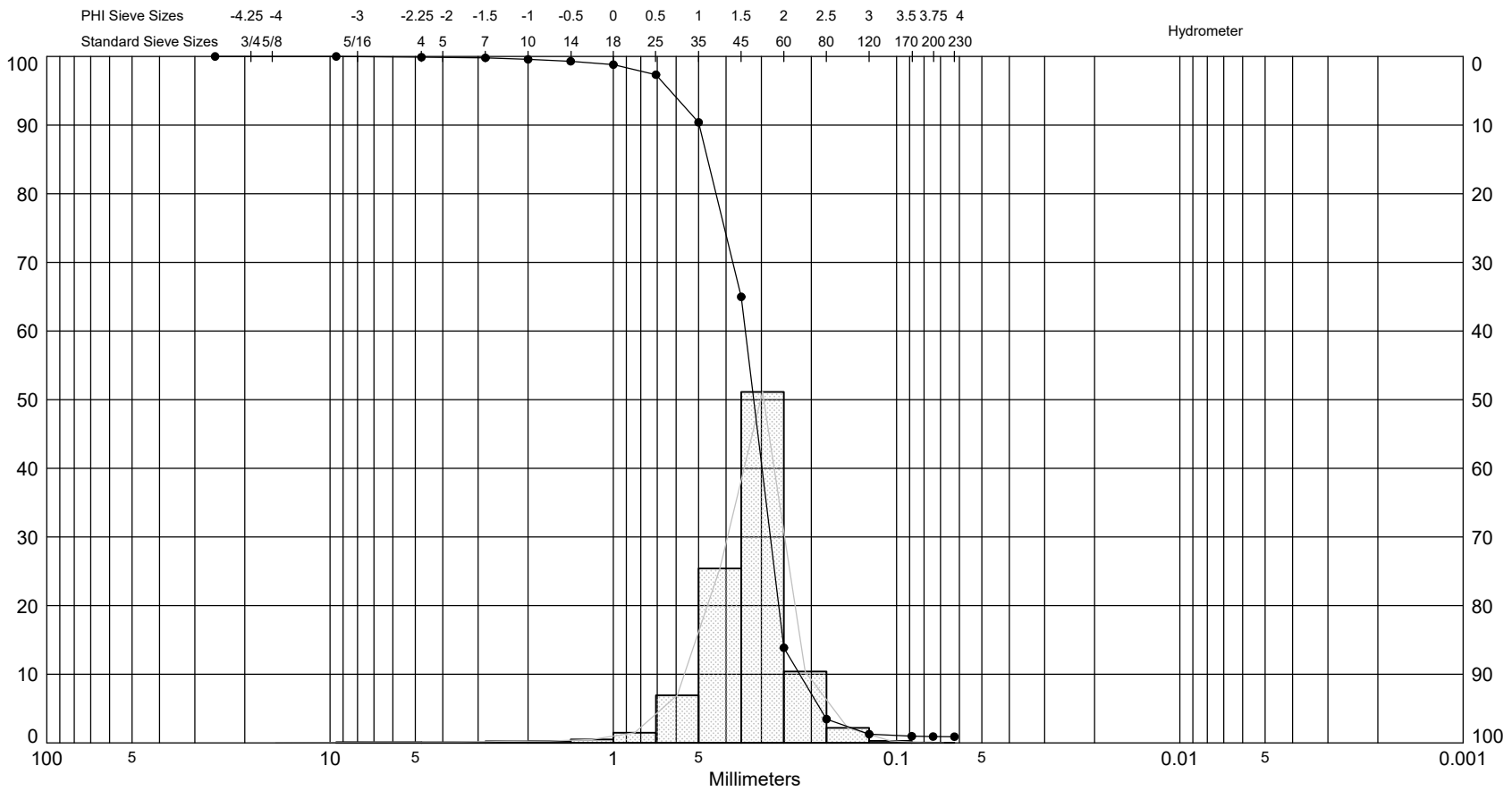
Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shells (%):
148.42	147.08			#200 - 0.92 #230 - 0.90			

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



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort
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

Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

Depths and elevations based on measured values

Sample Information	
Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Analysis Date:	08-01-22
Analyzed By:	CRM
Easting (X, ft):	2,744,209
Northing (Y, ft):	329,932
Horizontal System:	NAD 1983
Vertical System:	MLLW

ATHENA TECHNOLOGIES, INC.

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

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

Granularmetric Report

Depths and elevations based on measured values

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

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

Easting (ft):	Northing (ft):	Coordinate System:	Elevation (ft):
2,744,209	329,932	NC State Plane, Zone 3200	-10.0 MLLW

USCS:	Munsell:	Comments:
SP	Moist - 5Y-7/1	Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

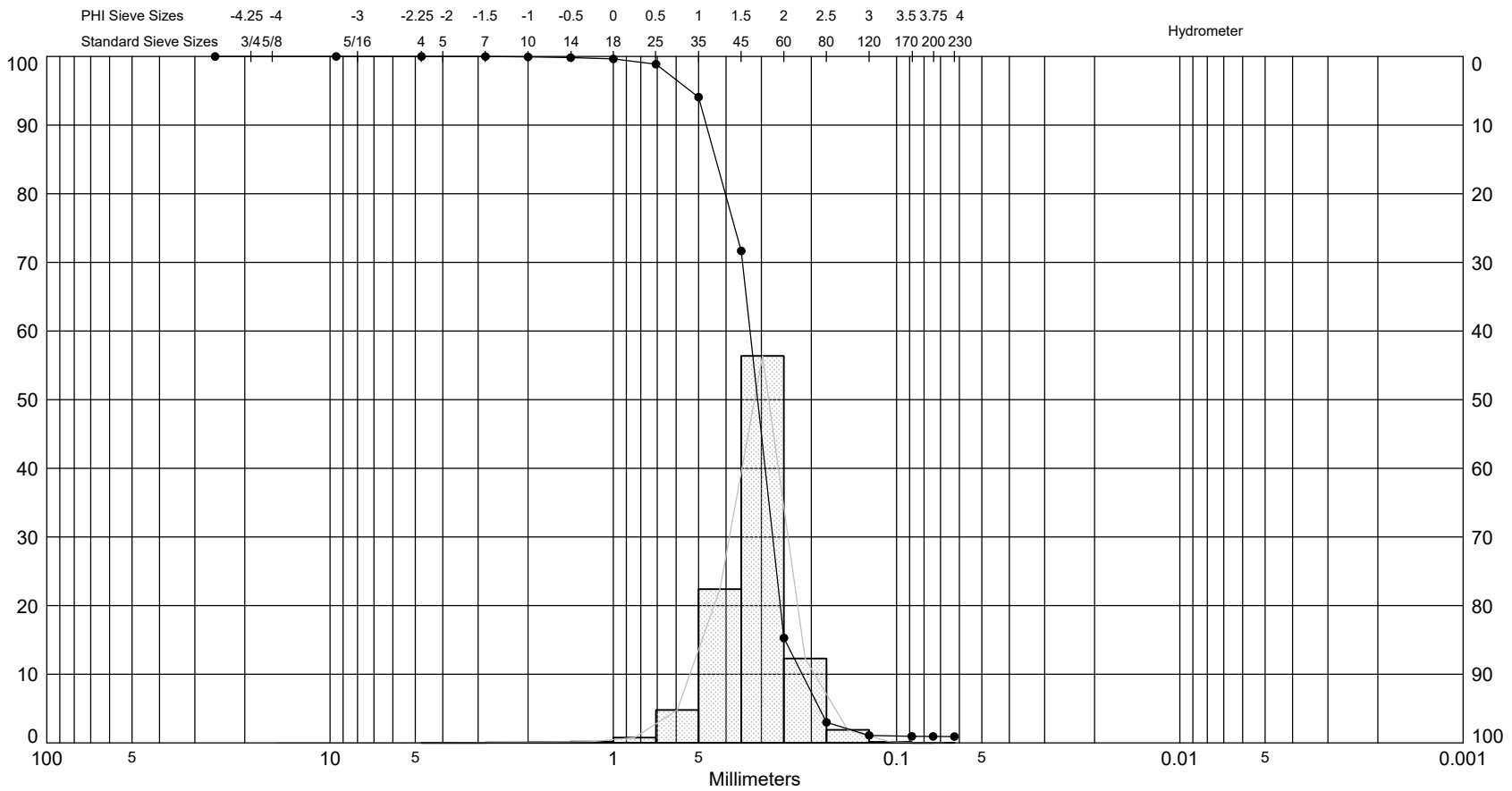
Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shells (%):
134.28	133.04			#200 - 0.94 #230 - 0.92			

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

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	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
Statistics	1.65	0.32	0.43	-0.72	7.09

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



Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort
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

Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

Depths and elevations based on measured values

Sample Information	
Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Analysis Date:	08-01-22
Analyzed By:	CRM
Easting (X, ft):	2,744,209
Northing (Y, ft):	329,932
Horizontal System:	NAD 1983
Vertical System:	MLLW

ATHENA TECHNOLOGIES, INC.

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

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

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):	Northing (ft):	Coordinate System:	Elevation (ft):
2,744,209	329,932	NC State Plane, Zone 3200	-12.0 MLLW

USCS:	Munsell:	Comments:
SP	Moist - 5Y-6/1	Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

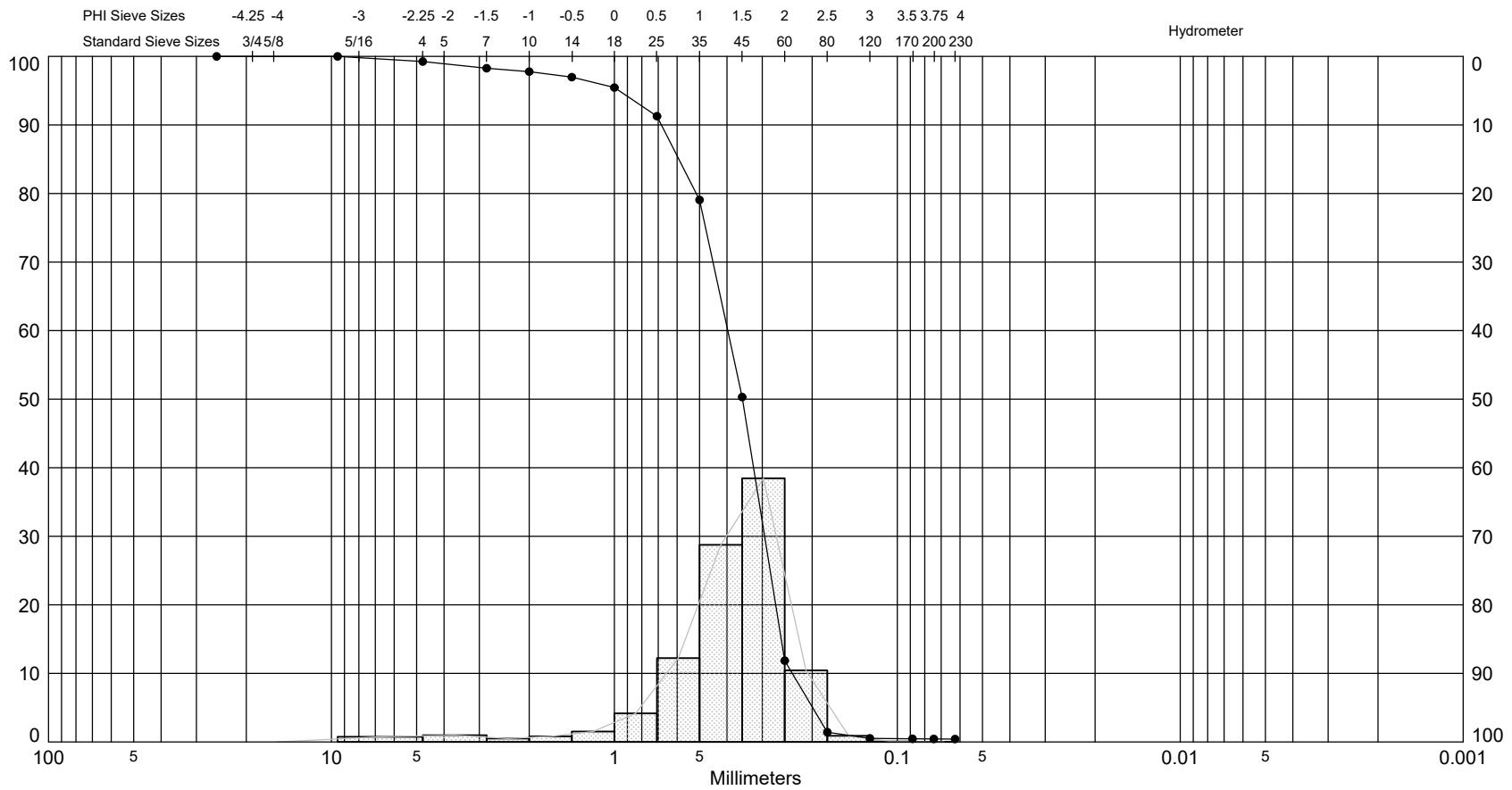
Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shells (%):
133.93	133.36			#200 - 0.44 #230 - 0.42			

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

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
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

Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

Depths and elevations based on measured values

Sample Information	
Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Analysis Date:	08-01-22
Analyzed By:	CRM
Easting (X, ft):	2,744,209
Northing (Y, ft):	329,932
Horizontal System:	NAD 1983
Vertical System:	MLLW

Athena Technologies, Inc.
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McClellanville, SC 29458
Office: 843-887-3800

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

Granularmetric Report

Depths and elevations based on measured values

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

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

Easting (ft):	Northing (ft):	Coordinate System:	Elevation (ft):
2,743,568	328,665	NC State Plane, Zone 3200	-3.1 MLLW

USCS:	Munsell:	Comments:
SP	Moist - 5Y-7/1	Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

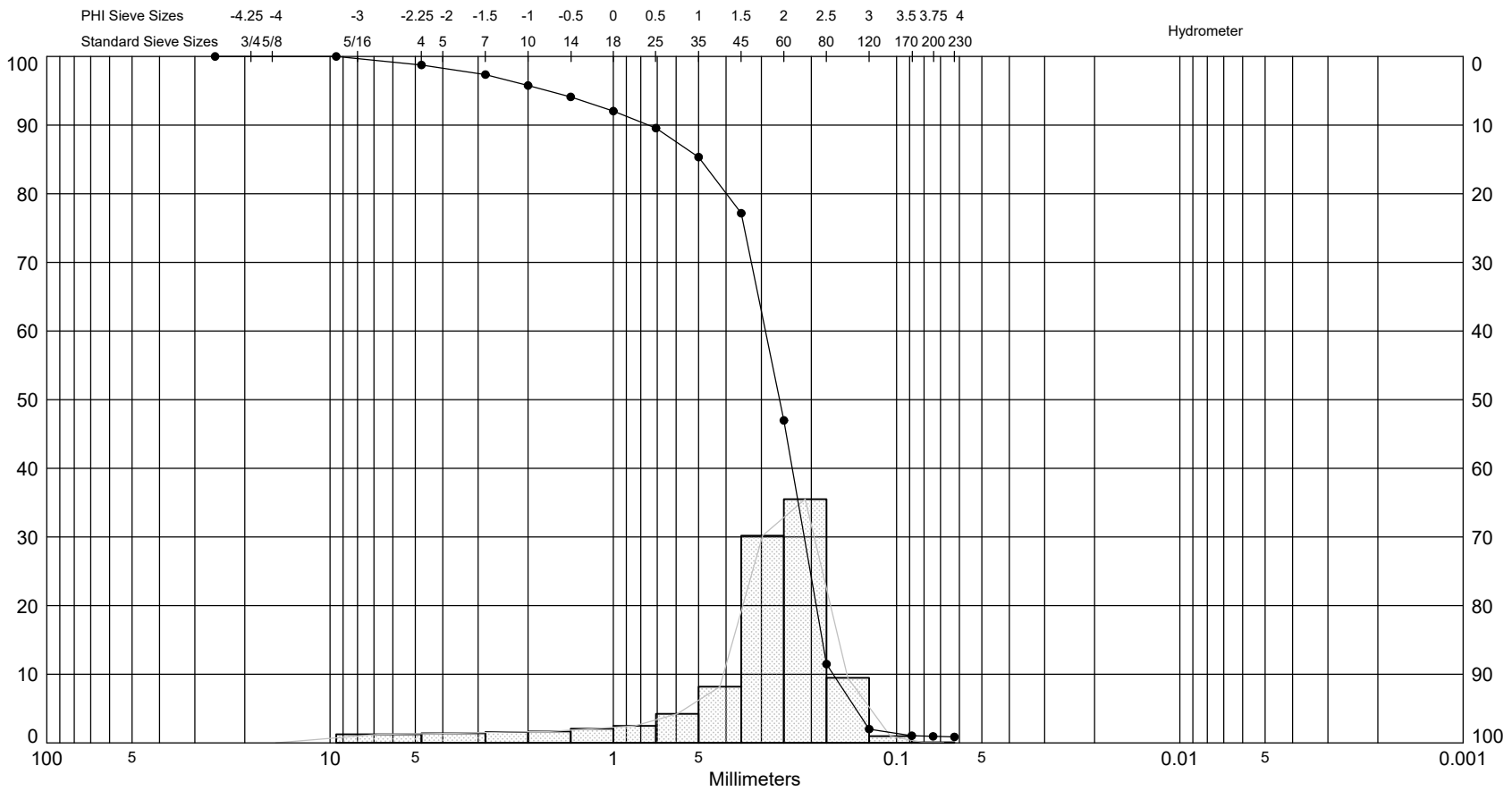
Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shells (%):
86.19	85.45			#200 - 0.95 #230 - 0.87			

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



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort
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

Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

Depths and elevations based on measured values

Sample Information	
Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Analysis Date:	08-01-22
Analyzed By:	CRM
Easting (X, ft):	2,743,568
Northing (Y, ft):	328,665
Horizontal System:	NAD 1983
Vertical System:	MLLW

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

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

Granularmetric Report

Depths and elevations based on measured values

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

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

Easting (ft):	Northing (ft):	Coordinate System:	Elevation (ft):
2,743,568	328,665	NC State Plane, Zone 3200	-5.6 MLLW

USCS:	Munsell:	Comments:
SP	Moist - 5Y-6/1	Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

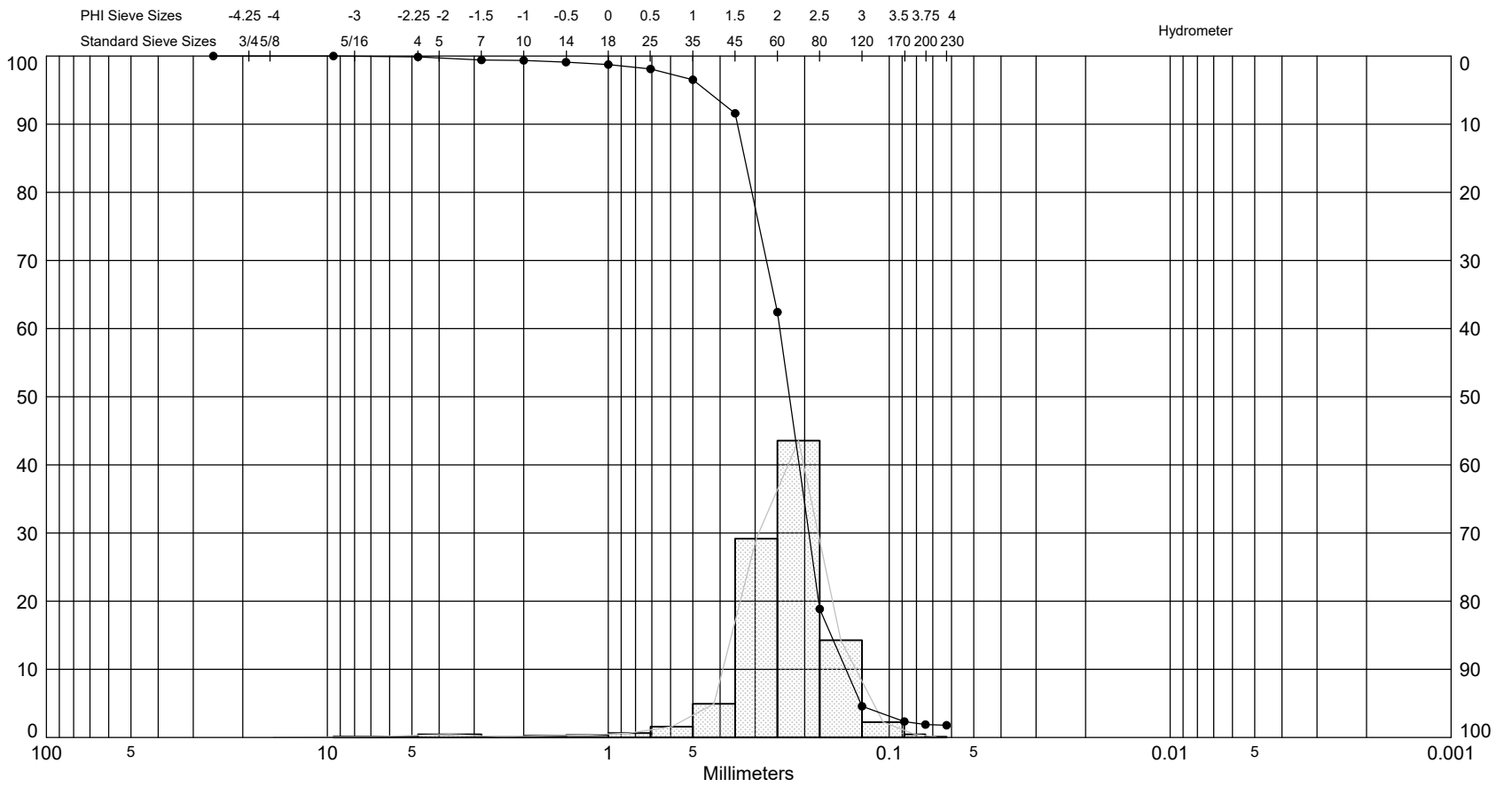
Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shells (%):
115.78	113.68			#200 - 1.89 #230 - 1.79			

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

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

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



Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort
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

Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

Depths and elevations based on measured values

Sample Information	
Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Analysis Date:	08-01-22
Analyzed By:	CRM
Easting (X, ft):	2,743,568
Northing (Y, ft):	328,665
Horizontal System:	NAD 1983
Vertical System:	MLLW

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

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

Granularmetric Report

Depths and elevations based on measured values

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

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

Easting (ft):	Northing (ft):	Coordinate System:	Elevation (ft):
2,743,568	328,665	NC State Plane, Zone 3200	-8.6 MLLW

USCS:	Munsell:	Comments:
SP	Moist - 5Y-6/1	Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

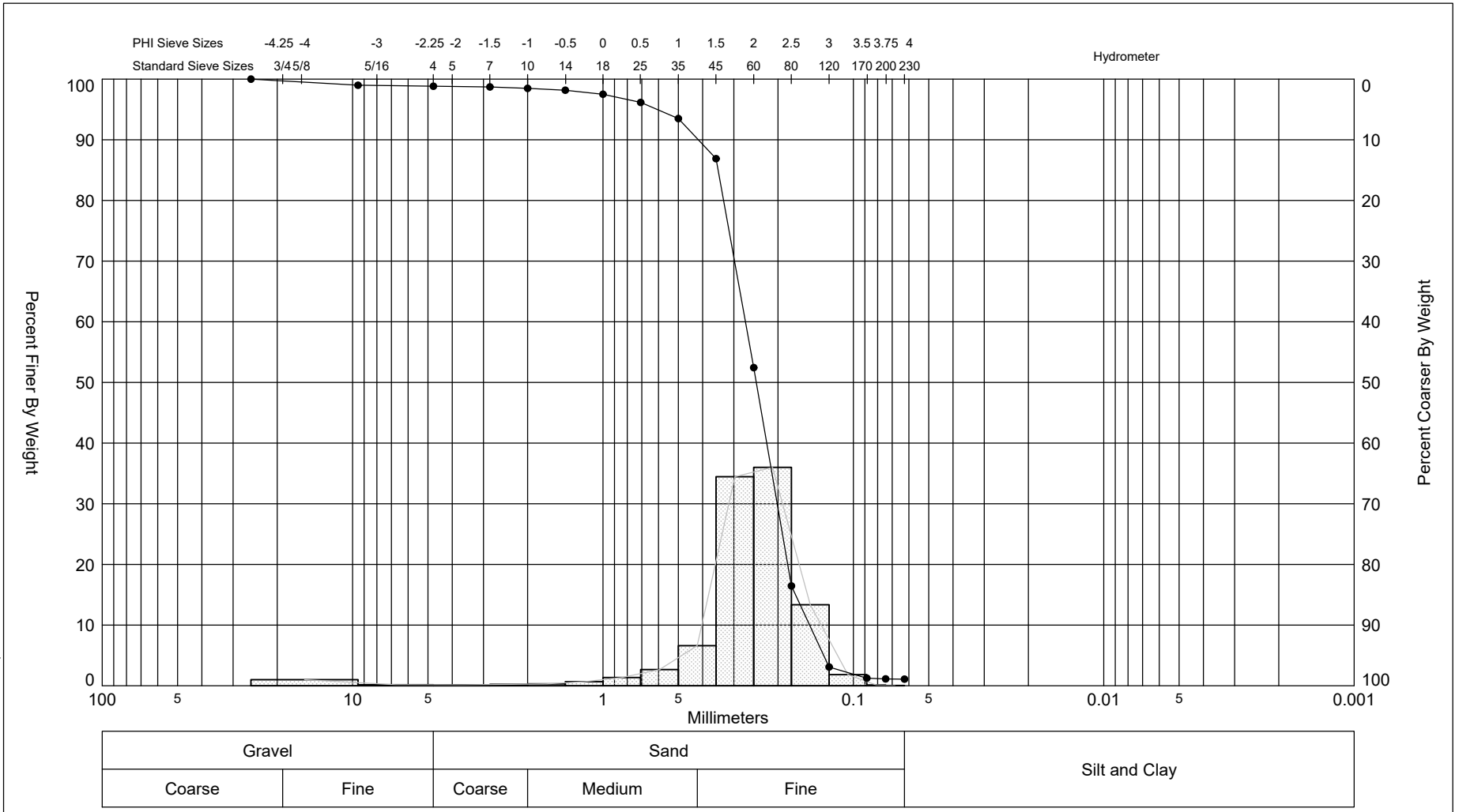
Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shells (%):
119.00	117.70			#200 - 1.13 #230 - 1.09			

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

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

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
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

Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

Depths and elevations based on measured values

Sample Information	
Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Analysis Date:	08-01-22
Analyzed By:	CRM
Easting (X, ft):	2,743,568
Northing (Y, ft):	328,665
Horizontal System:	NAD 1983
Vertical System:	MLLW

ATHENA TECHNOLOGIES, INC.

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

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

Granularmetric Report

Depths and elevations based on measured values

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

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

Easting (ft):	Northing (ft):	Coordinate System:	Elevation (ft):
2,743,568	328,665	NC State Plane, Zone 3200	-10.8 MLLW

USCS:	Munsell:	Comments:
SP	Moist - 5Y-7/1	Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

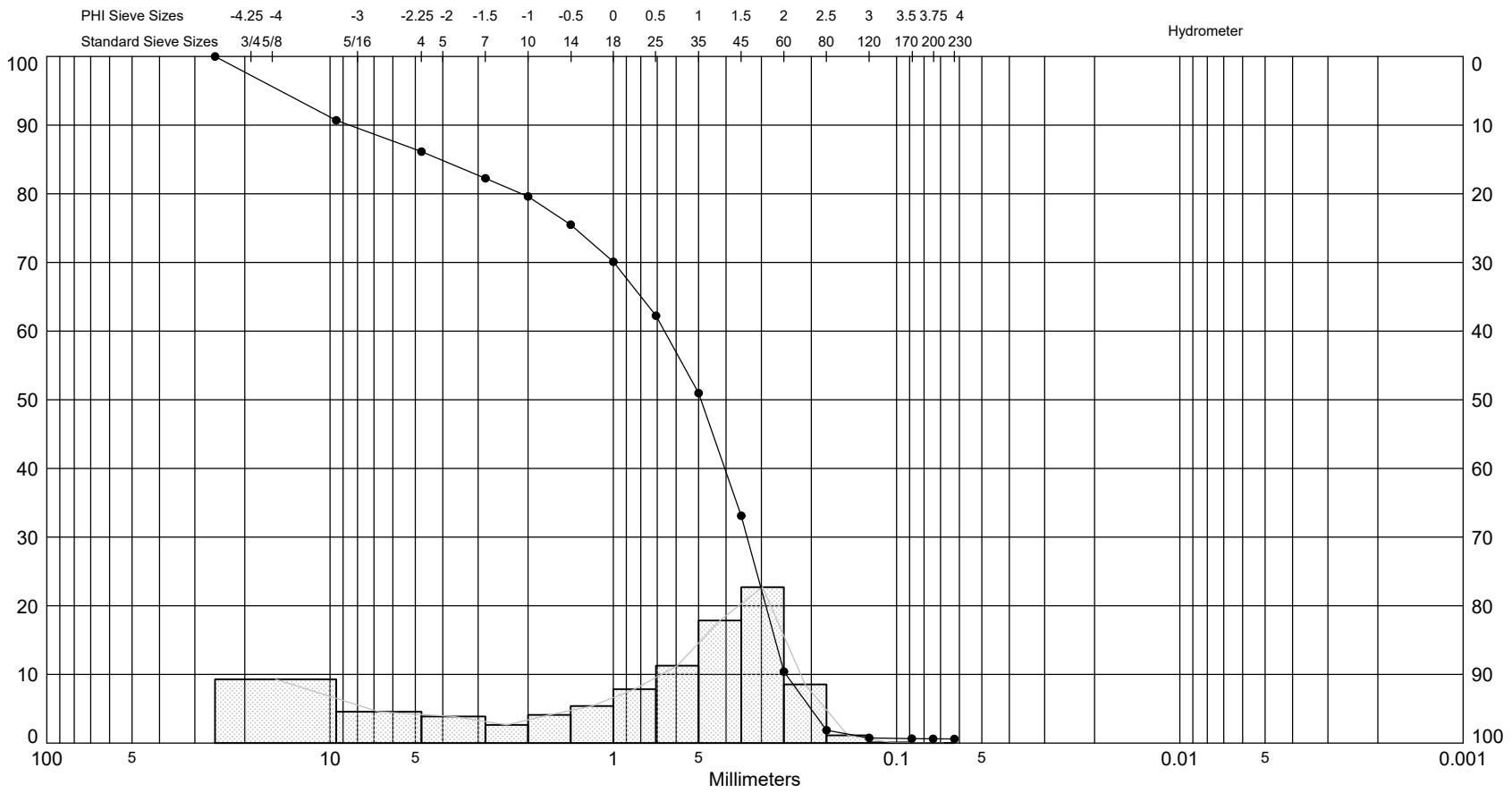
Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shells (%):
153.63	152.69			#200 - 0.62 #230 - 0.60			

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

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



Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort
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

Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

Depths and elevations based on measured values

Sample Information	
Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Analysis Date:	08-01-22
Analyzed By:	CRM
Easting (X, ft):	2,743,568
Northing (Y, ft):	328,665
Horizontal System:	NAD 1983
Vertical System:	MLLW

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

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

Granularmetric Report

Depths and elevations based on measured values

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

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

Easting (ft):	Northing (ft):	Coordinate System:	Elevation (ft):
2,742,945	327,885	NC State Plane, Zone 3200	-4.5 MLLW

USCS:	Munsell:	Comments:
SP	Moist - 5Y-7/2	Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

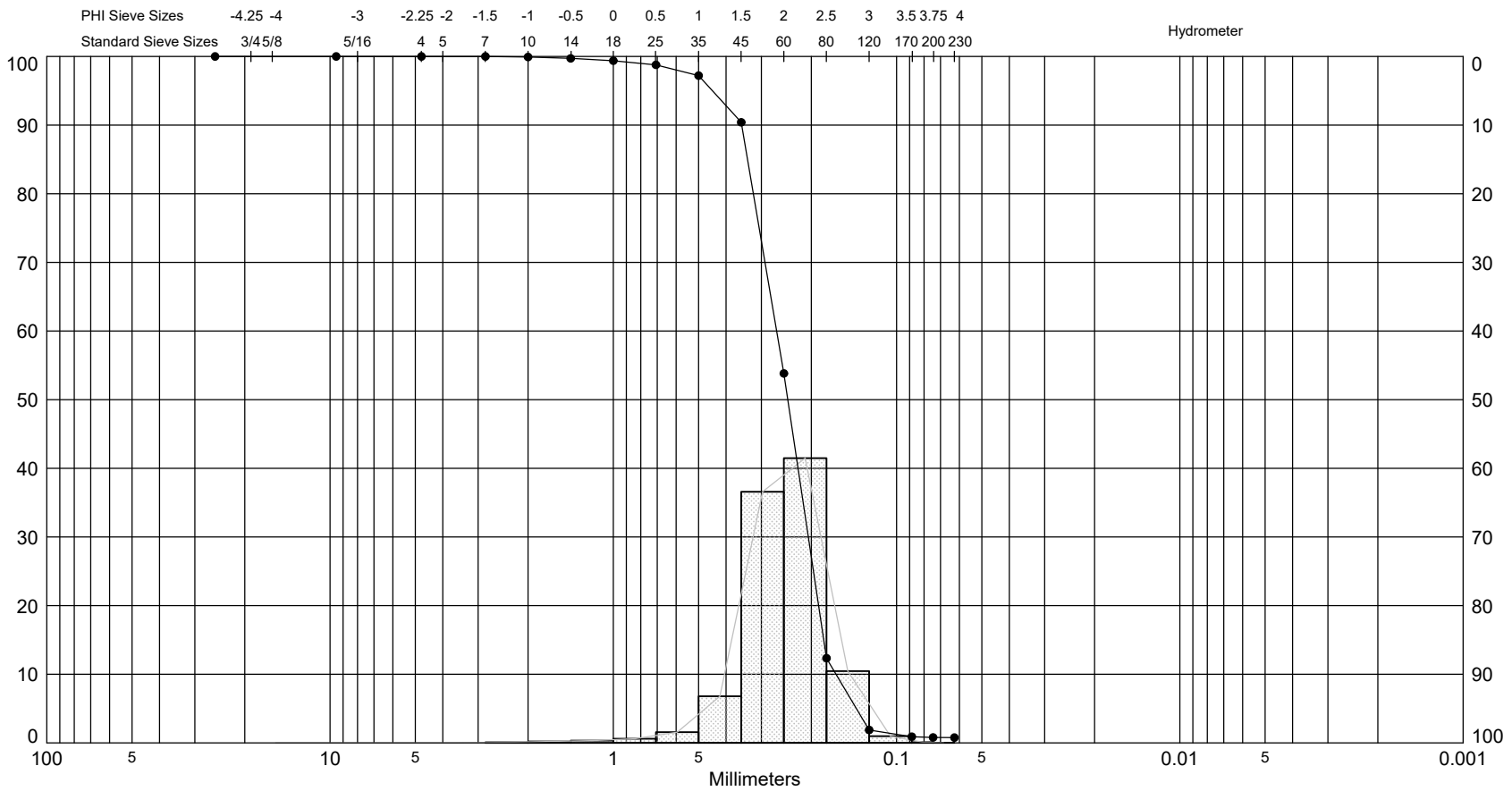
Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shells (%):
116.60	115.70			#200 - 0.79 #230 - 0.77			

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

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

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



Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort
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

Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

Depths and elevations based on measured values

Sample Information	
Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Analysis Date:	08-01-22
Analyzed By:	CRM
Easting (X, ft):	2,742,945
Northing (Y, ft):	327,885
Horizontal System:	NAD 1983
Vertical System:	MLLW

ATHENA TECHNOLOGIES, INC.

Athena Technologies, Inc.
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McClellanville, SC 29458
Office: 843-887-3800

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

Granularmetric Report

Depths and elevations based on measured values

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

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

Easting (ft):	Northing (ft):	Coordinate System:	Elevation (ft):
2,742,945	327,885	NC State Plane, Zone 3200	-7.0 MLLW

USCS:	Munsell:	Comments:
SP	Moist - 5Y-6/1	Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

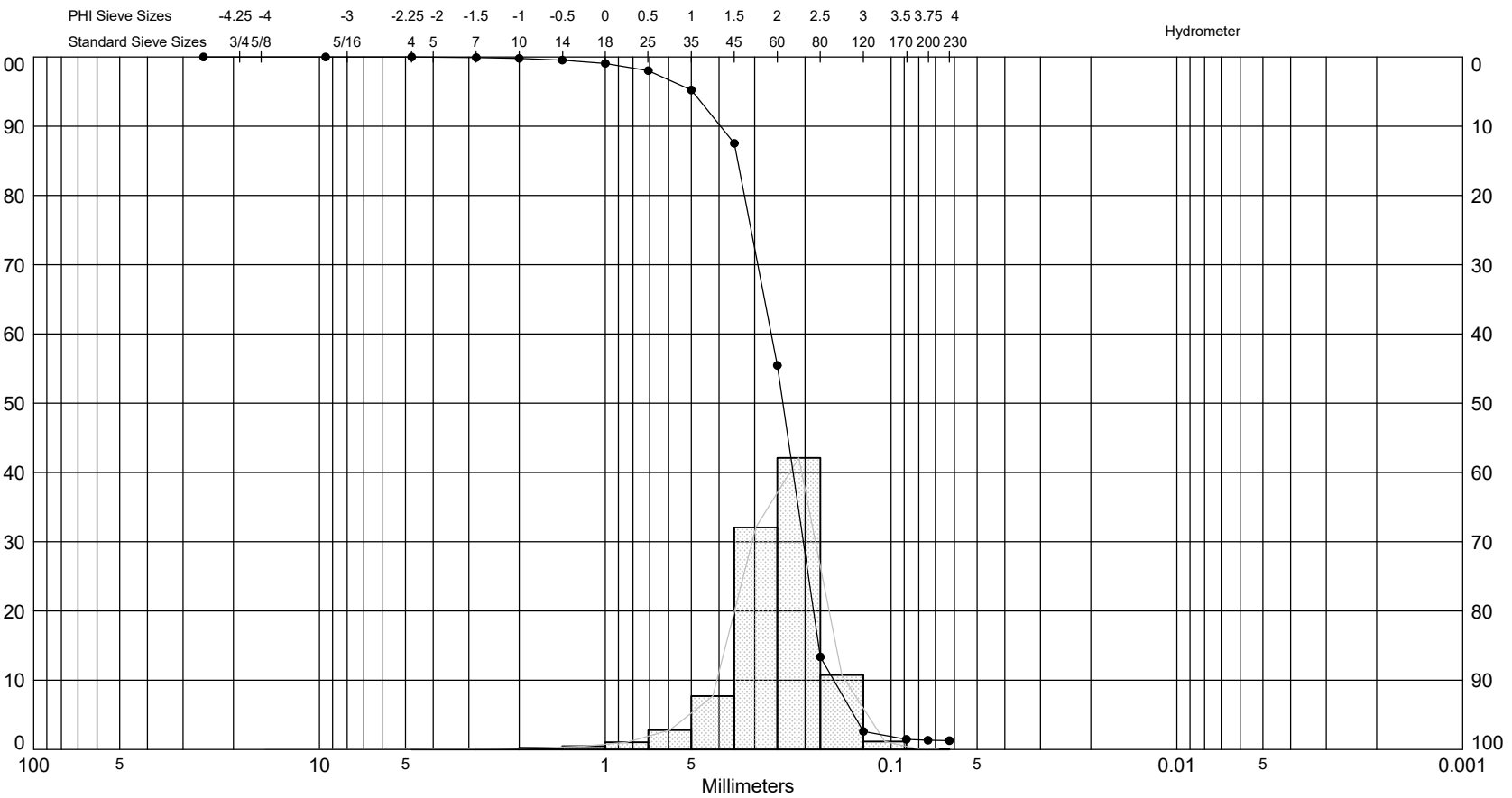
Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shells (%):
142.65	140.85			#200 - 1.33 #230 - 1.27			

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

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

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



Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort
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

Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

Depths and elevations based on measured values

Sample Information	
Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Analysis Date:	08-01-22
Analyzed By:	CRM
Easting (X, ft):	2,742,945
Northing (Y, ft):	327,885
Horizontal System:	NAD 1983
Vertical System:	MLLW

Athena Technologies, Inc.
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McClellanville, SC 29458
Office: 843-887-3800

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

Granularmetric Report

Depths and elevations based on measured values

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

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

Easting (ft):	Northing (ft):	Coordinate System:	Elevation (ft):
2,742,945	327,885	NC State Plane, Zone 3200	-9.2 MLLW

USCS:	Munsell:	Comments:
SP	Moist - 5Y-6/1	Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

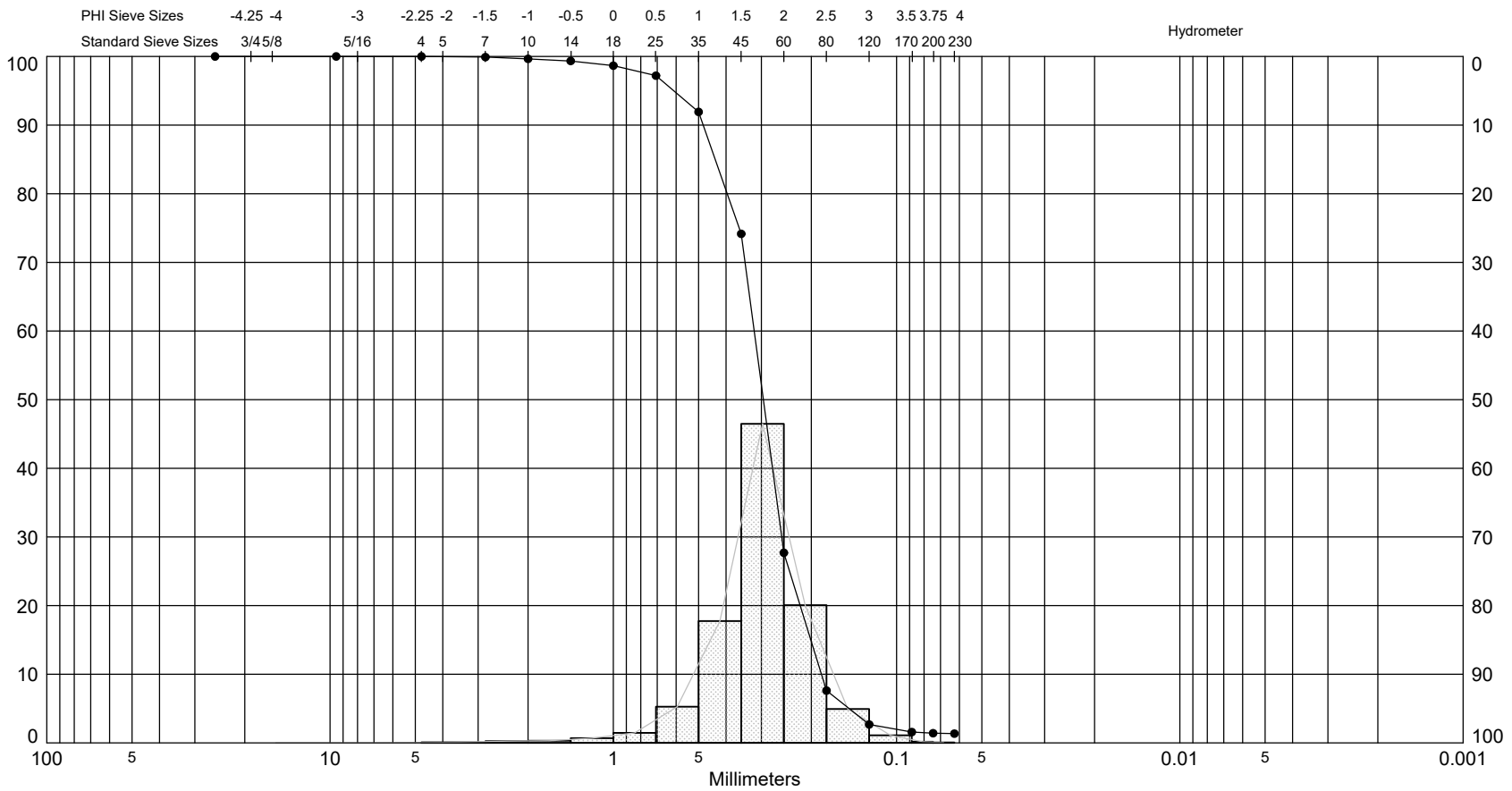
Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shells (%):
100.82	99.45			#200 - 1.41 #230 - 1.35			

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

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



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort
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

Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

Depths and elevations based on measured values

Sample Information	
Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Analysis Date:	08-01-22
Analyzed By:	CRM
Easting (X, ft):	2,742,945
Northing (Y, ft):	327,885
Horizontal System:	NAD 1983
Vertical System:	MLLW

Athena Technologies, Inc.
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McClellanville, SC 29458
Office: 843-887-3800

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

Granularmetric Report

Depths and elevations based on measured values

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

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

Easting (ft):	Northing (ft):	Coordinate System:	Elevation (ft):
2,742,945	327,885	NC State Plane, Zone 3200	-12.0 MLLW

USCS:	Munsell:	Comments:
SP	Moist - 5Y-7/1	Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

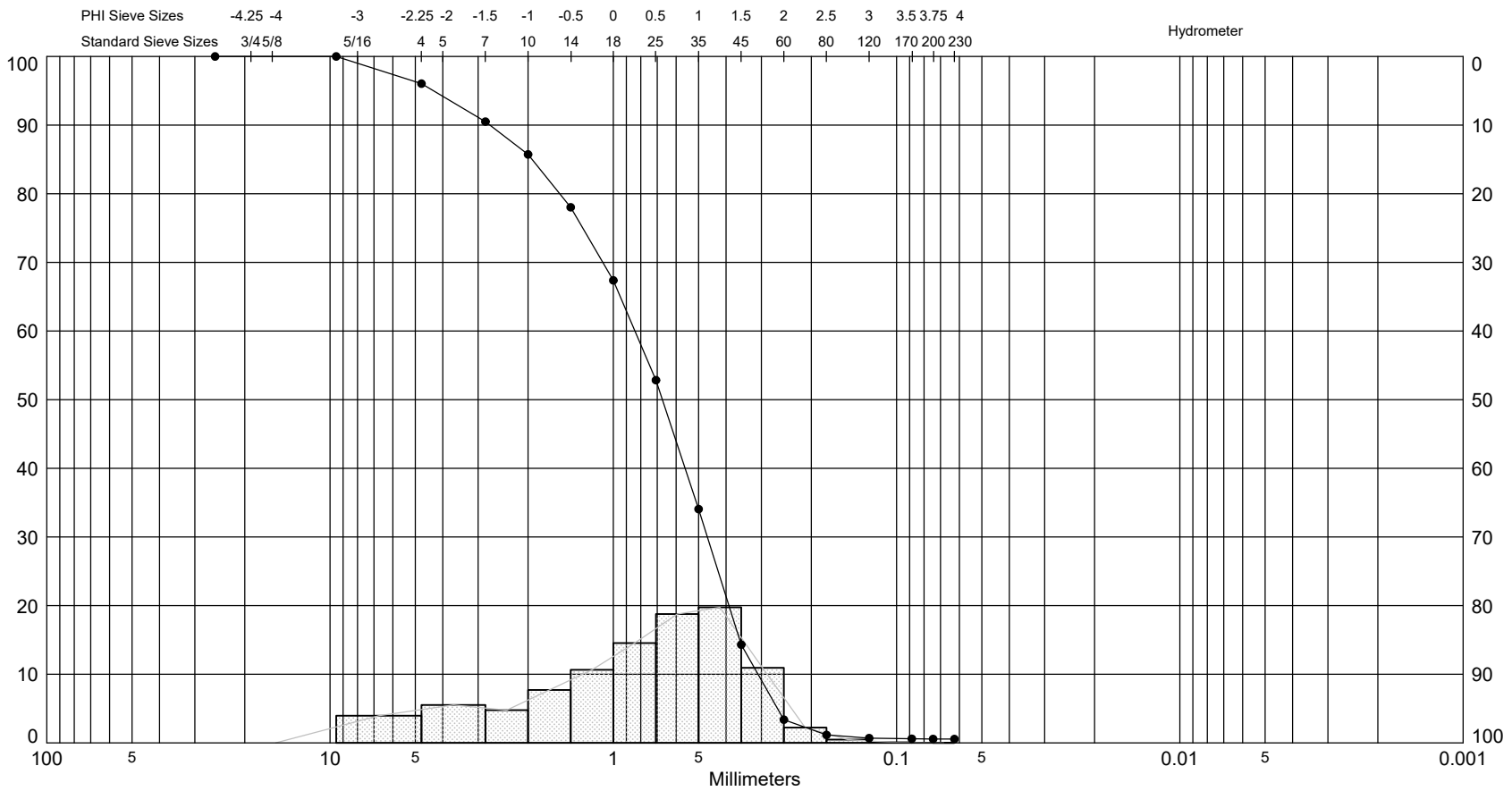
Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shells (%):
151.97	151.12			#200 - 0.57 #230 - 0.56			

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

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

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
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

Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

Depths and elevations based on measured values

Sample Information	
Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Analysis Date:	08-01-22
Analyzed By:	CRM
Easting (X, ft):	2,742,945
Northing (Y, ft):	327,885
Horizontal System:	NAD 1983
Vertical System:	MLLW

Athena Technologies, Inc.
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McClellanville, SC 29458
Office: 843-887-3800

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

Granularmetric Report

Depths and elevations based on measured values

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

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

Easting (ft):	Northing (ft):	Coordinate System:	Elevation (ft):
2,742,315	327,106	NC State Plane, Zone 3200	-6.0 MLLW

USCS:	Munsell:	Comments:
SP	Moist - 5Y-7/2	Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

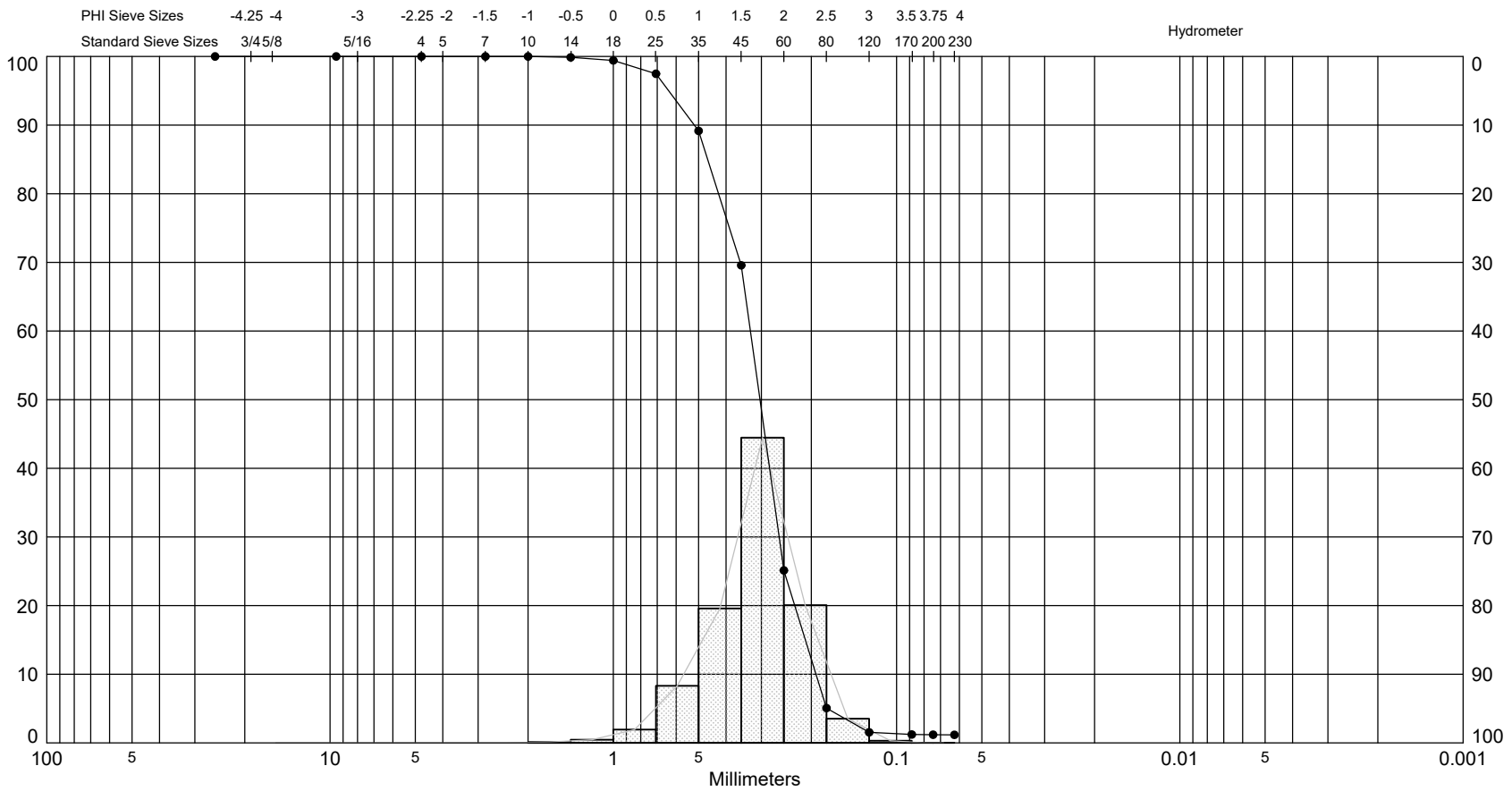
Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shells (%):
123.47	122.03			#200 - 1.19 #230 - 1.17			

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

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

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
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

Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

Depths and elevations based on measured values

Sample Information	
Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Analysis Date:	08-01-22
Analyzed By:	CRM
Easting (X, ft):	2,742,315
Northing (Y, ft):	327,106
Horizontal System:	NAD 1983
Vertical System:	MLLW

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

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

Granularmetric Report

Depths and elevations based on measured values

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

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

Easting (ft):	Northing (ft):	Coordinate System:	Elevation (ft):
2,742,315	327,106	NC State Plane, Zone 3200	-7.5 MLLW

USCS:	Munsell:	Comments:
SP	Moist - 5Y-7/1	Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

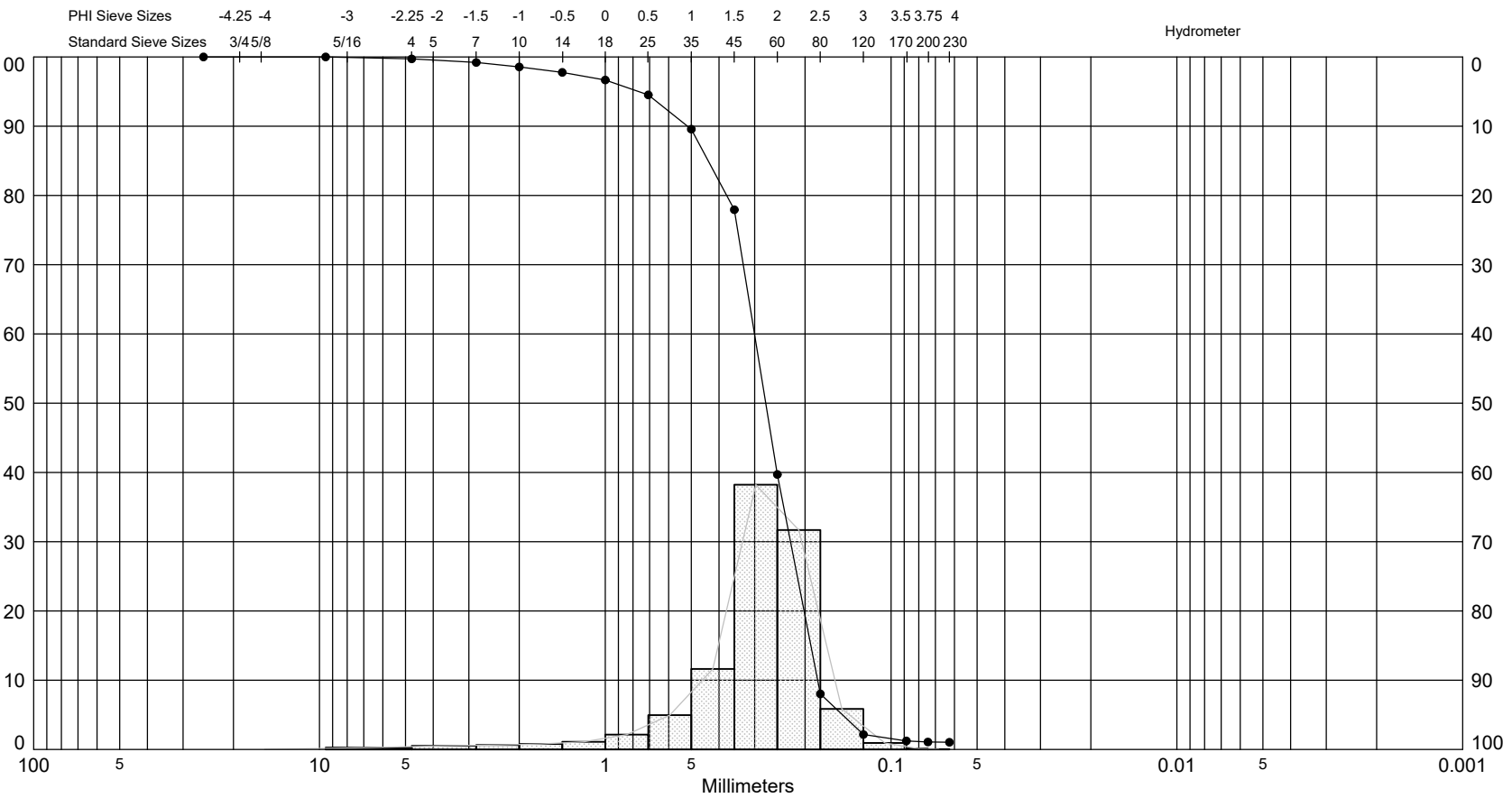
Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shells (%):
139.72	138.25			#200 - 1.08 #230 - 1.04			

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

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



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort
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

Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

Depths and elevations based on measured values

Sample Information	
Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Analysis Date:	08-01-22
Analyzed By:	CRM
Easting (X, ft):	2,742,315
Northing (Y, ft):	327,106
Horizontal System:	NAD 1983
Vertical System:	MLLW

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

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

Granularmetric Report

Depths and elevations based on measured values

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

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

Easting (ft):	Northing (ft):	Coordinate System:	Elevation (ft):
2,742,315	327,106	NC State Plane, Zone 3200	-9.5 MLLW

USCS:	Munsell:	Comments:
SP	Moist - 5Y-7/1	Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

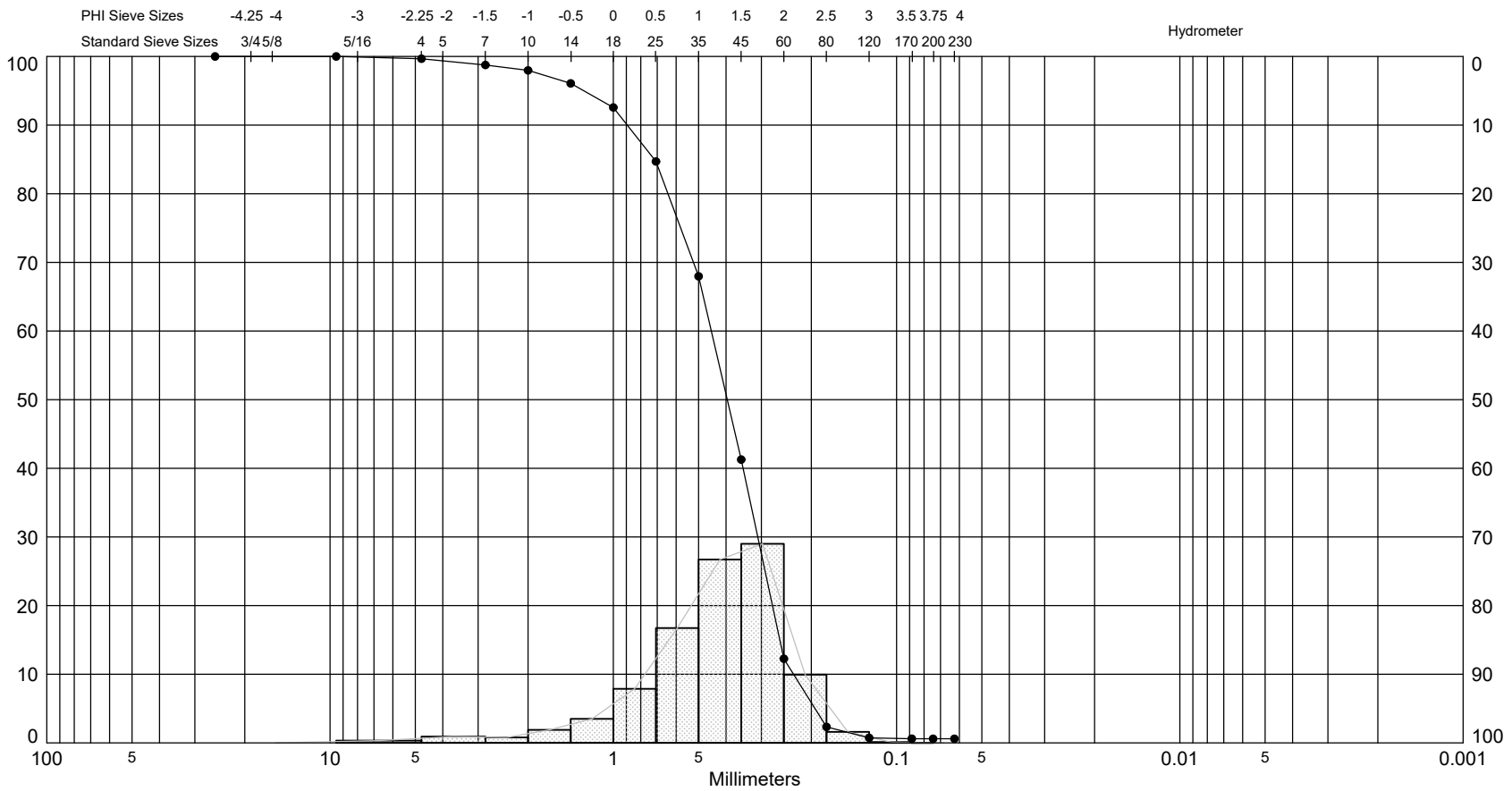
Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shells (%):
153.41	152.52			#200 - 0.60 #230 - 0.60			

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

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



Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort
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

Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

Depths and elevations based on measured values

Sample Information	
Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Analysis Date:	08-01-22
Analyzed By:	CRM
Easting (X, ft):	2,742,315
Northing (Y, ft):	327,106
Horizontal System:	NAD 1983
Vertical System:	MLLW

Athena Technologies, Inc.
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McClellanville, SC 29458
Office: 843-887-3800

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

Granularmetric Report

Depths and elevations based on measured values

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

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

Easting (ft):	Northing (ft):	Coordinate System:	Elevation (ft):
2,742,315	327,106	NC State Plane, Zone 3200	-11.5 MLLW

USCS:	Munsell:	Comments:
SP	Moist - 5Y-6/1	Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

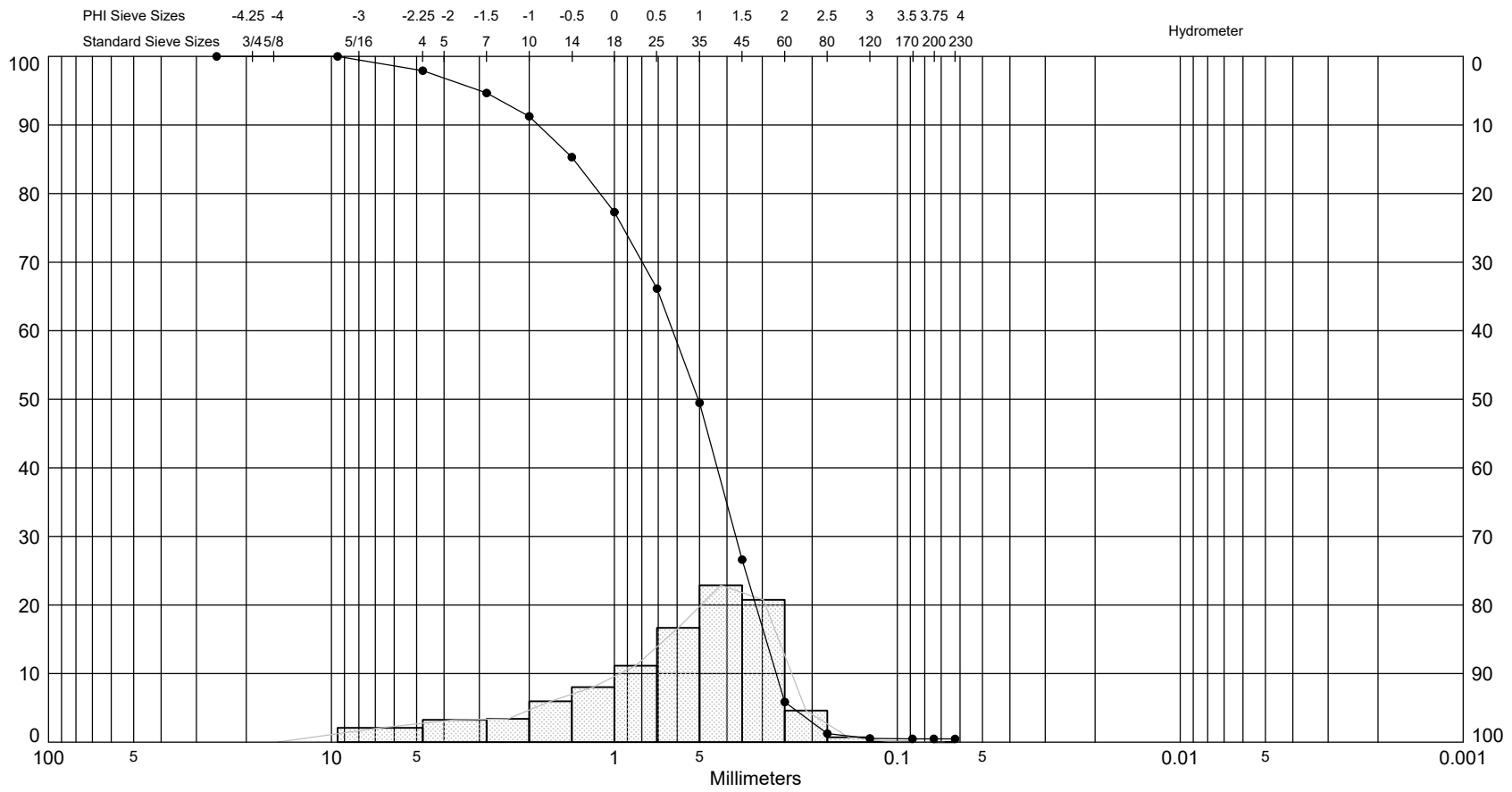
Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shells (%):
176.01	175.21			#200 - 0.48 #230 - 0.47			

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

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

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
CLO-22-V-016 #S-4	—●—	-11.5	SP	#200 - 0.48 #230 - 0.47			0.98	0.71	-1	3.74	1.12

Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

Depths and elevations based on measured values

Sample Information	
Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Analysis Date:	08-01-22
Analyzed By:	CRM
Easting (X, ft):	2,742,315
Northing (Y, ft):	327,106
Horizontal System:	NAD 1983
Vertical System:	MLLW

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

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

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):	Northing (ft):	Coordinate System:	Elevation (ft):
2,741,740	325,790	NC State Plane, Zone 3200	-3.0 MLLW

USCS:	Munsell:	Comments:
SP	Moist - 5Y-6/1	Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

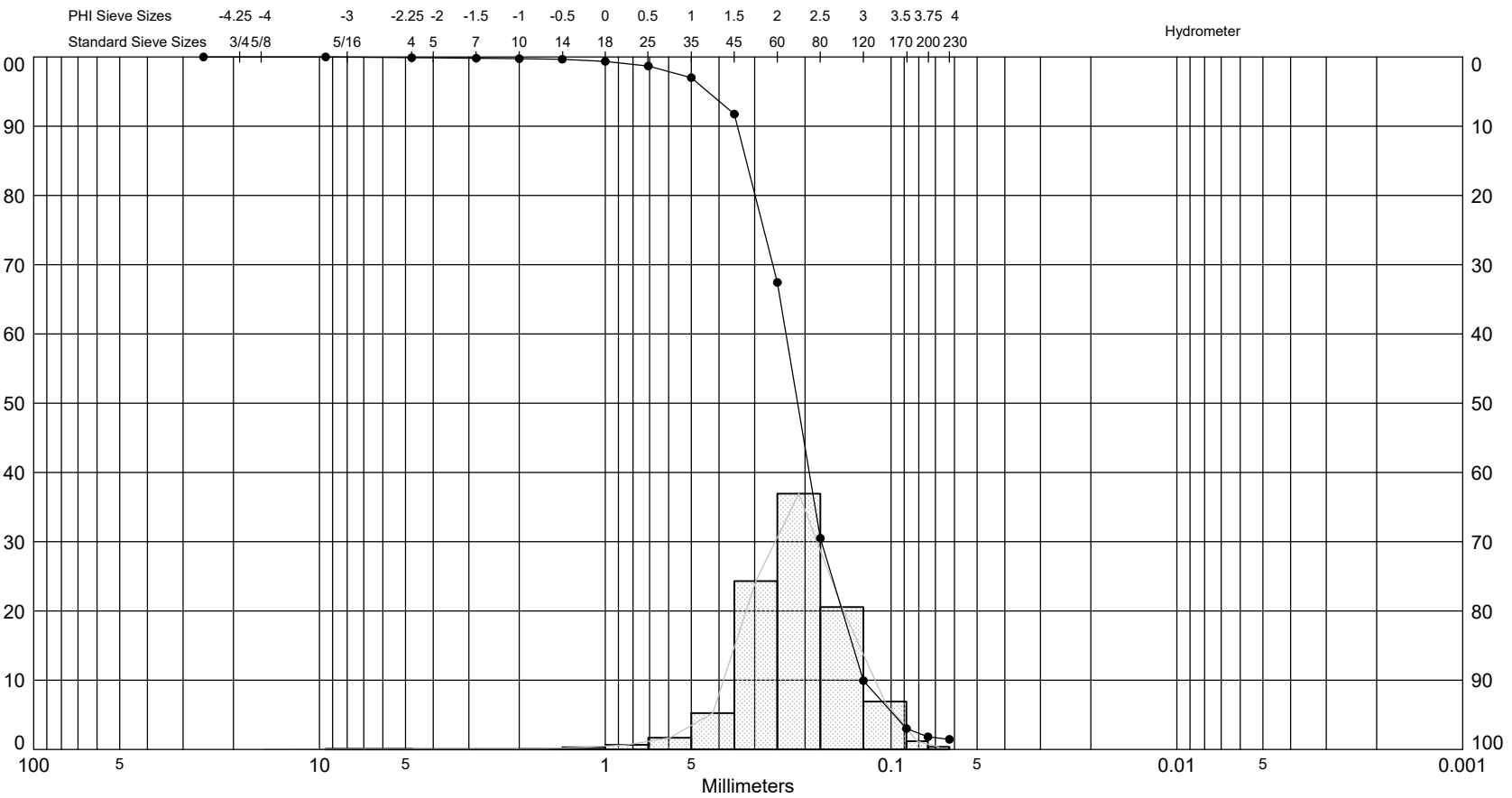
Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shells (%):
106.76	105.21			#200 - 1.83 #230 - 1.46			

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

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



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort
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

Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

Depths and elevations based on measured values

Sample Information	
Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Analysis Date:	08-01-22
Analyzed By:	CRM
Easting (X, ft):	2,741,740
Northing (Y, ft):	325,790
Horizontal System:	NAD 1983
Vertical System:	MLLW

ATHENA TECHNOLOGIES, INC.

Athena Technologies, Inc.
1293 Graham Farm Road
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SIEVE ANALYSIS USACE, 2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT 8/12/22

Granularmetric Report

Depths and elevations based on measured values

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

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

Easting (ft):	Northing (ft):	Coordinate System:	Elevation (ft):
2,741,740	325,790	NC State Plane, Zone 3200	-5.5 MLLW

USCS:	Munsell:	Comments:
SP	Moist - 5Y-7/1	Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

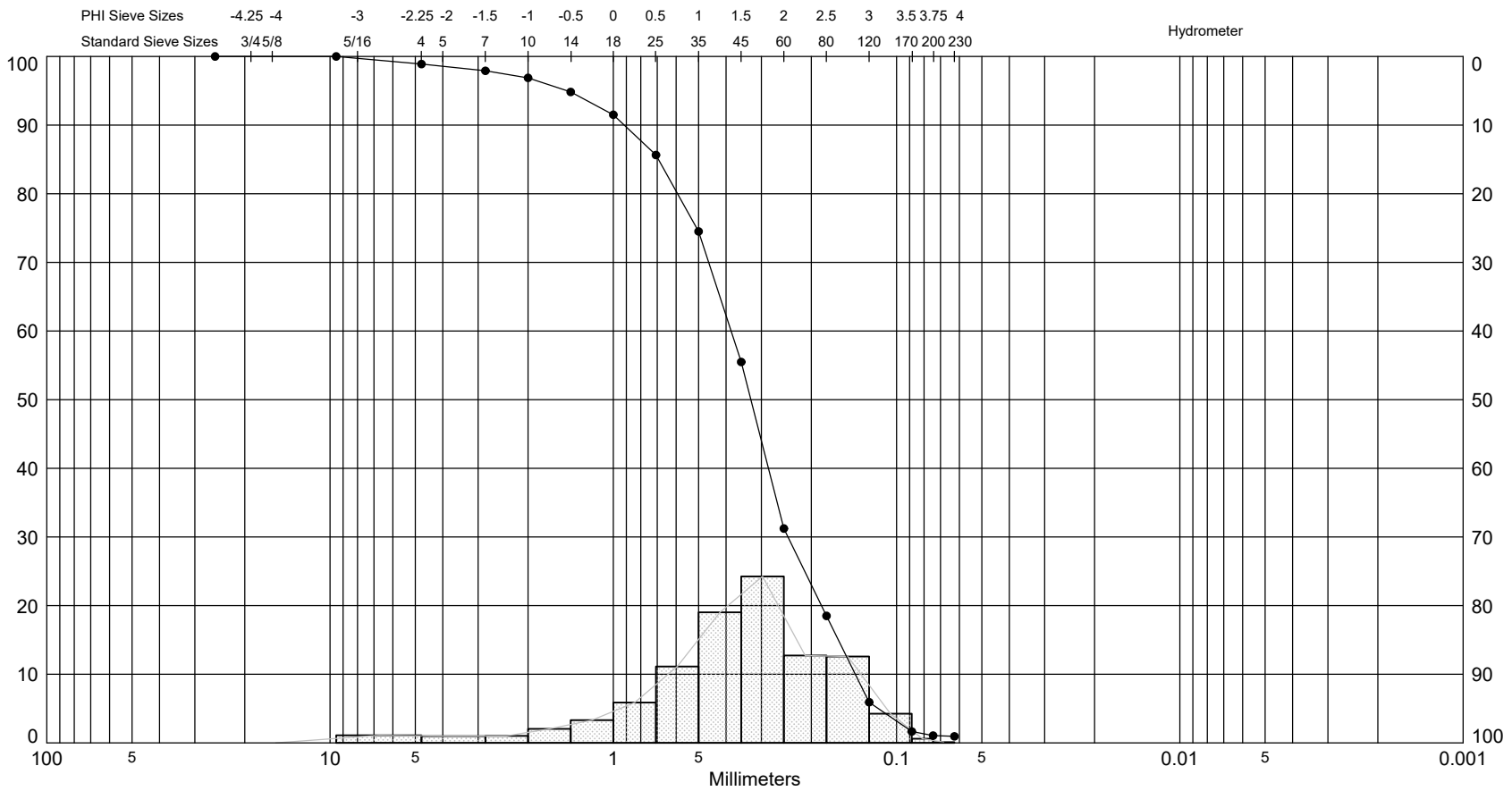
Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shells (%):
109.73	108.68			#200 - 1.06 #230 - 0.95			

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

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



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort
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

Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

Depths and elevations based on measured values

Sample Information	
Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Analysis Date:	08-01-22
Analyzed By:	CRM
Easting (X, ft):	2,741,740
Northing (Y, ft):	325,790
Horizontal System:	NAD 1983
Vertical System:	MLLW

Athena Technologies, Inc.
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McClellanville, SC 29458
Office: 843-887-3800

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

Granularmetric Report

Depths and elevations based on measured values

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

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

Easting (ft):	Northing (ft):	Coordinate System:	Elevation (ft):
2,741,740	325,790	NC State Plane, Zone 3200	-7.0 MLLW

USCS:	Munsell:	Comments:
SP	Moist - 5Y-7/1	Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

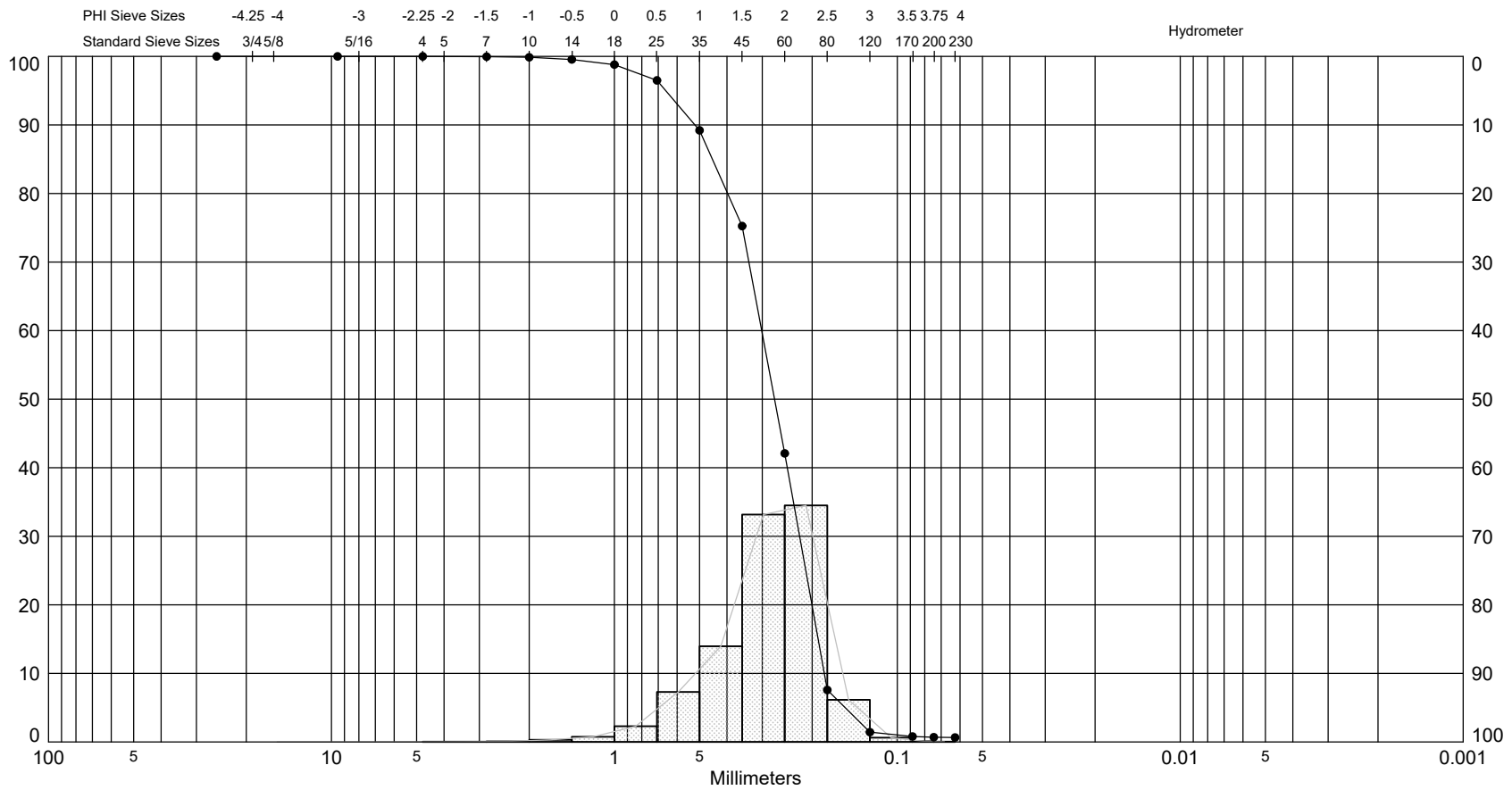
Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shells (%):
111.56	110.83			#200 - 0.69 #230 - 0.65			

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

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



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort
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

Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

Depths and elevations based on measured values

Sample Information	
Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Analysis Date:	08-01-22
Analyzed By:	CRM
Easting (X, ft):	2,741,740
Northing (Y, ft):	325,790
Horizontal System:	NAD 1983
Vertical System:	MLLW

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

Granularmetric Report

Depths and elevations based on measured values

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

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

Easting (ft):	Northing (ft):	Coordinate System:	Elevation (ft):
2,741,740	325,790	NC State Plane, Zone 3200	-9.5 MLLW

USCS:	Munsell:	Comments:
SP	Moist - 5Y-7/1	Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

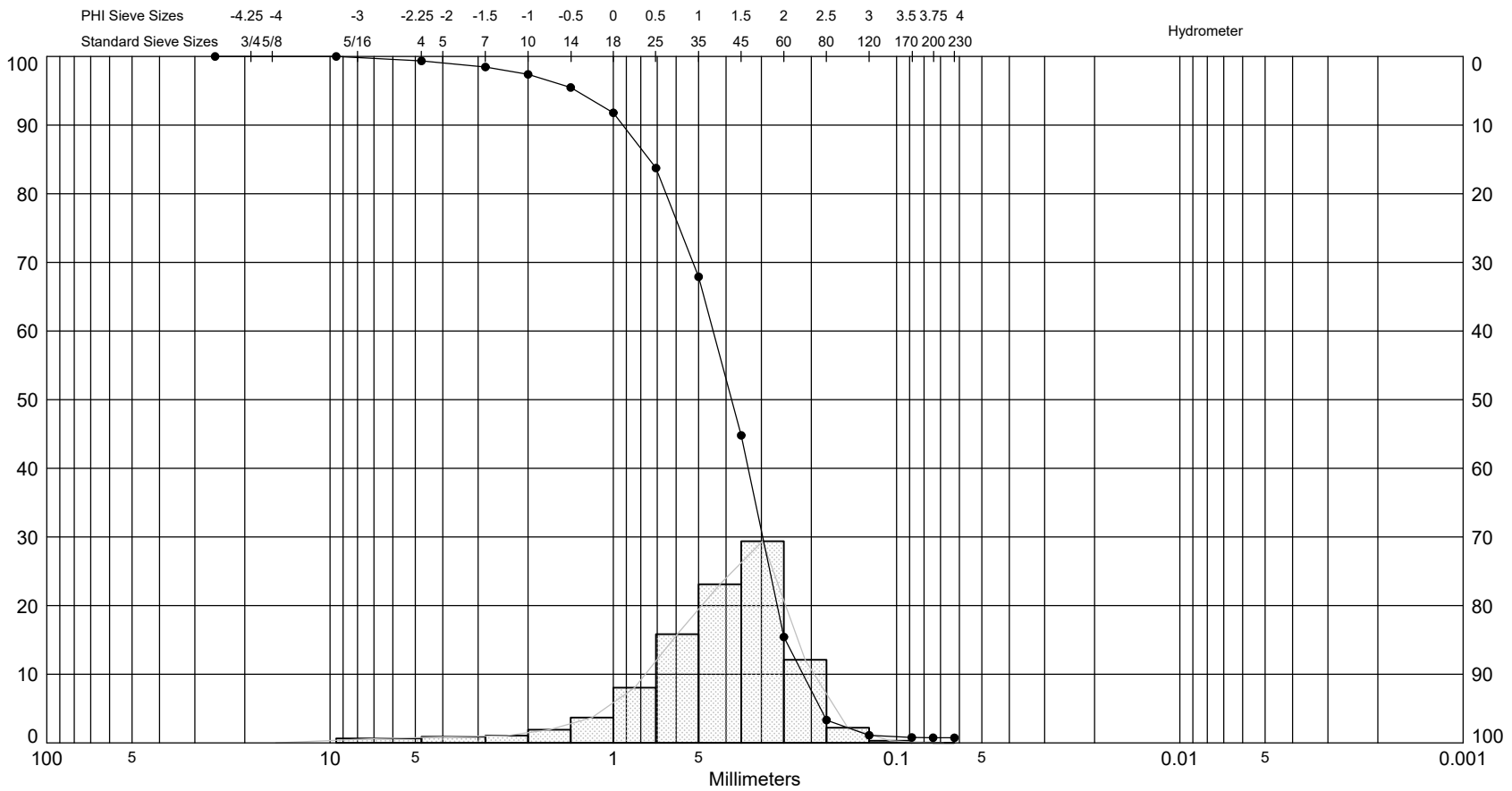
Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shells (%):
147.51	146.44			#200 - 0.75 #230 - 0.74			

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

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



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort
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

Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

Depths and elevations based on measured values

Sample Information	
Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Analysis Date:	08-01-22
Analyzed By:	CRM
Easting (X, ft):	2,741,740
Northing (Y, ft):	325,790
Horizontal System:	NAD 1983
Vertical System:	MLLW

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

Granularmetric Report

Depths and elevations based on measured values

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

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

Easting (ft):	Northing (ft):	Coordinate System:	Elevation (ft):
2,741,532	326,627	NC State Plane, Zone 3200	-7.1 MLLW

USCS:	Munsell:	Comments:
SP	Moist - 5Y-6/2	Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

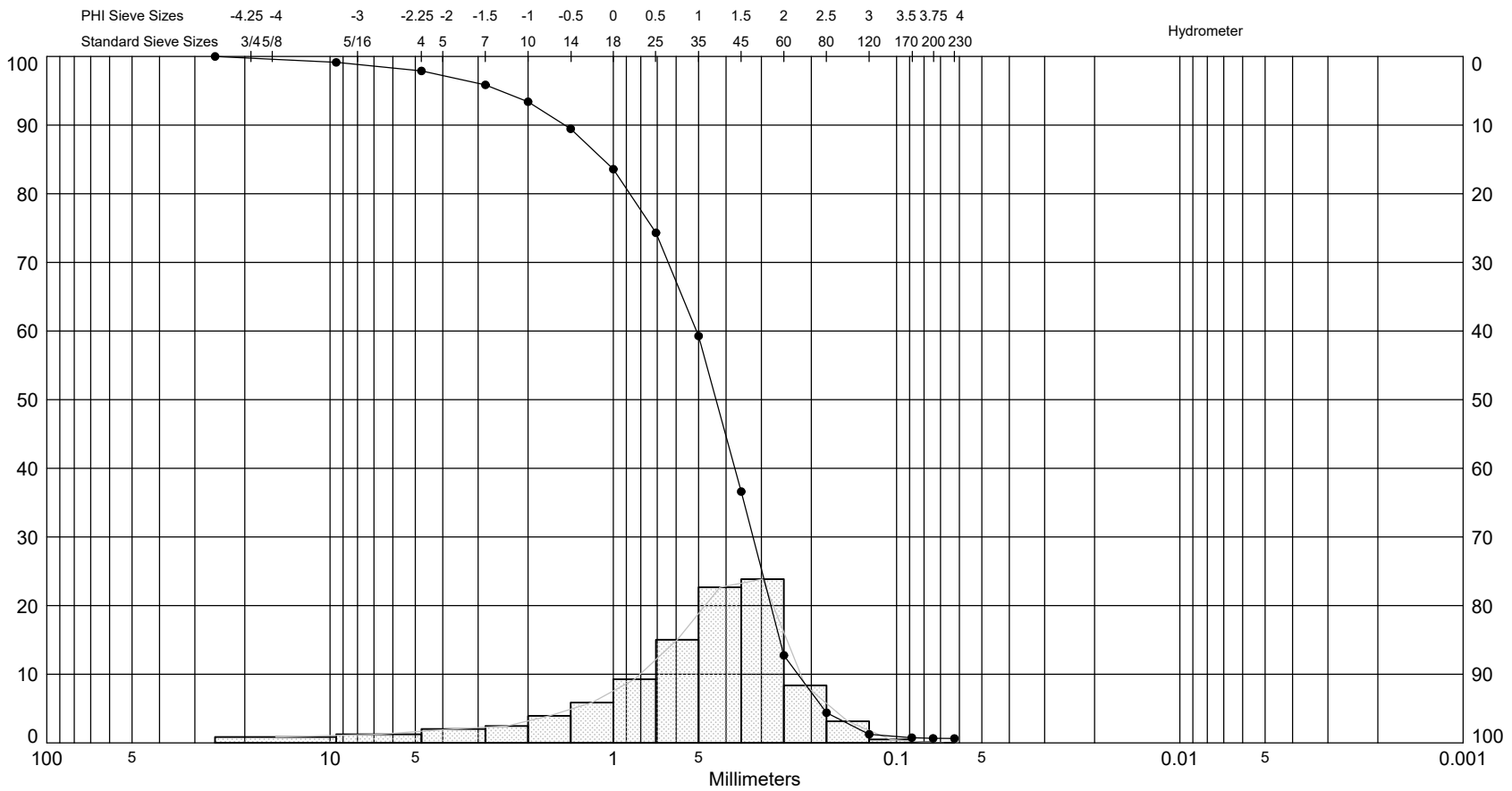
Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shells (%):
111.14	110.42			#200 - 0.66 #230 - 0.64			

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

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



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort
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

Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

Depths and elevations based on measured values

Sample Information	
Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Analysis Date:	08-01-22
Analyzed By:	CRM
Easting (X, ft):	2,741,532
Northing (Y, ft):	326,627
Horizontal System:	NAD 1983
Vertical System:	MLLW

ATHENA TECHNOLOGIES, INC.

Athena Technologies, Inc.
1293 Graham Farm Road
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SIEVE ANALYSIS USACE, 2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT 8/12/22

Granularmetric Report

Depths and elevations based on measured values

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

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

Easting (ft):	Northing (ft):	Coordinate System:	Elevation (ft):
2,741,532	326,627	NC State Plane, Zone 3200	-9.1 MLLW

USCS:	Munsell:	Comments:
SP	Moist - 5Y-7/1	Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

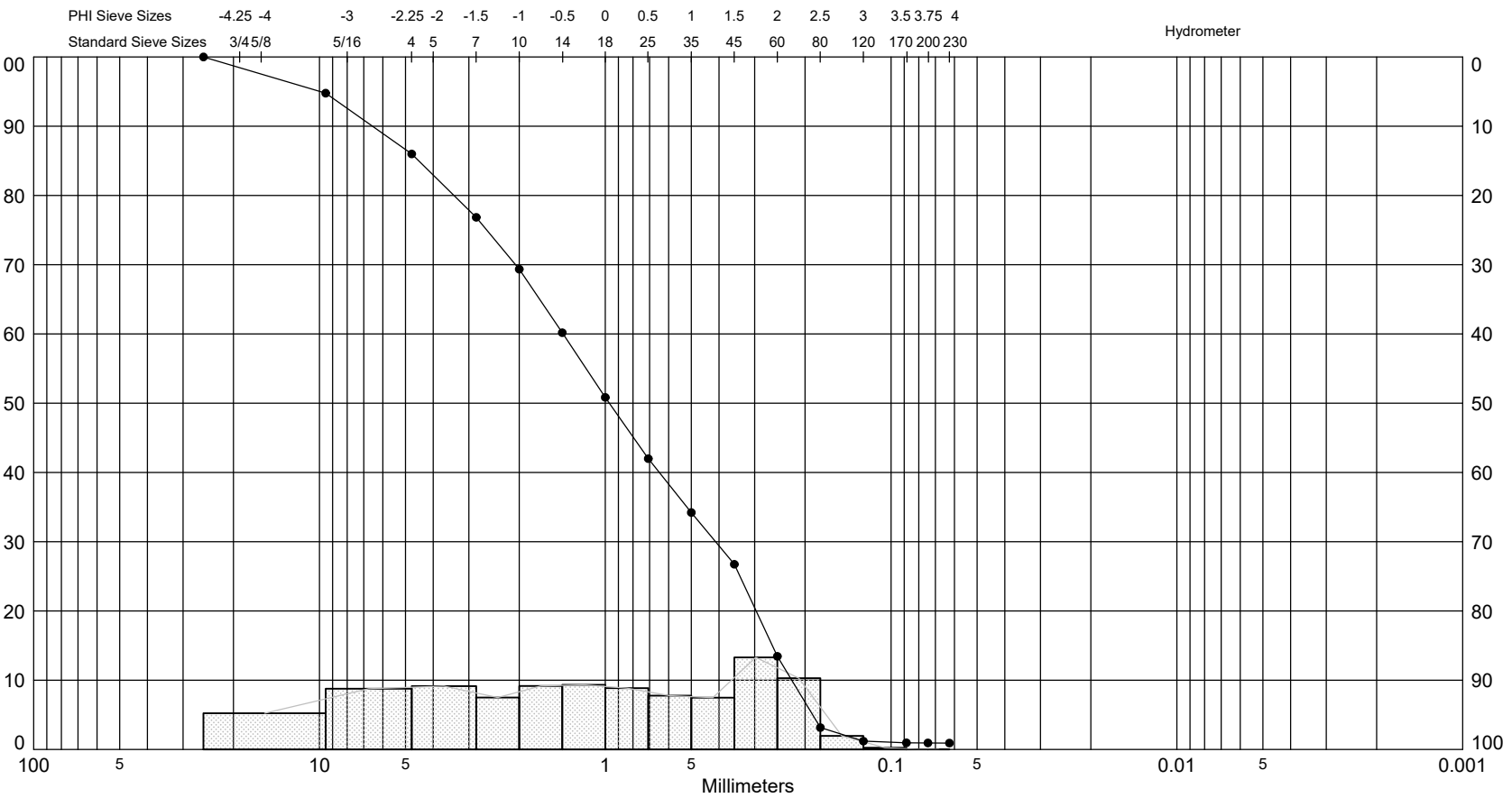
Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shells (%):
127.96	126.77			#200 - 0.94 #230 - 0.92			

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

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



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort
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

Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

Depths and elevations based on measured values

Sample Information	
Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Analysis Date:	08-01-22
Analyzed By:	CRM
Easting (X, ft):	2,741,532
Northing (Y, ft):	326,627
Horizontal System:	NAD 1983
Vertical System:	MLLW

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

Granularmetric Report

Depths and elevations based on measured values

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

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

Easting (ft):	Northing (ft):	Coordinate System:	Elevation (ft):
2,741,532	326,627	NC State Plane, Zone 3200	-10.6 MLLW

USCS:	Munsell:	Comments:
SP	Moist - 5Y-6/1	Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

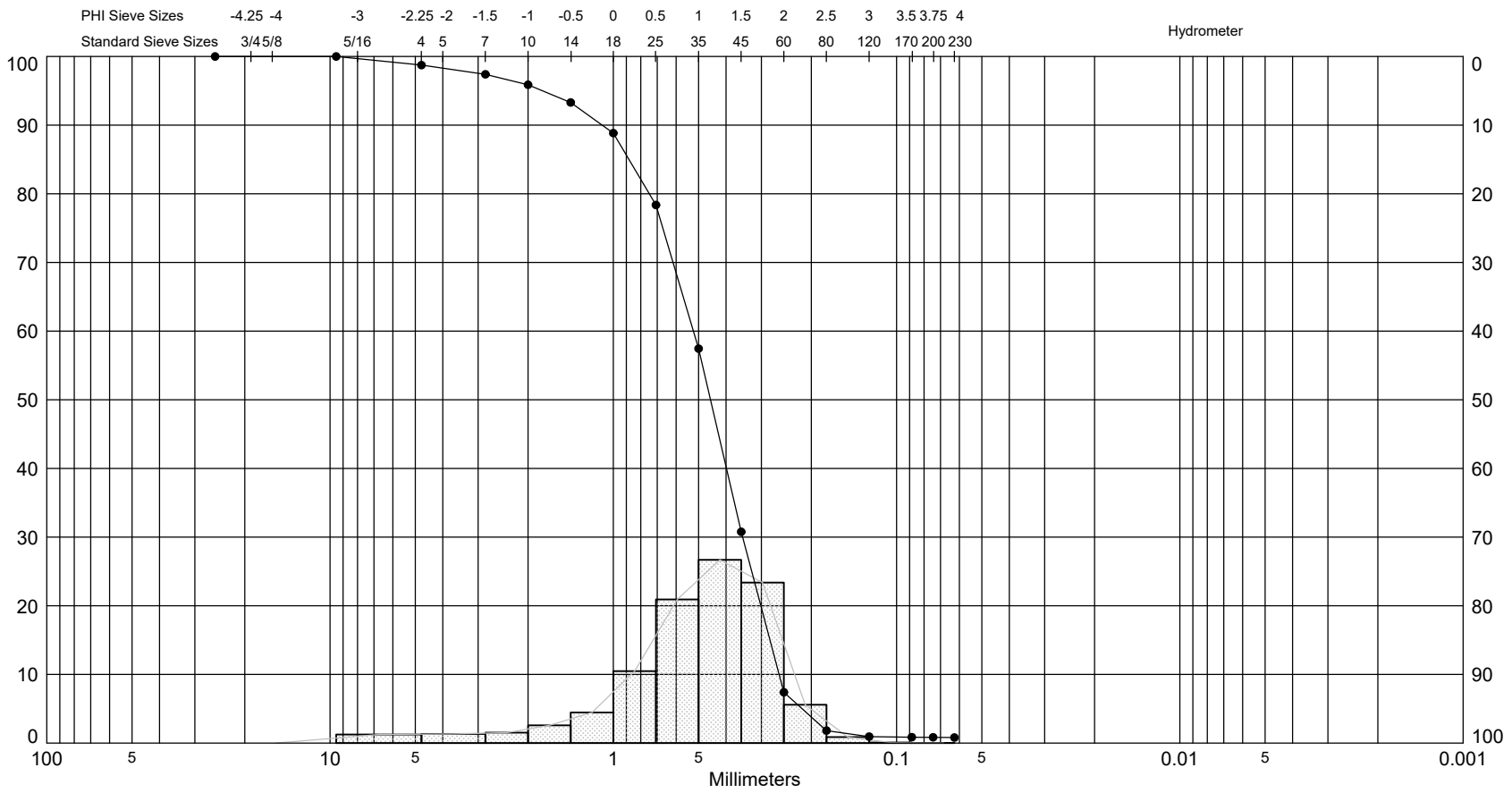
Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shells (%):
157.06	155.79			#200 - 0.84 #230 - 0.81			

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

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

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



Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort
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

Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

Depths and elevations based on measured values

Sample Information	
Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Analysis Date:	08-01-22
Analyzed By:	CRM
Easting (X, ft):	2,741,532
Northing (Y, ft):	326,627
Horizontal System:	NAD 1983
Vertical System:	MLLW

ATHENA TECHNOLOGIES, INC.

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

Granularmetric Report

Depths and elevations based on measured values

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

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

Easting (ft):	Northing (ft):	Coordinate System:	Elevation (ft):
2,740,637	326,293	NC State Plane, Zone 3200	-3.5 MLLW

USCS:	Munsell:	Comments:
SP	Moist - 5Y-7/1	Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

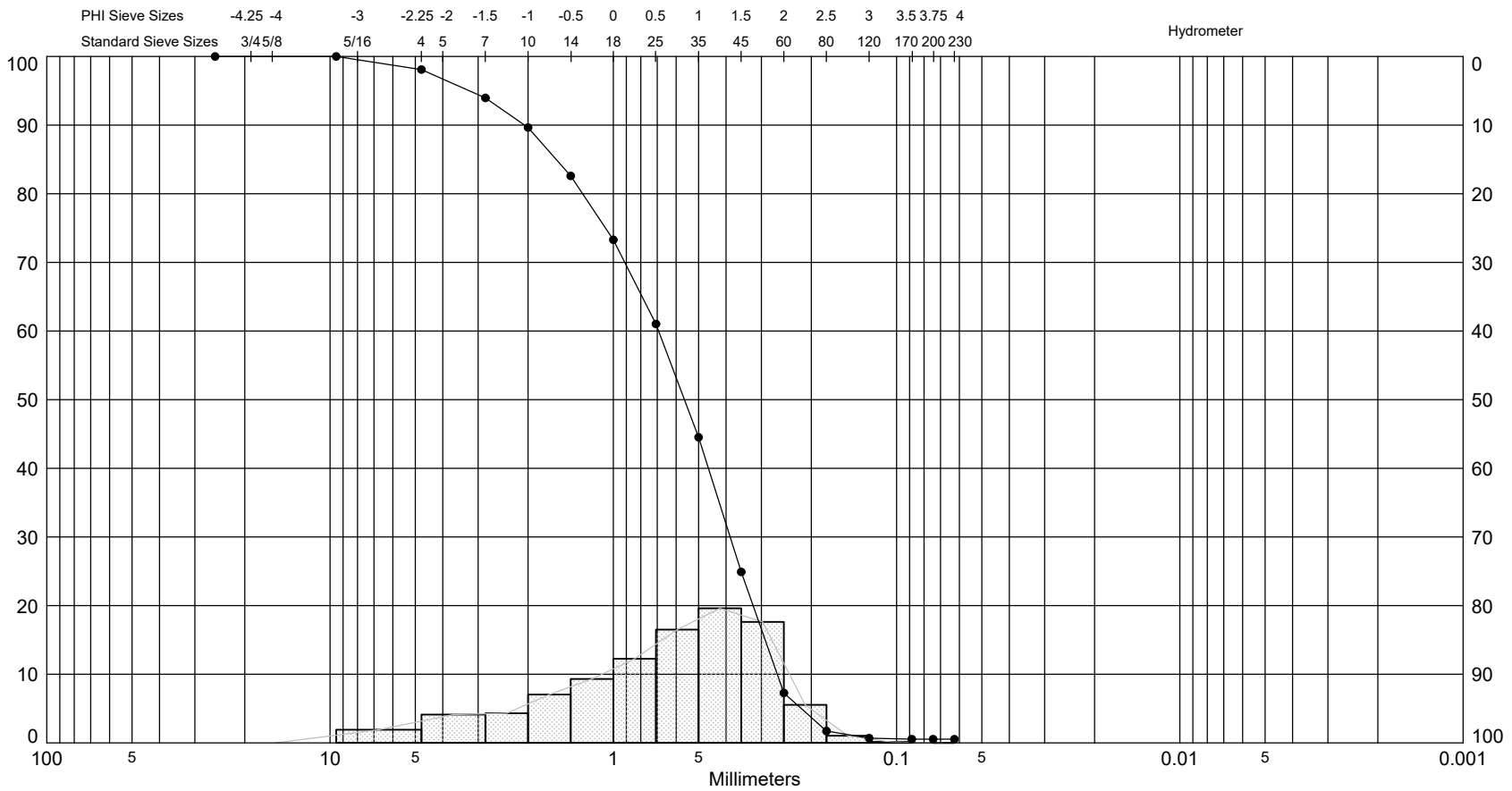
Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shells (%):
150.19	149.36			#200 - 0.55 #230 - 0.54			

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

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

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
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

Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

Depths and elevations based on measured values

Sample Information	
Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Analysis Date:	08-01-22
Analyzed By:	CRM
Easting (X, ft):	2,740,637
Northing (Y, ft):	326,293
Horizontal System:	NAD 1983
Vertical System:	MLLW

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

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

Granularmetric Report

Depths and elevations based on measured values

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

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

Easting (ft):	Northing (ft):	Coordinate System:	Elevation (ft):
2,740,637	326,293	NC State Plane, Zone 3200	-4.5 MLLW

USCS:	Munsell:	Comments:
SP	Moist - 5Y-7/1	Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

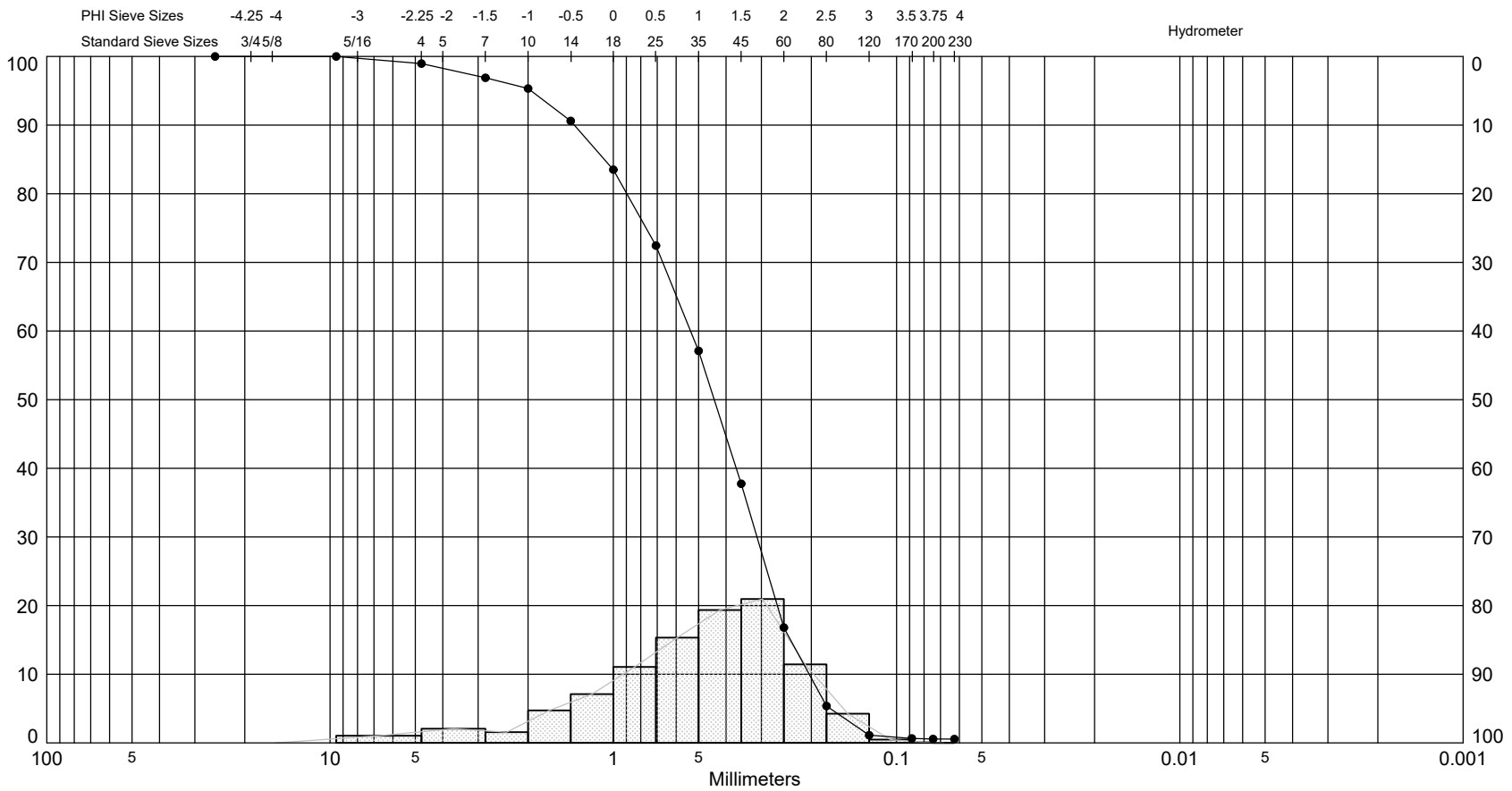
Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shells (%):
111.76	111.12			#200 - 0.57 #230 - 0.56			

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

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



Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort
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

Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

Depths and elevations based on measured values

Sample Information	
Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Analysis Date:	08-01-22
Analyzed By:	CRM
Easting (X, ft):	2,740,637
Northing (Y, ft):	326,293
Horizontal System:	NAD 1983
Vertical System:	MLLW

ATHENA TECHNOLOGIES, INC.

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

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

Granularmetric Report

Depths and elevations based on measured values

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

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

Easting (ft):	Northing (ft):	Coordinate System:	Elevation (ft):
2,740,637	326,293	NC State Plane, Zone 3200	-5.5 MLLW

USCS:	Munsell:	Comments:
SP	Moist - 5Y-7/1	Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

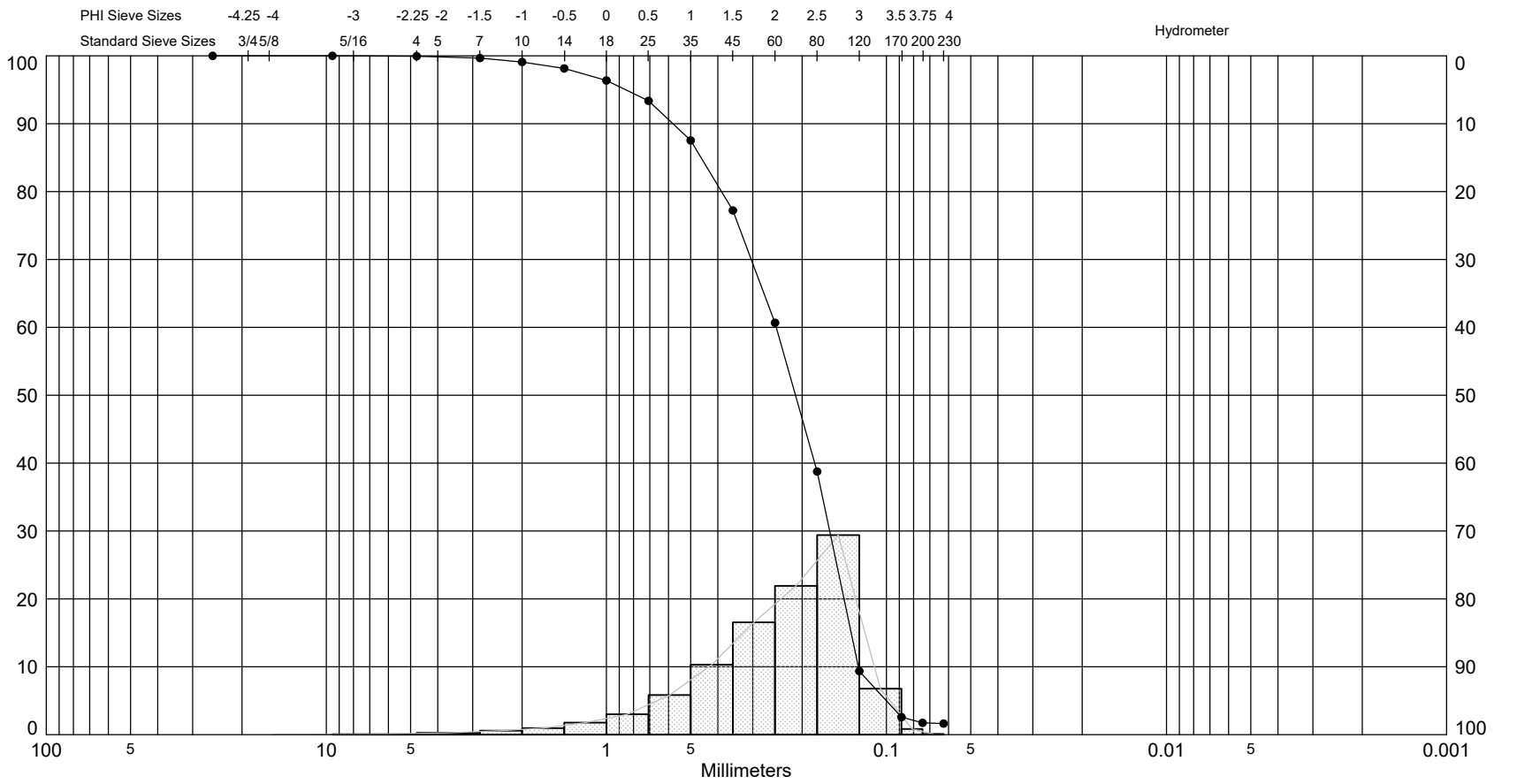
Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shells (%):
114.67	112.79			#200 - 1.74 #230 - 1.63			

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

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

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



Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort
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

Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

Depths and elevations based on measured values

Sample Information	
Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Analysis Date:	08-01-22
Analyzed By:	CRM
Easting (X, ft):	2,740,637
Northing (Y, ft):	326,293
Horizontal System:	NAD 1983
Vertical System:	MLLW

ATHENA TECHNOLOGIES, INC.

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

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

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-019 #S-4

Analysis Date: 08-01-22

Analyzed By: CRM

Easting (ft):	Northing (ft):	Coordinate System:	Elevation (ft):
2,740,637	326,293	NC State Plane, Zone 3200	-7.7 MLLW

USCS:	Munsell:	Comments:
SP	Moist - 5Y-6/1	Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

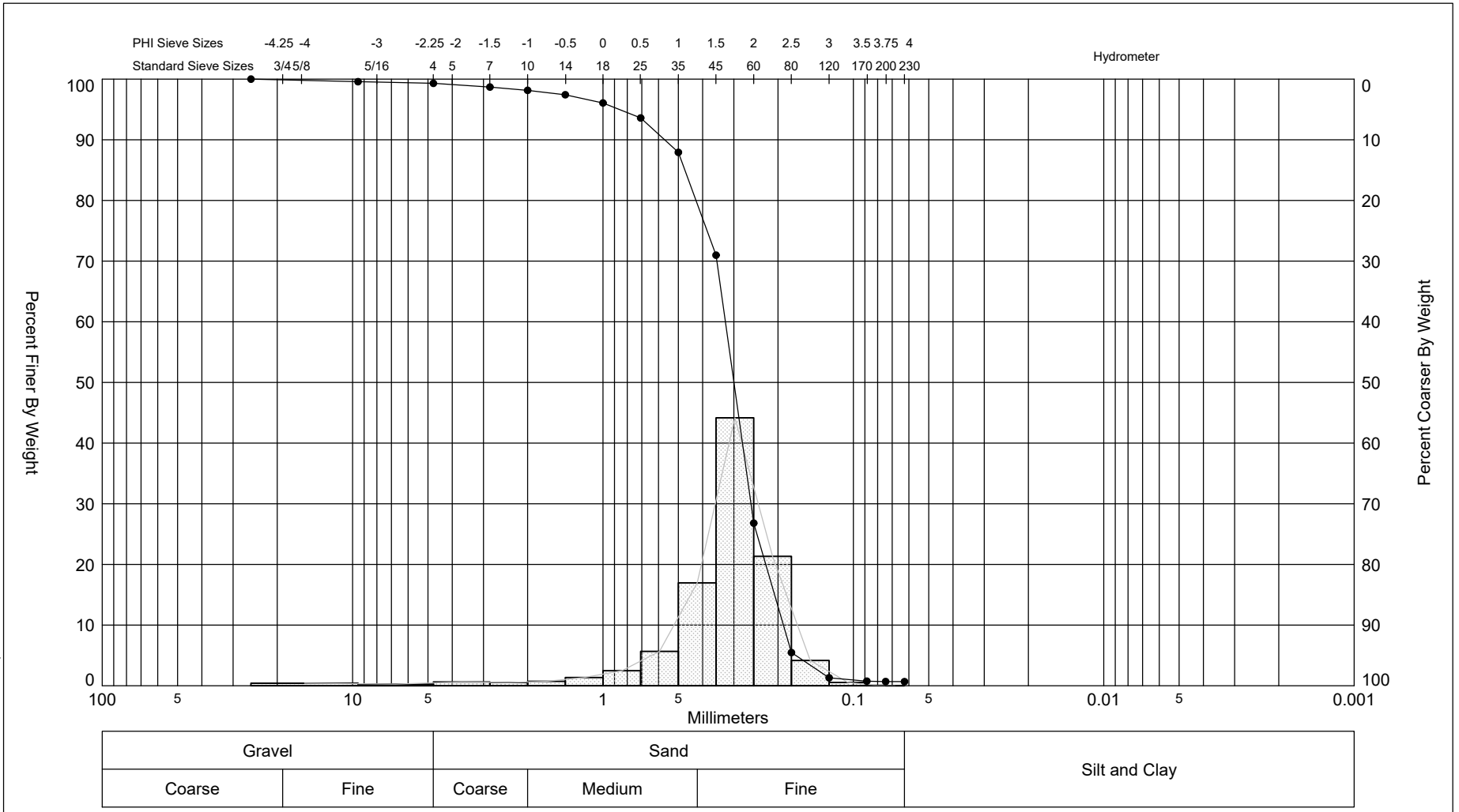
Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shells (%):
103.57	102.87			#200 - 0.69 #230 - 0.68			

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

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

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
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

Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

Depths and elevations based on measured values

Sample Information	
Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Analysis Date:	08-01-22
Analyzed By:	CRM
Easting (X, ft):	2,740,637
Northing (Y, ft):	326,293
Horizontal System:	NAD 1983
Vertical System:	MLLW

ATHENA TECHNOLOGIES, INC.

Athena Technologies, Inc.
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McClellanville, SC 29458
Office: 843-887-3800

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

Granularmetric Report

Depths and elevations based on measured values

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

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

Easting (ft):	Northing (ft):	Coordinate System:	Elevation (ft):
2,740,637	326,293	NC State Plane, Zone 3200	-9.7 MLLW

USCS:	Munsell:	Comments:
SP	Moist - 5Y-6/2	Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

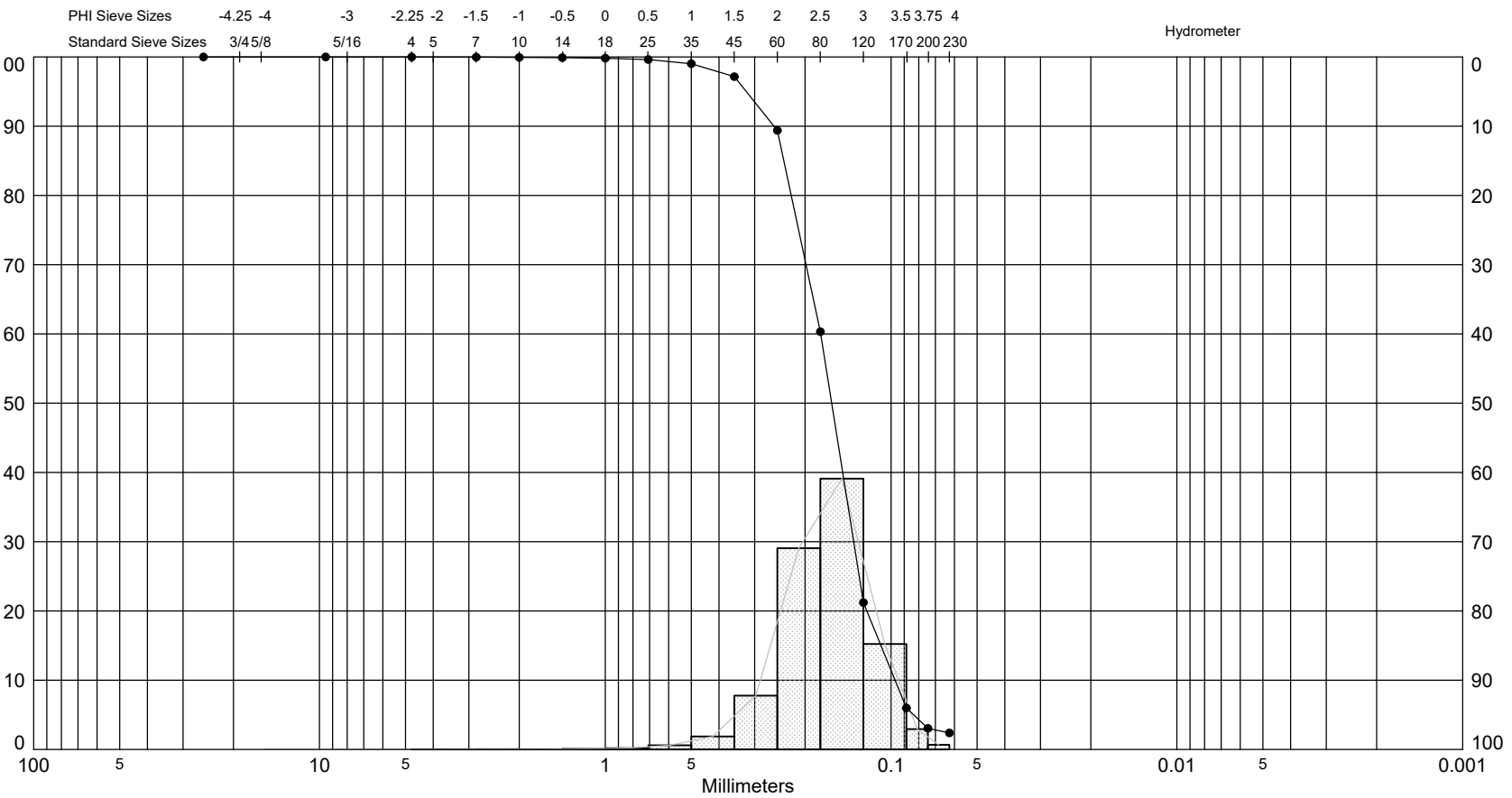
Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shells (%):
117.30	114.47			#200 - 3.05 #230 - 2.39			

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

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



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort
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

Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

Depths and elevations based on measured values

Sample Information	
Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Analysis Date:	08-01-22
Analyzed By:	CRM
Easting (X, ft):	2,740,637
Northing (Y, ft):	326,293
Horizontal System:	NAD 1983
Vertical System:	MLLW

ATHENA TECHNOLOGIES, INC.

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

Granularmetric Report

Depths and elevations based on measured values

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

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

Easting (ft):	Northing (ft):	Coordinate System:	Elevation (ft):
2,740,813	327,342	NC State Plane, Zone 3200	-1.4 MLLW

USCS:	Munsell:	Comments:
SP	Moist - 5Y-7/1	Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

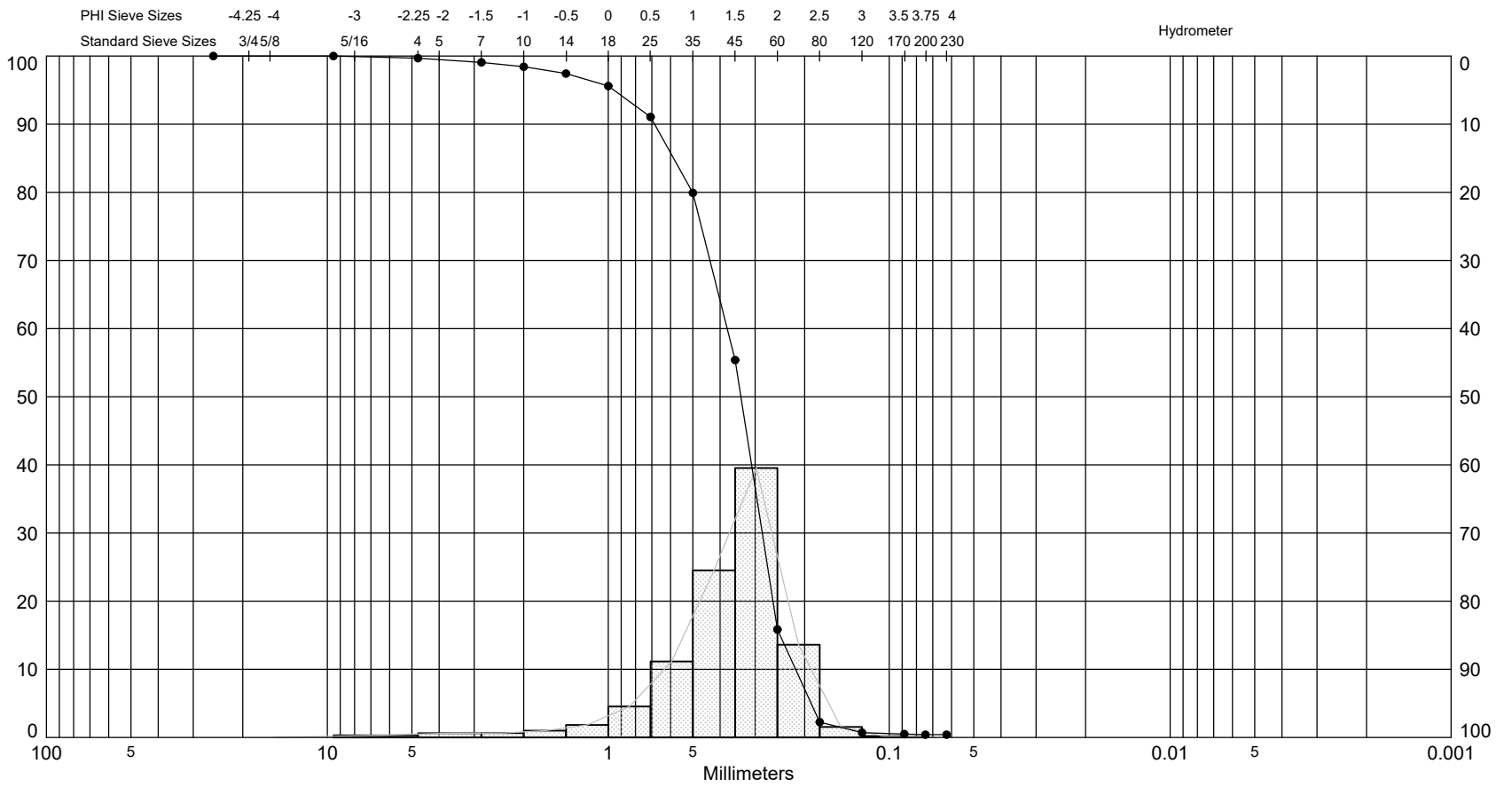
Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shells (%):
126.54	126.02			#200 - 0.41 #230 - 0.41			

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

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

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
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

Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

Depths and elevations based on measured values

Sample Information	
Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Analysis Date:	08-01-22
Analyzed By:	CRM
Easting (X, ft):	2,740,813
Northing (Y, ft):	327,342
Horizontal System:	NAD 1983
Vertical System:	MLLW

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McClellanville, SC 29458
Office: 843-887-3800

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

Granularmetric Report

Depths and elevations based on measured values

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

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

Easting (ft):	Northing (ft):	Coordinate System:	Elevation (ft):
2,740,813	327,342	NC State Plane, Zone 3200	-3.4 MLLW

USCS:	Munsell:	Comments:
SP	Moist - 5Y-7/1	Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

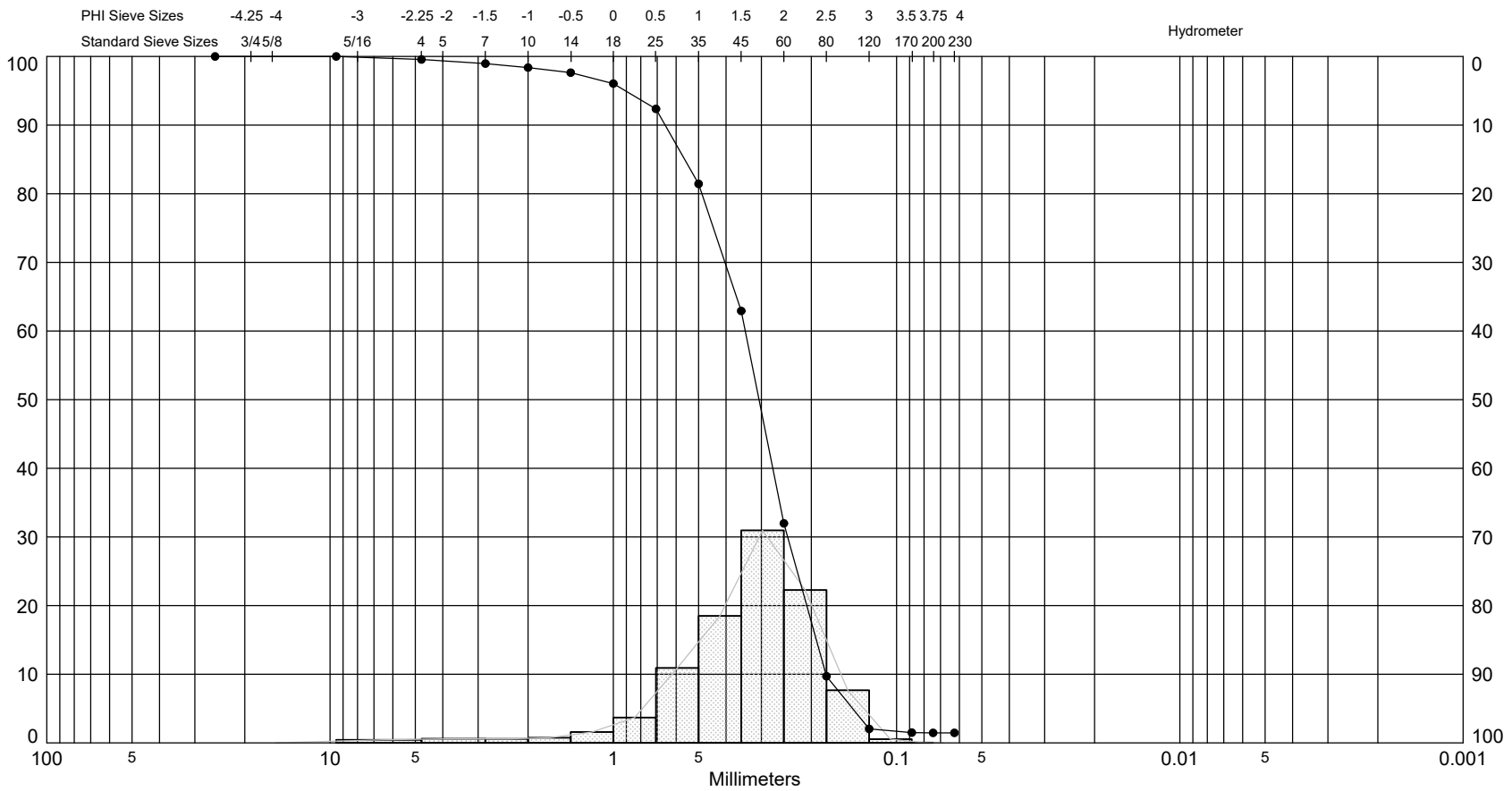
Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shells (%):
97.63	96.21			#200 - 1.46 #230 - 1.46			

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

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



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort
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

Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

Depths and elevations based on measured values

Sample Information	
Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Analysis Date:	08-01-22
Analyzed By:	CRM
Easting (X, ft):	2,740,813
Northing (Y, ft):	327,342
Horizontal System:	NAD 1983
Vertical System:	MLLW

ATHENA TECHNOLOGIES, INC.

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

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

Granularmetric Report

Depths and elevations based on measured values

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

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

Easting (ft):	Northing (ft):	Coordinate System:	Elevation (ft):
2,740,813	327,342	NC State Plane, Zone 3200	-5.4 MLLW

USCS:	Munsell:	Comments:
SP	Moist - 5Y-6/1	Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

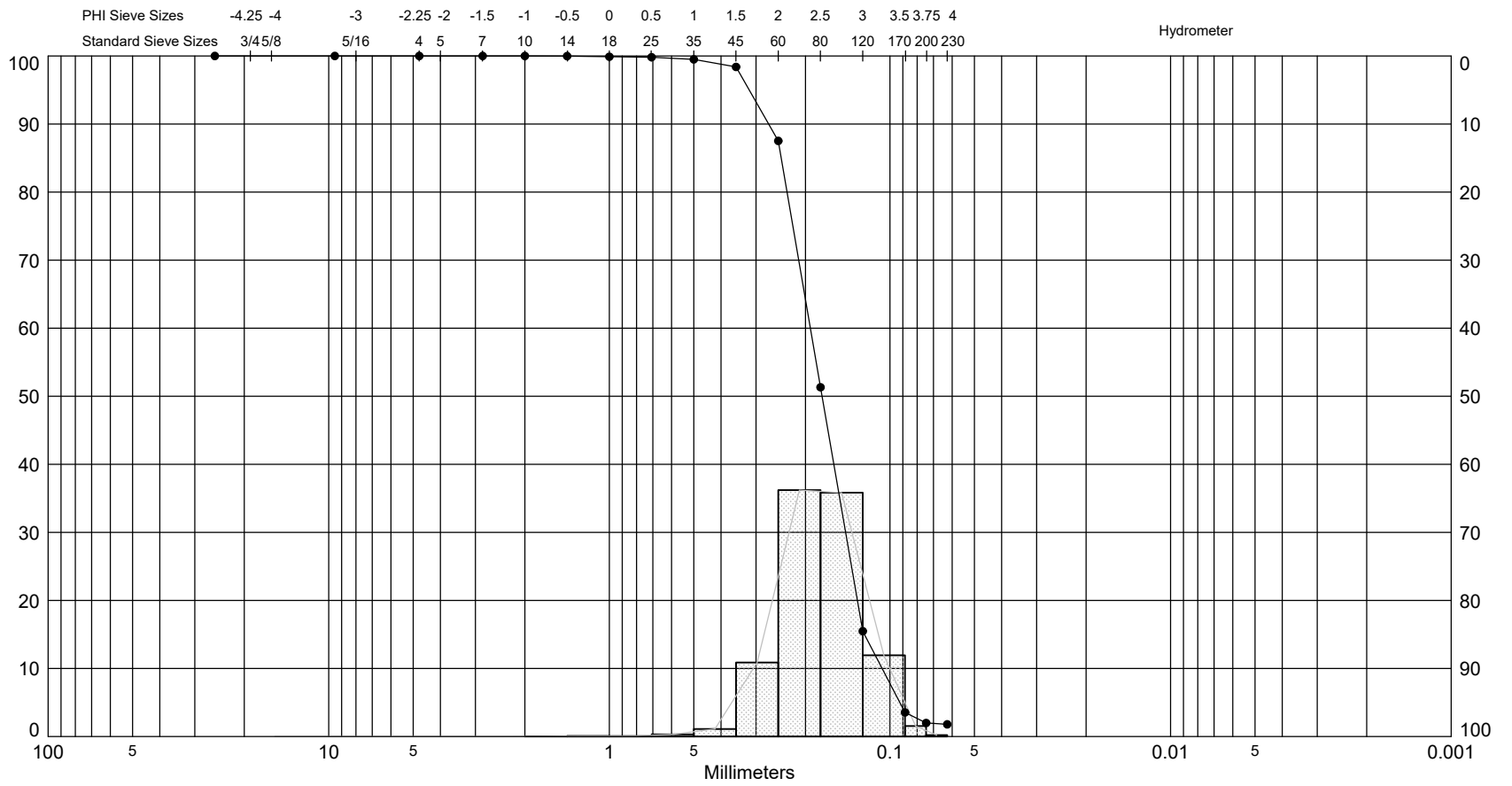
Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shells (%):
81.77	80.31			#200 - 1.99 #230 - 1.79			

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

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

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



Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort
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

Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

Depths and elevations based on measured values

Sample Information	
Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Analysis Date:	08-01-22
Analyzed By:	CRM
Easting (X, ft):	2,740,813
Northing (Y, ft):	327,342
Horizontal System:	NAD 1983
Vertical System:	MLLW

ATHENA TECHNOLOGIES, INC.

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

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

Granularmetric Report

Depths and elevations based on measured values

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

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

Easting (ft):	Northing (ft):	Coordinate System:	Elevation (ft):
2,740,813	327,342	NC State Plane, Zone 3200	-7.4 MLLW

USCS:	Munsell:	Comments:
SP	Moist - 5Y-6/1	Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

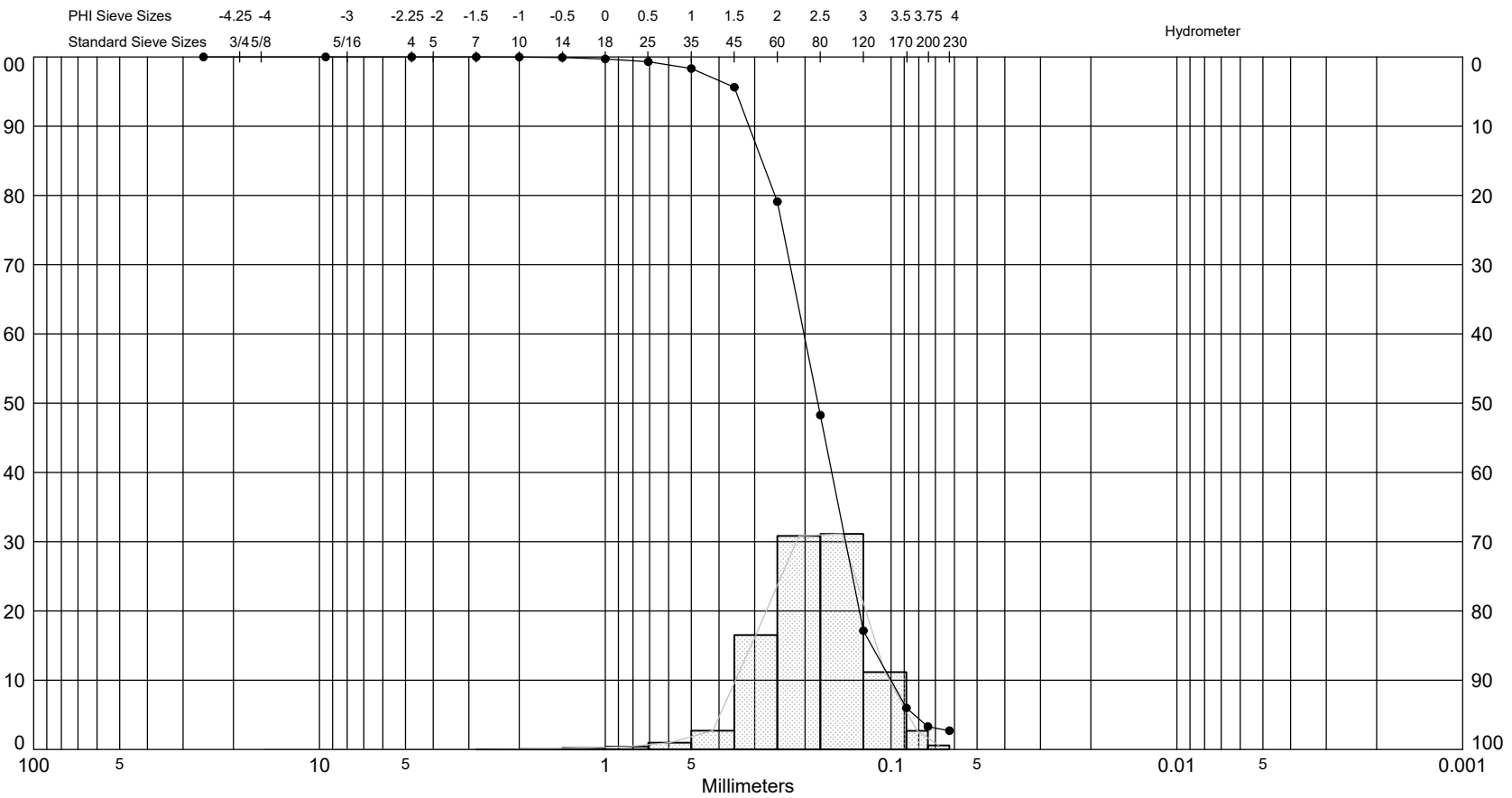
Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shells (%):
122.78	119.44			#200 - 3.30 #230 - 2.71			

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

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

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



Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort
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

Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

Depths and elevations based on measured values

Sample Information	
Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Analysis Date:	08-01-22
Analyzed By:	CRM
Easting (X, ft):	2,740,813
Northing (Y, ft):	327,342
Horizontal System:	NAD 1983
Vertical System:	MLLW

ATHENA TECHNOLOGIES, INC.

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

Granularmetric Report

Depths and elevations based on measured values

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

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

Easting (ft):	Northing (ft):	Coordinate System:	Elevation (ft):
2,740,813	327,342	NC State Plane, Zone 3200	-8.4 MLLW

USCS:	Munsell:	Comments:
SP	Moist - 5Y-7/1	Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

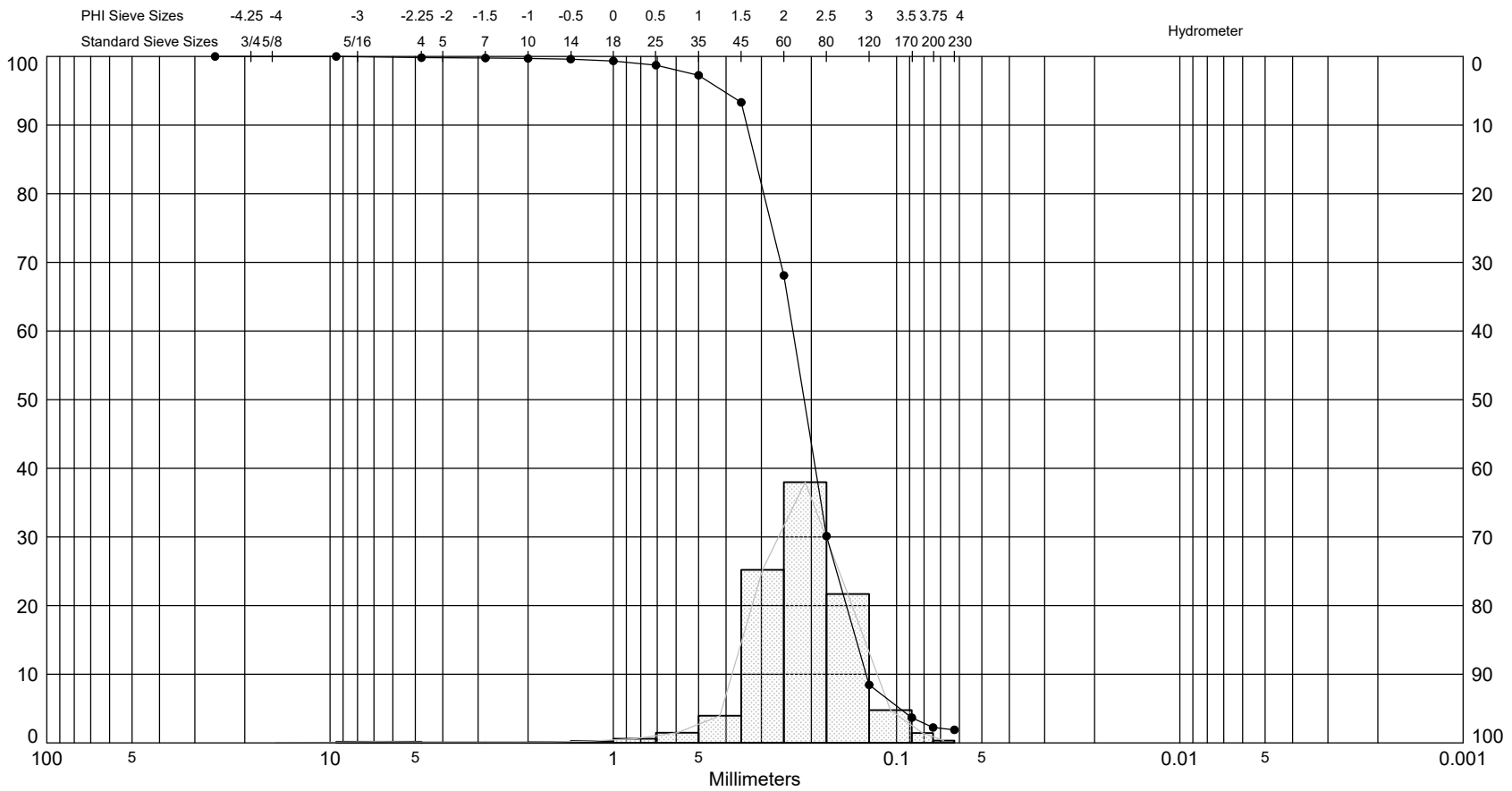
Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shells (%):
90.24	88.50			#200 - 2.24 #230 - 1.90			

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

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

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



Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort
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

Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

Depths and elevations based on measured values

Sample Information	
Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Analysis Date:	08-01-22
Analyzed By:	CRM
Easting (X, ft):	2,740,813
Northing (Y, ft):	327,342
Horizontal System:	NAD 1983
Vertical System:	MLLW

ATHENA TECHNOLOGIES, INC.

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

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

Granularmetric Report

Depths and elevations based on measured values

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

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

Easting (ft):	Northing (ft):	Coordinate System:	Elevation (ft):
2,741,212	328,338	NC State Plane, Zone 3200	-0.8 MLLW

USCS:	Munsell:	Comments:
SP	Moist - 5Y-7/2	Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

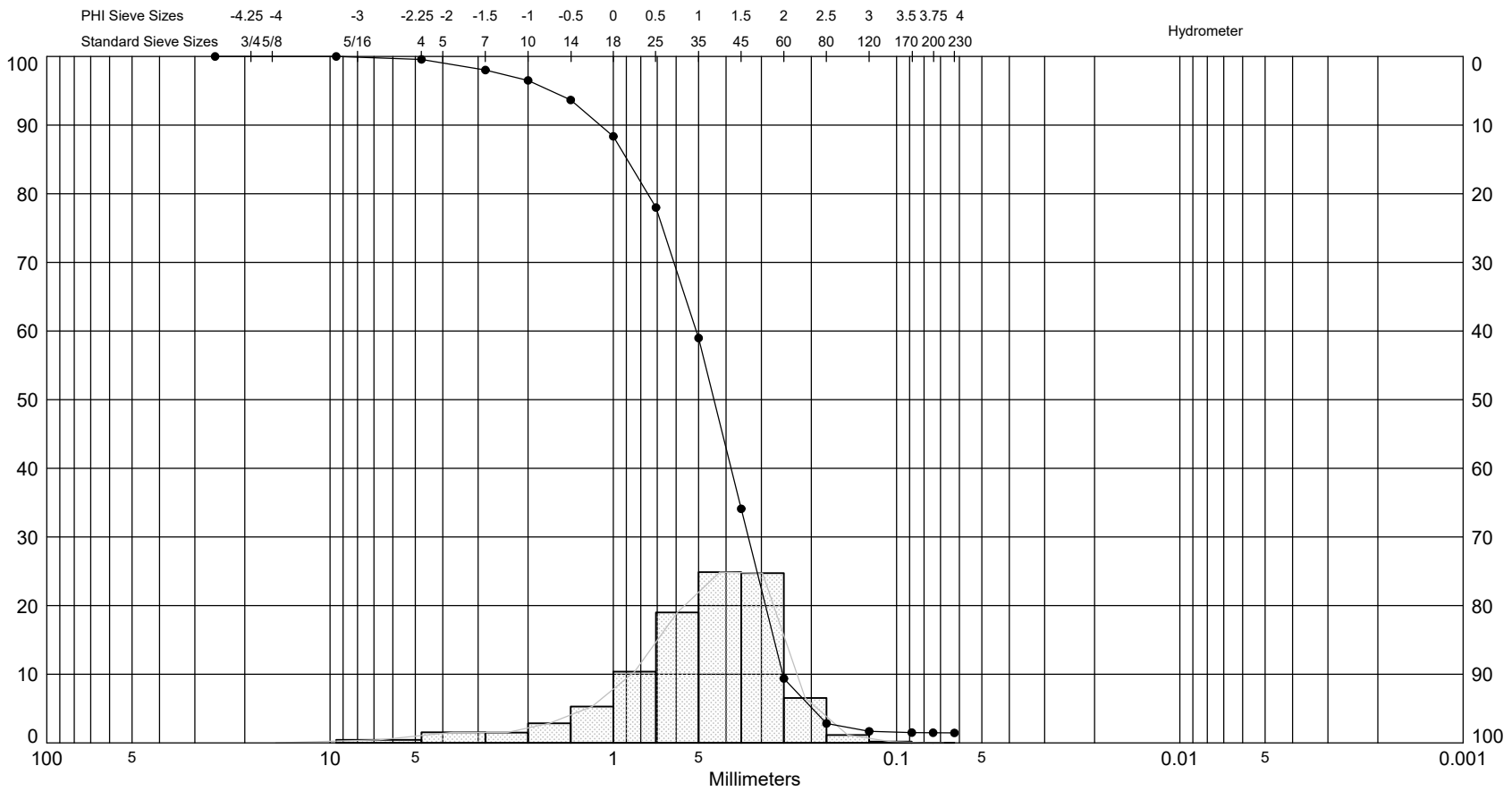
Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shells (%):
108.23	106.64			#200 - 1.48 #230 - 1.45			

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

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

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
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

Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

Depths and elevations based on measured values

Sample Information	
Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Analysis Date:	08-01-22
Analyzed By:	CRM
Easting (X, ft):	2,741,212
Northing (Y, ft):	328,338
Horizontal System:	NAD 1983
Vertical System:	MLLW

ATHENA TECHNOLOGIES, INC.

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McClellanville, SC 29458
Office: 843-887-3800

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

Granularmetric Report

Depths and elevations based on measured values

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

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

Easting (ft):	Northing (ft):	Coordinate System:	Elevation (ft):
2,741,212	328,338	NC State Plane, Zone 3200	-2.8 MLLW

USCS:	Munsell:	Comments:
SP	Moist - 5Y-7/2	Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

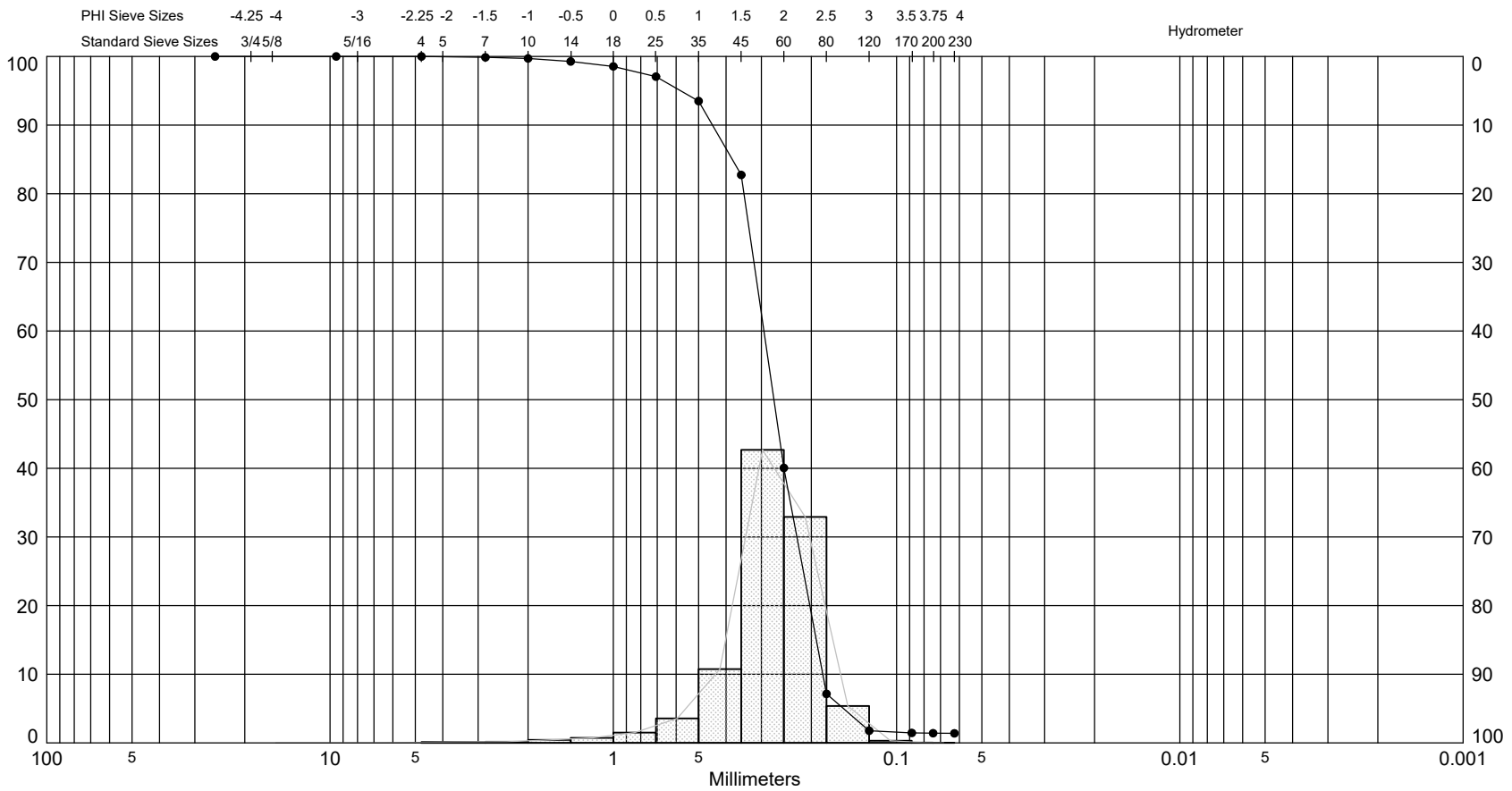
Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shells (%):
121.98	120.28			#200 - 1.41 #230 - 1.39			

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

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

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



Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort
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

Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

Depths and elevations based on measured values

Sample Information	
Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Analysis Date:	08-01-22
Analyzed By:	CRM
Easting (X, ft):	2,741,212
Northing (Y, ft):	328,338
Horizontal System:	NAD 1983
Vertical System:	MLLW

ATHENA TECHNOLOGIES, INC.

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McClellanville, SC 29458
Office: 843-887-3800

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

Granularmetric Report

Depths and elevations based on measured values

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

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

Easting (ft):	Northing (ft):	Coordinate System:	Elevation (ft):
2,741,212	328,338	NC State Plane, Zone 3200	-5.8 MLLW

USCS:	Munsell:	Comments:
SP	Moist - 5Y-6/1	Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

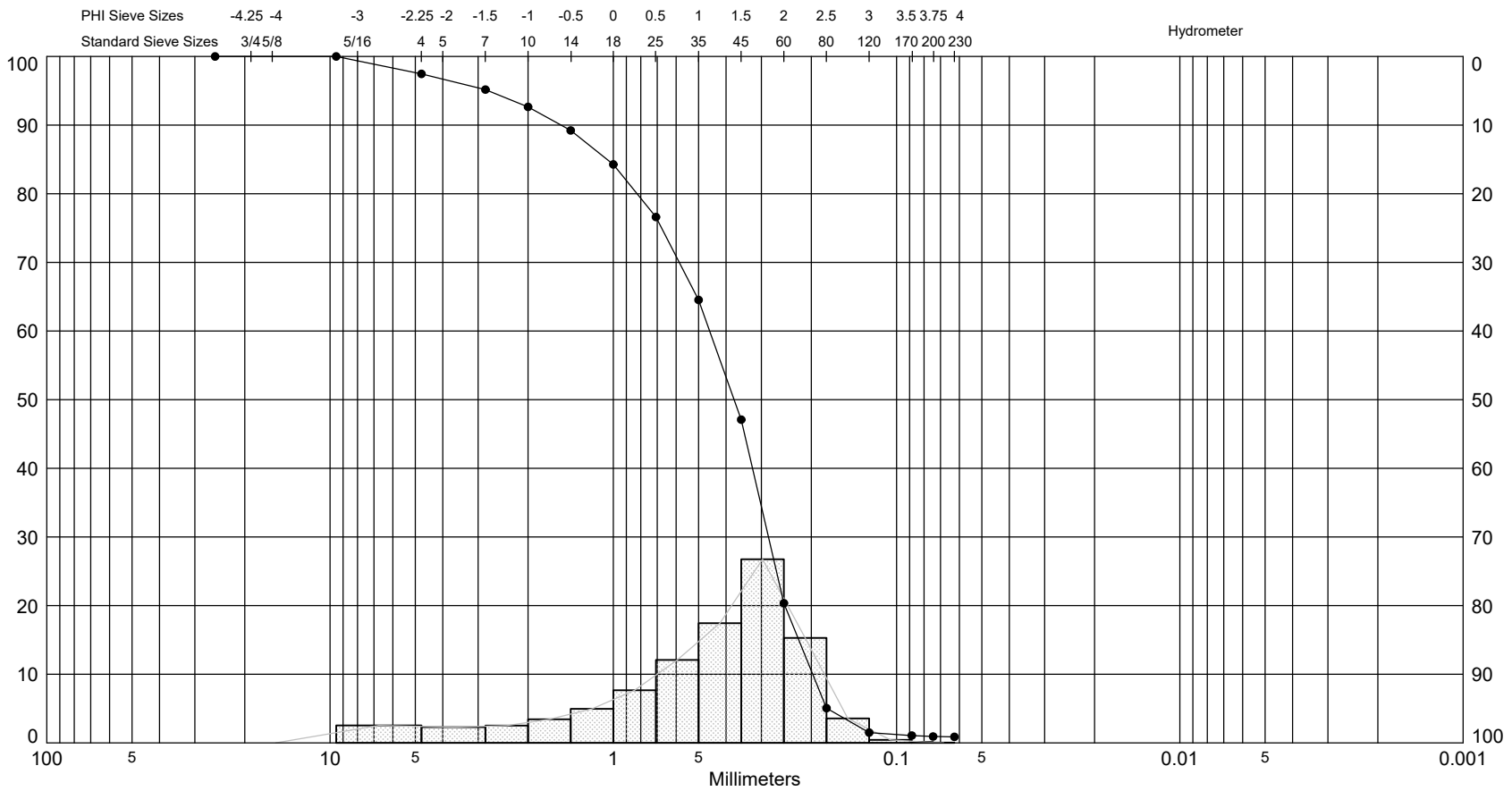
Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shells (%):
79.80	79.10			#200 - 0.93 #230 - 0.88			

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

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

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



Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort
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

Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

Depths and elevations based on measured values

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

Sample Information	
Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Analysis Date:	08-01-22
Analyzed By:	CRM
Easting (X, ft):	2,741,212
Northing (Y, ft):	328,338
Horizontal System:	NAD 1983
Vertical System:	MLLW

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

Granularmetric Report

Depths and elevations based on measured values

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

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

Easting (ft):	Northing (ft):	Coordinate System:	Elevation (ft):
2,741,212	328,338	NC State Plane, Zone 3200	-7.8 MLLW

USCS:	Munsell:	Comments:
SP	Moist - 5Y-7/1	Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

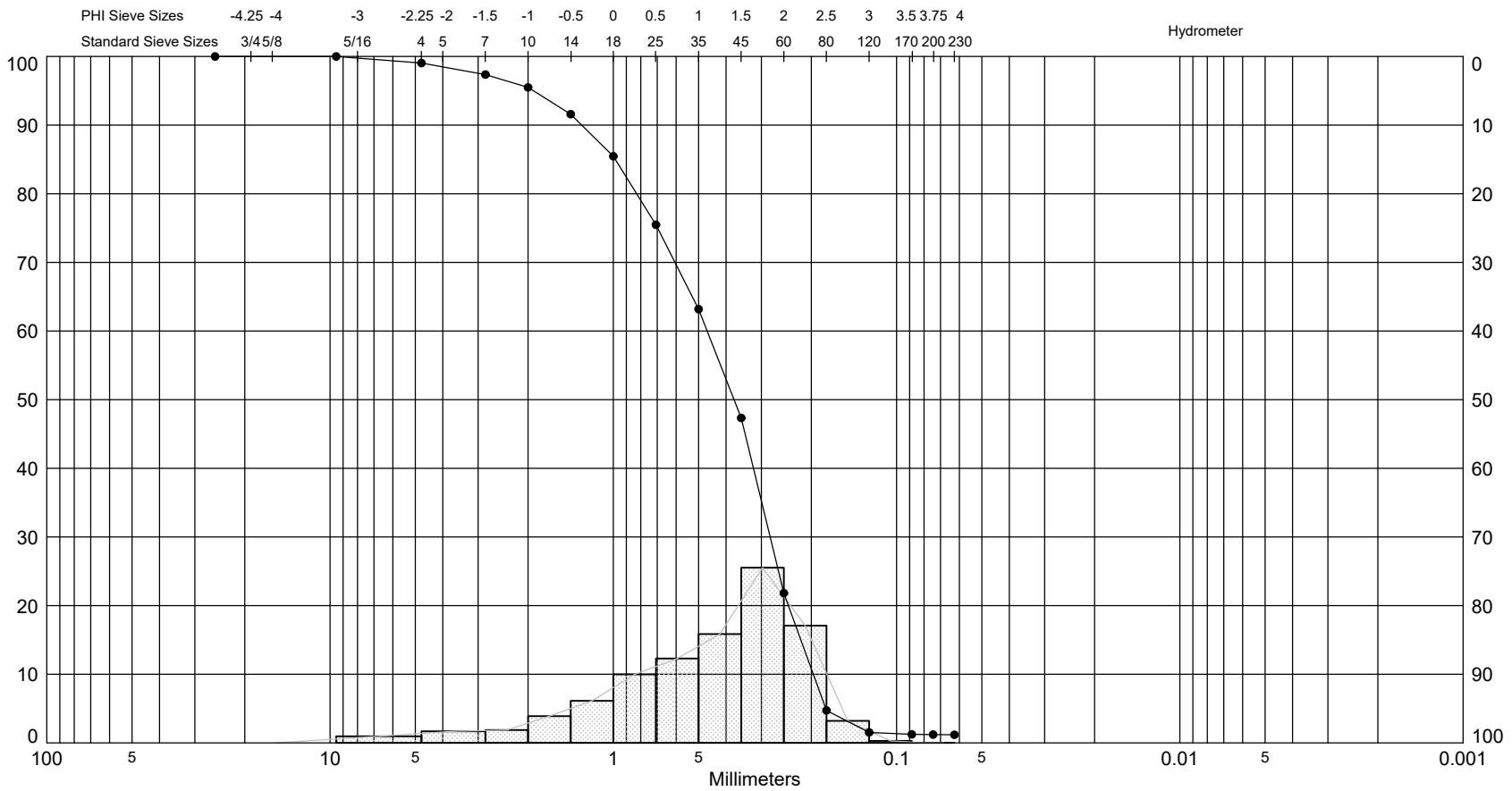
Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shells (%):
118.87	117.45			#200 - 1.21 #230 - 1.18			

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

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

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
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

Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

Depths and elevations based on measured values

Sample Information	
Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Analysis Date:	08-01-22
Analyzed By:	CRM
Easting (X, ft):	2,741,212
Northing (Y, ft):	328,338
Horizontal System:	NAD 1983
Vertical System:	MLLW

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

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

Granularmetric Report

Depths and elevations based on measured values

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

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

Easting (ft):	Northing (ft):	Coordinate System:	Elevation (ft):
2,741,212	328,338	NC State Plane, Zone 3200	-8.8 MLLW

USCS:	Munsell:	Comments:
SP	Moist - 5Y-7/1	Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

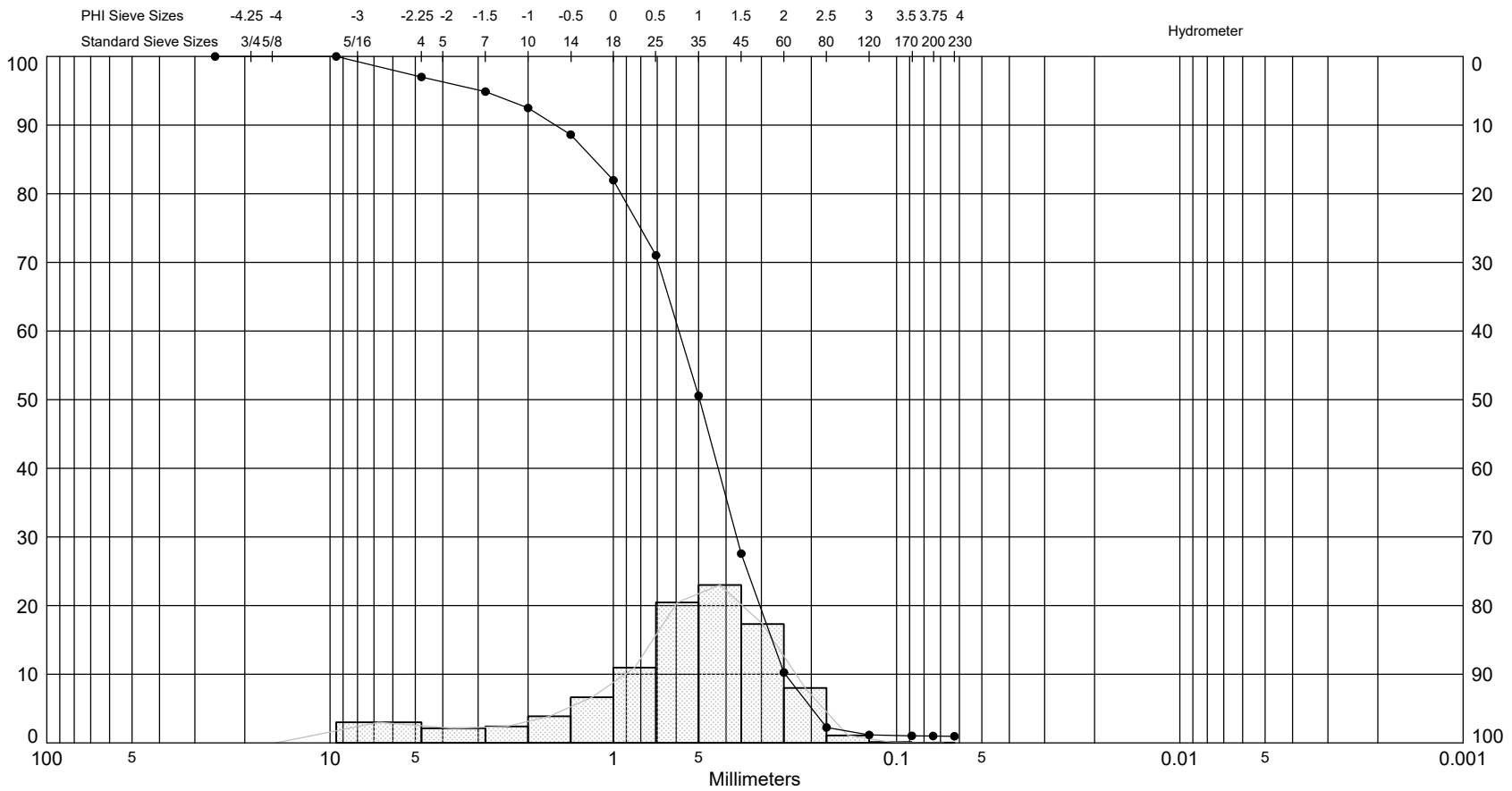
Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shells (%):
114.19	113.08			#200 - 1.00 #230 - 0.96			

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

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



Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort
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

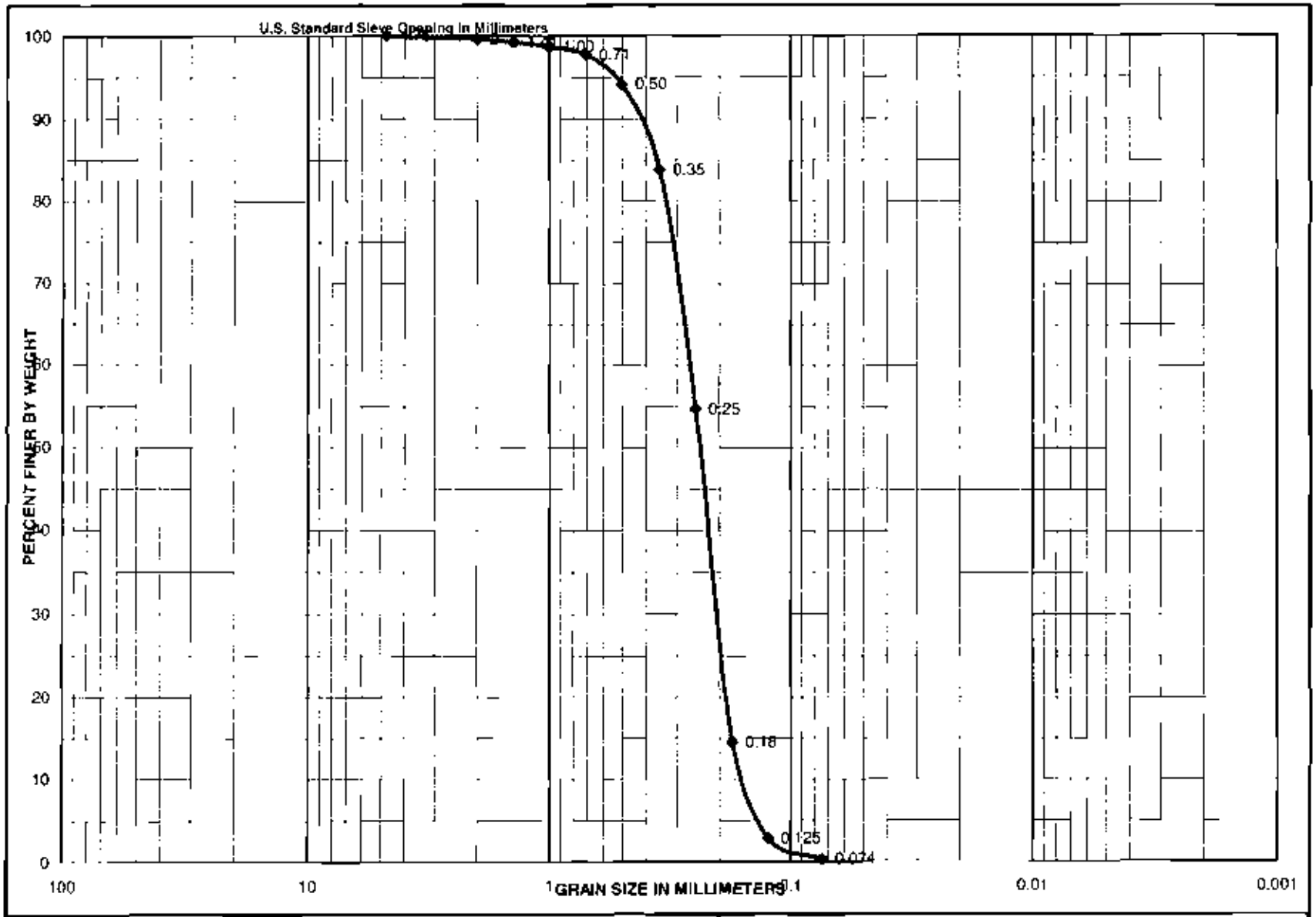
Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL

Depths and elevations based on measured values

Sample Information	
Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Analysis Date:	08-01-22
Analyzed By:	CRM
Easting (X, ft):	2,741,212
Northing (Y, ft):	328,338
Horizontal System:	NAD 1983
Vertical System:	MLLW

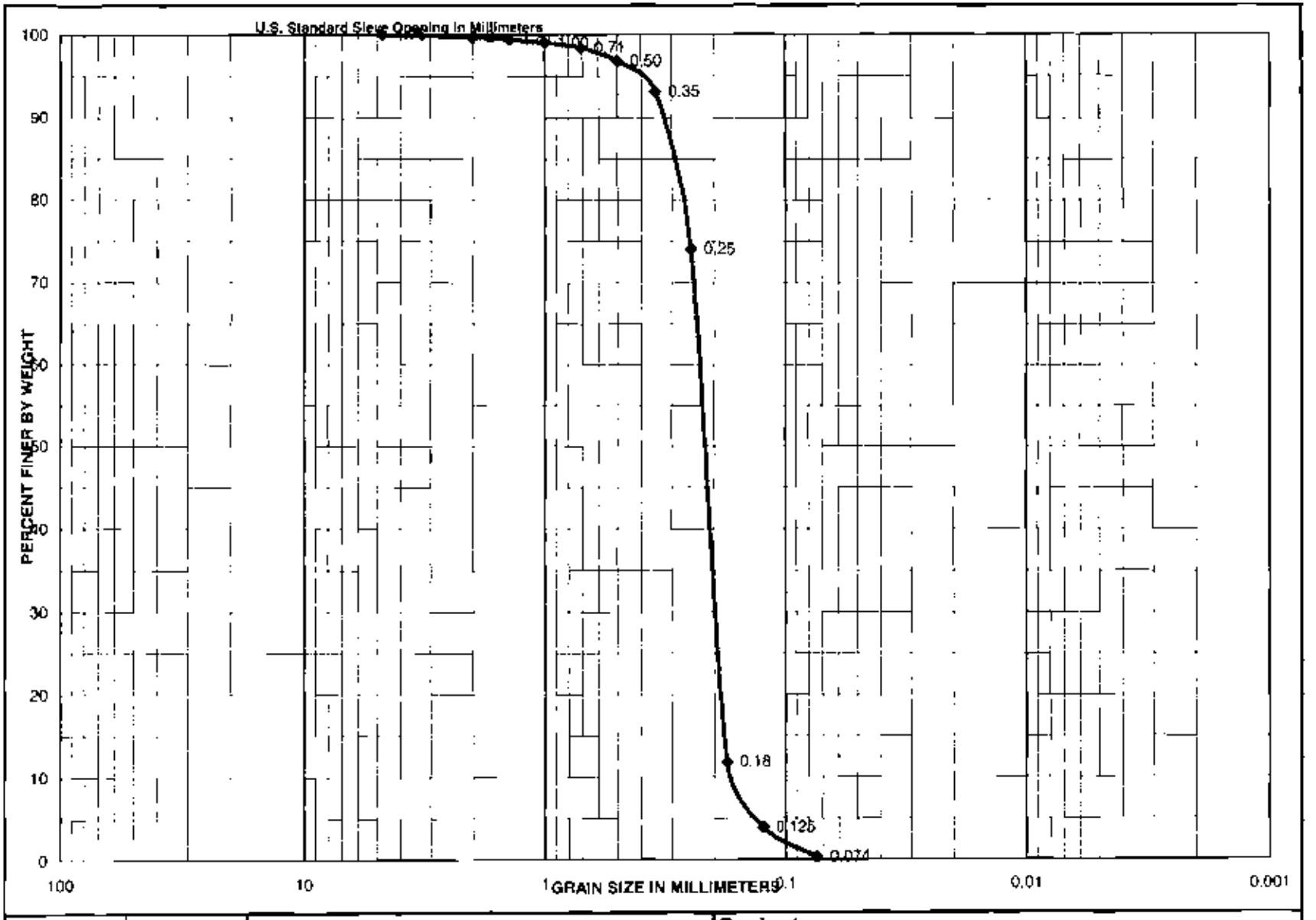
Athena Technologies, Inc.
1293 Graham Farm Road
McClellanville, SC 29458
Office: 843-887-3800

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



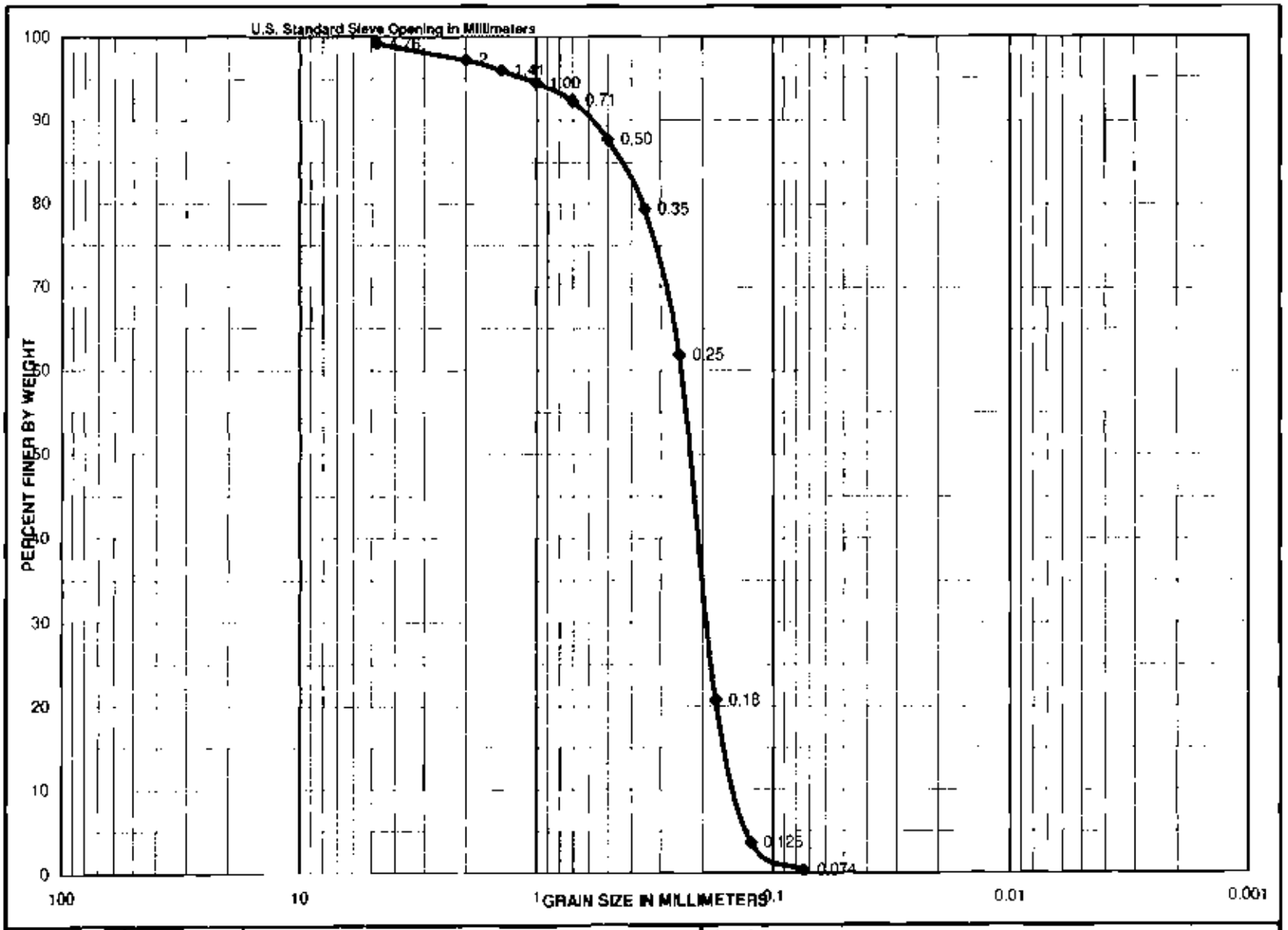
Sample No.	Depth (ft)	Classification
1	3.9-4.4	Olive gray poorly graded sand with trace shells, SP
		2.35% Shells

Project	USACOE Various Sites
Area	Cape Lookout
CATLIN Geotechnical Laboratory	
Boring No.	CL-04-V-1
Date	7/29/2004



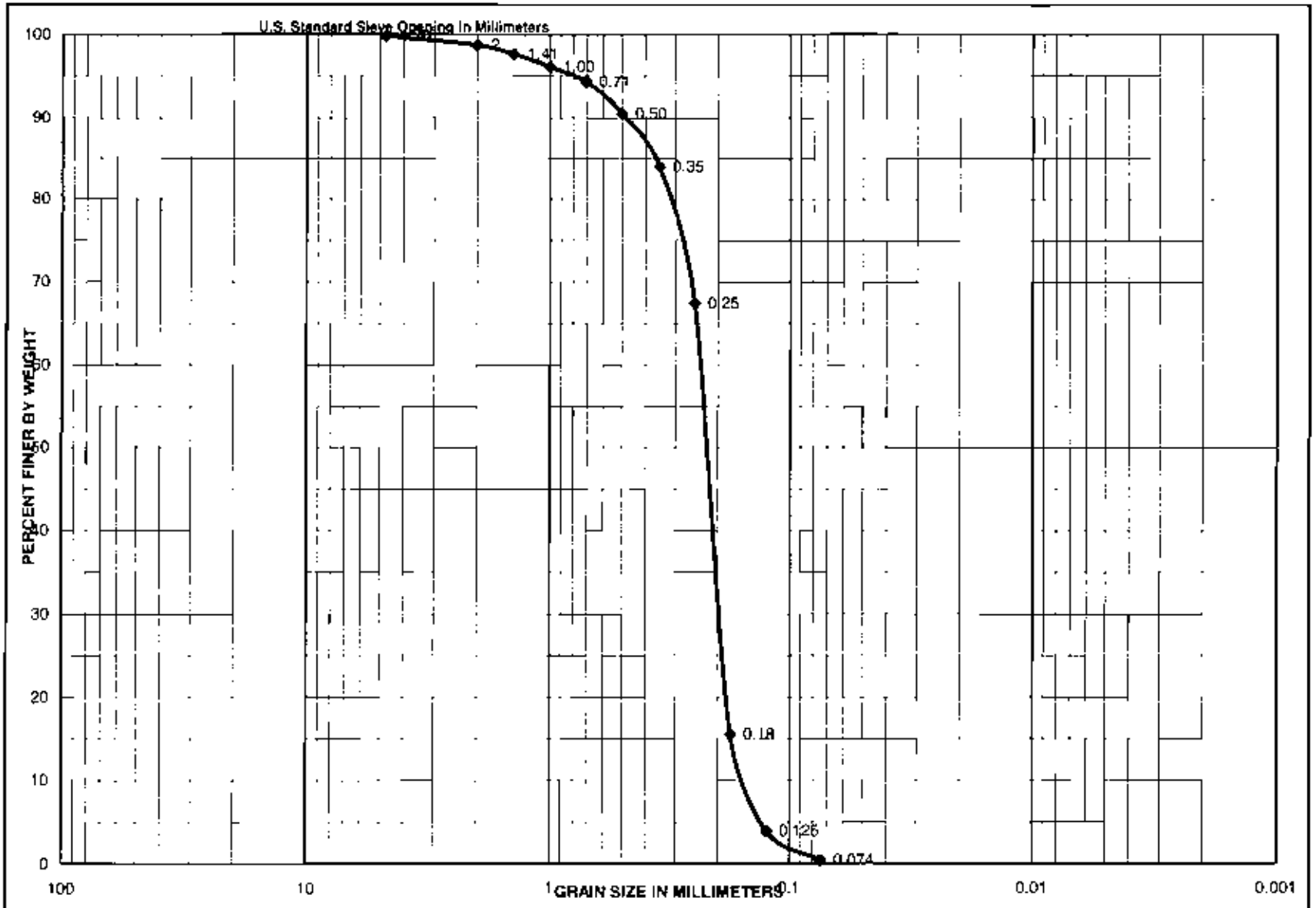
Sample No.	Depth (ft)	Classification
2	8.0-8.5	Olive gray poorly graded sand with trace shells, SP
		1.63% Shells

Project	USACOE Various Sites
Area	Cape Lookout
CATLIN Geotechnical Laboratory	
Boring No.	CL-04-V-1
Date	7/29/2004

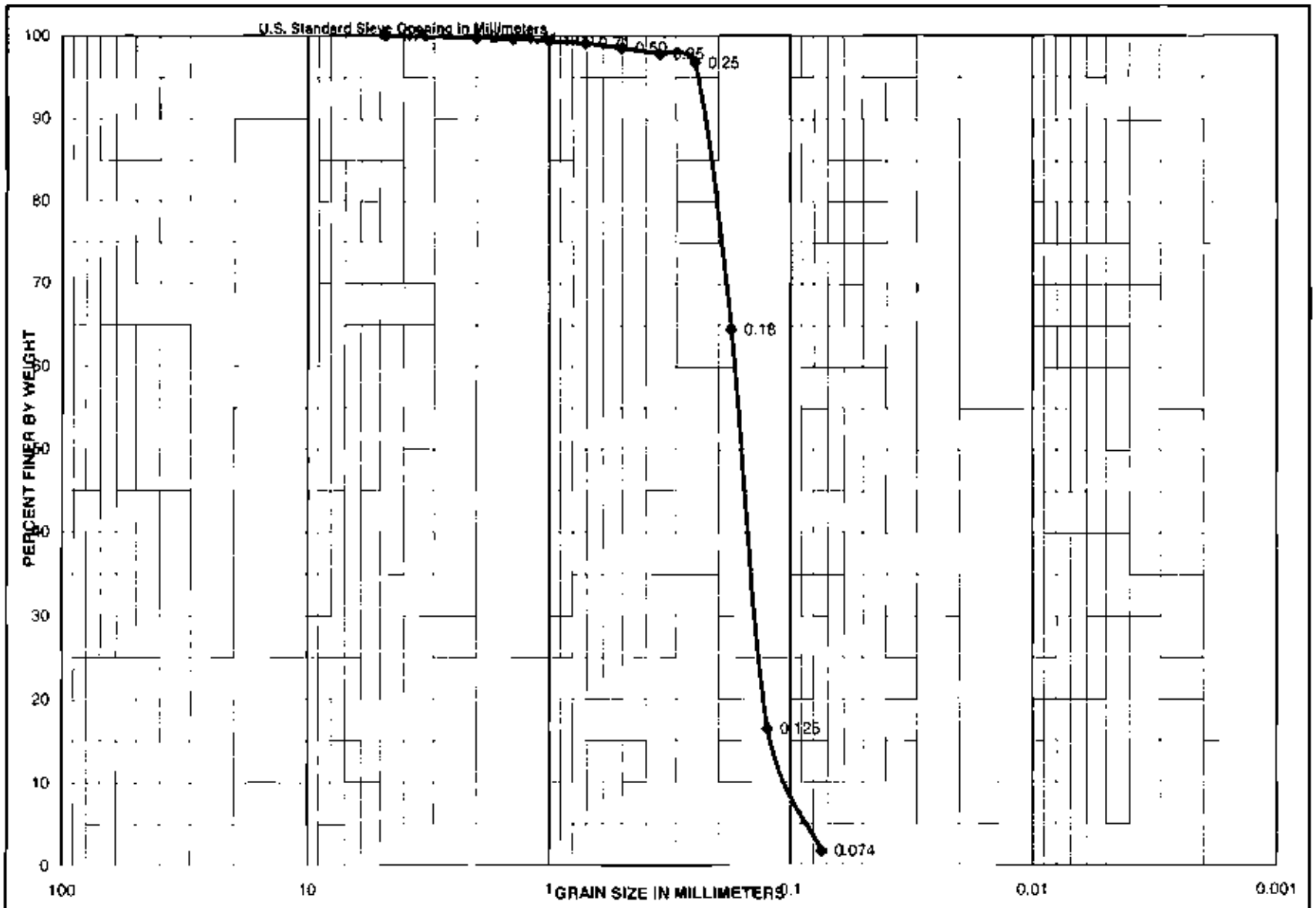


Sample No.	Depth (ft)	Classification
1	4.7-5.2	Dark gray poorly graded sand with few shells, SP
		7.70% Shells

Project	USACOE Various Sites
Area	Cape Lookout
CATLIN Geotechnical Laboratory	
Boring No.	CL-04-V-2
Date	7/29/2004

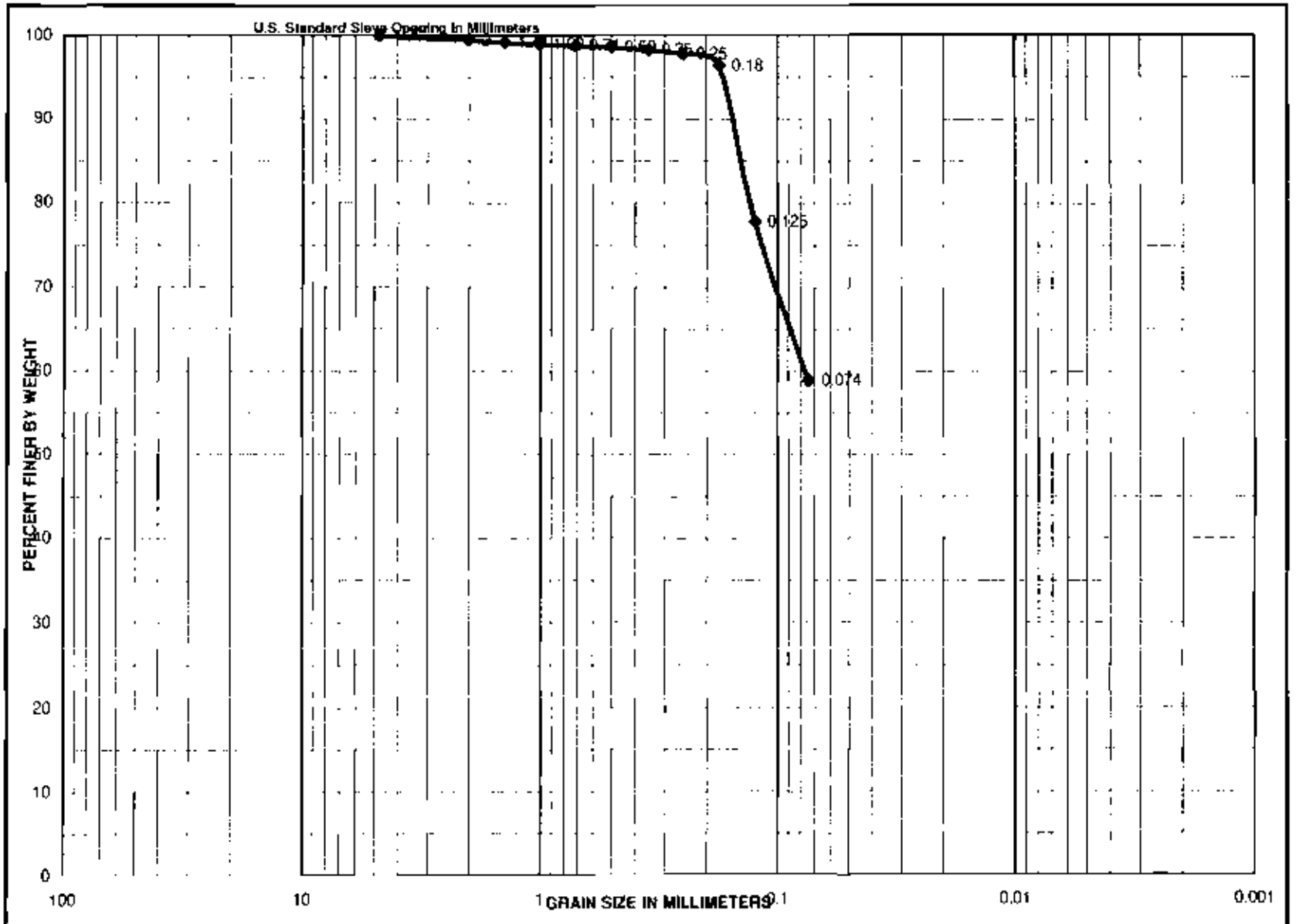


Sample No.	Depth (ft)	Classification	
2	8.7-9.2	Olive gray poorly graded sand with few shells, SP	**Project** USACOE Various Sites
		5.71% Shells	**Area** Cape Lookout
			CATLIN Geotechnical Laboratory
			Boring No. CL-04-V-2
			Date 7/29/2004



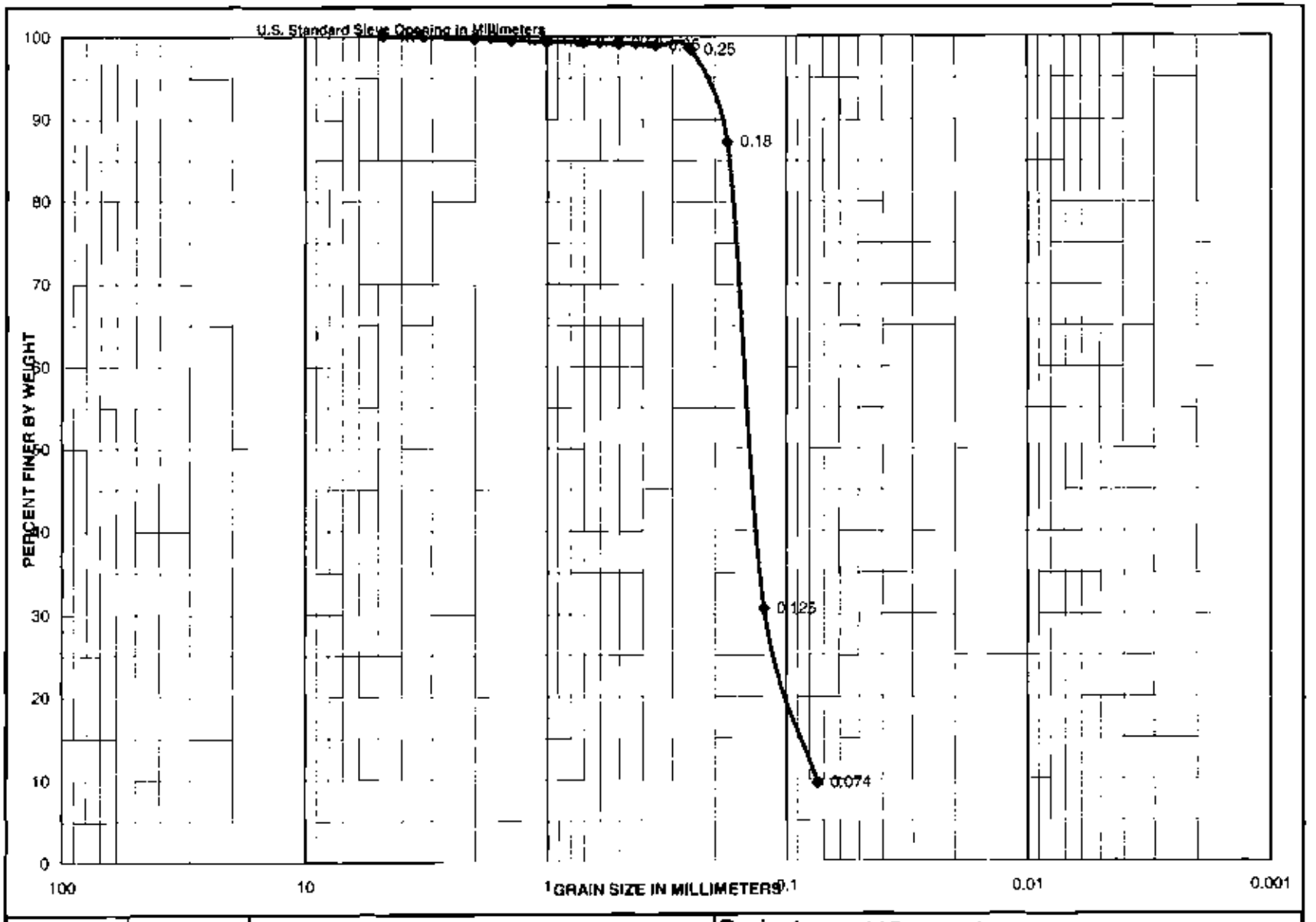
Sample No.	Depth (ft)	Classification
1	3.2-3.7	Dark gray poorly graded sand with trace shells, SP
		0.18% Shells

Project	USACOE Various Sites
Area	Cape Lookout
CATLIN Geotechnical Laboratory	
Boring No.	CL-04-V-2A
Date	7/29/2004

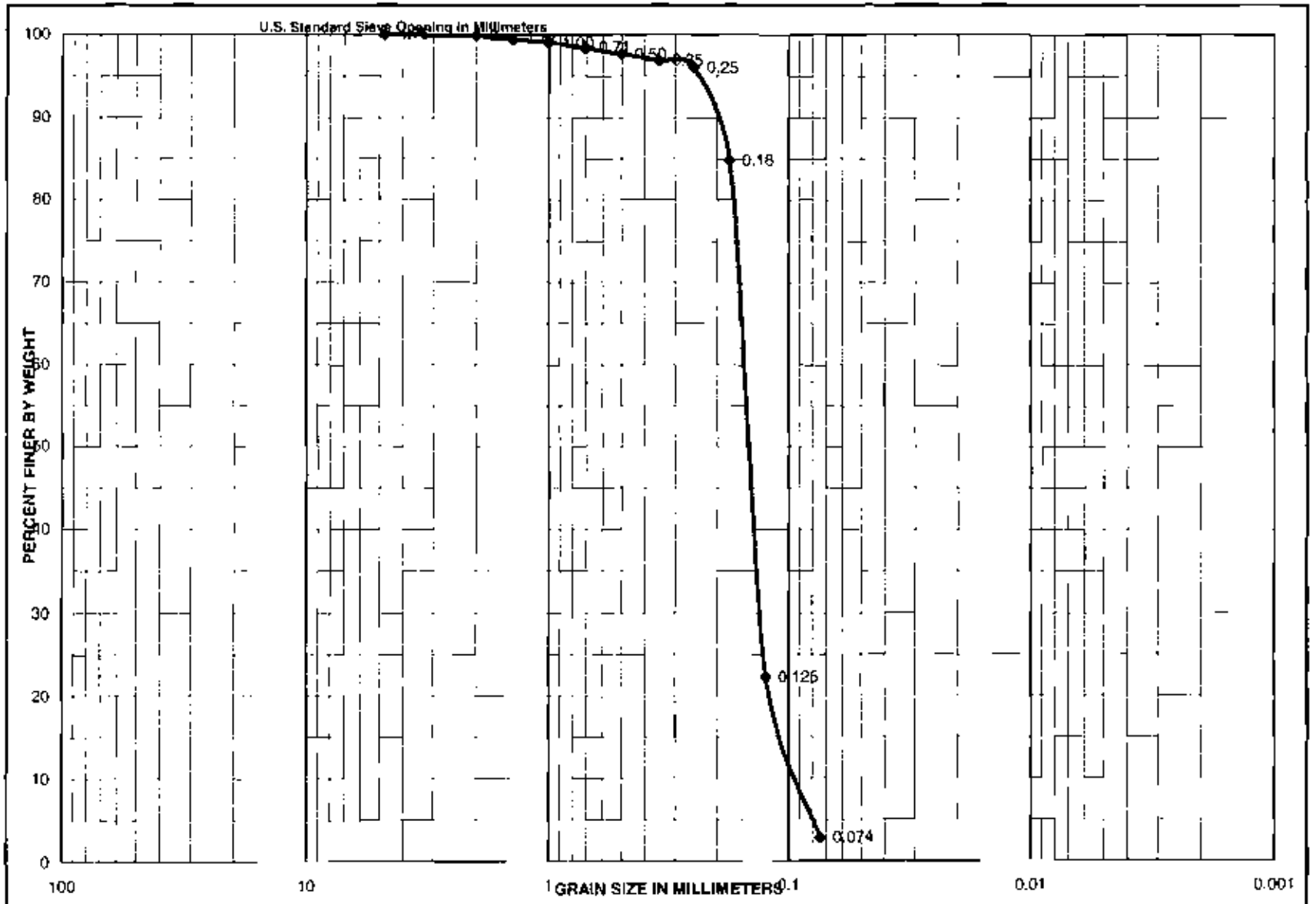


Sample No.	Depth (ft)	Classification
2	7.2-7.7	Dark gray sandy elastic silt with trace shells, MH
		1.53 % Shells

Project	USACOE Various Sites
Area	Cape Lookout
CATLIN Geotechnical Laboratory	
Boring No.	CL-04-V-2A
Date	7/29/2004

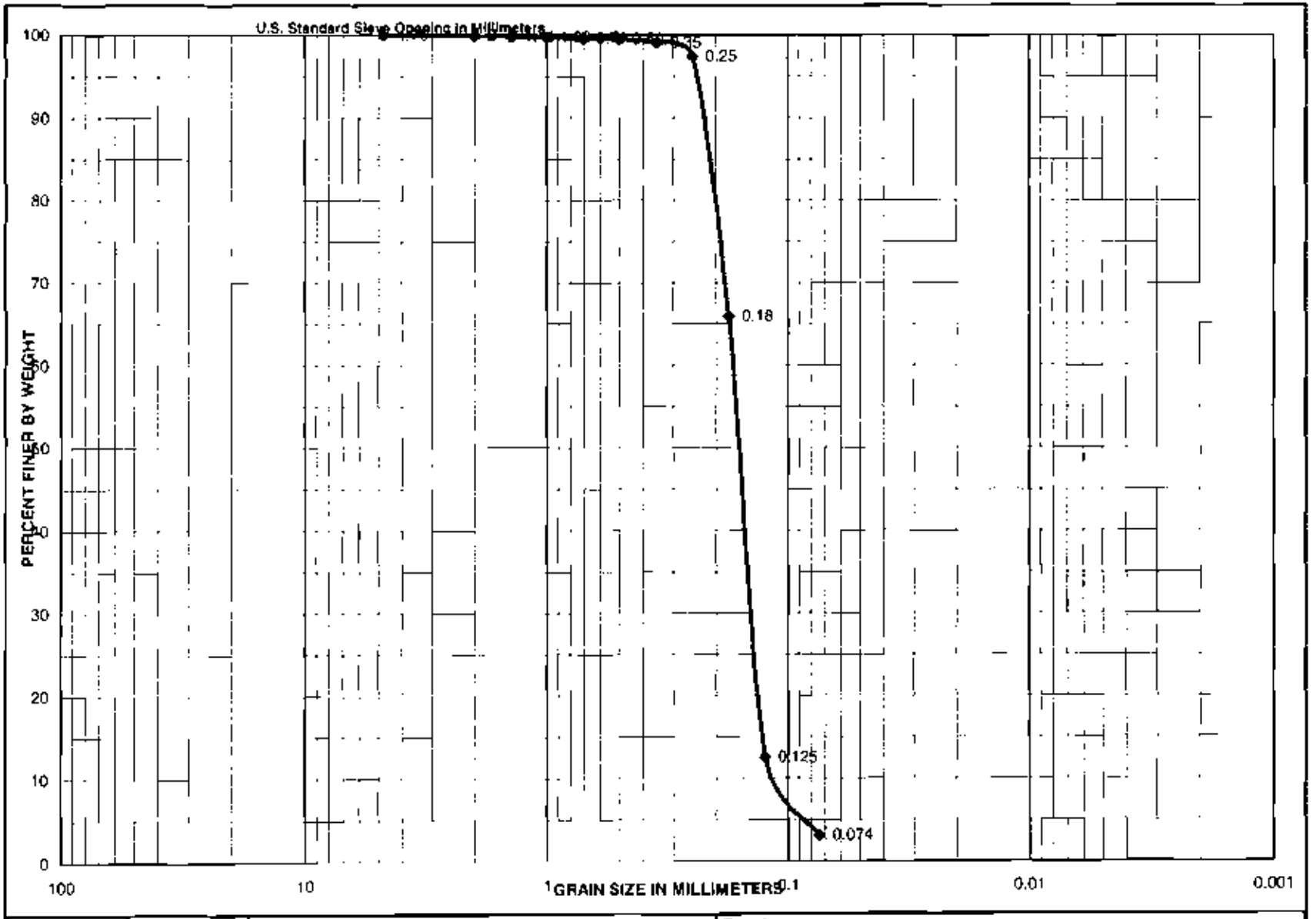


Sample No.	Depth (ft)	Classification	
3	8.6-9.1	Dark gray poorly graded sand with silt and	**Project** USACOE Various Sites
		trace shells, SP-SM 0.43% Shells	**Area** Cape Lookout
			CATLIN Geotechnical Laboratory
			Boring No. CL-04-V-2A
			Date 7/29/2004



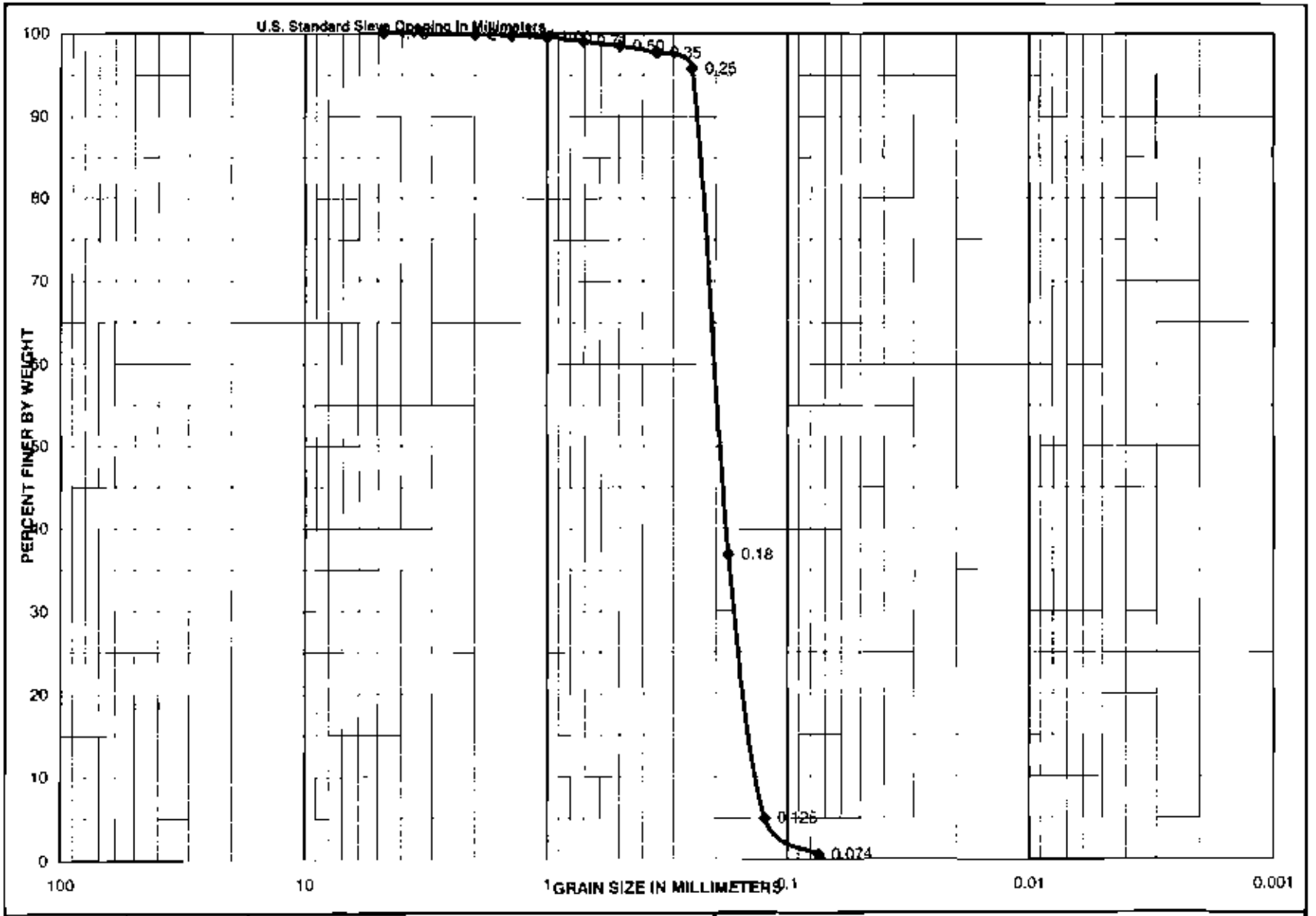
Sample No.	Depth (ft)	Classification
1	4.4-4.9	Dark gray poorly graded sand with trace shells, SP
		1.04% Shells

Project	USACOE Various Sites
Area	Cape Lookout
CATLIN Geotechnical Laboratory	
Boring No.	CL-04-V-3
Date	7/29/2004



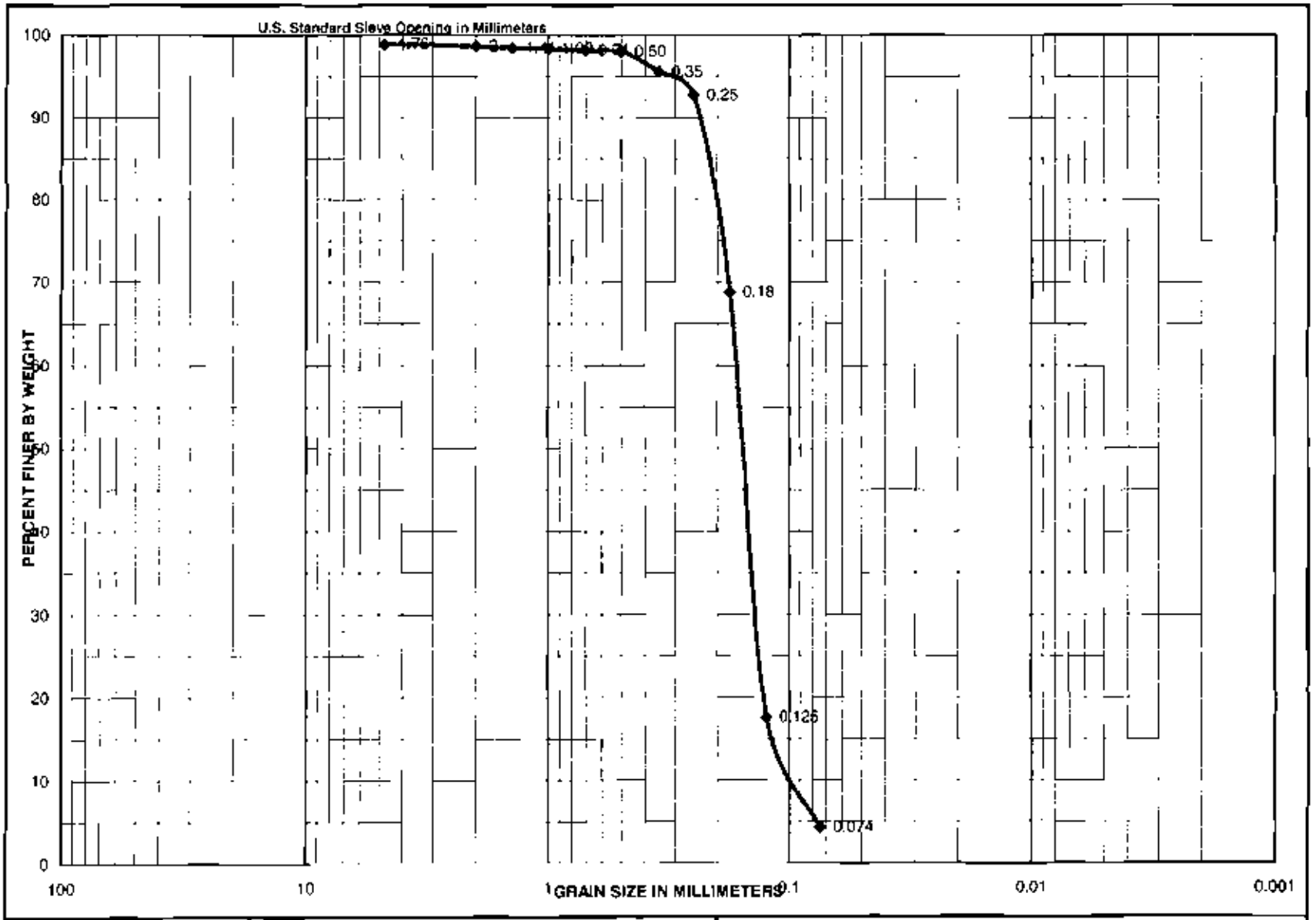
Sample No.	Depth (ft)	Classification
2	8.8-9.3	Dark gray poorly graded sand with trace shells, SP
		0.11% Shells

Project	USACOE Various Sites
Area	Cape Lookout
CATLIN Geotechnical Laboratory	
Boring No.	CL-04-V-3
Date	7/29/2004



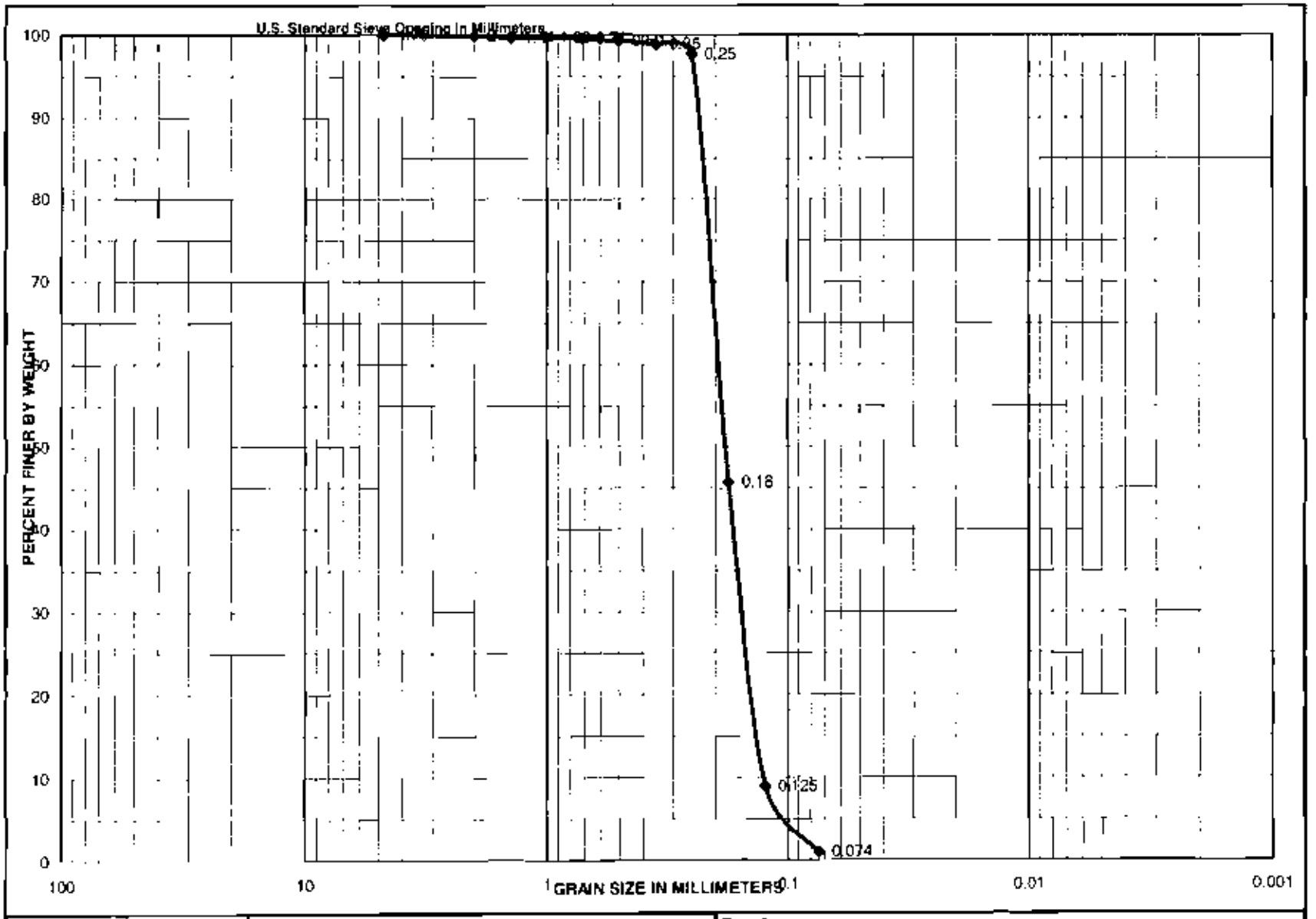
Sample No.	Depth (ft)	Classification
1	3.4-3.9	Dark gray poorly graded sand, SP
		0.0% Shells

Project	USACOE Various Sites
Area	Cape Lookout
CATLIN Geotechnical Laboratory	
Boring No.	CL-04-V-4
Date	7/29/2004



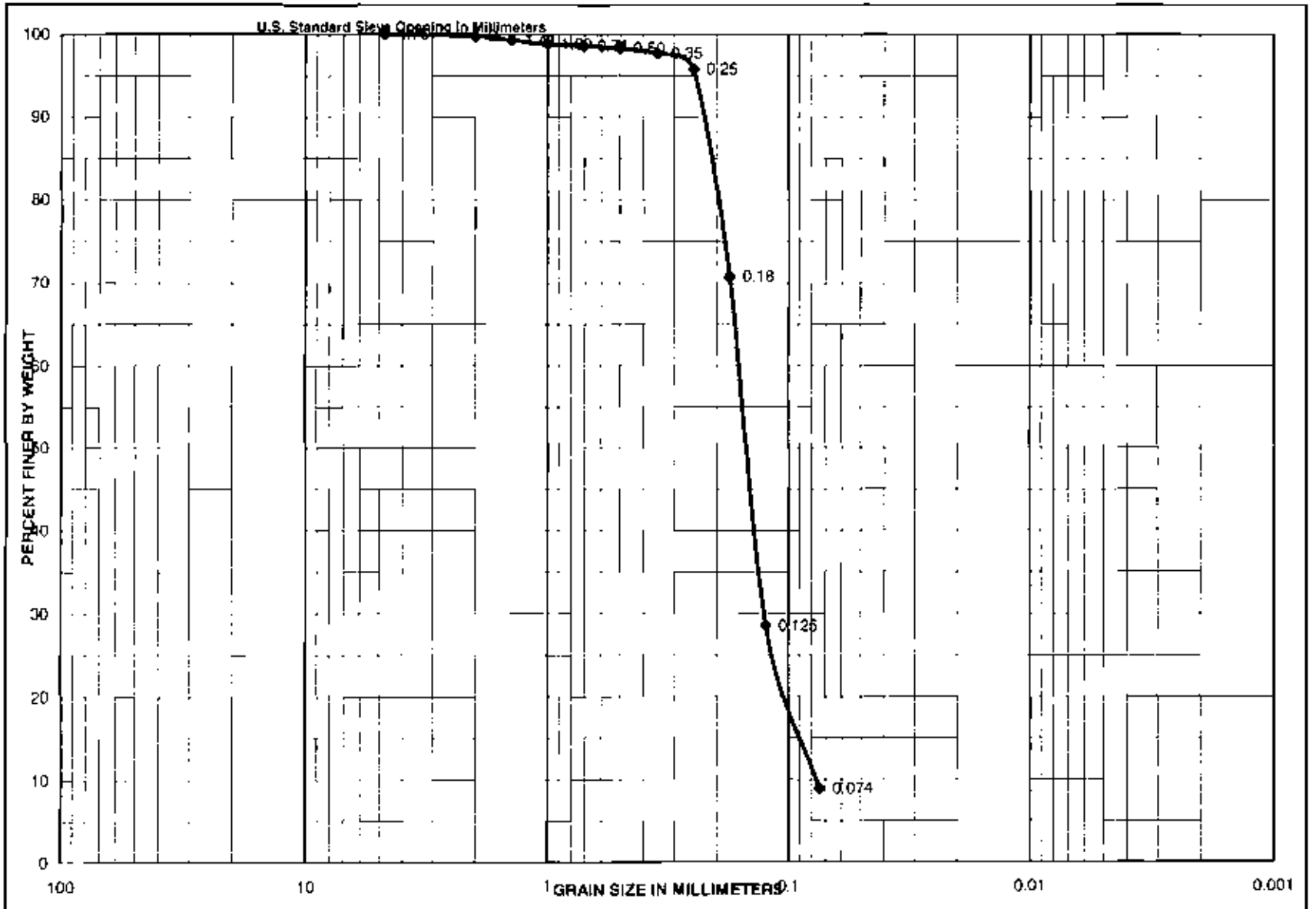
Sample No.	Depth (ft)	Classification
2	7.3-7.8	Olive gray poorly graded sand with trace shells, SP
		1.61% Shells

Project	USACOE Various Sites
Area	Cape Lookout
CATLIN Geotechnical Laboratory	
Boring No.	CL-04-V-4
Date	7/29/2004



Sample No.	Depth (ft)	Classification
1	3.8-4.3	Dark gray poorly graded sand with trace shells, SP
		0.08% Shells

Project	USACOE Various Sites
Area	Cape Lookout
CATLIN Geotechnical Laboratory	
Boring No.	CL-04-V-5
Date	7/29/2004



Sample No.	Depth (ft)	Classification	
2	7.3-7.8	Olive gray poorly graded sand with silt and	**Project** USACOE Various Sites
		trace shells, SP-SM 0.19% Shells	**Area** Cape Lookout
			CATLIN Geotechnical Laboratory
			Boring No. CL-04-V-5
			Date 7/29/2004

WOLF TECHNOLOGIES, INC.

3047-4 St. Johns Bluff Road S.
Jacksonville, Florida 32246
(904) 997-1400 (Tel) · (904) 997-9150 (Fax)

VISUAL SHELL CONTENT

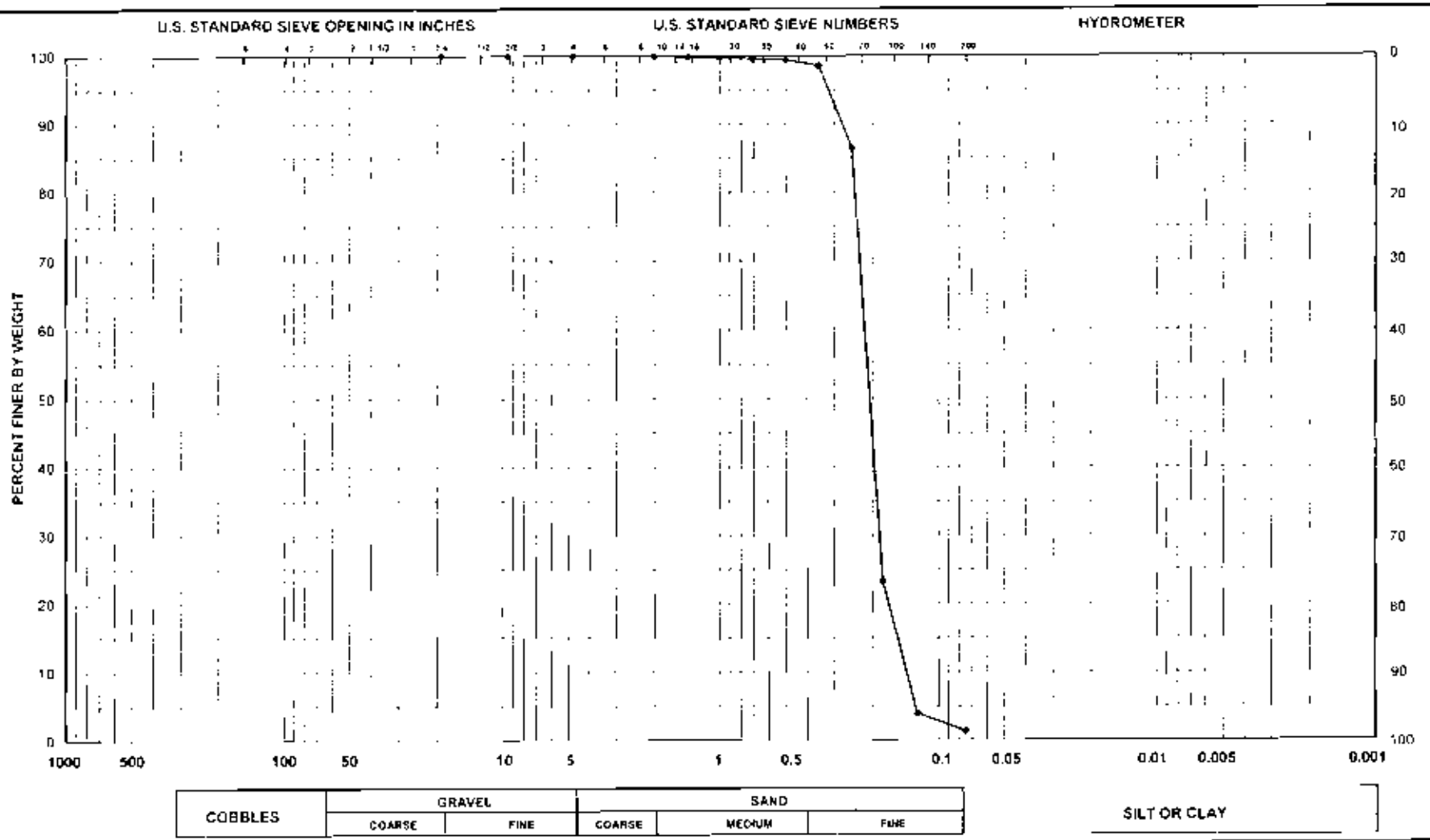
GRAIN SIZE AND VISUAL SHELL CONTENT

Project:	**Cape Lookout**	**Depth:**	**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 %



Station	Boring No.	Classification	% CO_3	G_s	Nat w%	LL	PL	PI
* V-1	1	SAND, poorly-graded, mostly fine-grained quartz sand, trace carbonate, trace silt, gray (SP)	2					

Project: Cape Lookout

Station: V-1

Boring No.: 1

Date: 2/4/2005

GRADATION CURVES

ENG FORM 2087

MAY 83

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Jacksonville, Florida 32246
(904) 997-1400 (Tel) · (904) 997-9150 (Fax)

VISUAL SHELL CONTENT

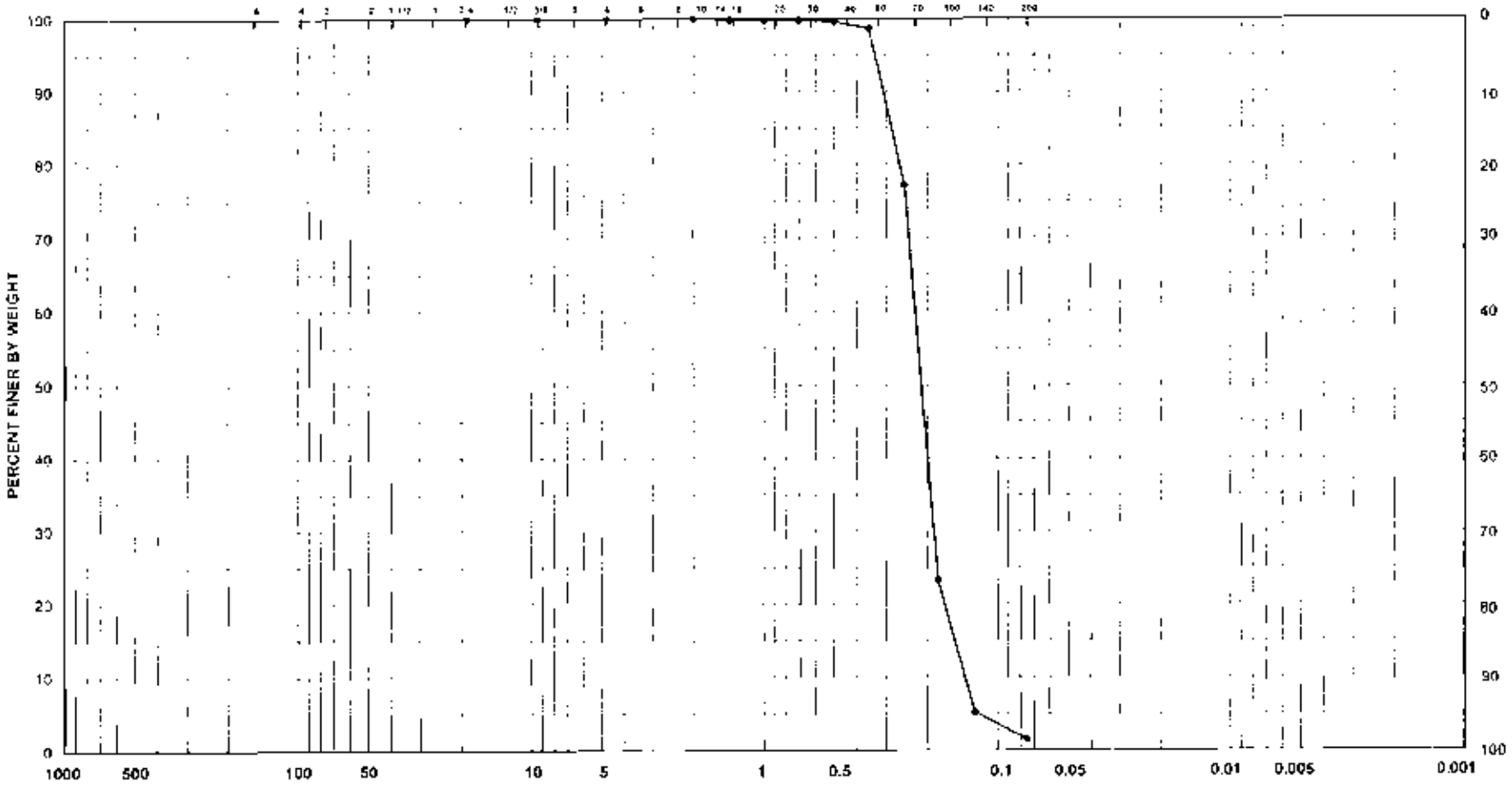
GRAIN SIZE AND VISUAL SHELL CONTENT

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 %



Station	Boring No.	Classification	% CO_3	G_s	Nat w%	LL	PL	PI
* V-1	2	SAND, poorly-graded, mostly fine-grained quartz sand, trace carbonate, trace silt, dark gray (SP)	1					

Project Cape Lookout

Station V-1

Boring No. 2

Date 2/4/2005

GRADATION CURVES

ENG FORM 2087

MAY 63

WOLF TECHNOLOGIES, INC.

3047-4 St. Johns Bluff Road S.
Jacksonville, Florida 32246
(904) 997-1400 (Tel) · (904) 997-9150 (Fax)

VISUAL SHELL CONTENT

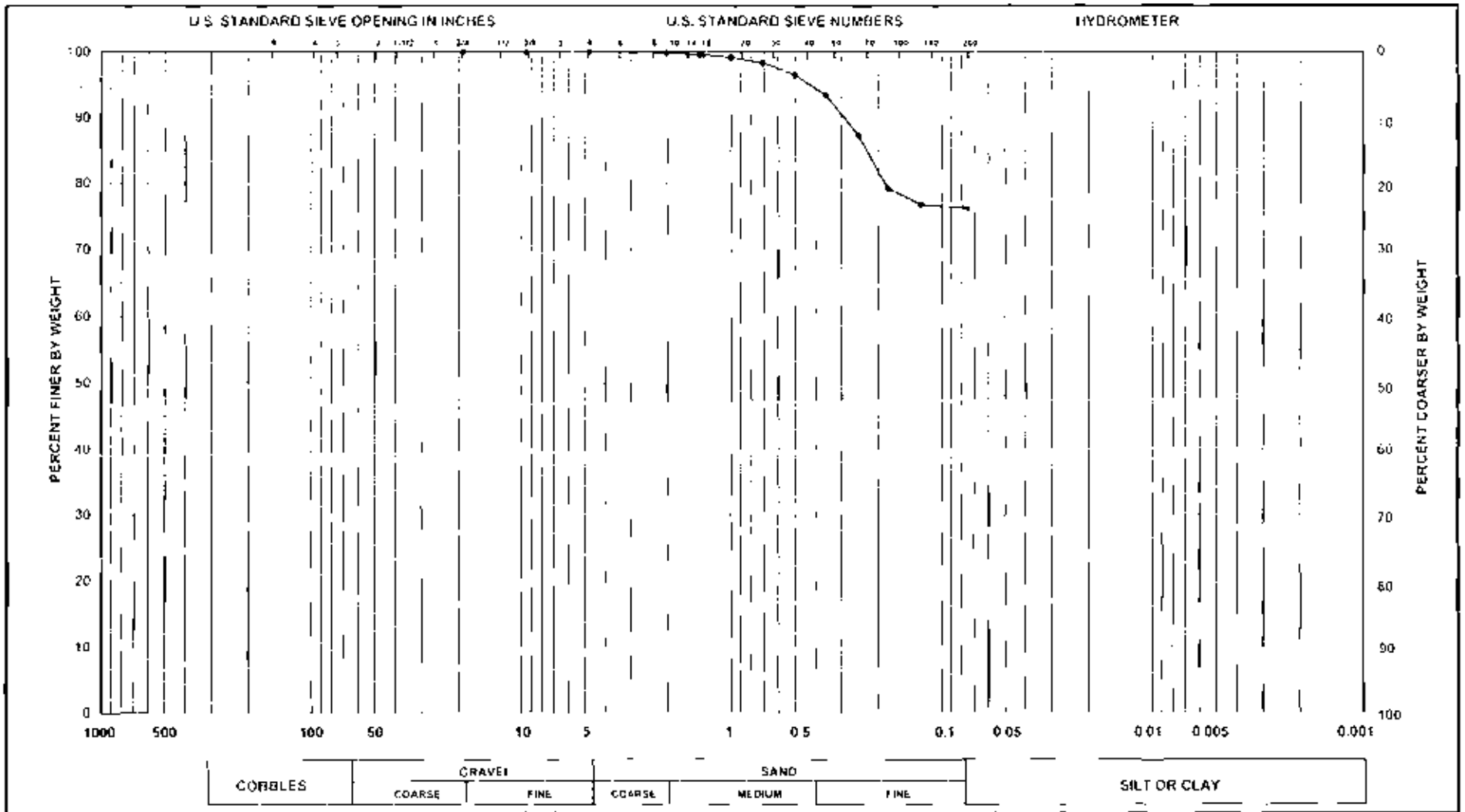
GRAIN SIZE AND VISUAL SHELL CONTENT

Project:	Cape Lookout	**Depth:**	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 %



Station	Boring No.	Classification	% CO_3	G_s	Nat w%	LL	PL	PI
• V-1	3	Silt, inorganic-I, little fine-grained quartz sand, trace carbonate, very dark gray (ML)	3					

Project Cape Lookout

Station V-1

Boring No. 3

Date 2/4/2005

GRADATION CURVES

ENG FORM 2087

MAY 63

WOLF TECHNOLOGIES, INC.

3047-4 St. Johns Bluff Road S.
Jacksonville, Florida 32246
(904) 997-1400 (Tel) · (904) 997-9150 (Fax)

VISUAL SHELL CONTENT

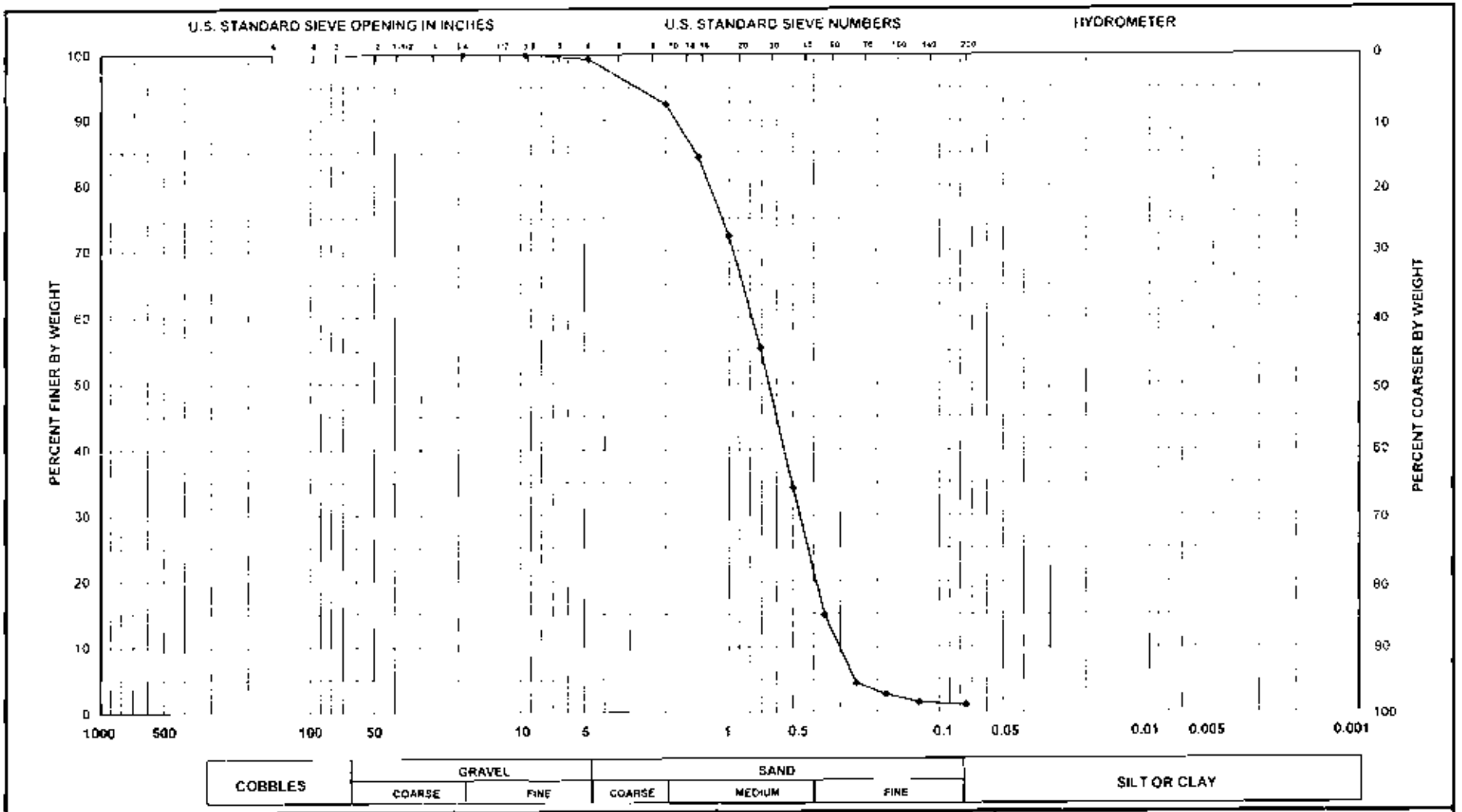
GRAIN SIZE AND VISUAL SHELL CONTENT

Project:	**Cape Lookout**	**Depth:**	**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** **%**



Station	Boring No.	Classification	% CO_3	G_s	Nat w%	LL	PL	PI
* V-1	4	SAND, poorly-graded, mostly medium to fine-grained quartz sand, little carbonate, trace silt, very dark gray (SP)	26					

GRADATION CURVES

Project Cape Lookout

Station V-1

Boring No. 4

Date 2/4/2005

ENG FORM 2087

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VISUAL SHELL CONTENT

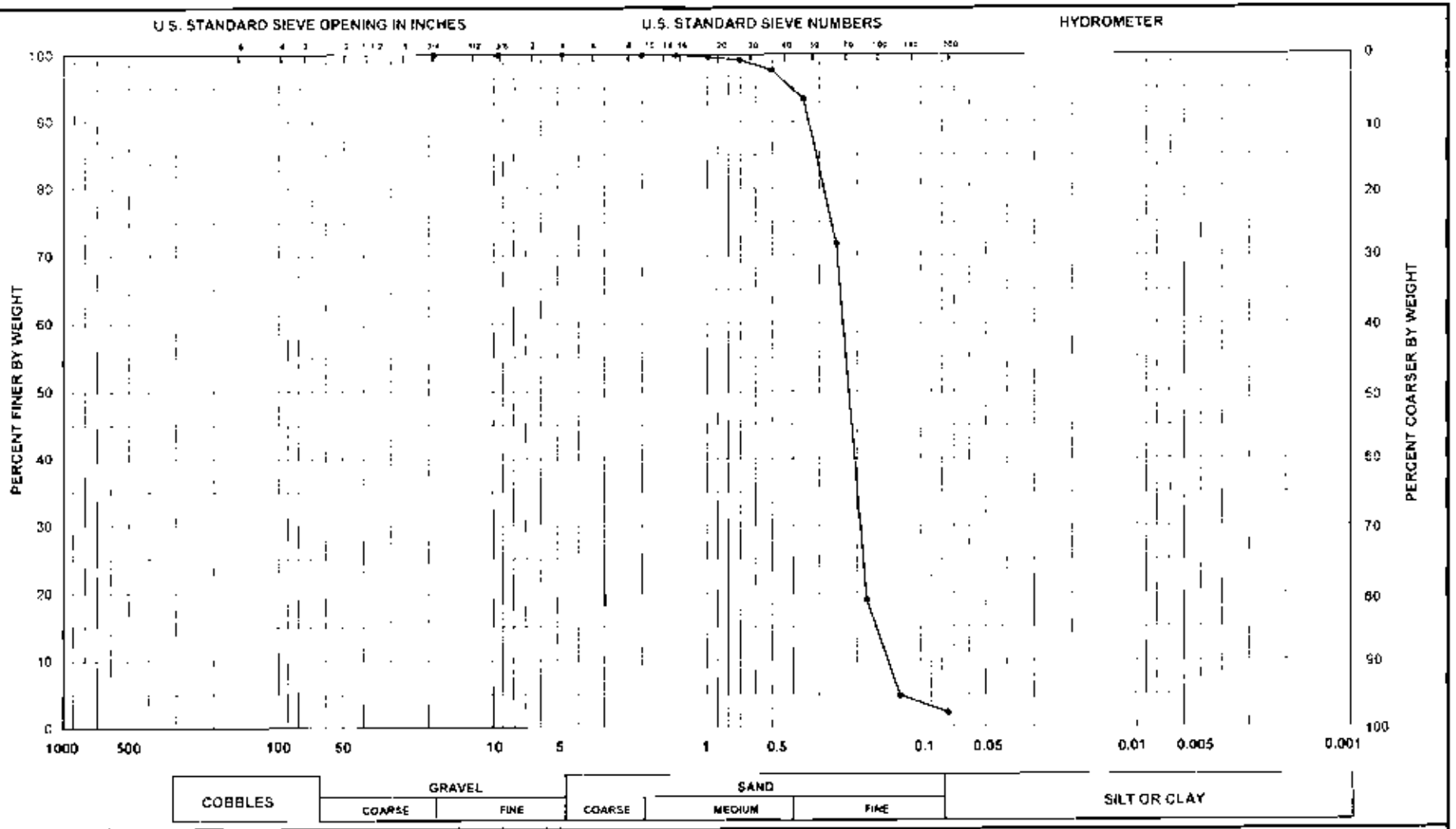
GRAIN SIZE AND VISUAL SHELL CONTENT

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** **%**



Station	Boring No.	Classification	% CO_3	G_s	Nat w%	LL	PL	PI
• V-2	1	SAND, poorly-graded, mostly fine-grained quartz sand, trace carbonate, trace silt, gray (SP)	2					

Project Cape Lookout

Station V-2

Boring No. 1

Date 2/4/2005

GRADATION CURVES

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VISUAL SHELL CONTENT

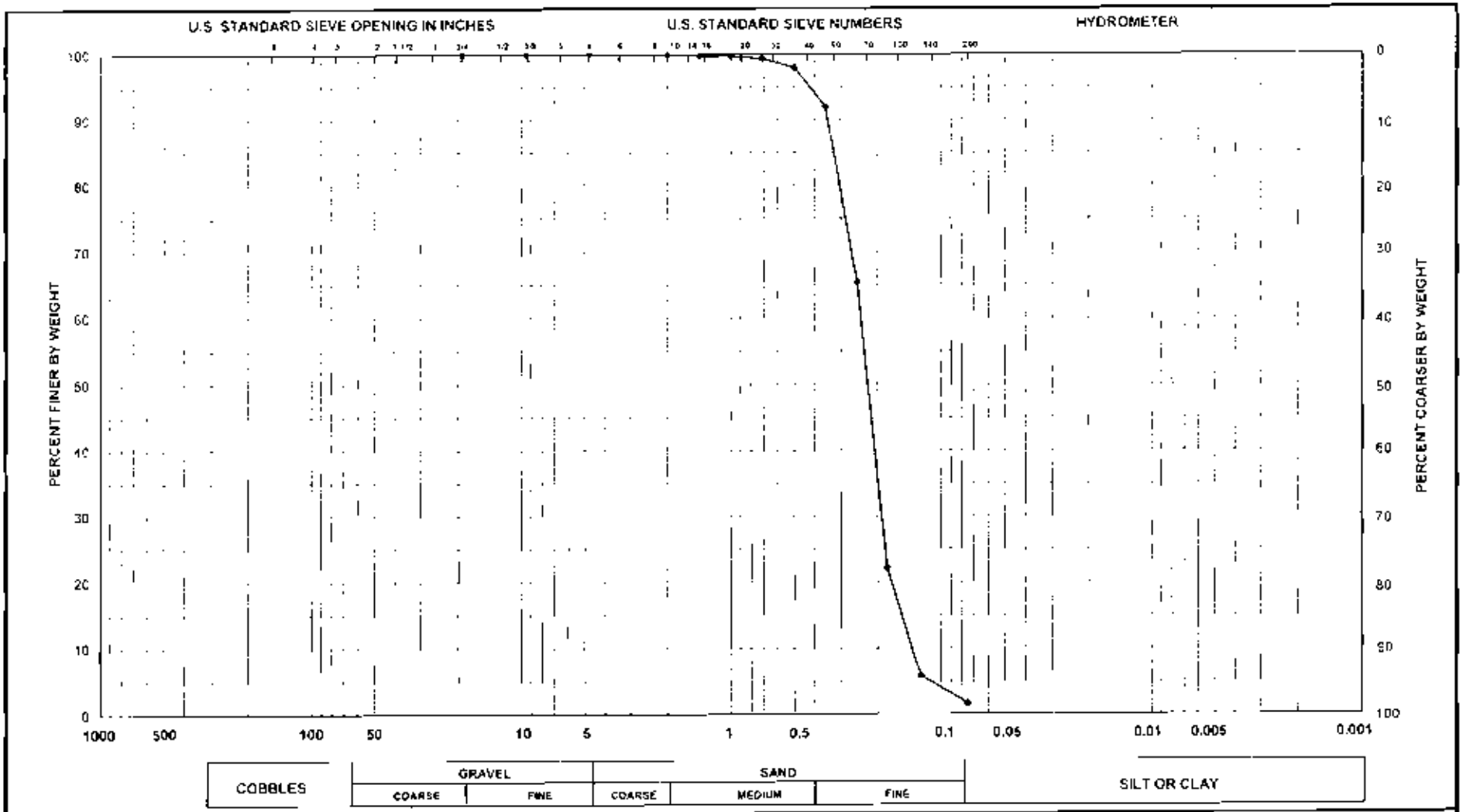
GRAIN SIZE AND VISUAL SHELL CONTENT

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 %



Station	Boring No.	Classification	% CO_3	G_s	Nat w%	LL	PL	PI
* V-2	2	SAND, poorly-graded, mostly fine-grained quartz sand, trace carbonate, trace silt, gray (SP)	3					

GRADATION CURVES

Project Cape Lookout

Station V-2

Boring No. 2

Date 2/4/2005

ENG FORM 2087

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VISUAL SHELL CONTENT

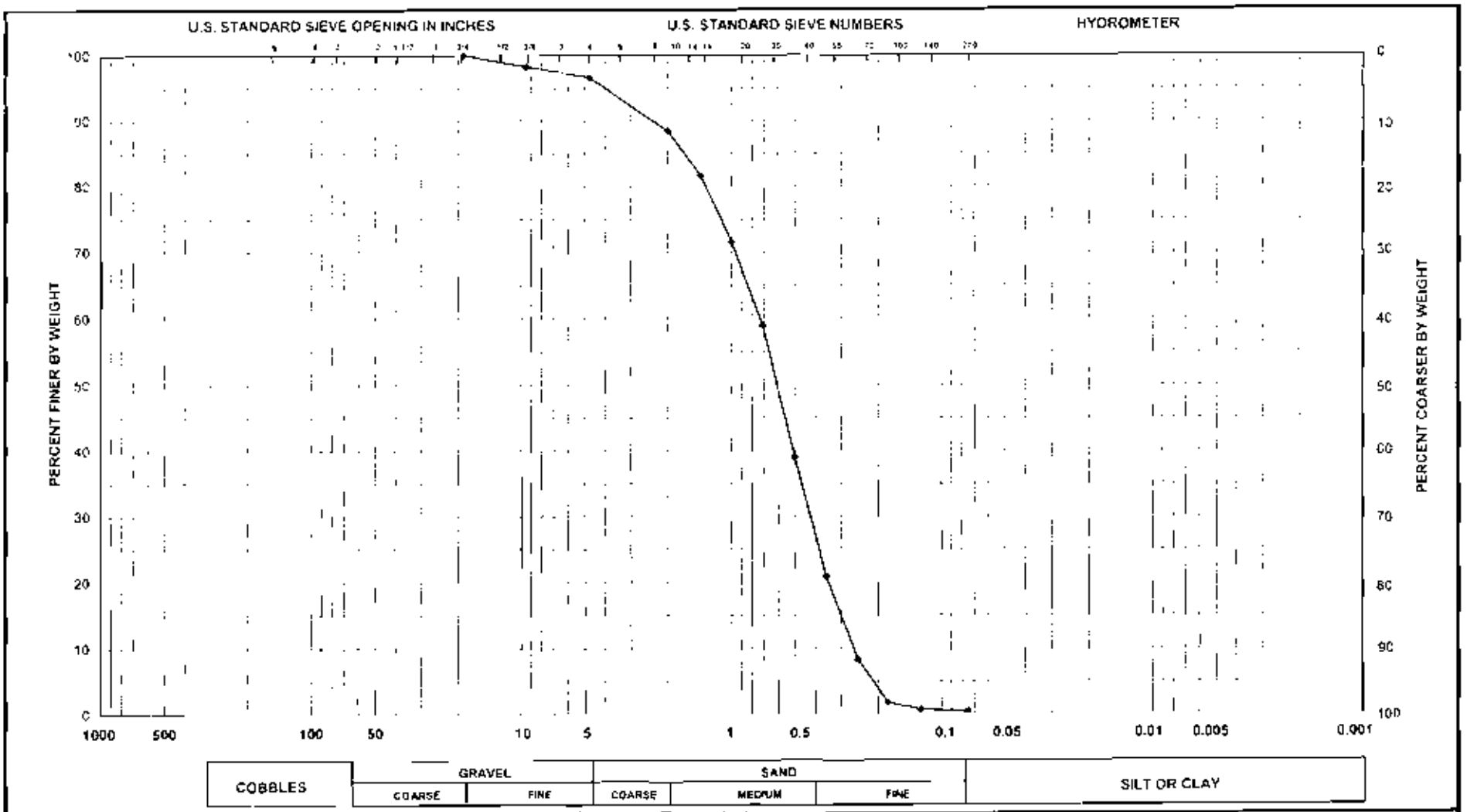
GRAIN SIZE AND VISUAL SHELL CONTENT

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** %



Station	Boring No.	Classification	% CO_3	G_s	Nat w%	LL	PL	PI
• V-2	3	SAND, poorly-graded, mostly medium to fine-grained quartz sand, little carbonate, gray (SP)	28					

GRADATION CURVES

Project Cape Lookout

Station V-2

Boring No. 3

Date 2/4/2005

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VISUAL SHELL CONTENT

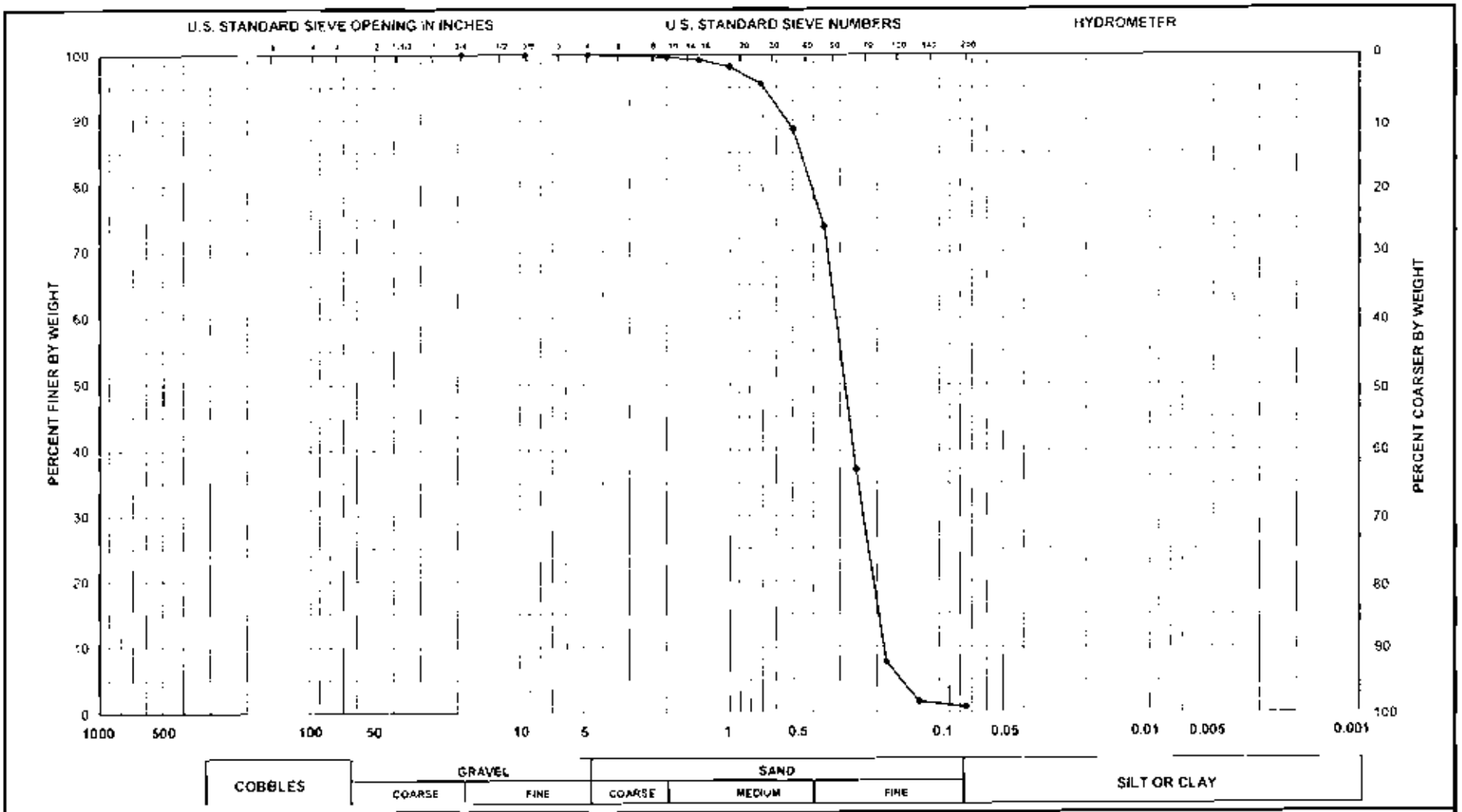
GRAIN SIZE AND VISUAL SHELL CONTENT

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** %



Station	Boring No.	Classification	% CO_3	G_s	Nat w%	LL	PL	PI
* V-3	1	SAND, poorly-graded, mostly medium to fine-grained quartz sand, few carbonate gray (SP)	6					

Project: Cape Lookout

Station: V-3

Boring No.: 1

Date: 2/4/2005

GRADATION CURVES

ENG FORM 2087

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VISUAL SHELL CONTENT

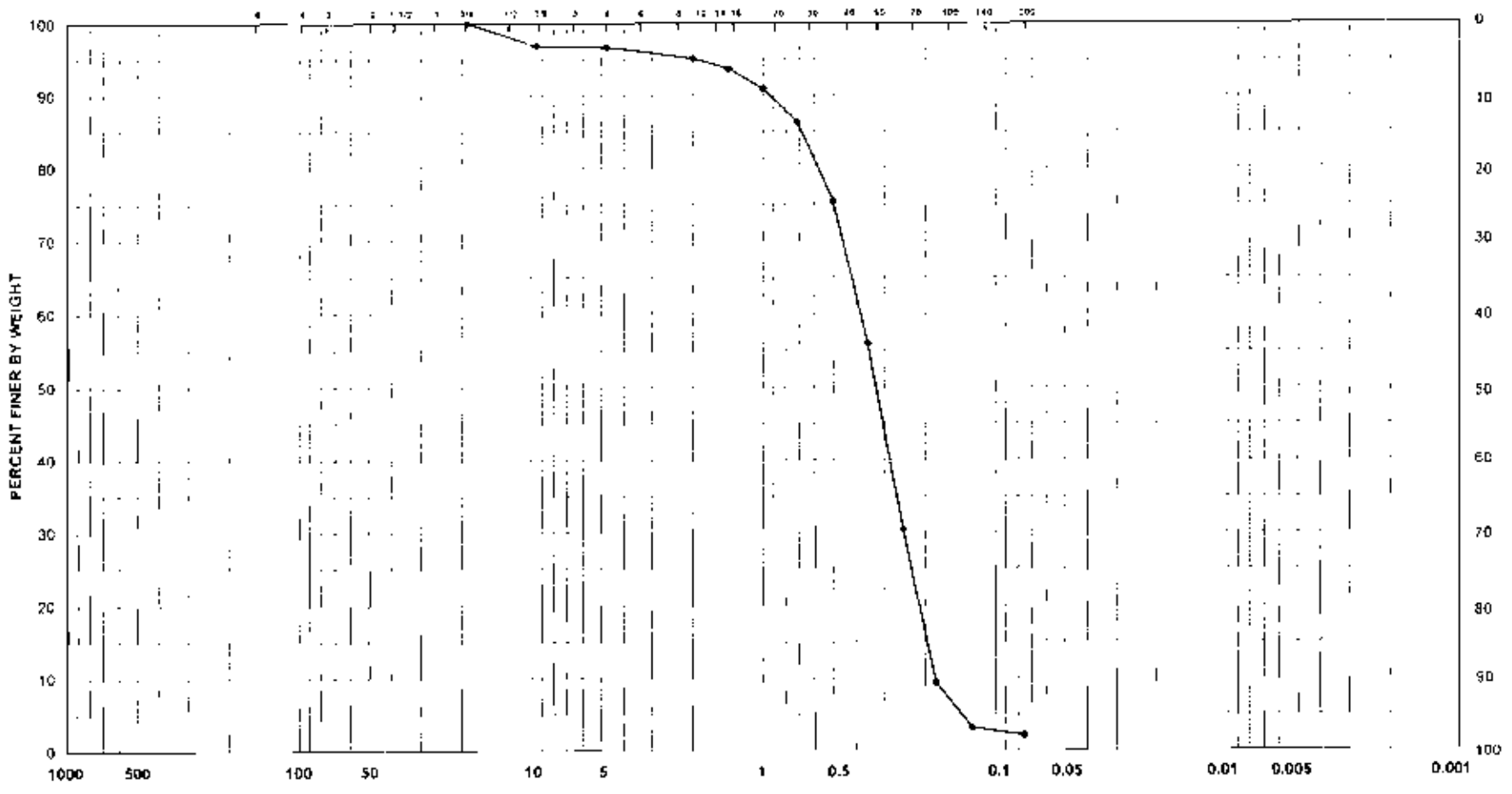
GRAIN SIZE AND VISUAL SHELL CONTENT

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** %



Station	Boring No.	Classification	% CO_3	G_s	Nat w%	LL	PL	PI
• V-3	2	SAND, poorly-graded, mostly medium to fine-grained quartz sand, little carbonate, trace silt, gray (SP)	12					

Project: Cape Lookout

Station: V-3

Boring No.: 2

Date: 2/4/2005

GRADATION CURVES

ENG FORM 2087

MAY 53

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Jacksonville, Florida 32246
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VISUAL SHELL CONTENT

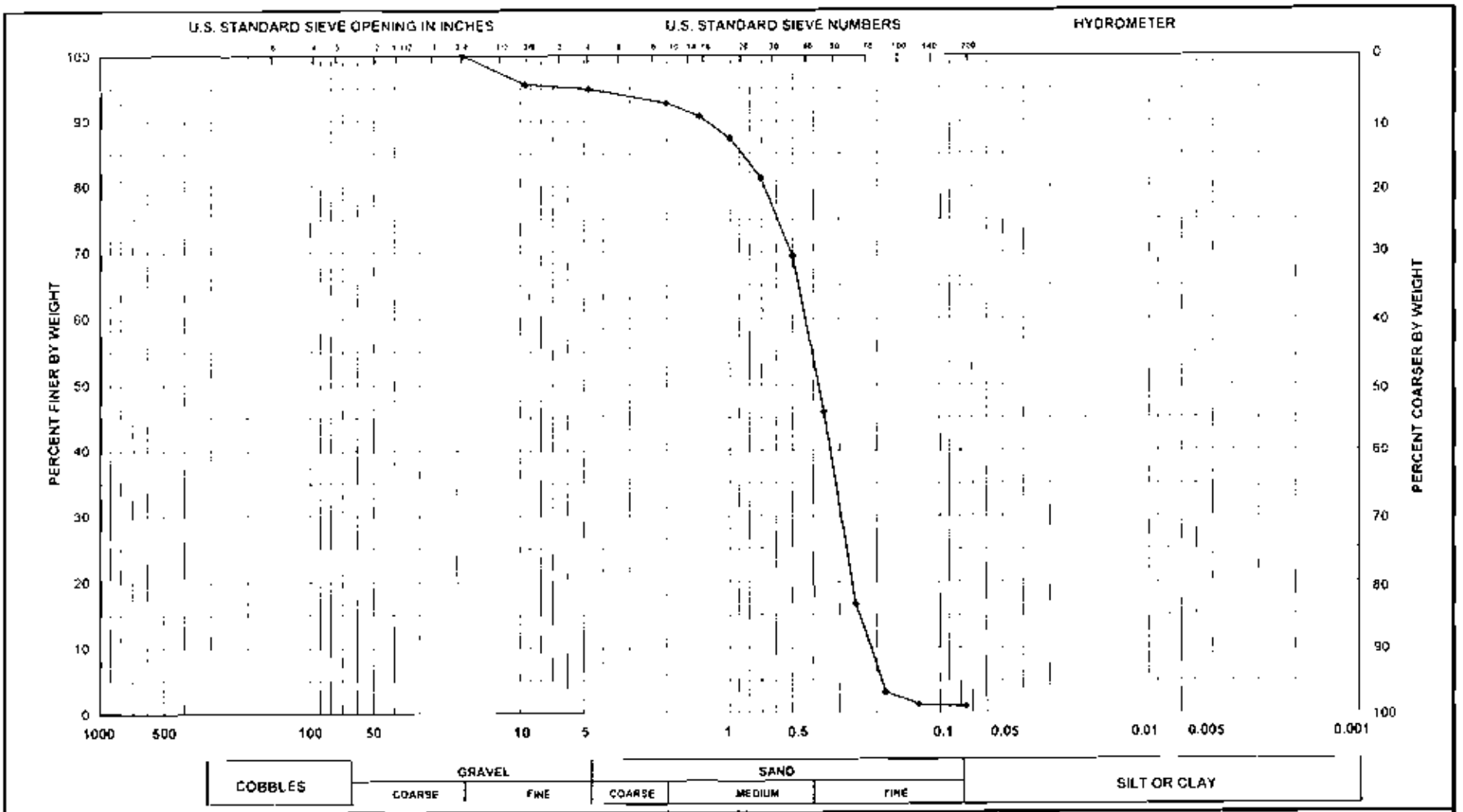
GRAIN SIZE AND VISUAL SHELL CONTENT

Project:	Cape Lookout	**Depth:**	**7.0-7.5**
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** **%**



Station	Boring No.	Classification	% CO_3	G_s	Nat w%	LL	PL	PI
• V-3	3	SAND, poorly-graded, mostly medium to fine-grained quartz sand, little carbonate, trace silt, gray (SP)	15					

GRADATION CURVES

Project Cape Lookout

Station V-3

Boring No. 3

Date 2/4/2005

ENG FORM 2087

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VISUAL SHELL CONTENT

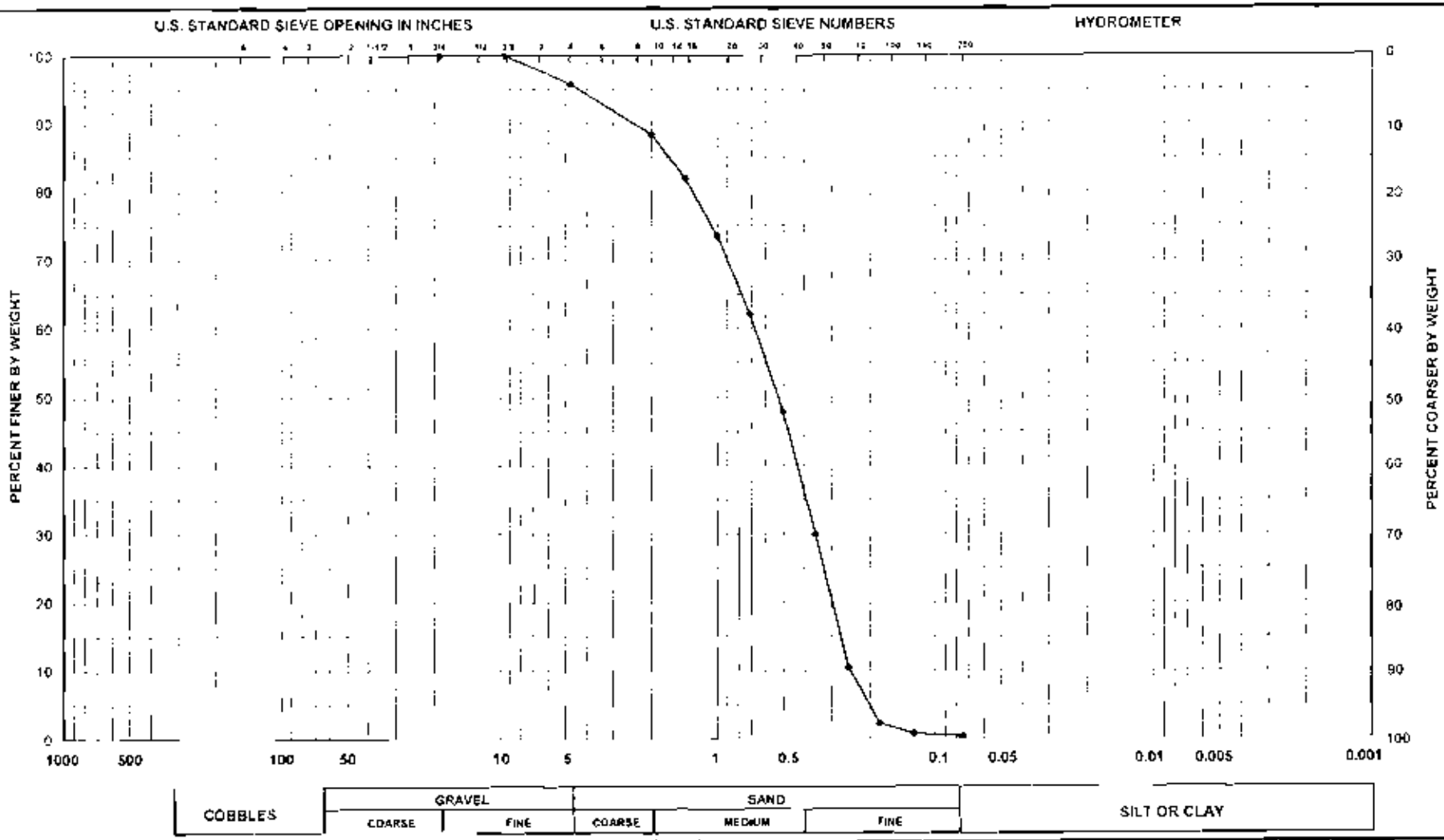
GRAIN SIZE AND VISUAL SHELL CONTENT

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** **%**



Station	Boring No.	Classification	% CO_3	G_s	Nat w%	LL	PL	PI
• V-3	4	SAND, poorly-graded, mostly medium to fine-grained quartz sand, little carbonate, dark gray (SP)	23					

Project Cape Lookout

Station V-3

Boring No. 4

Date 2/4/2005

GRADATION CURVES

ENG FORM 2087

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VISUAL SHELL CONTENT

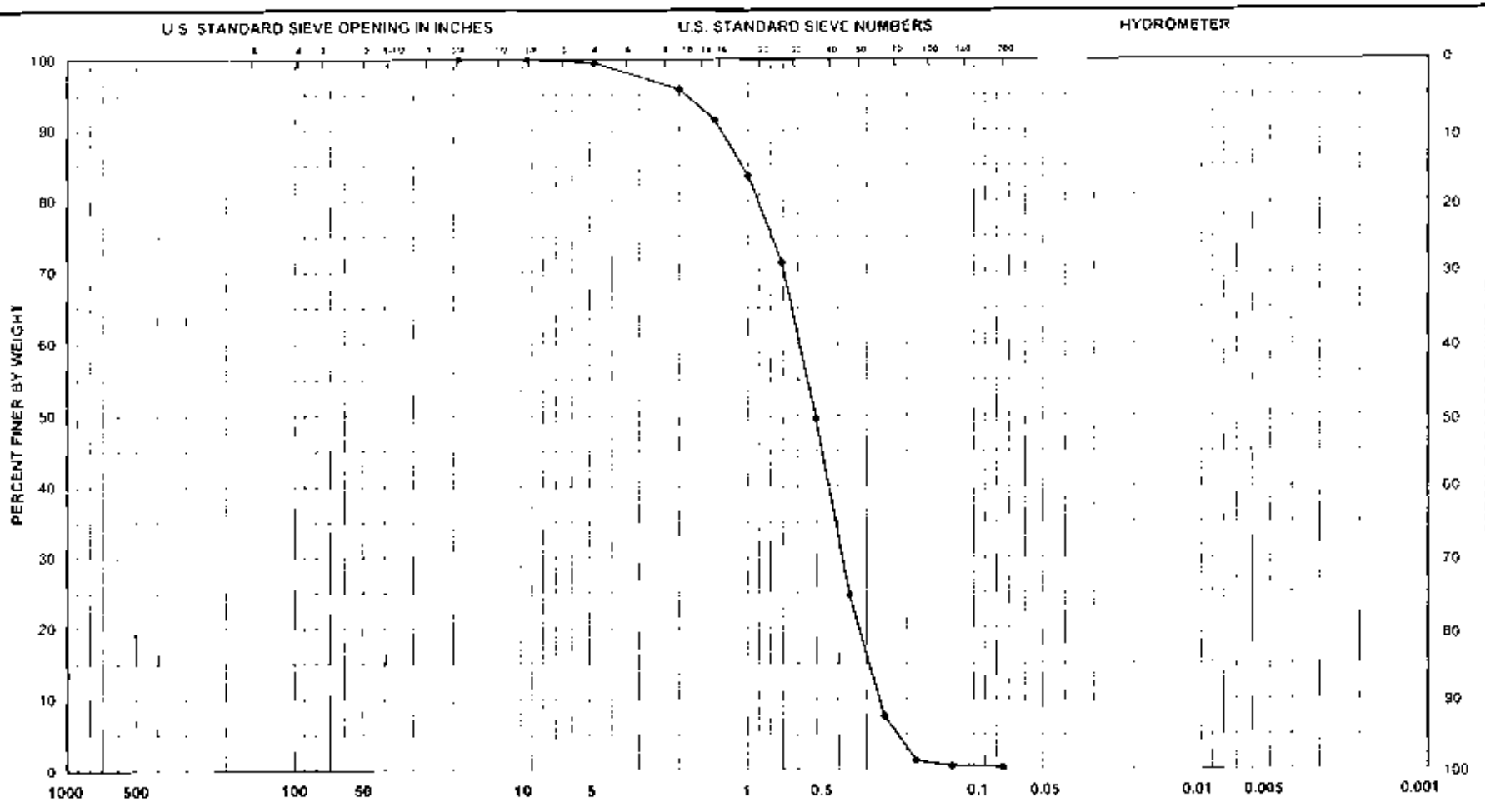
GRAIN SIZE AND VISUAL SHELL CONTENT

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 %



Station	Boring No.	Classification	% CO_3	G_s	Nat w%	LL	PL	PI
• V-5	1	SAND, poorly-graded, mostly medium to fine-grained quartz sand, little carbonate, gray (SP)	17					

Project Cape Lookout

Station V-5

Boring No. 1

Date 2/4/2005

GRADATION CURVES

ENG FORM 2087

MAY 63

WOLF TECHNOLOGIES, INC.

3047-4 St. Johns Bluff Road S.
Jacksonville, Florida 32246
(904) 997-1400 (Tel) · (904) 997-9150 (Fax)

VISUAL SHELL CONTENT

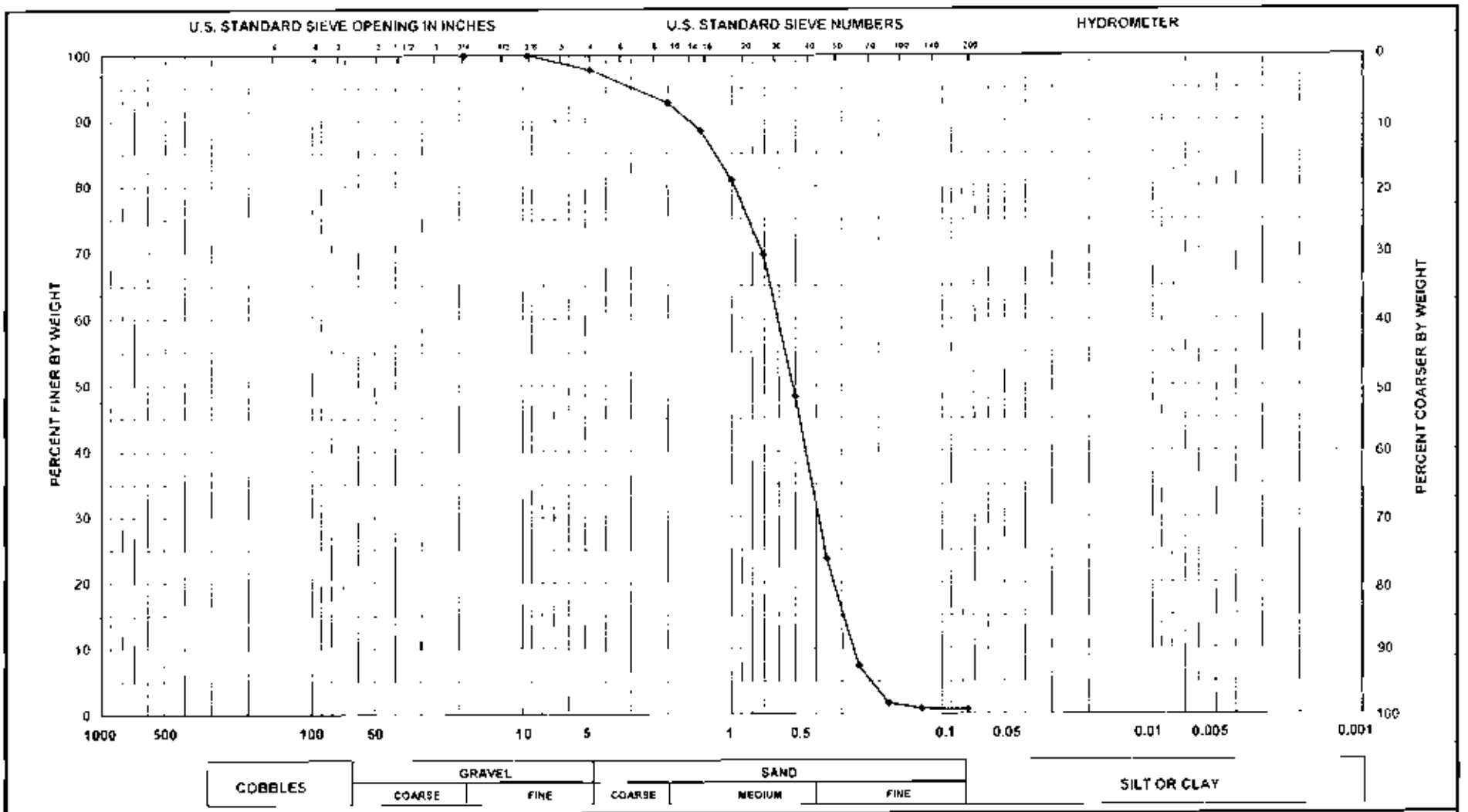
GRAIN SIZE AND VISUAL SHELL CONTENT

Project:	**Cape Lookout**	**Depth:**	**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** **%**



Station	Boring No.	Classification	% CO_3	G_s	Nat w%	LL	PL	PI
* V-5	2	SAND, poorly-graded, mostly medium to fine-grained quartz sand, little carbonate, gray (SP)	18					

Project Cape Lookout

Station V-5

Boring No. 2

Date 2/4/2005

GRADATION CURVES

ENG FORM 2087

MAY 63

WOLF TECHNOLOGIES, INC.

3047-4 St. Johns Bluff Road S.
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VISUAL SHELL CONTENT

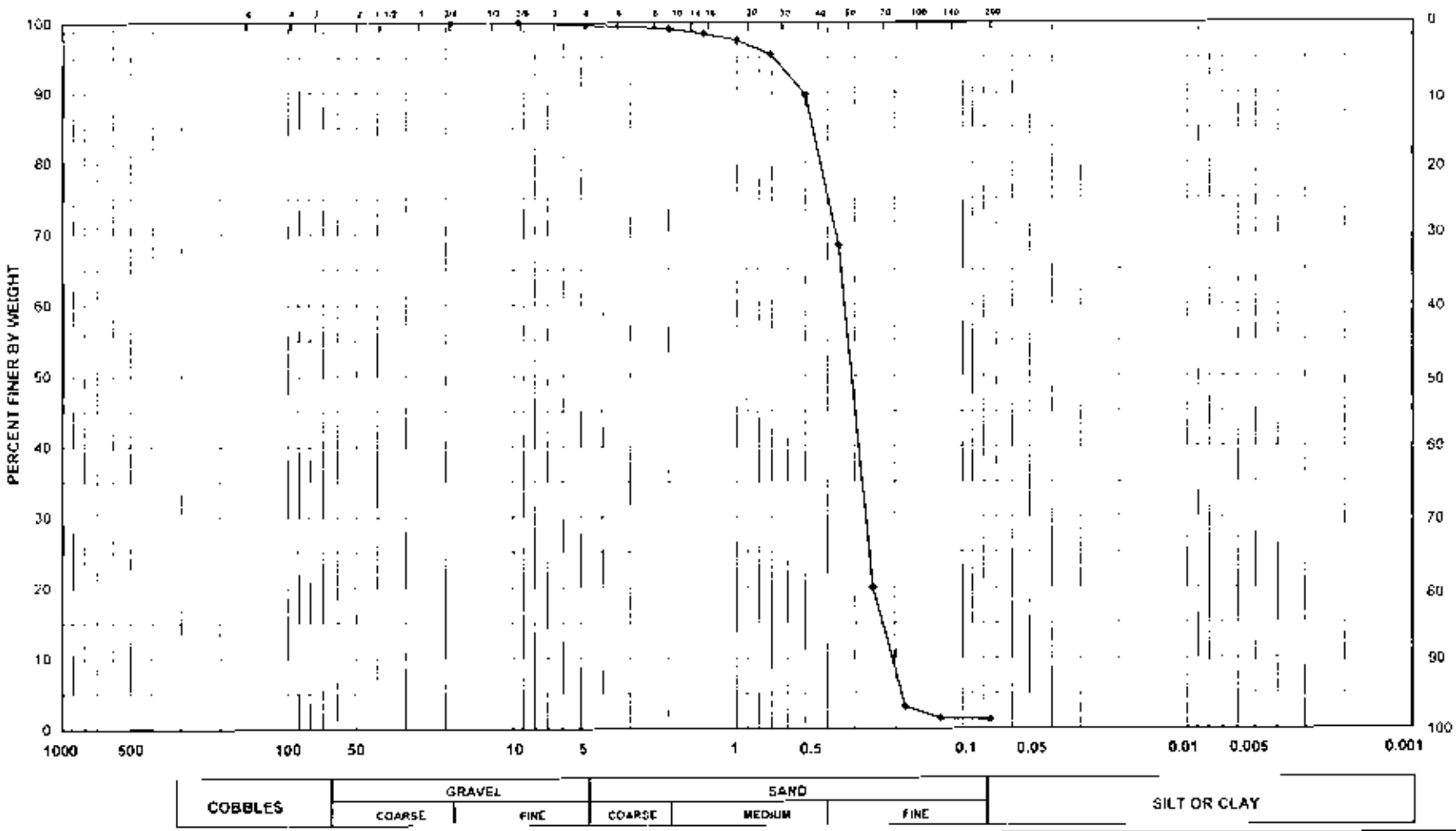
GRAIN SIZE AND VISUAL SHELL CONTENT

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** **%**



Station	Boring No.	Classification	% CO_3	G_s	Nat w%	LL	PL	PI
* V-5	3	SAND, poorly-graded, mostly fine-grained quartz sand, few carbonate, trace silt, gray (SP)	7					

GRADATION CURVES

Project: Cape Lookout

Station: V-5

Boring No.: 3

Date: 2/4/2005

ENG FORM 2087

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VISUAL SHELL CONTENT

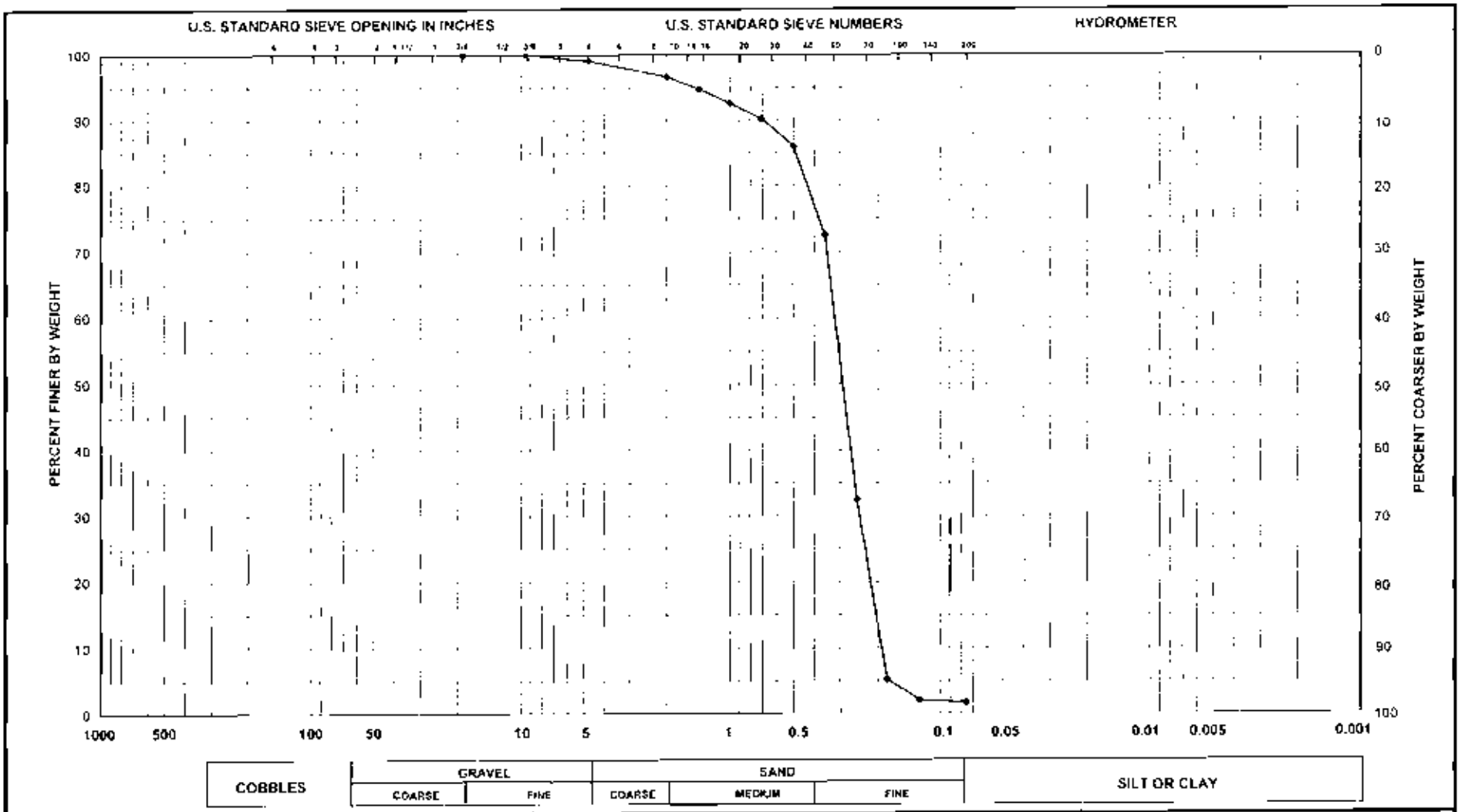
GRAIN SIZE AND VISUAL SHELL CONTENT

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** %



Station	Boring No.	Classification	% CO_3	G_s	Nat w%	LL	PL	PI
◆ V-5	4	SAND, poorly-graded, mostly medium to fine-grained quartz sand, few carbonate, trace silt, gray (SP)	9					

Project: Cape Lookout

Station: V-5

Boring No.: 4

Date: 2/4/2005

GRADATION CURVES

ENG FORM 2087

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VISUAL SHELL CONTENT

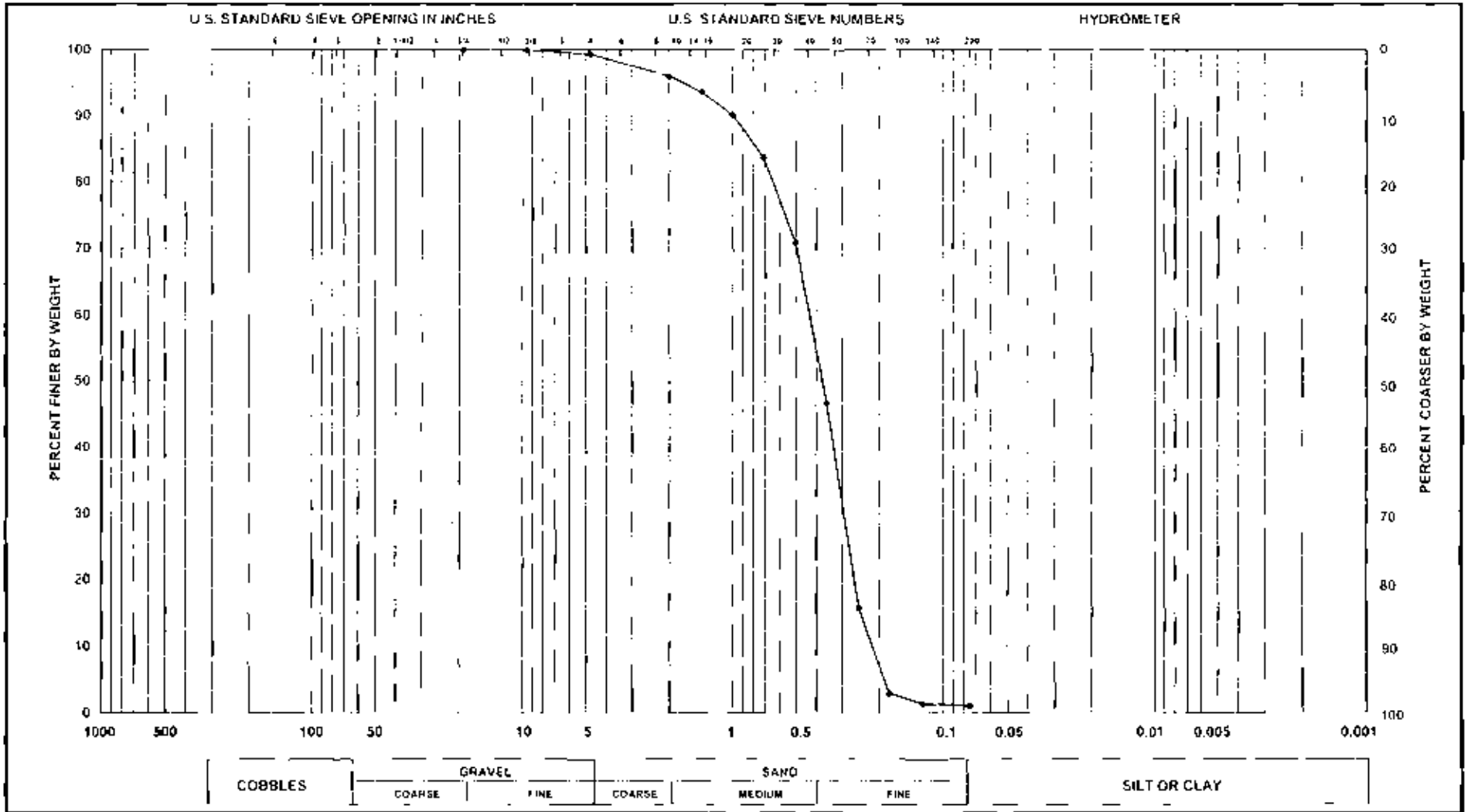
GRAIN SIZE AND VISUAL SHELL CONTENT

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 %



Station	Boring No.	Classification	% CO_3	G_s	Nat w%	LL	PL	PI
* V-7	1	SAND, poorly-graded, mostly medium to fine-grained quartz sand, little carbonate, trace silt, gray (SP)	13					

Project Cape Lookout

Station V-7

Boring No. 1

Date 2/4/2005

GRADATION CURVES

ENG FORM 2087

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VISUAL SHELL CONTENT

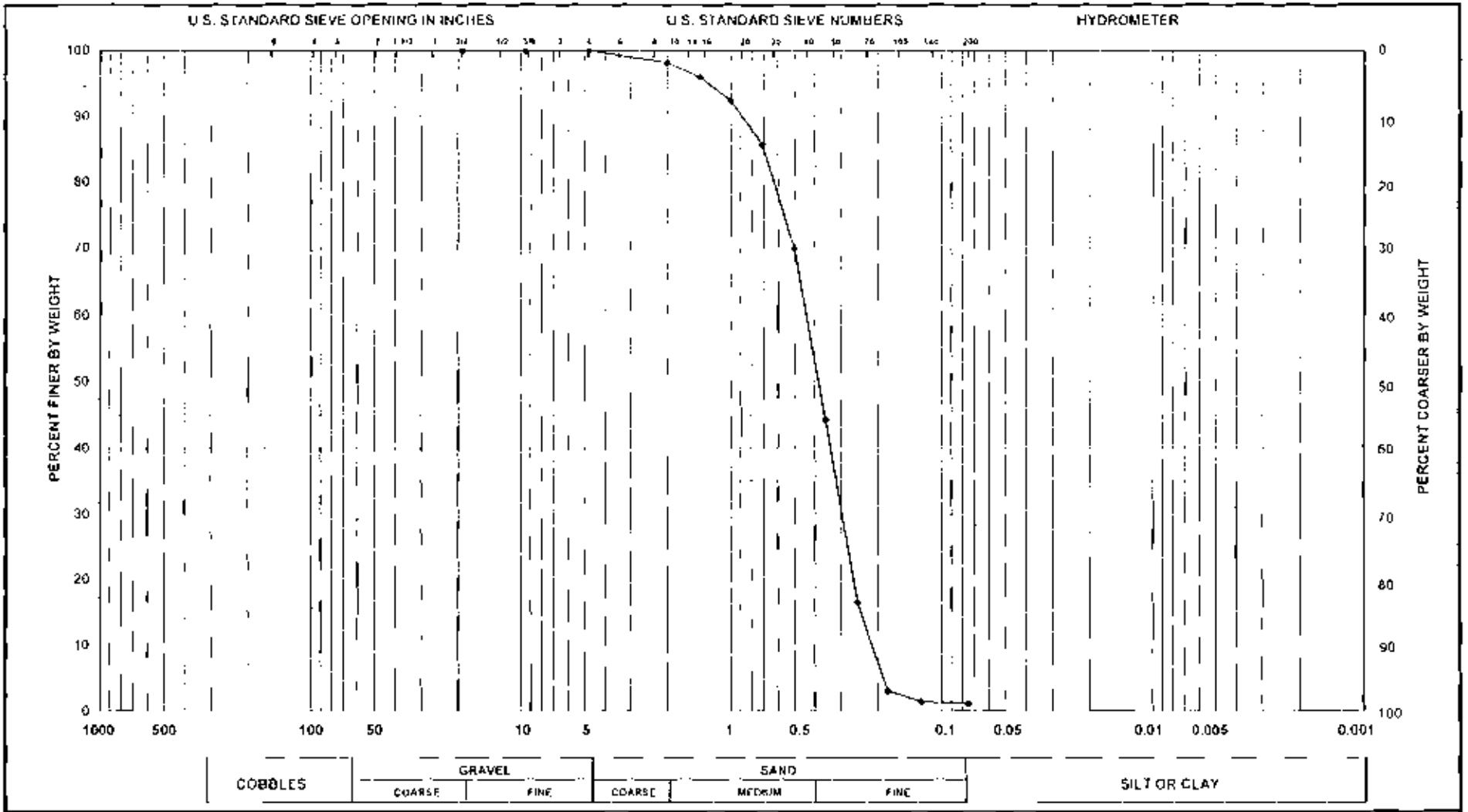
GRAIN SIZE AND VISUAL SHELL CONTENT

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** %



Station	Boring No.	Classification	% CO_3	G_s	Nat w%	LL	PL	PI
* V-7	2	SAND, poorly-graded mostly medium to fine-grained quartz sand, little carbonate, trace silt, dark gray (SP)	12					

Project Cape Lookout

Station V-7

Boring No. 2

Date 2/4/2005

GRADATION CURVES

ENG FORM 2087

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VISUAL SHELL CONTENT

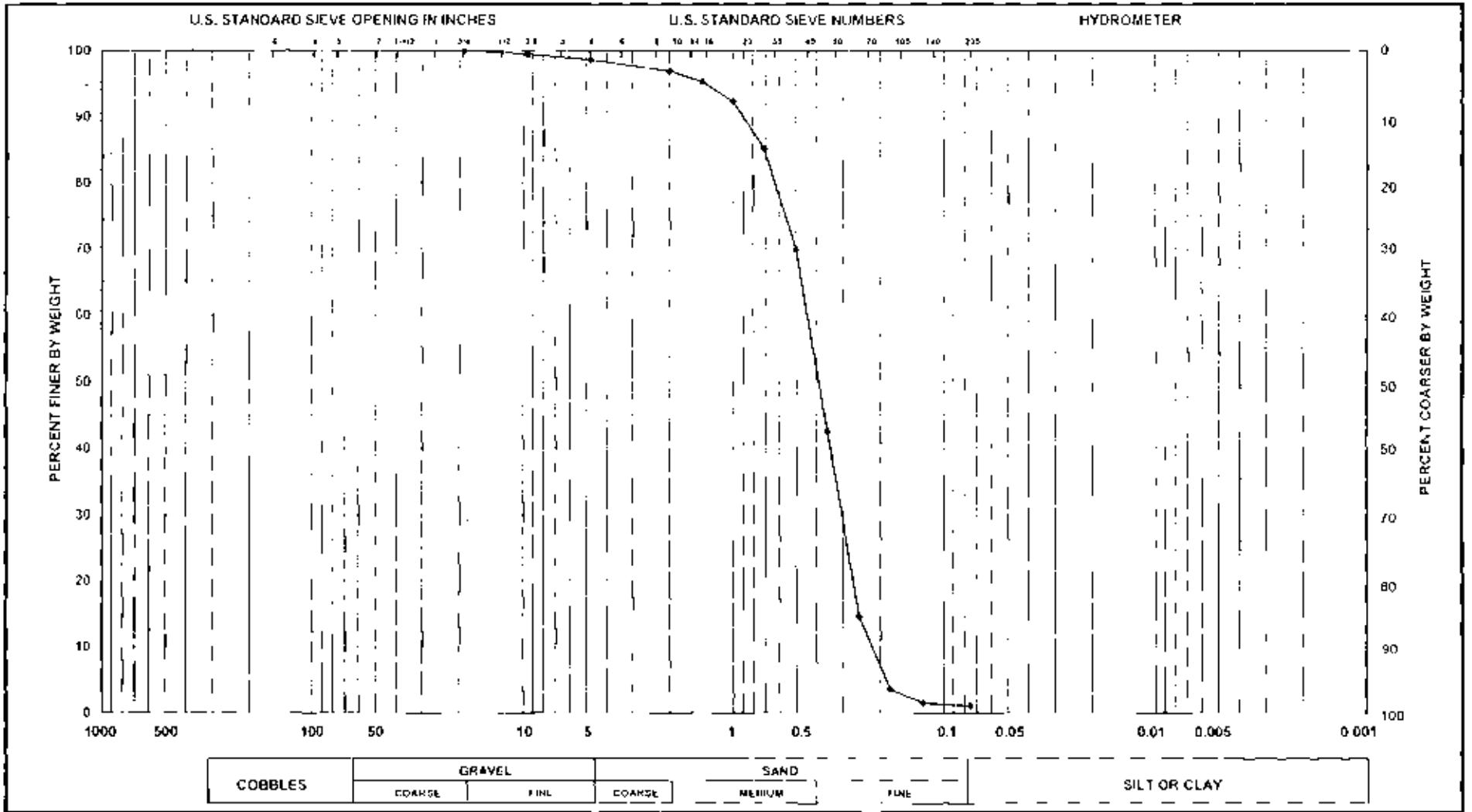
GRAIN SIZE AND VISUAL SHELL CONTENT

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 %



Station	Boring No.	Classification	% CO_3	G_s	Nat w%	LL	PL	PI
* V-7	3	SAND, poorly-graded, mostly medium to fine-grained quartz sand, little carbonate, trace silt, dark gray (SP)	13					

Project Cape Lookout

Station V-7

Boring No. 3

Date 2/4/2005

GRADATION CURVES

ENG FORM 2087

MAY 63

WOLF TECHNOLOGIES, INC.

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Jacksonville, Florida 32246
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VISUAL SHELL CONTENT

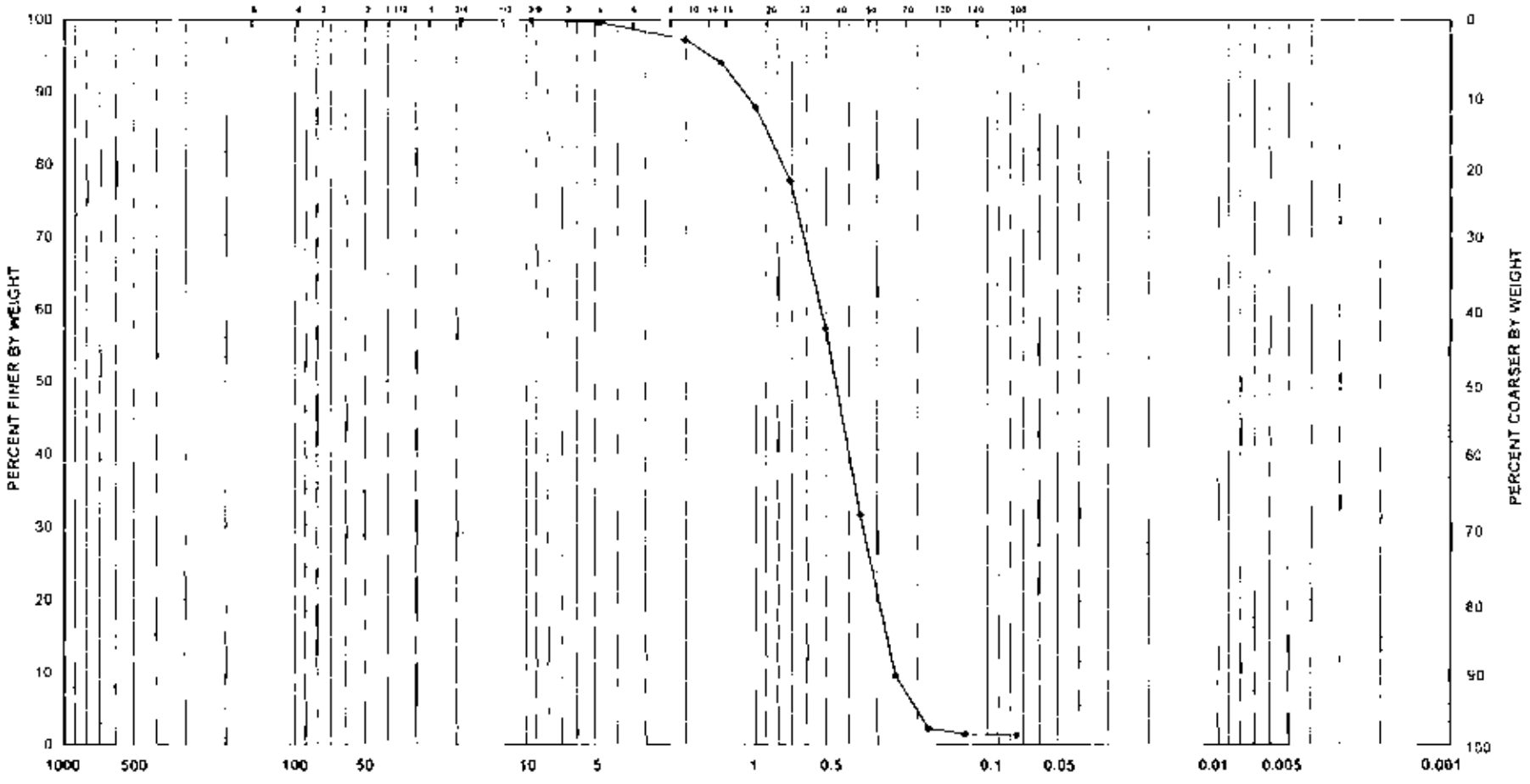
GRAIN SIZE AND VISUAL SHELL CONTENT

Project:	Cape Lookout	Depth:	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 %



Station	Boring No.	Classification	% CO_3	G_s	Nat w%	LL	PL	PI
V-7	4	SAND, poorly-graded, mostly medium to fine-grained quartz sand, little carbonate, trace silt, gray (SP)	14					

Project: Cape Lookout

Station: V-7

Boring No.: 4

Date: 2/4/2005

GRADATION CURVES

ENG FORM 2087

MAY 63

WOLF TECHNOLOGIES, INC.

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Jacksonville, Florida 32246
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VISUAL SHELL CONTENT

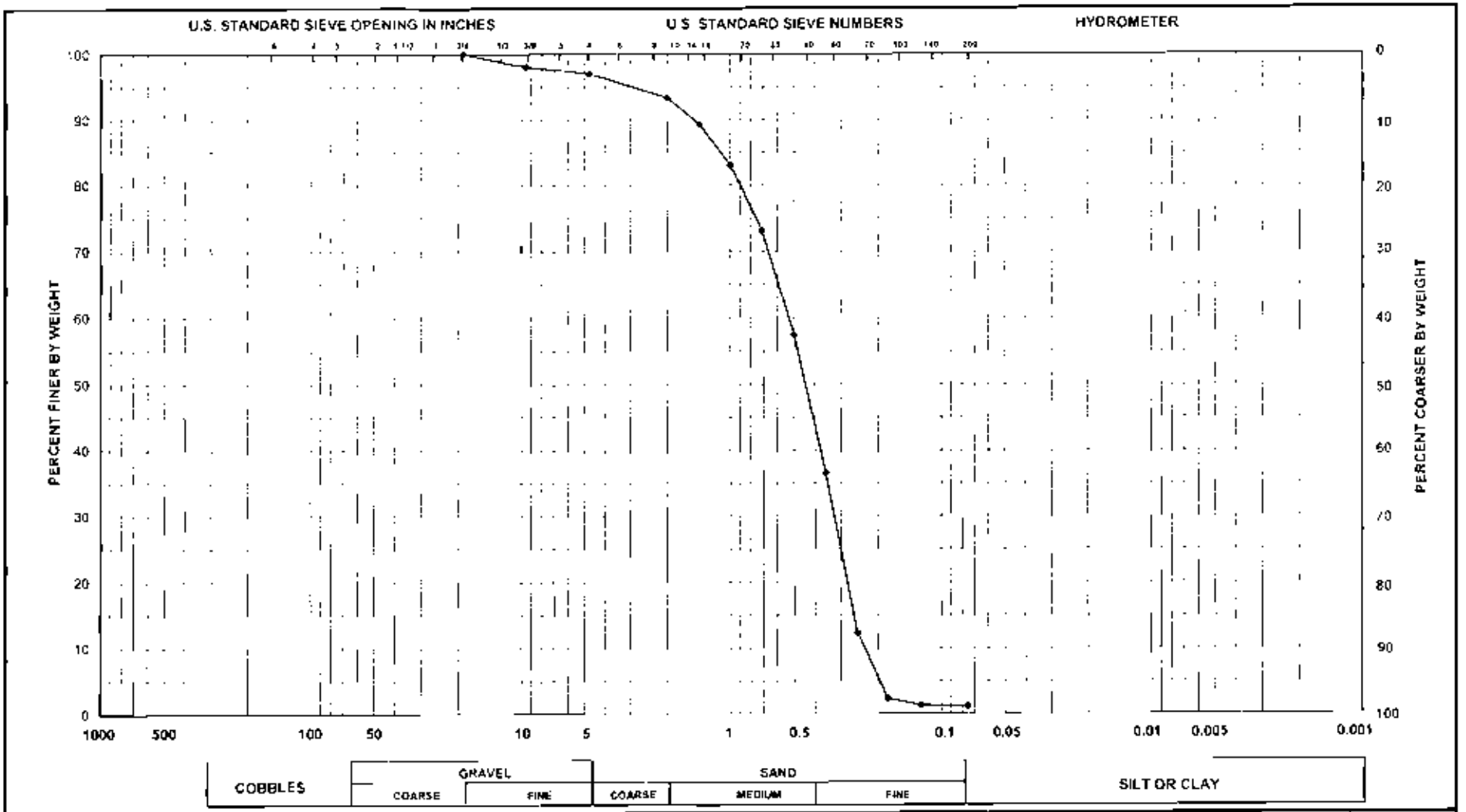
GRAIN SIZE AND VISUAL SHELL CONTENT

Project:	**Cape Lookout**	**Depth:**	**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** %



Station	Boring No.	Classification	% CO_3	G_s	Nat w%	LL	PL	PI
• V-8	1	SAND, poorly-graded, mostly medium to fine-grained quartz sand, little carbonate, trace silt, gray (SP)	17					

GRADATION CURVES

Project Cape Lookout

Station V-8

Boring No. 1

Date 2/4/2005

ENG FORM 2087

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WOLF TECHNOLOGIES, INC.

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VISUAL SHELL CONTENT

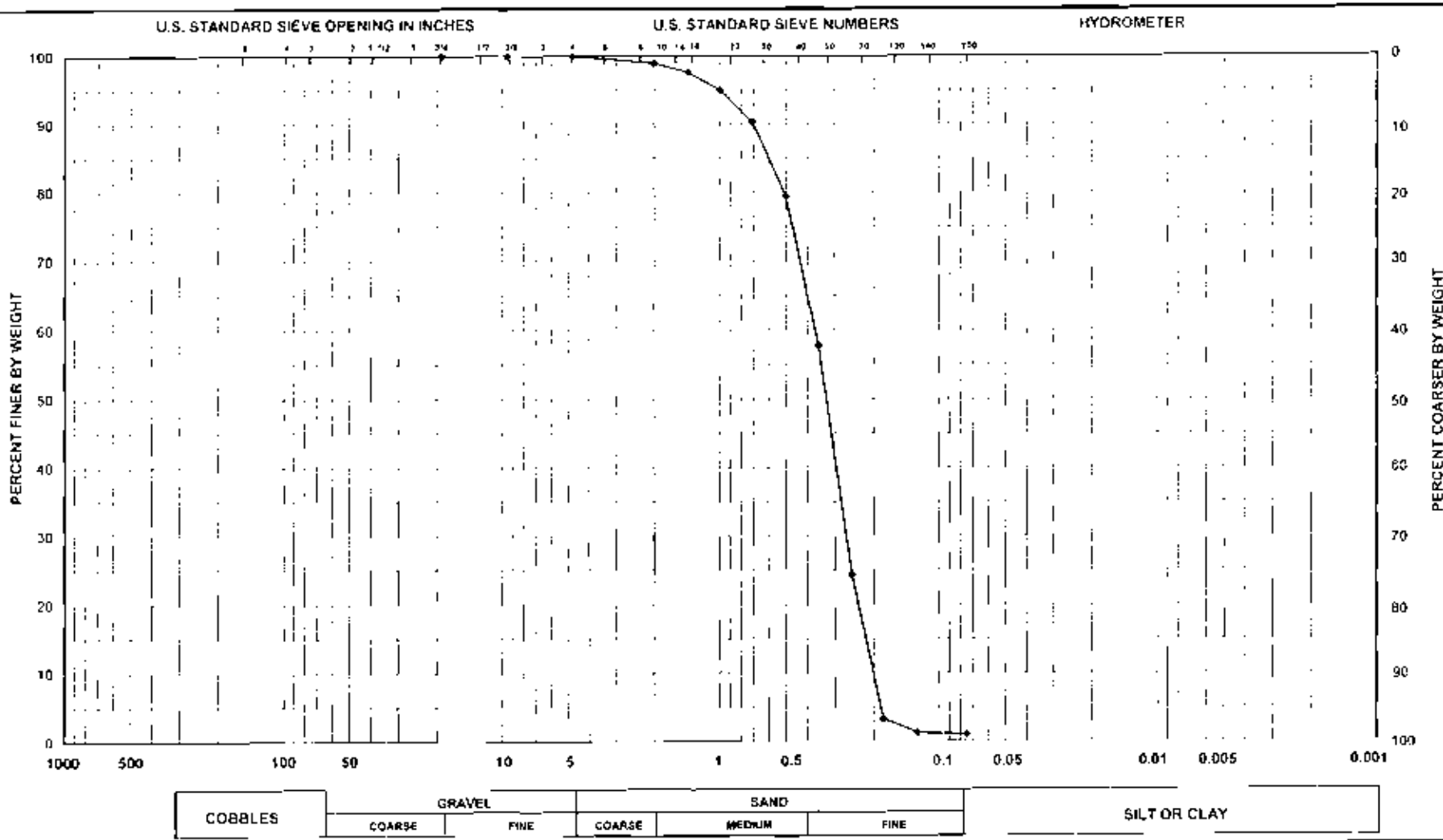
GRAIN SIZE AND VISUAL SHELL CONTENT

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 %



Station	Boring No.	Classification	% CO_3	G_s	Nat w%	LL	PL	PI
* V-8	2	SAND, poorly-graded, mostly medium to fine-grained quartz sand, few carbonate, trace silt, dark gray (SP)	10					

Project: Cape Lookout

Station: V-8

Boring No.: 2

Date: 2/15/2005

GRADATION CURVES

ENG FORM 2087

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WOLF TECHNOLOGIES, INC.

3047-4 St. Johns Bluff Road S.
Jacksonville, Florida 32246
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VISUAL SHELL CONTENT

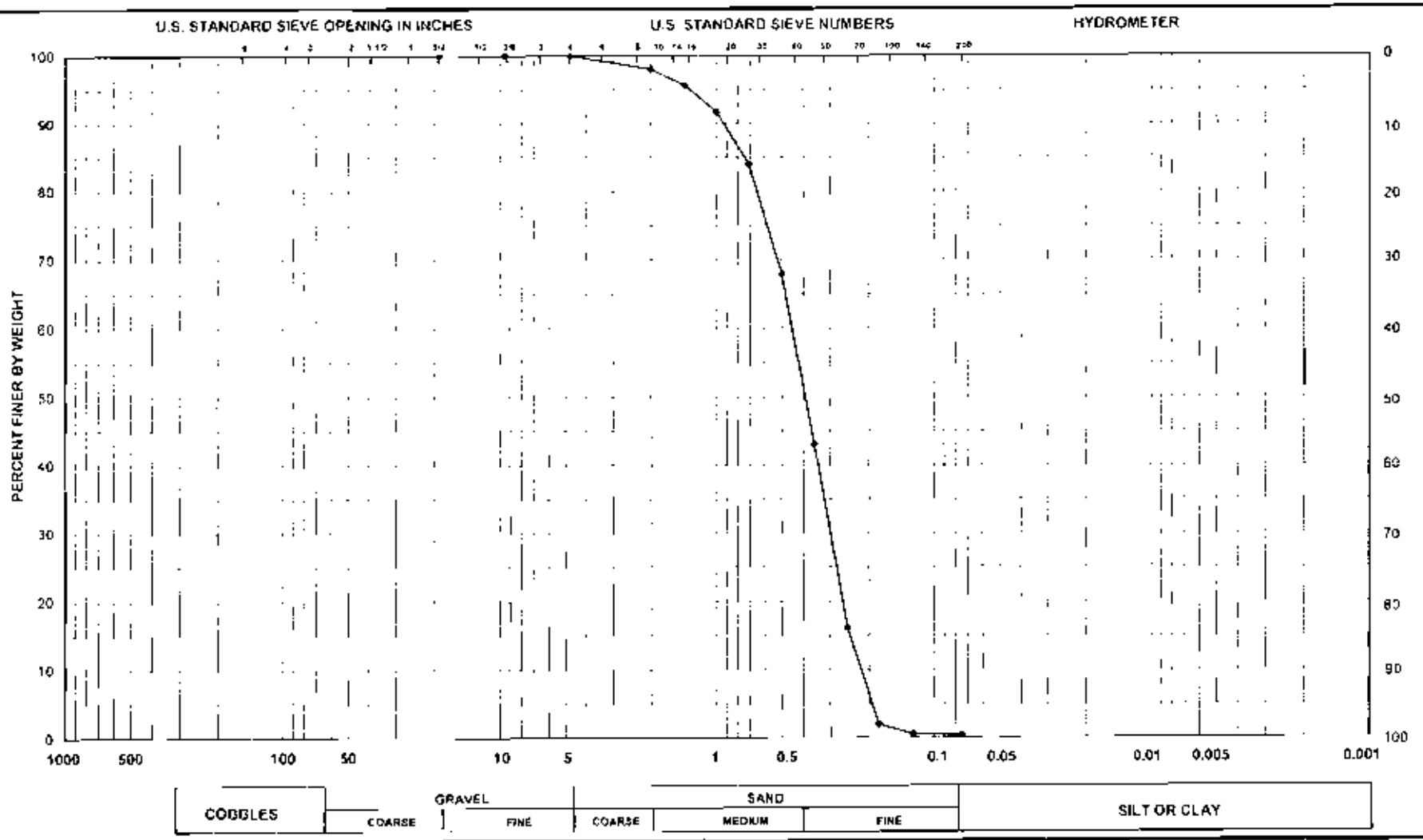
GRAIN SIZE AND VISUAL SHELL CONTENT

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 %



Station	Boring No.	Classification	% CO_3	G_s	Nat w%	LL	PL	PI
V-8	3	SAND, poorly-graded mostly medium to fine-grained quartz sand, few carbonate, gray (SP)	10					

Project Cape Lookout

Station V-8

Boring No. 3

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

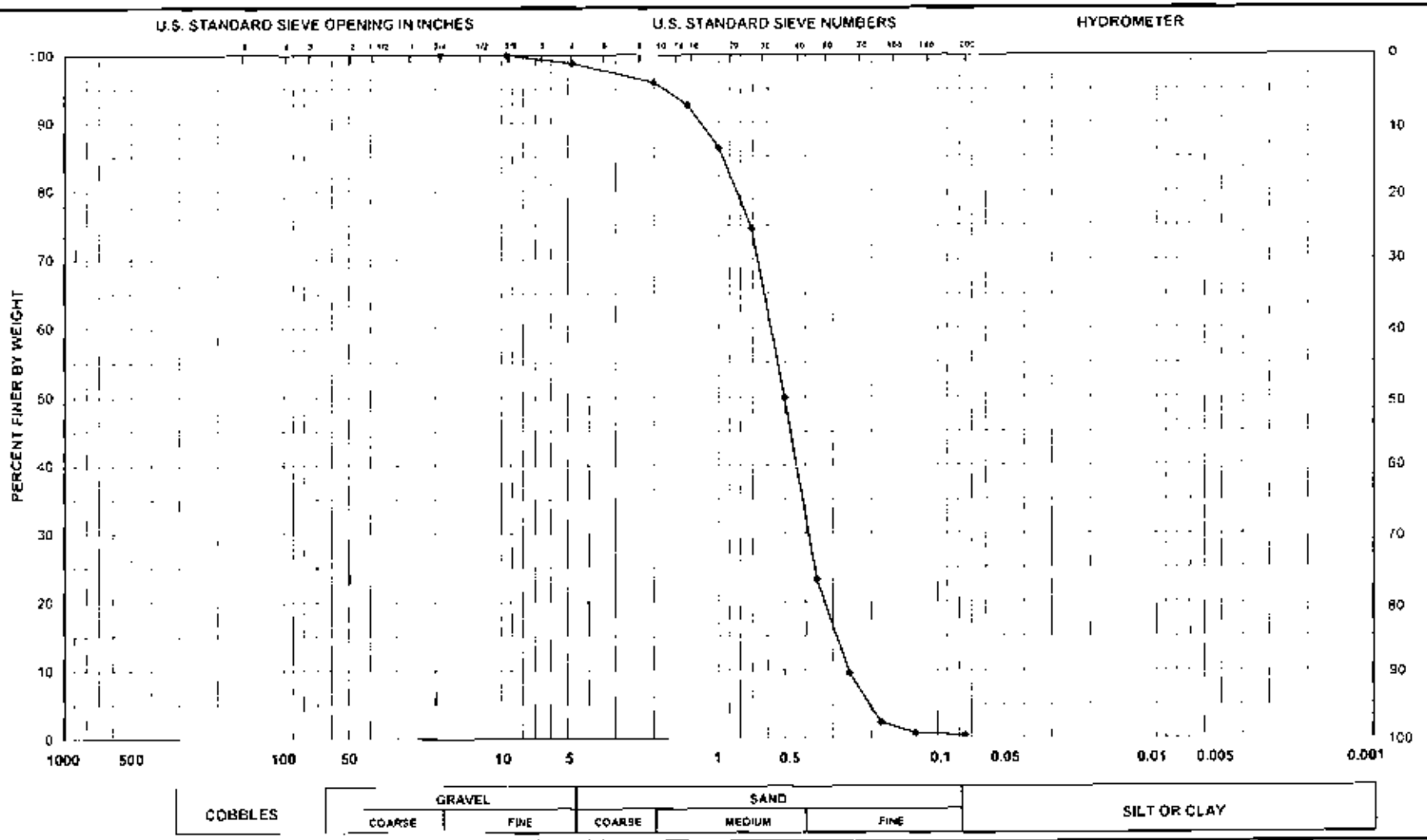
GRAIN SIZE AND VISUAL SHELL CONTENT

Project:	**Cape Lookout**	**Depth:**	**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** **%**



Station	Boring No.	Classification	% CO_3	G_s	Nat w%	LL	PL	PI
* V-8	4	SAND, poorly-graded, mostly medium to fine-grained quartz sand, little carbonate, dark gray (SP)	19					

GRADATION CURVES

Project: Cape Lookout

Station: V-8

Boring No.: 4

Date: 2/15/2005

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WOLF TECHNOLOGIES, INC.

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Jacksonville, Florida 32246
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VISUAL SHELL CONTENT

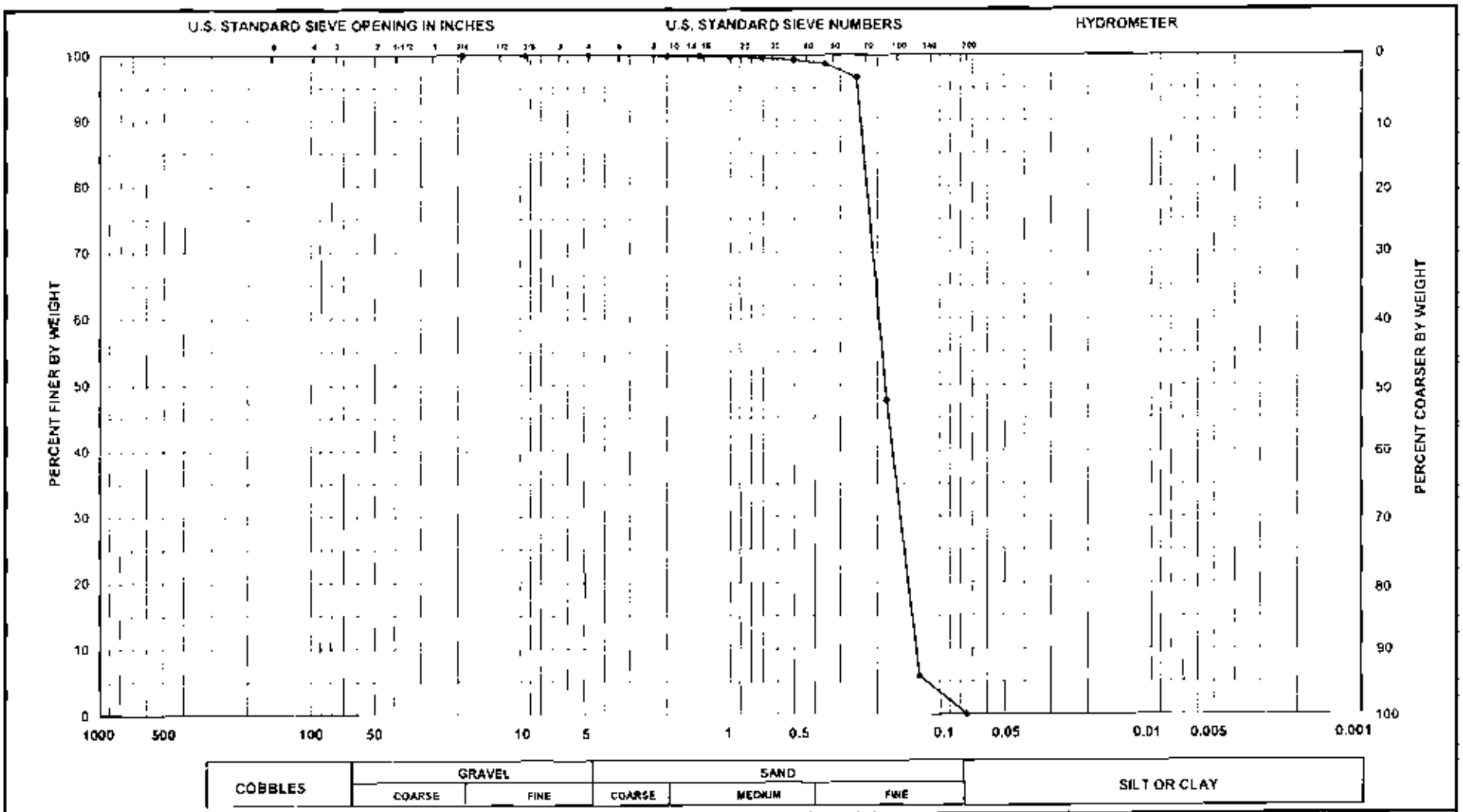
GRAIN SIZE AND VISUAL SHELL CONTENT

Project:	Cape Lookout	**Depth:**	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 %



Station	Boring No.	Classification	% CO_3	G_s	Nat w%	LL	PL	PI
• V-9	1	SAND, poorly-graded, mostly fine-grained quartz sand, trace carbonate, dark gray (SP)	1					

GRADATION CURVES

Project: Cape Lookout

Station: V-9

Boring No.: 1

Date: 2/15/2005

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VISUAL SHELL CONTENT

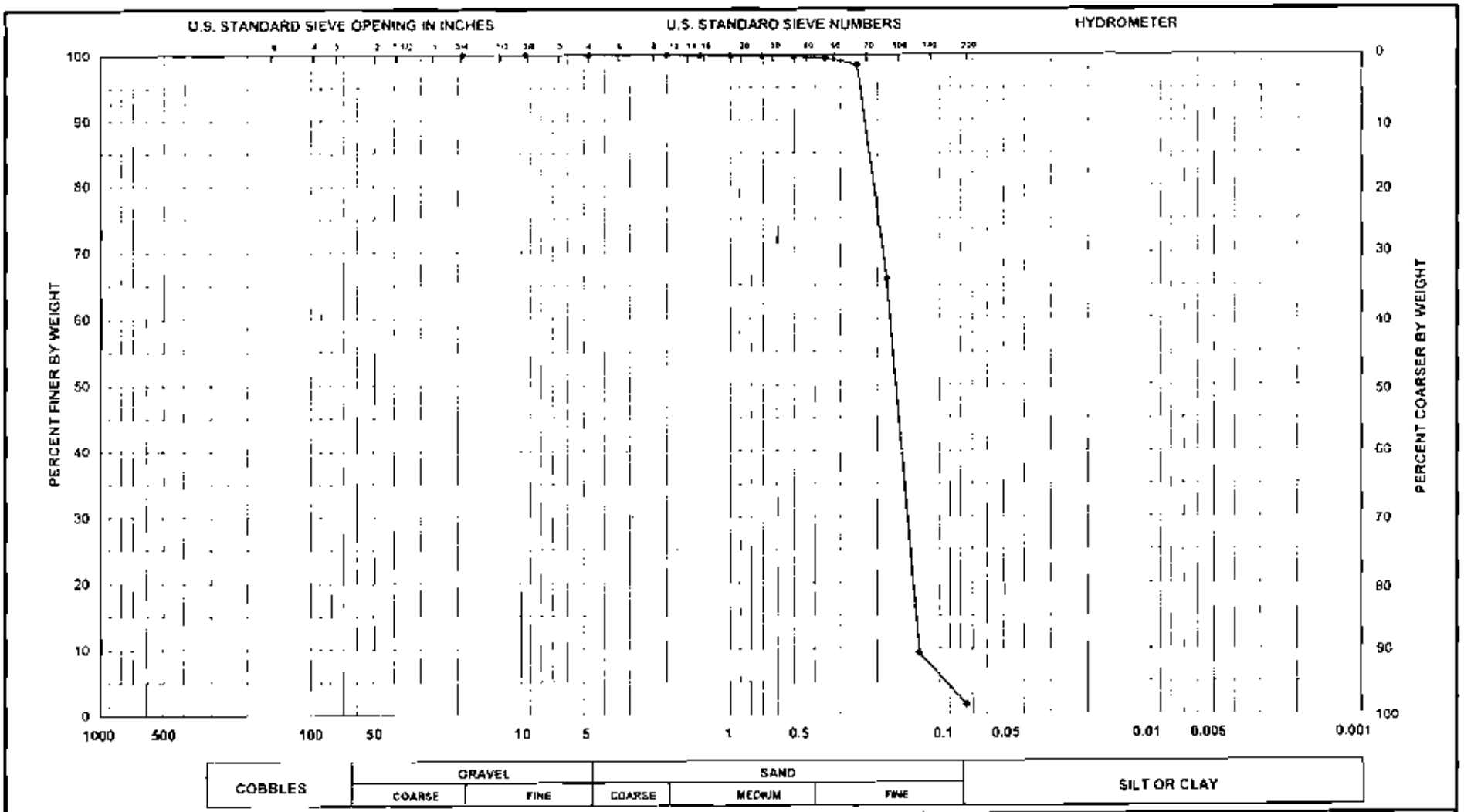
GRAIN SIZE AND VISUAL SHELL CONTENT

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 %



Station	Boring No.	Classification	% CO_3	G_s	Nat w%	LL	PL	PI
• V-9	2	SAND, poorly-graded, mostly fine-grained quartz sand, trace carbonate, trace silt dark gray (SP)	2					

Project: Cape Lookout

Station: V-9

Boring No.: 2

Date: 2/15/2005

GRADATION CURVES

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VISUAL SHELL CONTENT

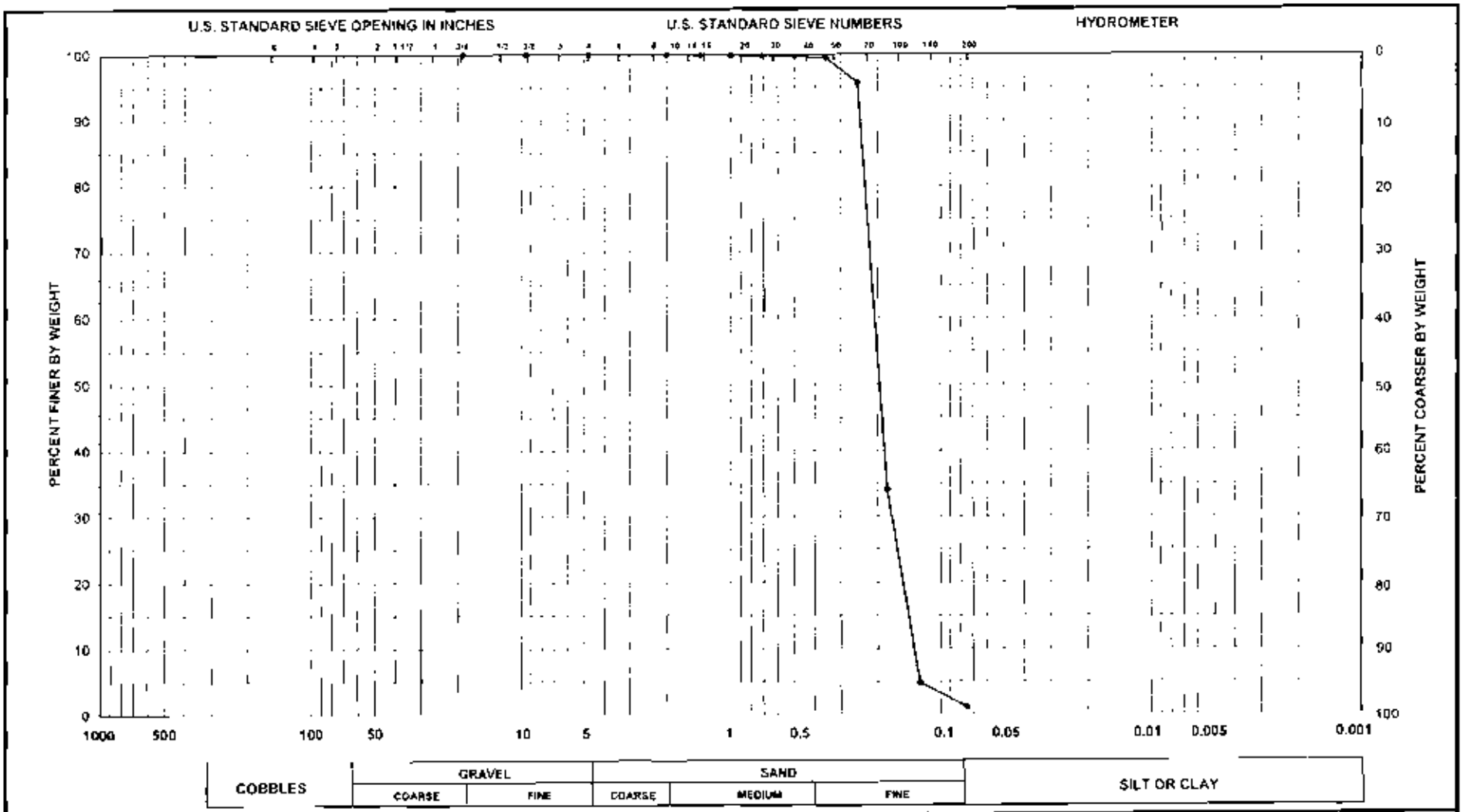
GRAIN SIZE AND VISUAL SHELL CONTENT

Project:	Cape Lookout	**Depth:**	5.0-5.5
Project No.:	2086-01-60	**Date:**	2/15/2005
Boring No.:	V-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 %



Station	Boring No.	Classification	% CO_3	G_s	Nat w%	LL	PL	PI
* V-9	3	SAND, poorly-graded, mostly fine-grained quartz sand, trace carbonate, trace silt, gray (SP)	2					

Project: Cape Lookout
Station: V-9
Boring No.: 3
Date: 2/15/2005

GRADATION CURVES

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VISUAL SHELL CONTENT

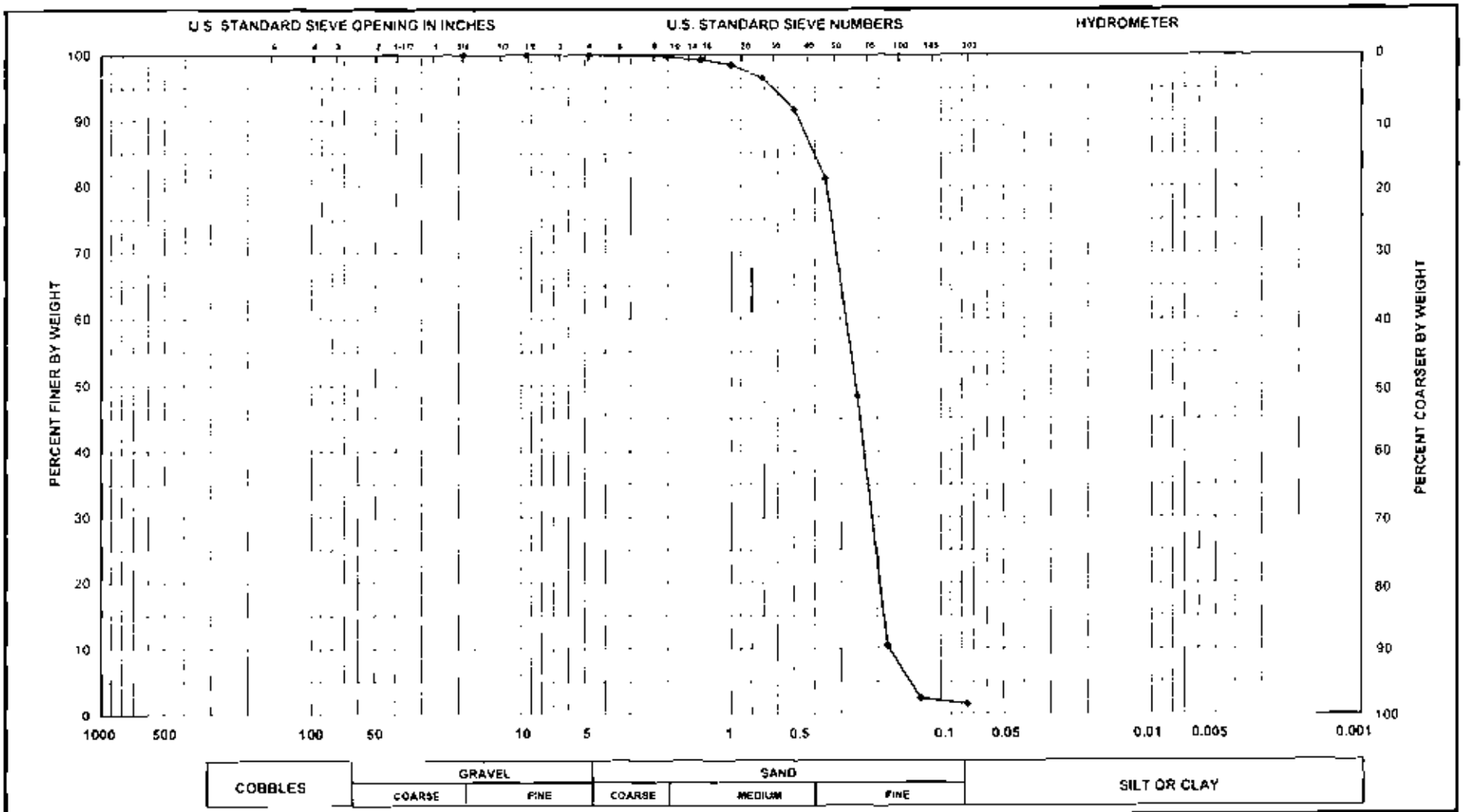
GRAIN SIZE AND VISUAL SHELL CONTENT

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** **%**



Station	Boring No.	Classification	% CO_3	G_s	Nat w%	LL	PL	PI
• V-9	4	SAND, poorly-graded, mostly fine-grained quartz sand, trace carbonate trace silt, gray (SP)	4					

Project Cape Lookout

Station V-9

Boring No. 4

Date 2/15/2005

GRADATION CURVES

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VISUAL SHELL CONTENT

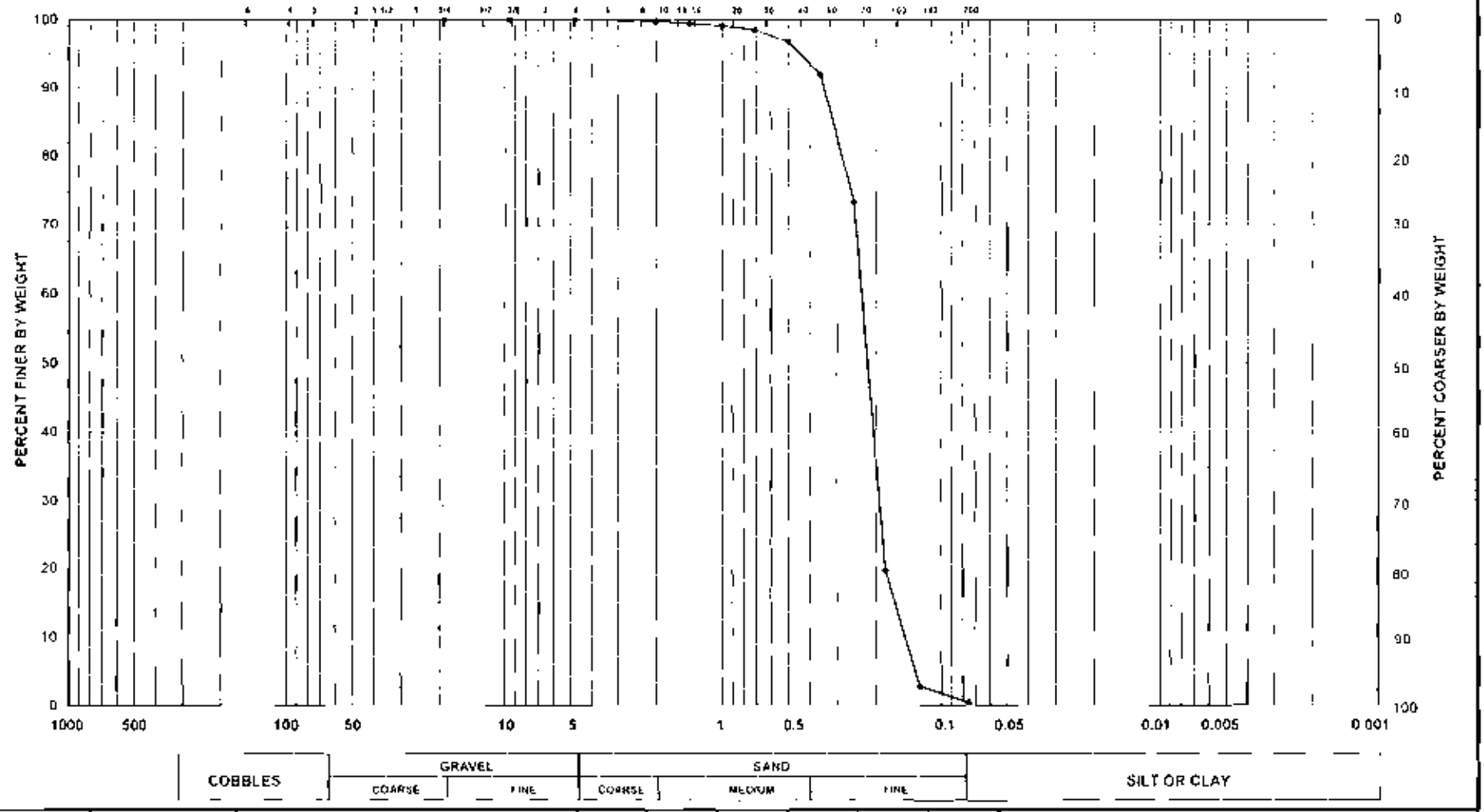
GRAIN SIZE AND VISUAL SHELL CONTENT

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 %



Station	Boring No.	Classification	% CO_3	G_s	Nat w%	LL	PL	PI
• V-10	1	SAND, poorly-graded, mostly fine-grained quartz sand, trace carbonate, gray (SP)	2					

Project	Cape Lookout
Station	V-10
Boring No.	1
Date	2/15/2005

GRADATION CURVES

ENG FORM 2087

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VISUAL SHELL CONTENT

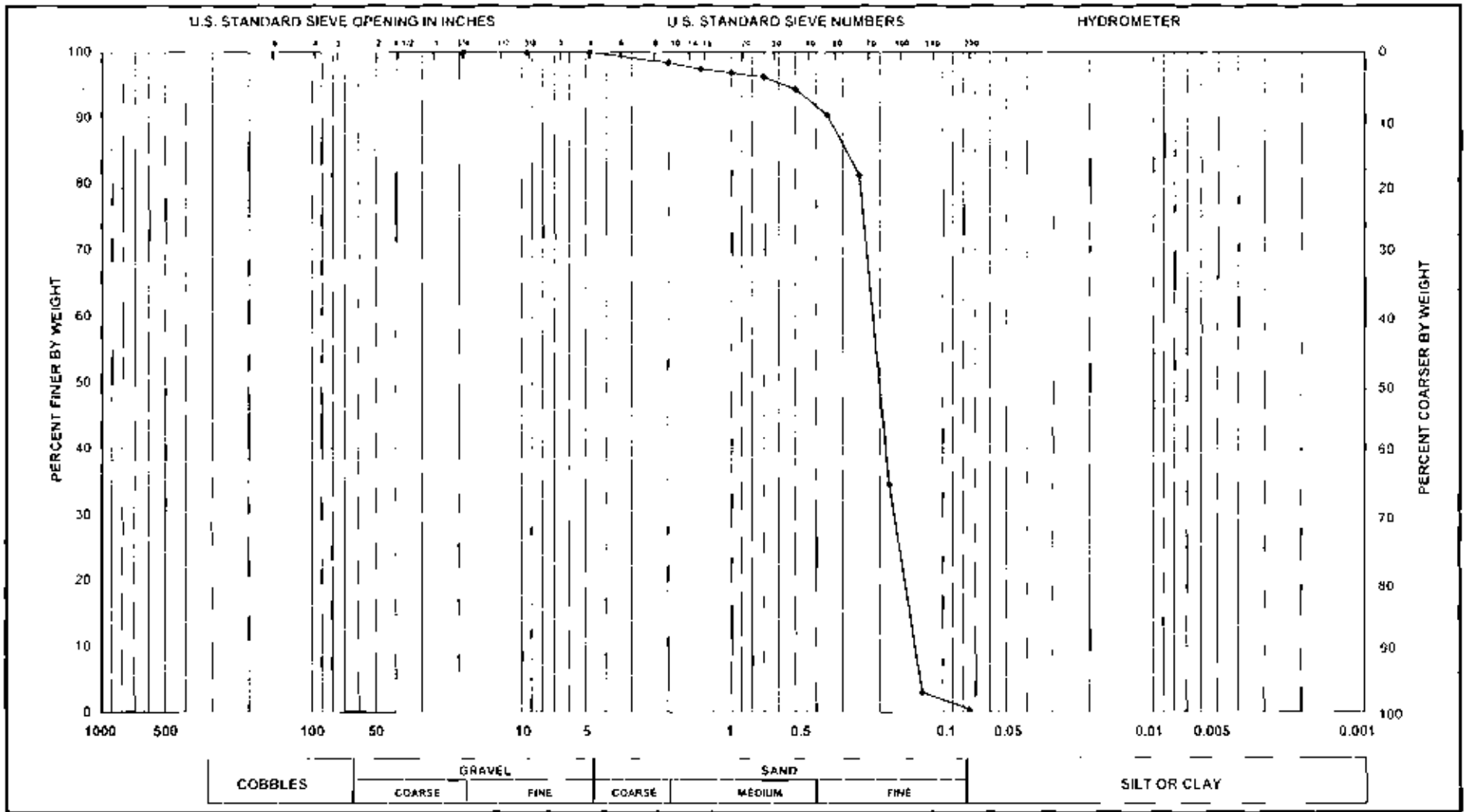
GRAIN SIZE AND VISUAL SHELL CONTENT

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** **%**



Station	Boring No.	Classification	% CO_3	G_s	Nat w%	LL	PL	PI
• V-10	2	SAND, poorly-graded, mostly fine-grained quartz sand, trace carbonate, gray (SP)	4					

Project: Cape Lookout
Station: V-10
Boring No.: 2
Date: 2/15/2005

GRADATION CURVES

ENG FORM 2087

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VISUAL SHELL CONTENT

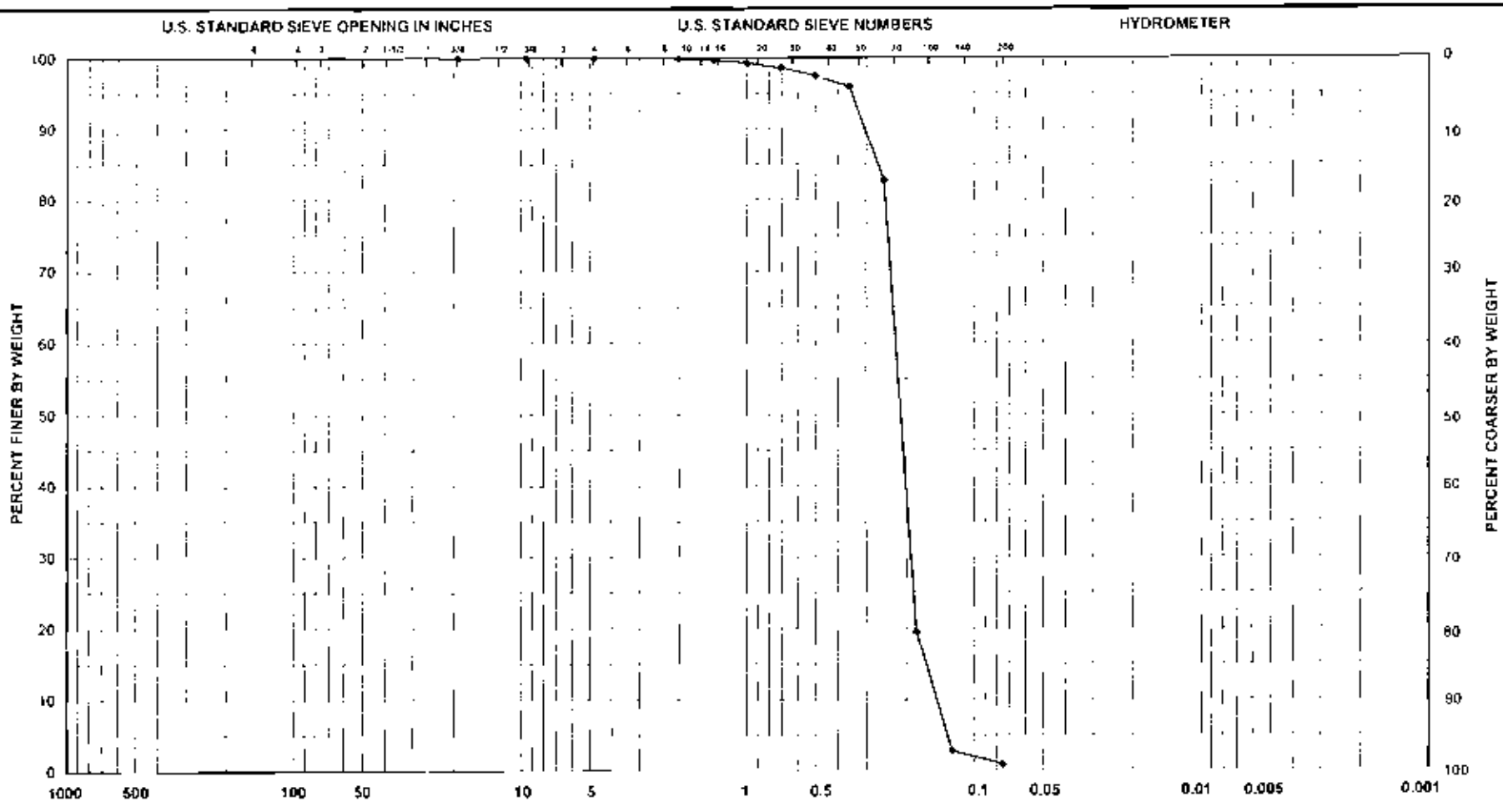
GRAIN SIZE AND VISUAL SHELL CONTENT

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** %



Station	Boring No.	Classification	% CO_3	G_s	Nat w%	LL	PL	PI
• V-10	4	SAND, poorly-graded, mostly fine-grained quartz sand, trace carbonate, gray (SP)	2					

Project	Cape Lookout
Station	V-10
Boring No.	4
Date	2/15/2005

GRADATION CURVES

ENG FORM 2087

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VISUAL SHELL CONTENT

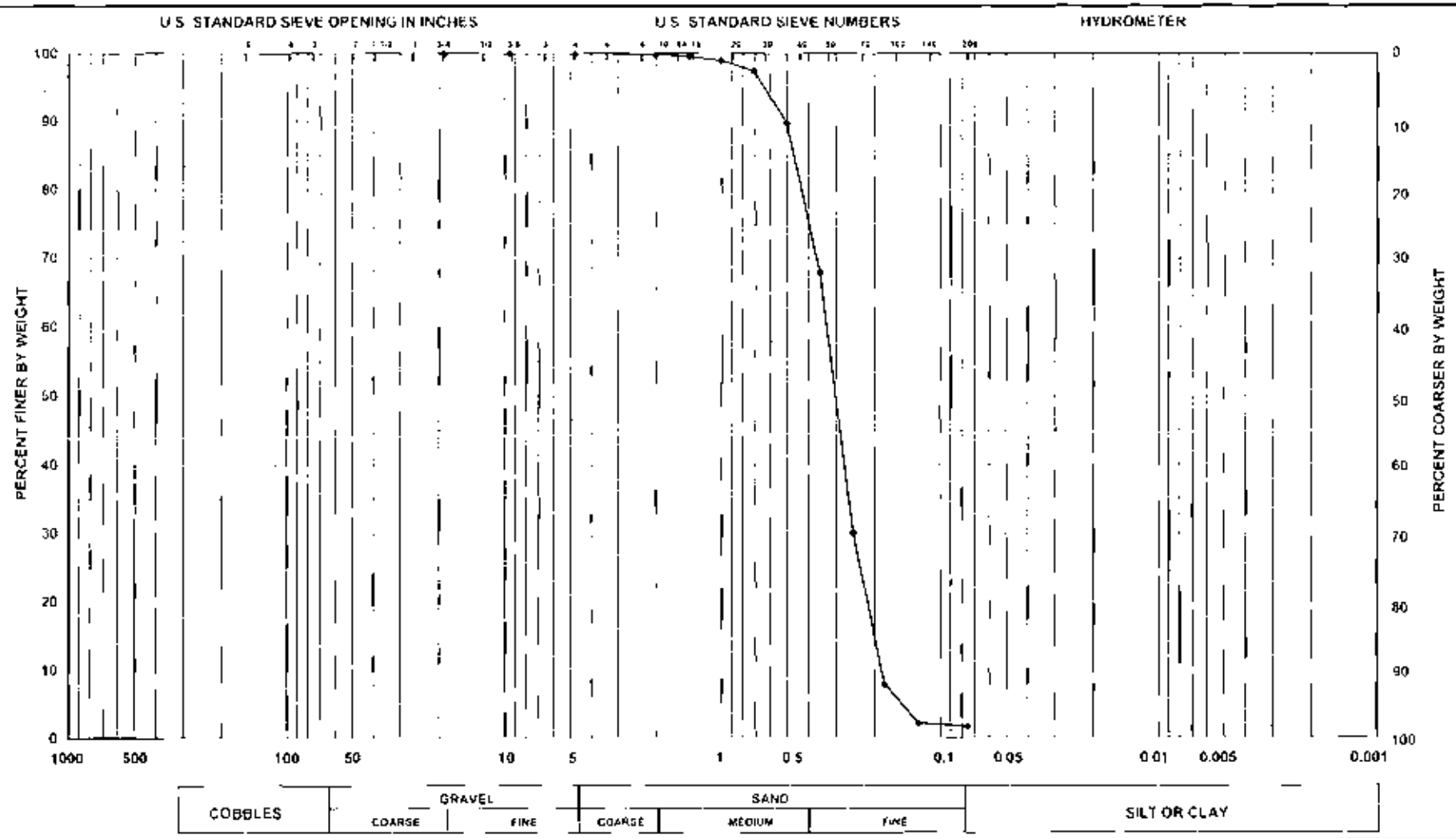
GRAIN SIZE AND VISUAL SHELL CONTENT

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** **%**



Station	Boring No.	Classification	% CO_3	G_s	Nat w%	LL	PL	PI
• V-10	5	SAND, poorly-graded, mostly fine-grained quartz sand, few carbonate, trace silt, dark gray (SP)	7					

Project Cape Lookout

Station V-10

Boring No. 5

Date 2/15/2005

GRADATION CURVES

ENG FORM 2087

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Jacksonville, Florida 32246
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VISUAL SHELL CONTENT

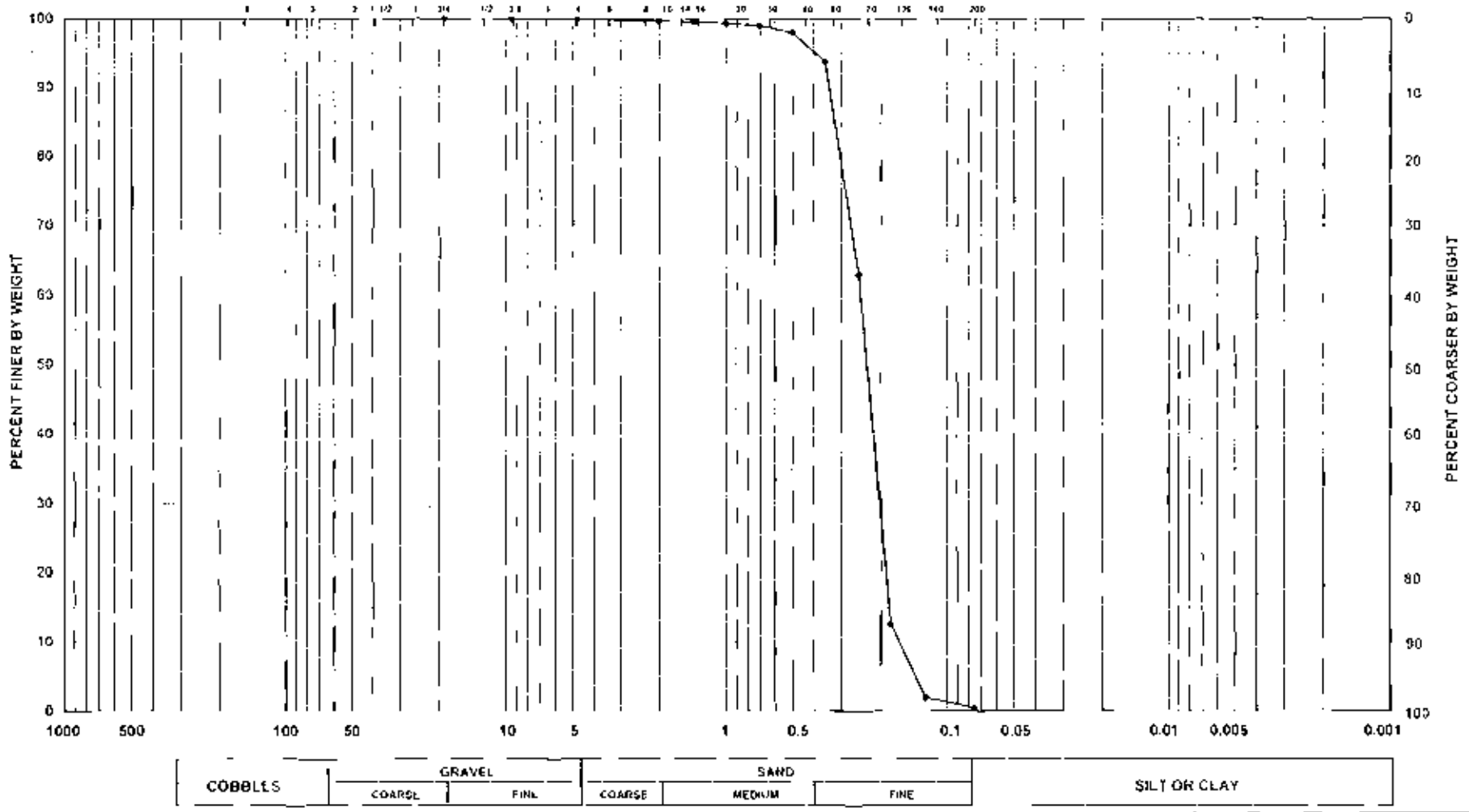
GRAIN SIZE AND VISUAL SHELL CONTENT

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** **%**



Station	Boring No.	Classification	% CO_3	G_s	Nat w%	LL	PL	PI
• V-11	1	SAND, poorly-graded, mostly fine-grained quartz sand, trace carbonate, gray (SP)	2					

Project Cape Lookout

Station V-11

Boring No. 1

Date 2/15/2005

GRADATION CURVES

ENG FORM 2087

MAY 83

WOLF TECHNOLOGIES, INC.

3047-4 St. Johns Bluff Road S.
Jacksonville, Florida 32246
(904) 997-1400 (Tel) · (904) 997-9150 (Fax)

VISUAL SHELL CONTENT

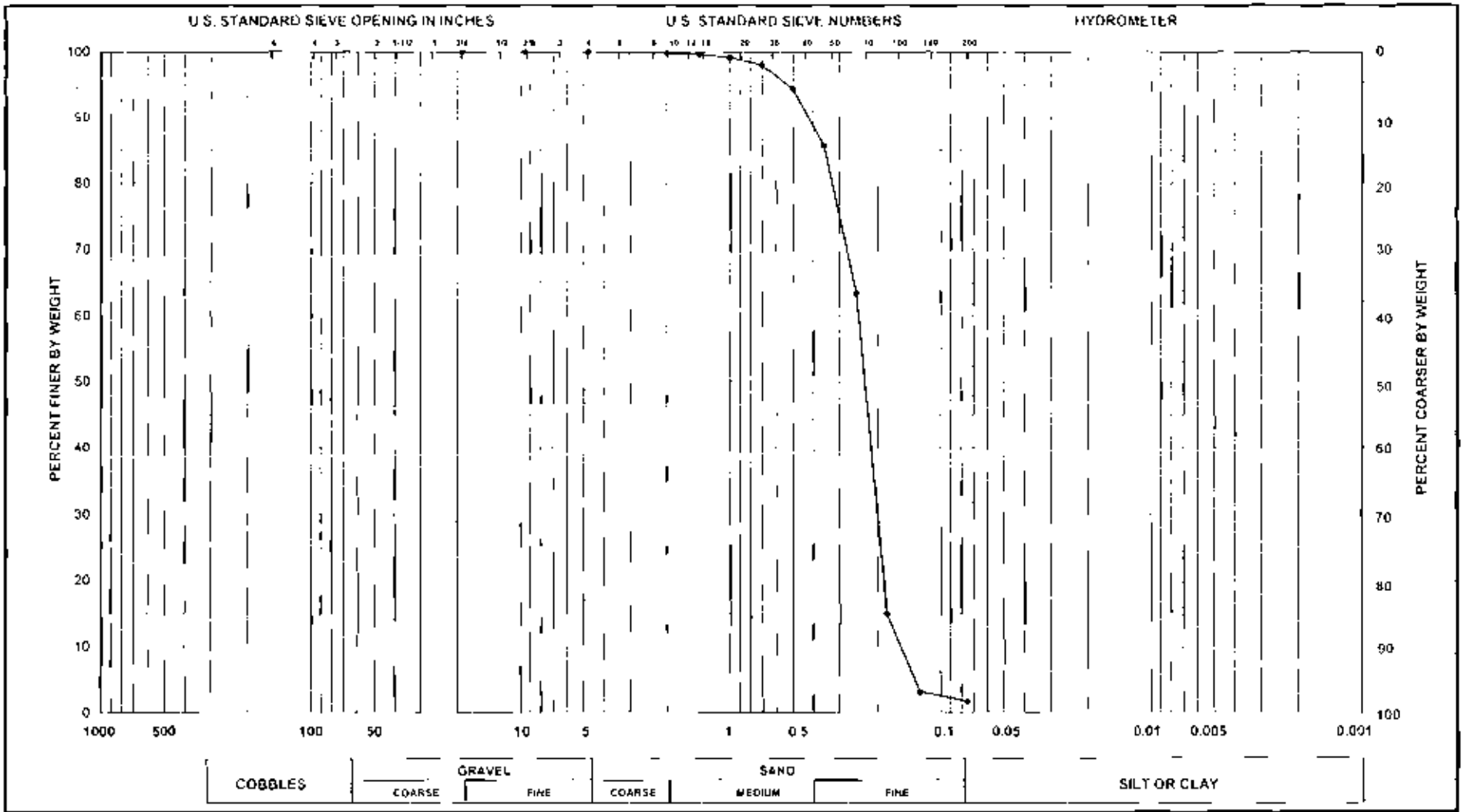
GRAIN SIZE AND VISUAL SHELL CONTENT

Project:	**Cape Lookout**	**Depth:**	**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 %



Station	Boring No.	Classification	% CO_3	G_s	Nat w%	LL	PL	PI
V-11	2	SAND, poorly-graded, mostly fine-grained quartz sand, trace carbonate, trace silt, dark gray (SP)	3					

Project: Cape Lookout

Station: V-11

Boring No.: 2

Date: 2/15/2005

GRADATION CURVES

ENG FORM 2087

MAY 53

WOLF TECHNOLOGIES, INC.

3047-4 St. Johns Bluff Road S.
Jacksonville, Florida 32246
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VISUAL SHELL CONTENT

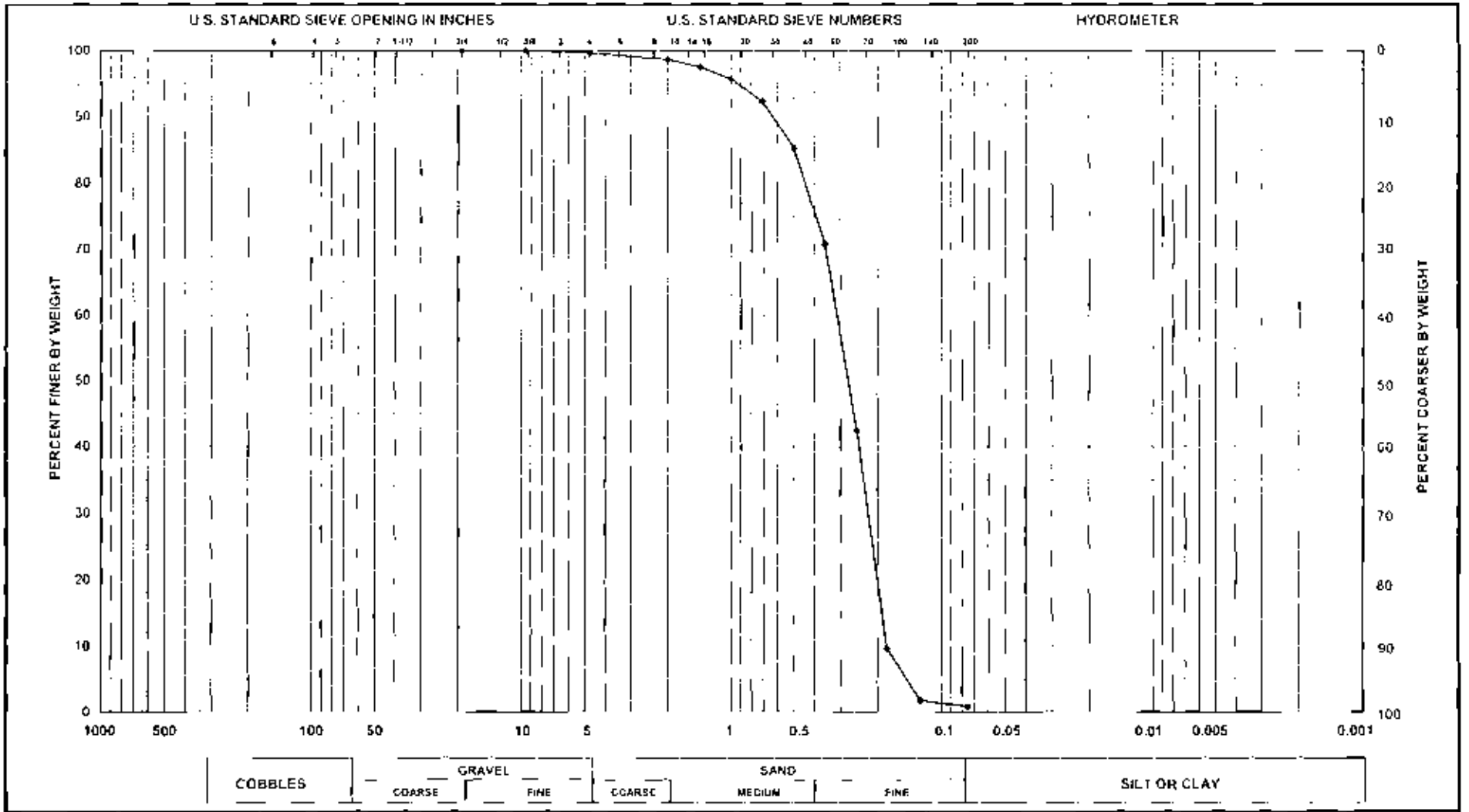
GRAIN SIZE AND VISUAL SHELL CONTENT

Project:	**Cape Lookout**	**Depth:**	**6.0-6.5**
Project No.:	**2086-01-60**	**Oate:**	**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 %



Station	Boring No.	Classification	% CO_3	G_s	Nat w%	LL	PL	PI
• V-11	3	SAND, poorly-graded, mostly fine-grained quartz sand, few carbonate, dark gray (SP)	8					

Project Cape Lookout

Station V-11

Boring No. 3

Date 2/15/2005

GRADATION CURVES

ENG FORM 2087

MAY 63

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VISUAL SHELL CONTENT

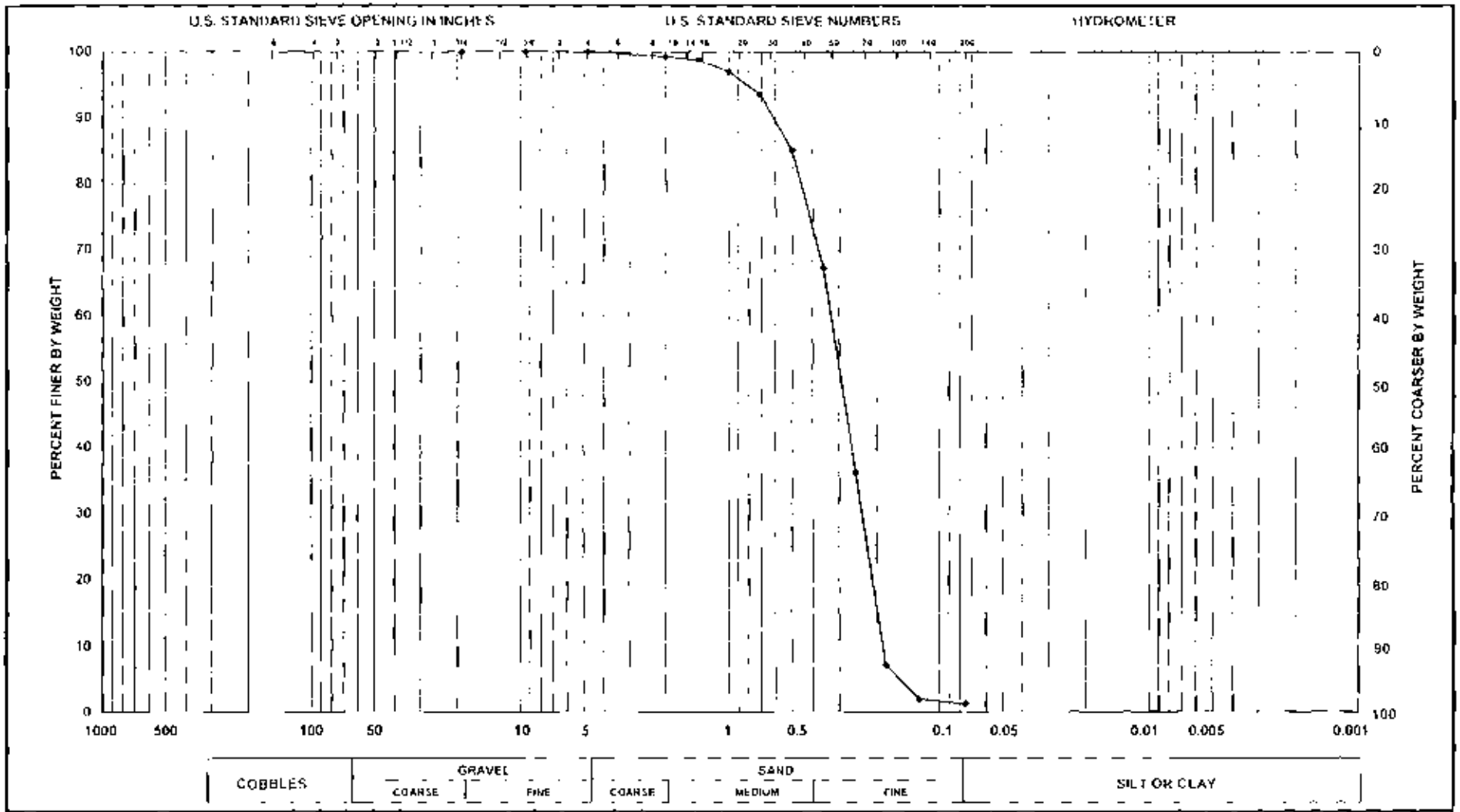
GRAIN SIZE AND VISUAL SHELL CONTENT

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 %



Station	Boring No.	Classification	% CO_3	G_s	Nat w%	LL	PL	PI
* V-14	1	SAND, poorly graded, mostly medium to fine-grained quartz sand, few carbonate, trace silt, dark gray (SP)	5					

GRADATION CURVES

Project	Cape Lockout
Station	V-14
Boring No.	1
Date	2/15/2005

ENG FORM 2087

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VISUAL SHELL CONTENT

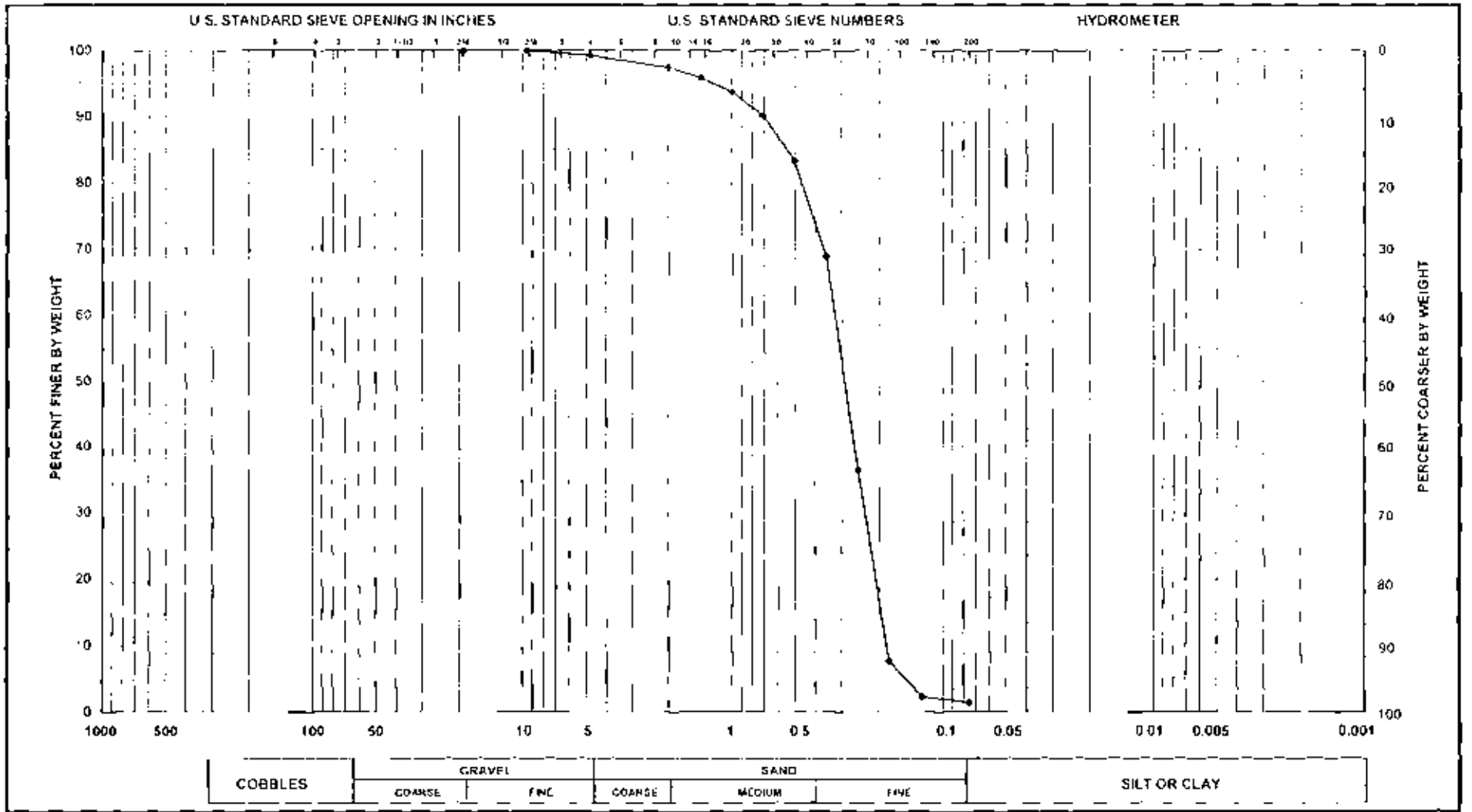
GRAIN SIZE AND VISUAL SHELL CONTENT

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 %



Station	Boring No.	Classification	% CO_3	G_s	Nat w%	LL	PL	PI
• V-14	2	SAND, poorly-graded, mostly medium to fine-grained quartz sand, few carbonate, trace silt, dark gray (SP)	7					

Project Cape Lookout

Station V-14

Boring No. 2

Date 2/15/2005

GRADATION CURVES

ENG FORM 2087

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VISUAL SHELL CONTENT

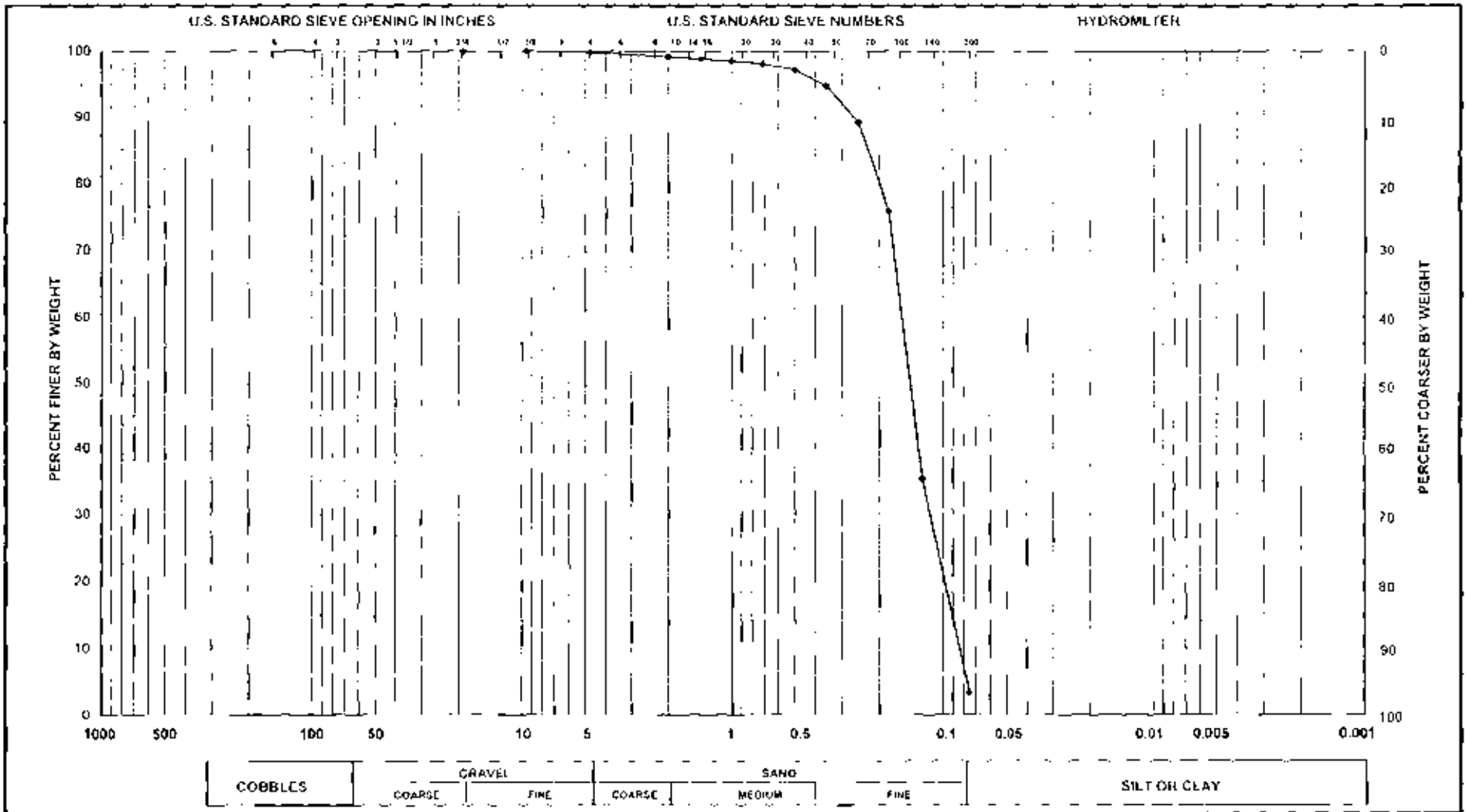
GRAIN SIZE AND VISUAL SHELL CONTENT

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 %



Station	Boring No	Classification	% CO_3	G_s	Nat w%	LL	PL	PI
• V-14	4	SAND, poorly-graded, mostly fine-grained quartz sand, trace carbonate, trace silt, very dark gray (SP)	3					

Project Cape Lookout

Station V-14

Boring No. 4

Date 2/15/2005

GRADATION CURVES

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VISUAL SHELL CONTENT

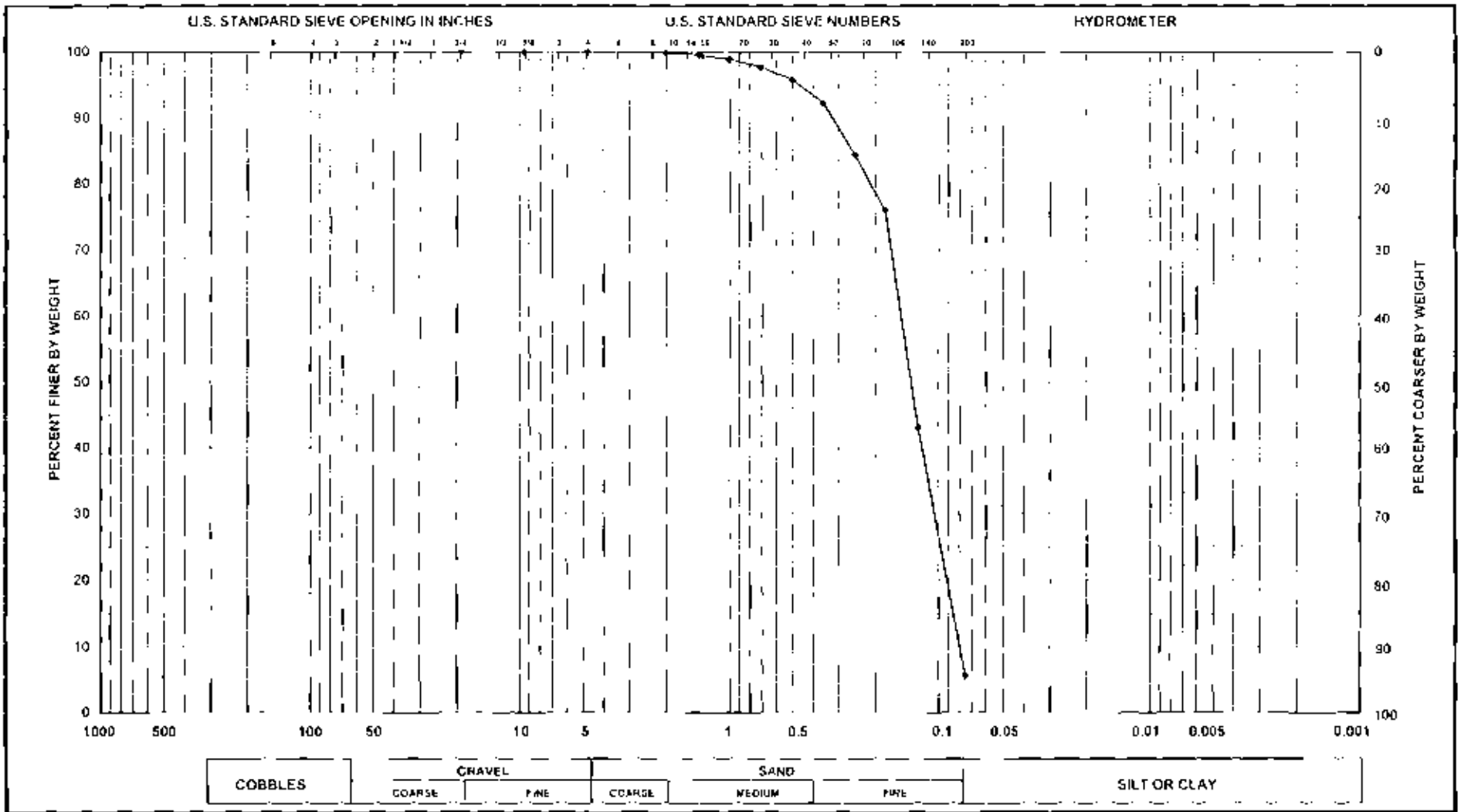
GRAIN SIZE AND VISUAL SHELL CONTENT

Project:	Cape Lookout	Depth:	7.0-7.5
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 %



Station	Boring No.	Classification	% CO_3	G_s	Nat w%	LL	PL	PI
* V-14	5	SAND poorly-graded with silt, mostly fine-grained quartz sand, few silt, trace carbonate, very dark gray (SP-SM)	2					

Project Cape Lookout

Station V-14

Boring No. 5

Date 2/15/2005

GRADATION CURVES

ENG FORM 2087

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VISUAL SHELL CONTENT

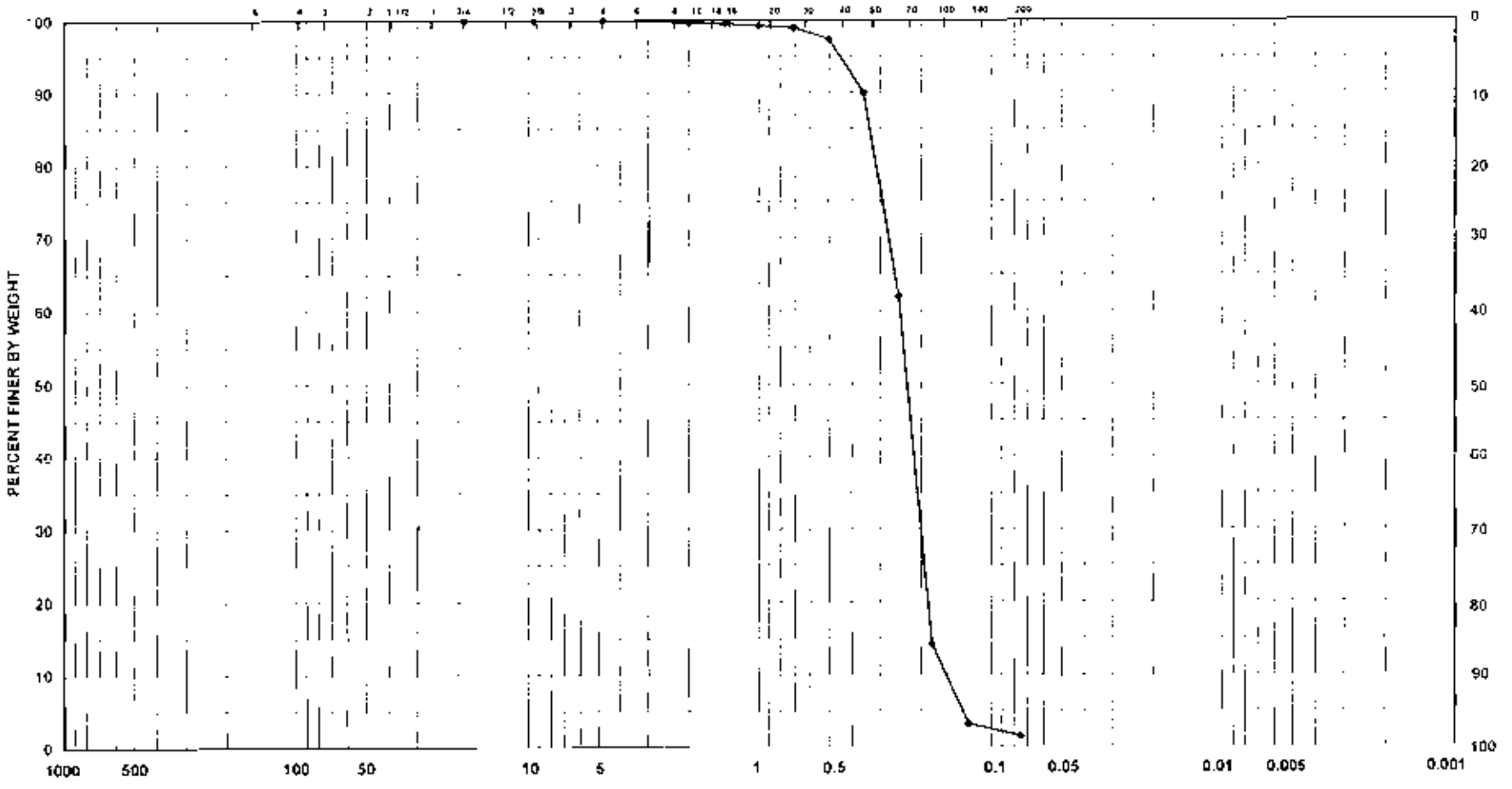
GRAIN SIZE AND VISUAL SHELL CONTENT

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** %



Station	Boring No.	Classification	% CO_3	G_s	Nat w%	LL	PL	PI
◆ V-15	1	SAND, poorly-graded, mostly fine-grained quartz sand, trace carbonate, trace silt, dark gray (SP)	2					

Project Cape Lookout

Station V-15

Boring No. 1

Date 2/15/2005

GRADATION CURVES

ENG FORM 2087

MAY 63

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Jacksonville, Florida 32246
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VISUAL SHELL CONTENT

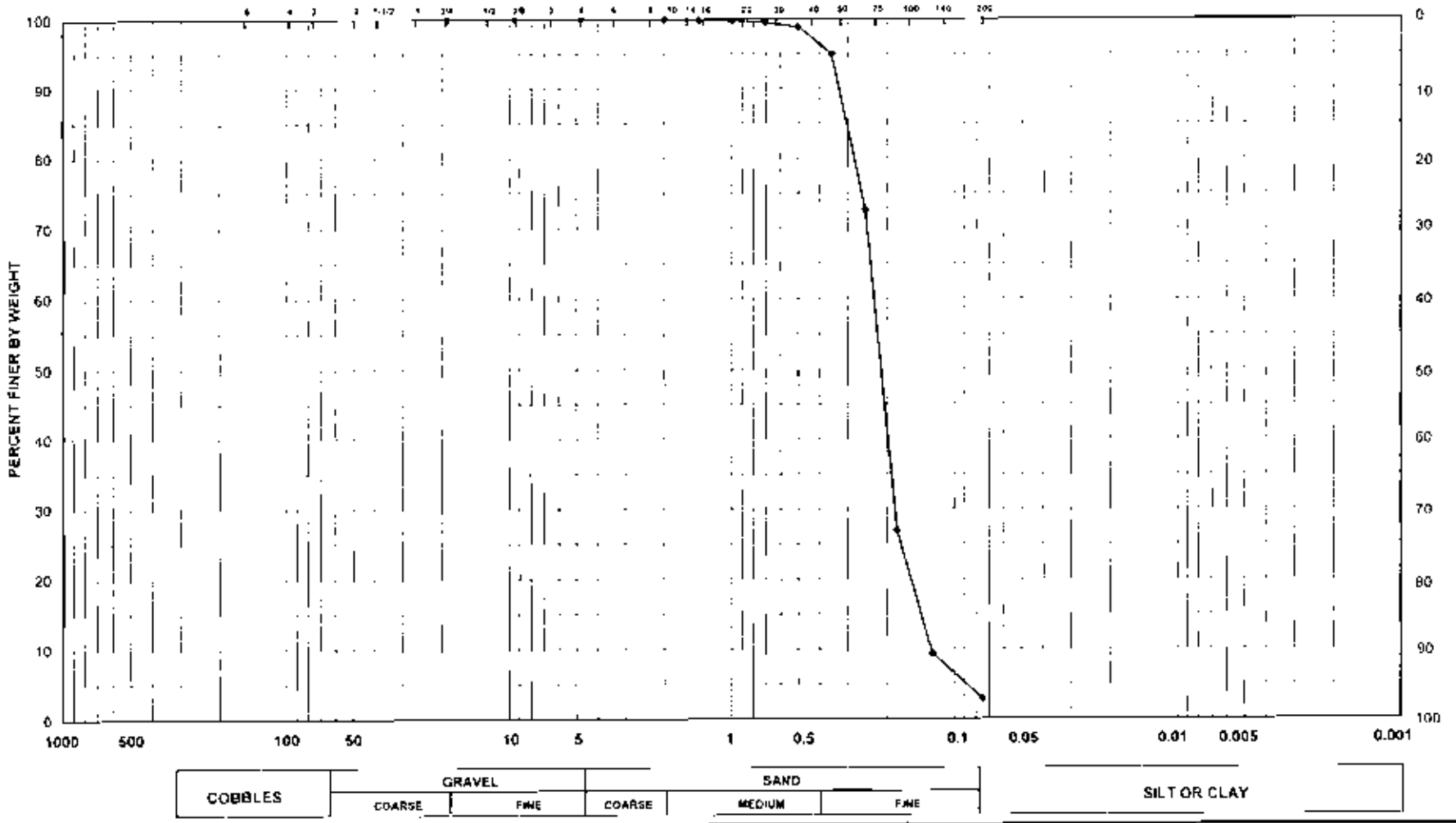
GRAIN SIZE AND VISUAL SHELL CONTENT

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** **%**



Station	Boring No.	Classification	% CO_3	G_s	Nat w%	LL	PL	PI
▸ V-15	3	SAND, poorly-graded, mostly fine-grained quartz sand, trace carbonate, trace silt, dark gray (SP)	2					

GRADATION CURVES

Project: Cape Lookout

Station: V-15

Boring No.: 3

Date: 2/15/2005

ENG FORM 2087

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VISUAL SHELL CONTENT

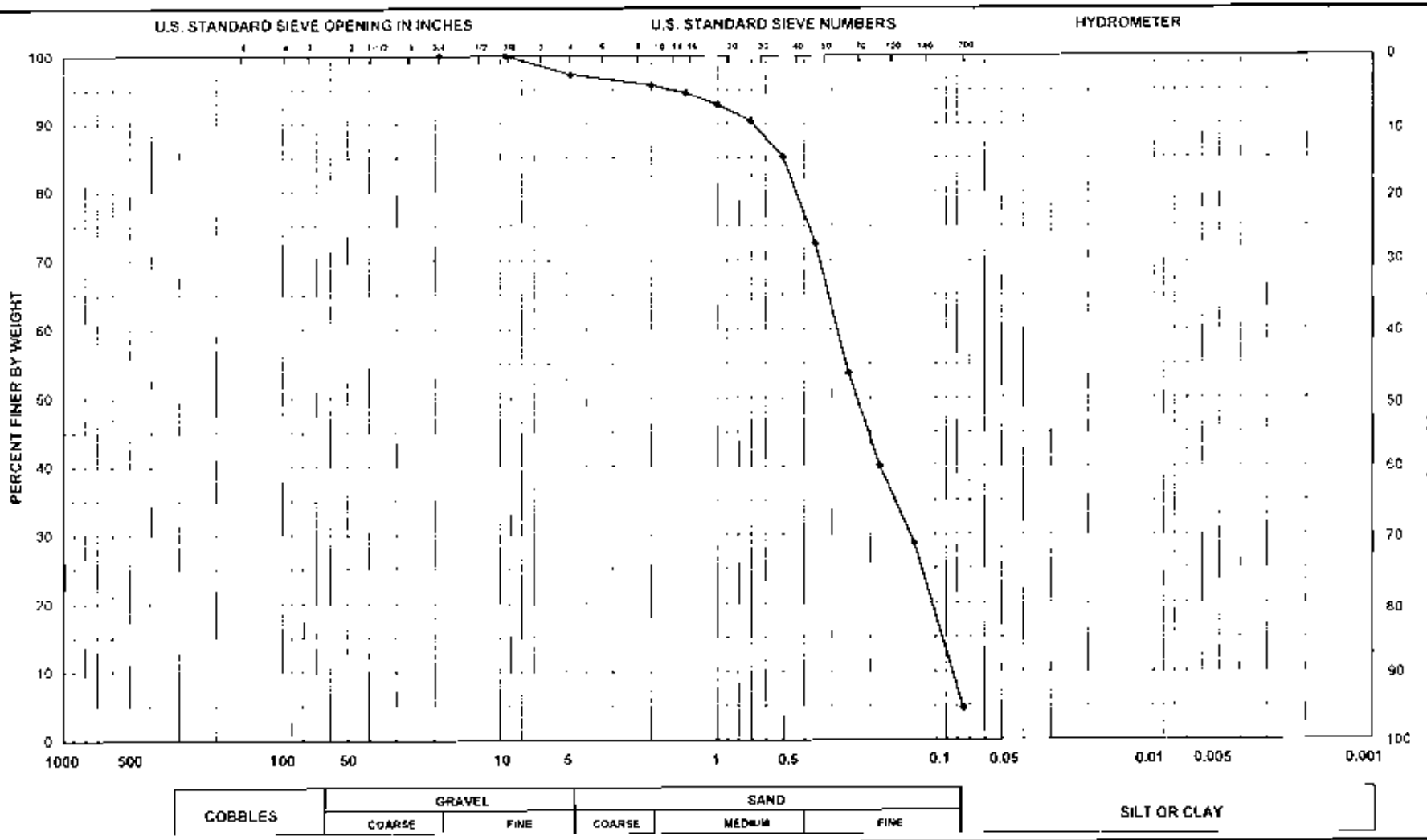
GRAIN SIZE AND VISUAL SHELL CONTENT

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** %



Station	Boring No.	Classification	% CO_3	G_s	Nat w%	LL	PL	PI
* V-15	4	SAND, poorly-graded, mostly fine-grained quartz sand, few carbonate, trace silt, very dark gray (SP)	9					

Project Cape Lookout

Station V-15

Boring No. 4

Date 2/15/2005

GRADATION CURVES

ENG FORM 2087

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VISUAL SHELL CONTENT

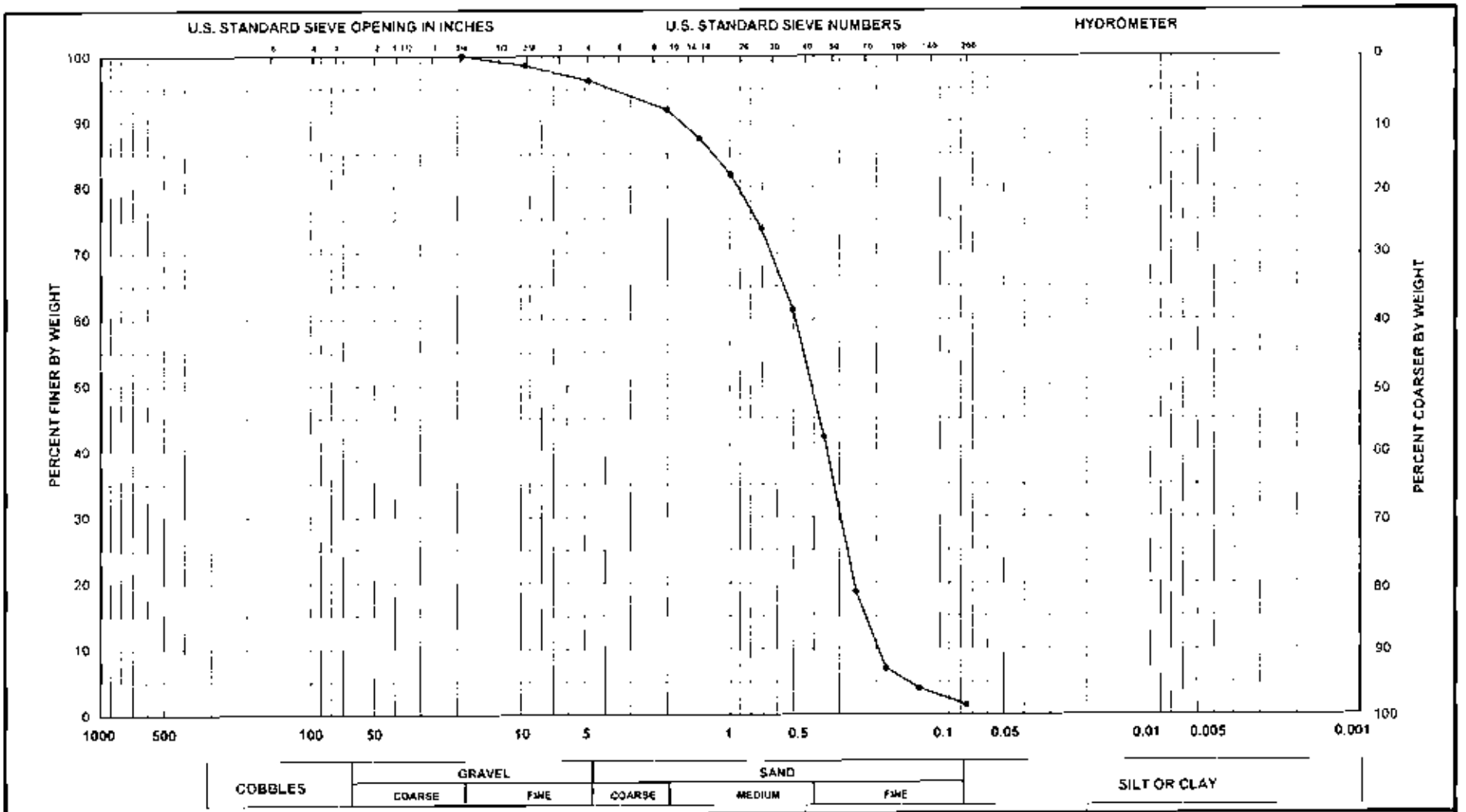
GRAIN SIZE AND VISUAL SHELL CONTENT

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** **%**



Station	Boring No.	Classification	% CO_3	G_s	Nat w%	LL	PL	PI
* V-15	5	SAND, poorly-graded, mostly medium to fine-grained quartz sand, little carbonate, trace silt, brownish gray (SP)	16					

Project: Cape Lookout

Station: V-15

Boring No.: 5

Date: 2/15/2005

GRADATION CURVES

ENG FORM 2087

MAY 63

TABLE 1
SUMMARY OF LABORATORY TESTING RESULTS
FOR GRAIN SIZE ANALYSIS

USACOE - CAPE LOOKOUT
CATLIN PROJECT NO. 205-054

BORING NUMBER	SAMPLE #	DEPTH	% SHELL	#4	#10	#14	#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	86.8	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

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 2 acres in size, and was last used for dredged material placement in 1997 when it was built to it 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 overfill 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

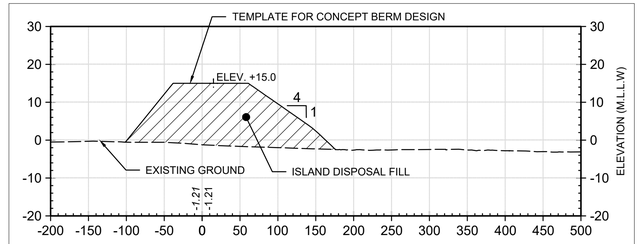
in the geotubes and/or sandbags will then need to be reworked and tie into the existing grade.

Avoidance and Minimization Measures:

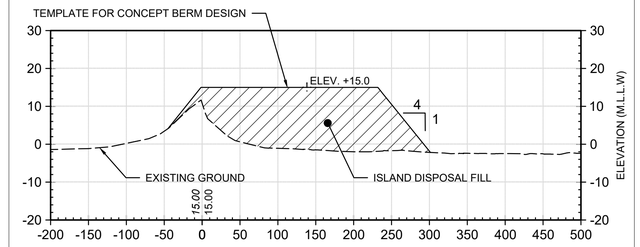
- Survey the existing island and proposed placement area to determine the existing topography and capacity for dredged material. Surrounding waters are very shallow (1-2 feet).
- At early stages of pumping/island construction, geotubes or sandbags will be necessary to contain the dredged material. Once 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.



CONCEPTUAL DESIGN FOR STA. -4+00 TO -2+00 & STA. 2+00 TO 8+00



CONCEPTIONAL DESIGN FOR STA. -2+00 TO 2+00 - TYPICAL SECTION

LEGEND

- PROPOSED BERM FOOTPRINT
- TOE OF FILL
- SUB AQUATIC VEGETATION (SAV)
- HISTORICAL SANDBAG CONSTRUCTION

N

0 200 400 Feet

US Army Corps of Engineers®

MARK	DESCRIPTION	DATE

DESIGNED BY: T. KNIGHT/S. FABIAN
DRAWN BY: T. KNIGHT
CHECKED BY: E. HUGHES
SUBMITTED BY:
SIZE: ANSI D
HORIZONTAL DATUM: NC STATE PLANE
VERTICAL DATUM: M.L.L.W.
IMAGERY: MS. EARTHSTAR
DRAWING DATE: 31 MAR 23
FILE NAME: EA Appendix-B 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
ENVIRONMENTAL ASSESSMENT
CARTERET COUNTY, NORTH CAROLINA

APPENDIX B
PROPOSED PLAN FOR SANDBAG ISLAND PLACEMENT AREA
FIGURE 1

SHEET ID
GI-001

APPENDIX C

SECTION 404(b)(1) GUIDELINES

ANALYSIS

CHANNELS FROM BACK SOUND TO LOOKOUT BIGHT

APRIL 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 preliminary 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 with Government Plant into open waters by means of sidecast dredging and special purpose hopper, and placement onto Sandbag bird island 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.

Section 404 Public Notice No. CESAW-ECP-PE-1.
Review of Compliance (230.10(a)-(d)) **Preliminary 1/** **Final 2/**

A review of the NEPA Document indicates that:

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 ☒ NO☐ YES ☐ NO☐

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☒ NO☐* YES☐ NO☐

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 organisms dependent on the aquatic ecosystem, ecosystem diversity, productivity and stability, and recreational, aesthetic, and economic values (if no, see section 2); YES☒ NO☐ YES☐ NO☐

d Appropriate and practicable steps have been taken to minimize potential adverse impacts of the discharge on the aquatic ecosystem (if no, see section 5). YES☒ NO☐* YES☐ NO☐

Proceed to Section 2

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.		X	
(2) Suspended particulates/turbidity impacts		X	
(3) Water column impacts.		X	
(4) Alteration of current patterns and water circulation.			
	NA		
(5) Alteration of normal water fluctuations/hydroperiod.			
	NA		
(6) Alteration of salinity gradients.	NA		
b. Biological Characteristics of the Aquatic Ecosystem (Subpart D)			
(1) Effect on threatened/endangered species and their habitat.			
		X	
(2) Effect on the aquatic food web.		X	
(3) Effect on other wildlife (mammals birds, reptiles, and amphibians).			
		X	
c Special Aquatic Sites (Subpart E)			
(1) Sanctuaries and refuges.		X	
(2) Wetlands.	NA		
(3) Mud flats.	NA		
(4) Vegetated shallows.	NA		
(5) Coral reefs.	NA		
(6) Riffle and pool complexes.	NA		
d. Human Use Characteristics (Subpart F)			
(1) Effects on municipal and private water supplies.	NA		
(2) Recreational and commercial fisheries impacts		X	
(3) Effects on water-related recreation.		X	
(4) Aesthetic impacts.		X	
(5) Effects on parks, national and historical monuments, national seashores, wilderness areas, research sites, and similar preserves.		X	

Proceed to Section 3

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 ☒

(2) Hydrography in relation to known or anticipated sources of contaminants ☒

(3) Results from previous testing of the material or similar material in the vicinity of the project ☒

(4) Known, significant sources of persistent pesticides from land runoff or percolation ☐

(5) Spill records for petroleum products or designated (Section 311 of CWA) hazardous substances ☐

(6) Other public records of significant introduction of contaminants from industries, municipalities, or other sources ☒

(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 ☐

(8) Other sources (specify). ☐

List appropriate references.

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 ☐*

Proceed to Section 4

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. ☒

(2) Current velocity, direction, and variability at disposal site ☒

(3) Degree of turbulence. ☒

(4) Water column stratification ☒

(5) Discharge vessel speed and direction ☒

(6) Rate of discharge ☒

(7) Dredged material characteristics (constituents, amount and type of material, settling velocities). ☒

(8) Number of discharges per unit of time. ☒

(9) Other factors affecting rates and patterns of mixing (specify)

List appropriate references.

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 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. List actions taken.

YES ☒ NO ☐*

Please refer to EA Section 8.0 Environmental Commitments for avoidance and minimization measures.

Return to section 1 for final stage of compliance review.

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 (review sections 2a, 3, 4, and 5). YES ☒ NO ☐*

b. Water circulation, fluctuation, and salinity (review sections 2a, 3, 4, and 5). YES ☒ NO ☐*

c. Suspended particulates/turbidity (review sections 2a, 3, 4, and 5). YES ☒ NO ☐*

d Contaminant availability (review sections 2a, 3, and 4). YES ☒ NO ☐*

e. Aquatic ecosystem structure and function (review sections 2b and c, 3, and 5). YES ☒ NO ☐*

f. Disposal site (review sections 2, 4, and 5). YES ☒ NO ☐*

g. Cumulative impact on the aquatic ecosystem. YES ☒ NO ☐*

h. Secondary impacts on the aquatic ecosystem. YES ☒ NO ☐*

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. . . . . ☐

_____

Jenny Owens
Acting Chief, Planning and
Environmental Branch

_____

Benjamin A. Bennett
Colonel, U.S. Army
District Engineer

*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/)

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

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

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[1], 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.

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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 *Myotis septentrionalis* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/9045	Threatened
West Indian Manatee *Trichechus manatus* There is **final** critical habitat for this species. The location of the critical habitat is not available. ***This species is also protected by the Marine Mammal Protection Act, and may have additional consultation requirements.*** Species profile: https://ecos.fws.gov/ecp/species/4469	Threatened

Birds

NAME	STATUS
Eastern Black Rail *Laterallus jamaicensis ssp. jamaicensis* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/10477	Threatened
Piping Plover *Charadrius melodus* Population: [Atlantic Coast and Northern Great Plains populations] - Wherever found, except those areas where listed as endangered. There is **final** critical habitat for this species. Your location overlaps the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/6039	Threatened
Red Knot *Calidris canutus rufa* There is **proposed** critical habitat for this species. The location of the critical habitat is not available. Species profile: https://ecos.fws.gov/ecp/species/1864	Threatened
Red-cockaded Woodpecker *Picoides borealis* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/7614	Endangered
Roseate Tern *Sterna dougallii dougallii* Population: Northeast U.S. nesting population No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/2083	Endangered

Reptiles

NAME	STATUS
American Alligator *Alligator mississippiensis* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/776	Similarity of Appearance (Threatened)
Green Sea Turtle *Chelonia mydas* Population: North Atlantic DPS There is **final** critical habitat for this species. The location of the critical habitat is not available. Species profile: https://ecos.fws.gov/ecp/species/6199	Threatened
Kemp's Ridley Sea Turtle *Lepidochelys kempii* There is **proposed** critical habitat for this species. The location of the critical habitat is not available. Species profile: https://ecos.fws.gov/ecp/species/5523	Endangered
Leatherback Sea Turtle *Dermochelys coriacea* There is **final** critical habitat for this species. The location of the critical habitat is not available. Species profile: https://ecos.fws.gov/ecp/species/1493	Endangered
Loggerhead Sea Turtle *Caretta caretta* Population: Northwest Atlantic Ocean DPS There is **final** critical habitat for this species. The location of the critical habitat is not available. Species profile: https://ecos.fws.gov/ecp/species/1110	Threatened

Insects

NAME	STATUS
Monarch Butterfly *Danaus plexippus* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/9743	Candidate

Flowering Plants

NAME	STATUS
Rough-leaved Loosestrife *Lysimachia asperulaefolia* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/2747	Endangered
Seabeach Amaranth *Amaranthus pumilus* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/8549	Threatened

Critical habitats

There is 1 critical habitat wholly or partially within your project area under this office's jurisdiction.

NAME	STATUS
Piping Plover *Charadrius melodus* https://ecos.fws.gov/ecp/species/6039#crithab	Final

Migratory Birds

Certain birds are protected under the Migratory Bird Treaty Act[1] and the Bald and Golden Eagle Protection Act[2].

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.

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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 *Falco sparverius paulus* This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA https://ecos.fws.gov/ecp/species/9587	Breeds Apr 1 to Aug 31
American Oystercatcher *Haematopus palliatus* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/8935	Breeds Apr 15 to Aug 31

NAME	BREEDING SEASON
Atlantic Puffin *Fratercula arctica* 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. https://ecos.fws.gov/ecp/species/8943	Breeds Apr 15 to Aug 15
Bald Eagle *Haliaeetus leucocephalus* 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 Sep 1 to Jul 31
Black Scoter *Melanitta nigra* 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
Black Skimmer *Rynchops niger* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/5234	Breeds May 20 to Sep 15
Brown Pelican *Pelecanus occidentalis* 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. https://ecos.fws.gov/ecp/species/6034	Breeds Jan 15 to Sep 30
Brown-headed Nuthatch *Sitta pusilla* This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA	Breeds Mar 1 to Jul 15
Chimney Swift *Chaetura pelagica* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds Mar 15 to Aug 25
Common Loon *gavia immer* 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. https://ecos.fws.gov/ecp/species/4464	Breeds Apr 15 to Oct 31
Cory's Shearwater *Calonectris diomedea* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds elsewhere
Gull-billed Tern *Gelochelidon nilotica* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9501	Breeds May 1 to Jul 31

NAME	BREEDING SEASON
Lesser Yellowlegs *Tringa flavipes* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9679	Breeds elsewhere
Long-tailed Duck *Clangula hyemalis* 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. https://ecos.fws.gov/ecp/species/7238	Breeds elsewhere
Marbled Godwit *Limosa fedoa* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9481	Breeds elsewhere
Painted Bunting *Passerina ciris* This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA	Breeds Apr 25 to Aug 15
Prairie Warbler *Dendroica discolor* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds May 1 to Jul 31
Prothonotary Warbler *Protonotaria citrea* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds Apr 1 to Jul 31
Purple Sandpiper *Calidris maritima* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds elsewhere
Razorbill *Alca torda* 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 Jun 15 to Sep 10
Red-breasted Merganser *Mergus serrator* 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
Red-headed Woodpecker *Melanerpes erythrocephalus* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds May 10 to Sep 10
Red-throated Loon *Gavia stellata* 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

NAME	BREEDING SEASON
Ring-billed Gull *Larus delawarensis* 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
Royal Tern *Thalasseus maximus* 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
Ruddy Turnstone *Arenaria interpres morinella* This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA	Breeds elsewhere
Short-billed Dowitcher *Limnodromus griseus* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9480	Breeds elsewhere
Surf Scoter *Melanitta perspicillata* 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
White-winged Scoter *Melanitta fusca* 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
Willet *Tringa semipalmata* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds Apr 20 to Aug 5
Wilson's Plover *Charadrius wilsonia* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds Apr 1 to Aug 20
Wilson's Storm-petrel *Oceanites oceanicus* 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.

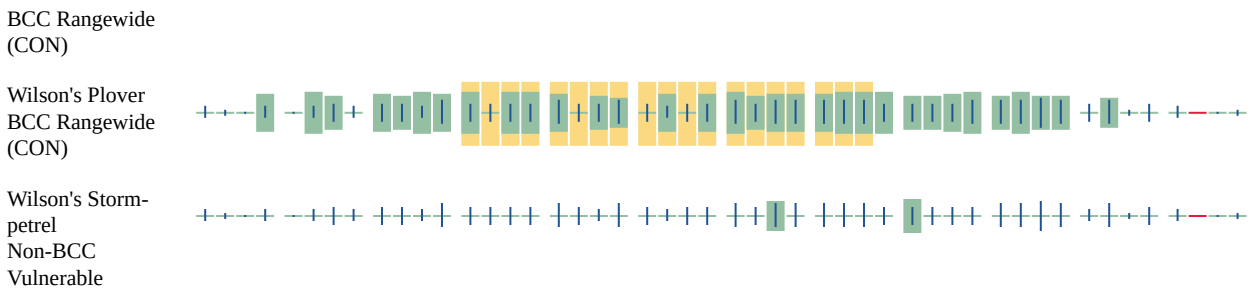
Survey Timeframe
Surveys from only the last 10 years are used in order to ensure delivery of currently relevant information. The exception to this is areas off the Atlantic coast, where bird returns are based on all years of available data, since data in these areas is currently much more sparse.

▪ probability of presence ▪ breeding season | survey effort – no data

SPECIES	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC


American Kestrel
BCC - BCR
American Oystercatcher
BCC Rangewide
(CON)
Atlantic Puffin
Non-BCC
Vulnerable
Bald Eagle
Non-BCC
Vulnerable
Black Scoter
Non-BCC
Vulnerable
Black Skimmer
BCC Rangewide
(CON)
Brown Pelican
Non-BCC
Vulnerable
Brown-headed
Nuthatch
BCC - BCR
Chimney Swift
BCC Rangewide
(CON)
Common Loon
Non-BCC
Vulnerable
Cory's Shearwater
BCC Rangewide
(CON)
Gull-billed Tern
BCC Rangewide
(CON)
SPECIES
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC
Lesser Yellowlegs
BCC Rangewide
(CON)
Long-tailed Duck
Non-BCC
Vulnerable
Marbled Godwit
BCC Rangewide
(CON)


Painted Bunting
BCC - BCR
Prairie Warbler
BCC Rangewide
(CON)
Prothonotary
Warbler
BCC Rangewide
(CON)
Purple Sandpiper
BCC Rangewide
(CON)
Razorbill
Non-BCC
Vulnerable
Red-breasted
Merganser
Non-BCC
Vulnerable
Red-headed
Woodpecker
BCC Rangewide
(CON)
Red-throated Loon
Non-BCC
Vulnerable
Ring-billed Gull
Non-BCC
Vulnerable
SPECIES
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC
Royal Tern
Non-BCC
Vulnerable
Ruddy Turnstone
BCC - BCR
Short-billed
Dowitcher
BCC Rangewide
(CON)
Surf Scoter
Non-BCC
Vulnerable
White-winged
Scoter
Non-BCC
Vulnerable
Willet



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-incidental-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 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

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.

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[1] and the Convention on International Trade in Endangered Species of Wild Fauna and Flora[2].

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[3] [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

West Indian Manatee *Trichechus manatus*

Species profile: https://ecos.fws.gov/ecp/species/4469

IPaC User Contact Information

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Phone: 9102514635

APPENDIX E

State Historic Preservation Officer (SHPO) Correspondence

Channels from Back Sound to Lookout Bight, Carteret County, NC

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 ≥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.

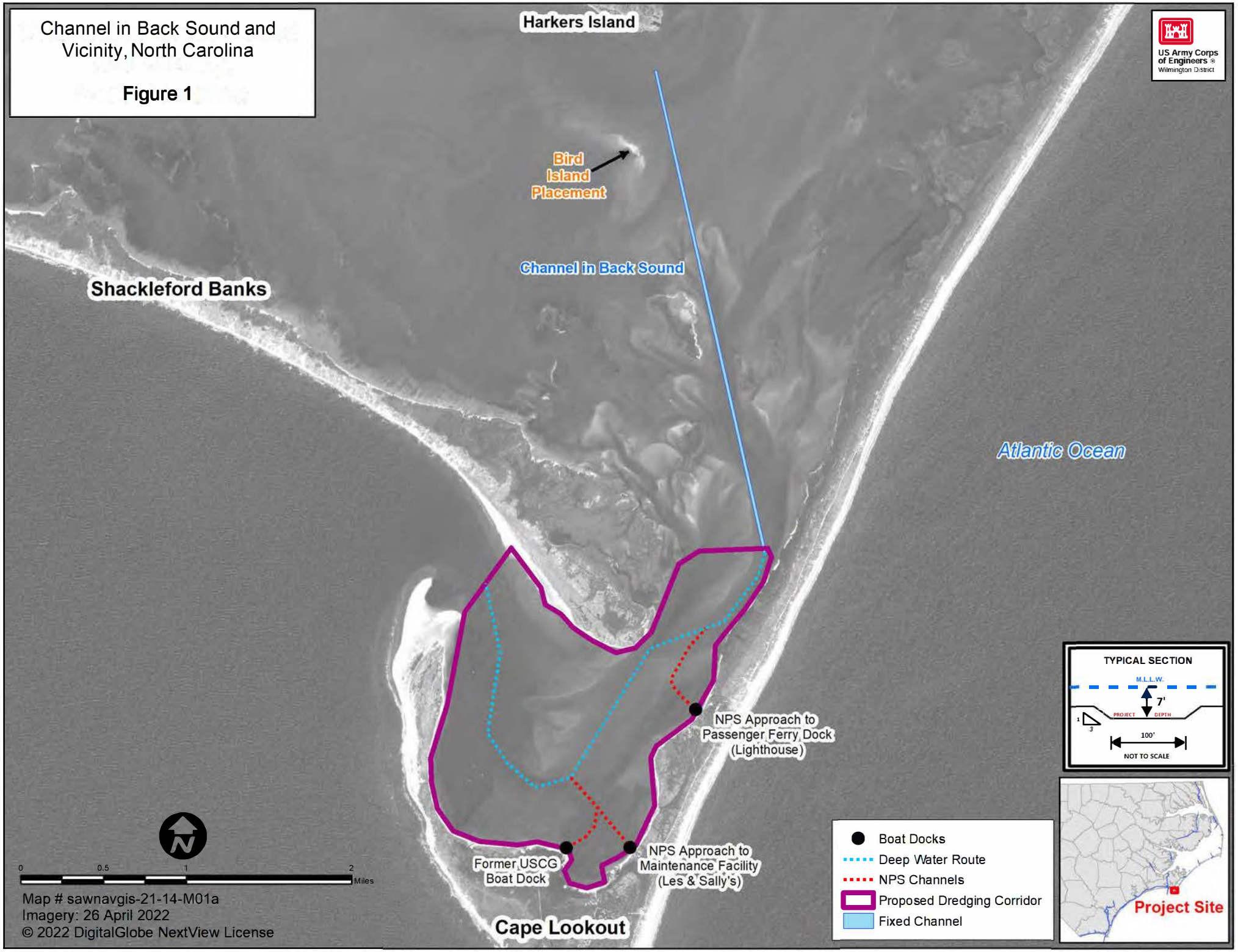
In order to effectively address any concerns that are raised, the Corps requests your input no later than 30 days from the date of this letter. Input may be directed to Ms. Emily Hughes, Environmental Resources Section, by email (Emily.B.Hughes@usace.army.mil).

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
US Army Corps of Engineers
Wilmington District
Harkers Island
Bird Island Placement
Channel in Back Sound
Shackleford Banks
Atlantic Ocean
NPS Approach to Passenger Ferry Dock (Lighthouse)
Former USCG Boat Dock
NPS Approach to Maintenance Facility (Les & Sally's)
Cape Lookout
TYPICAL SECTION
M.L.L.W.
7'
PROJECT DEPTH
1
3
100'
NOT TO SCALE
Boat Docks
Deep Water Route
NPS Channels
Proposed Dredging Corridor
Fixed Channel
Project Site
0
0.5
1
2
Miles
Map # sawnavgis-21-14-M01a
Imagery: 26 April 2022
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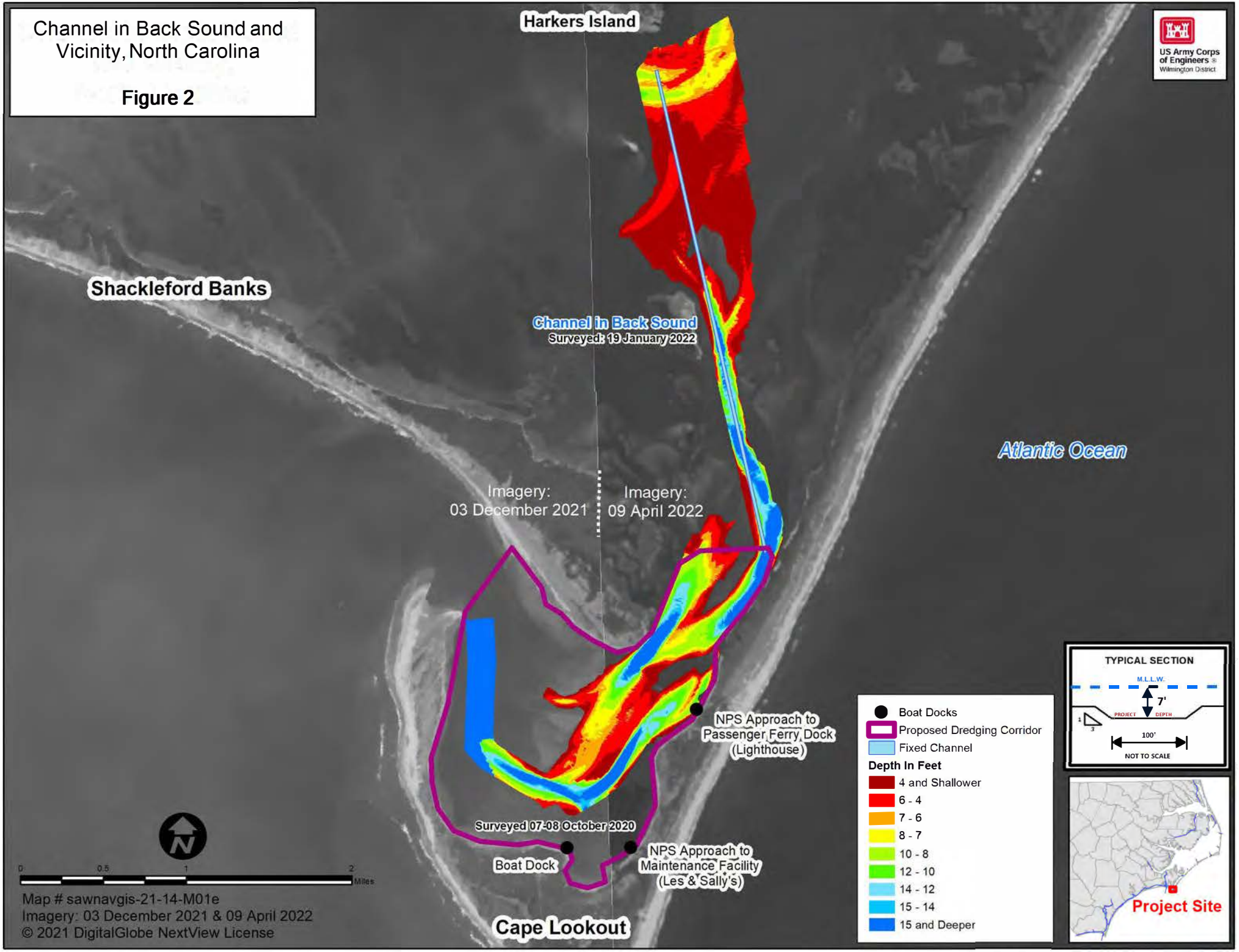
Channel in Back Sound and Vicinity, North Carolina
Figure 2
Harkers Island
US Army Corps of Engineers
Wilmington District
Shackleford Banks
Channel in Back Sound
Surveyed: 19 January 2022
Atlantic Ocean
Imagery:
03 December 2021
Imagery:
09 April 2022
NPS Approach to Passenger Ferry Dock (Lighthouse)
Surveyed 07-08 October 2020
Boat Dock
NPS Approach to Maintenance Facility (Les & Sally's)
Cape Lookout
Boat Docks
Proposed Dredging Corridor
Fixed Channel
Depth In Feet
4 and Shallower
6 - 4
7 - 6
8 - 7
10 - 8
12 - 10
14 - 12
15 - 14
15 and Deeper
TYPICAL SECTION
M.L.L.W.
7'
PROJECT DEPTH
1
3
100'
NOT TO SCALE
Project Site
0
0.5
1
2
Miles
Map # sawnavgis-21-14-M01e
Imagery: 03 December 2021 & 09 April 2022
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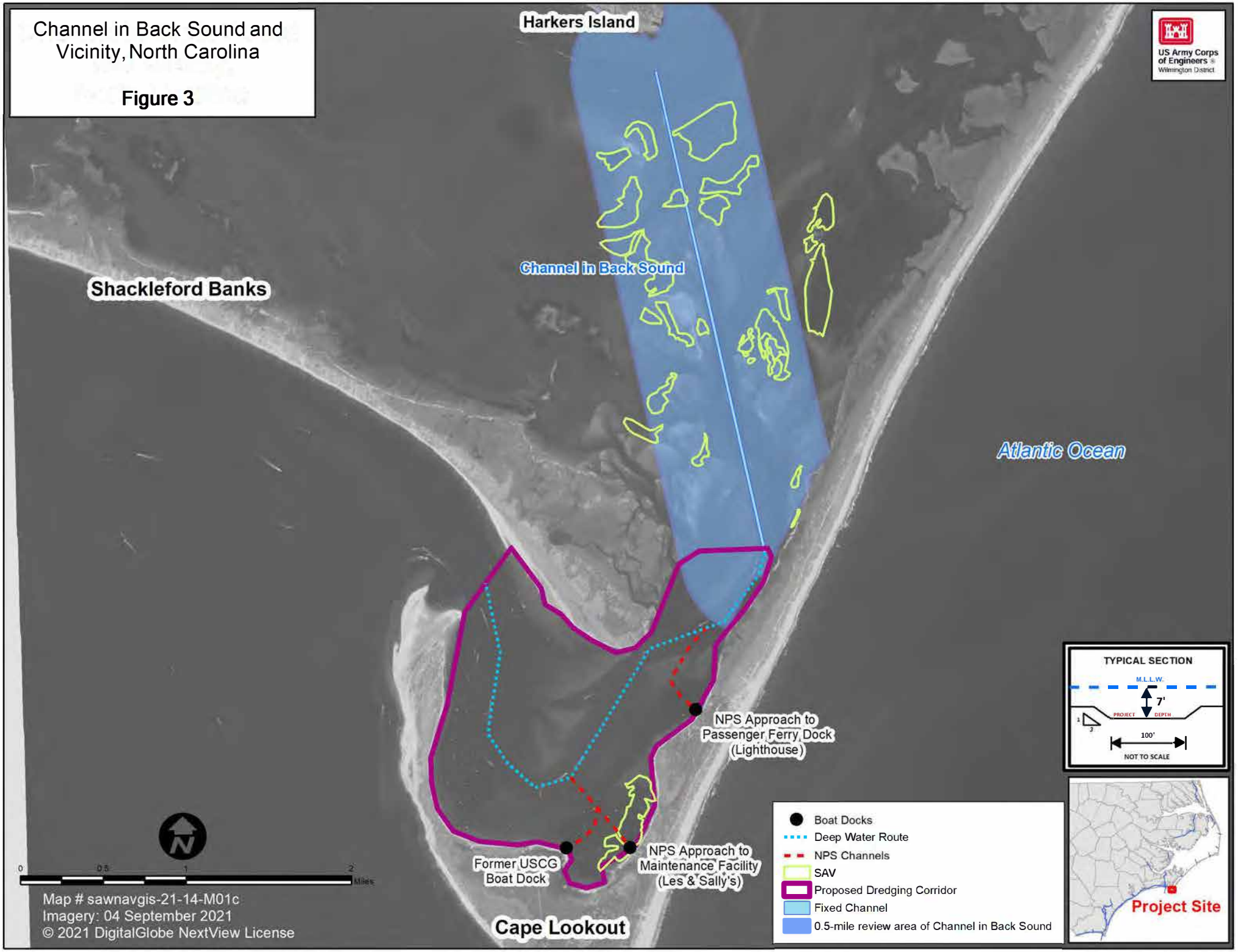
Channel in Back Sound and Vicinity, North Carolina
Figure 3
Harkers Island
US Army Corps of Engineers
Wilmington District
Channel in Back Sound
Shackleford Banks
Atlantic Ocean
NPS Approach to Passenger Ferry Dock (Lighthouse)
Former USCG Boat Dock
NPS Approach to Maintenance Facility (Les & Sally's)
Cape Lookout
TYPICAL SECTION
M.L.L.W.
7'
PROJECT DEPTH
100'
NOT TO SCALE
Boat Docks
Deep Water Route
NPS Channels
SAV
Proposed Dredging Corridor
Fixed Channel
0.5-mile review area of Channel in Back Sound
Project Site
0
0.5
1
2
Miles
Map # sawnavgis-21-14-M01c
Imagery: 04 September 2021
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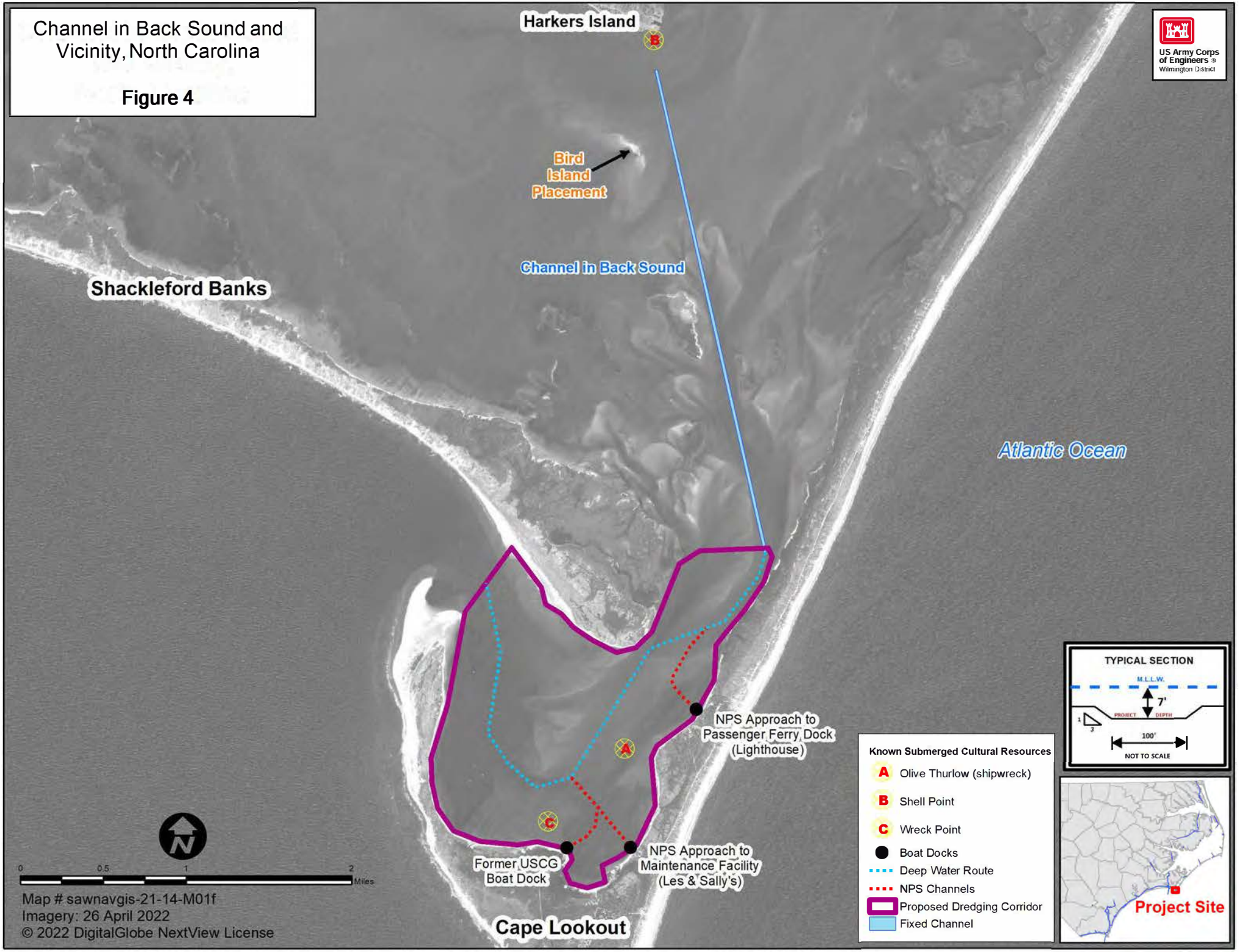
Channel in Back Sound and Vicinity, North Carolina
Figure 4
US Army Corps of Engineers
Wilmington District
Harkers Island
B
Bird Island Placement
Channel in Back Sound
Shackleford Banks
Atlantic Ocean
NPS Approach to Passenger Ferry Dock (Lighthouse)
A
C
Former USCG Boat Dock
NPS Approach to Maintenance Facility (Les & Sally's)
Cape Lookout
TYPICAL SECTION
M.L.L.W.
7'
PROJECT DEPTH
1
3
100'
NOT TO SCALE
Known Submerged Cultural Resources
A Olive Thurlow (shipwreck)
B Shell Point
C Wreck Point
Boat Docks
Deep Water Route
NPS Channels
Proposed Dredging Corridor
Fixed Channel
Project Site
N
0
0.5
1
2
Miles
Map # sawnavgis-21-14-M01f
Imagery: 26 April 2022
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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 justin.p.bashaw@usace.army.mil
Cultural Resources Manager
U.S. Army Corps of Engineers, South Atlantic Division
Wilmington District

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. In all future communication concerning this project, please cite the above referenced tracking number.

Sincerely,

Renee Gledhill-Earley

for Ramona Bartos, Deputy
State Historic Preservation Officer

US Army Corps of Engineers ®
Wilmington District

APPENDIX F

CONSIDERATION OF POTENTIAL IMPACTS OF CLIMATE CHANGE AND SEA LEVEL RISE ON MAINTENANCE DREDGING OF CHANNELS FROM BACKSOUND TO LOOKOUT BIGHT

April 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^{o}F since the beginning of the 20th 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.

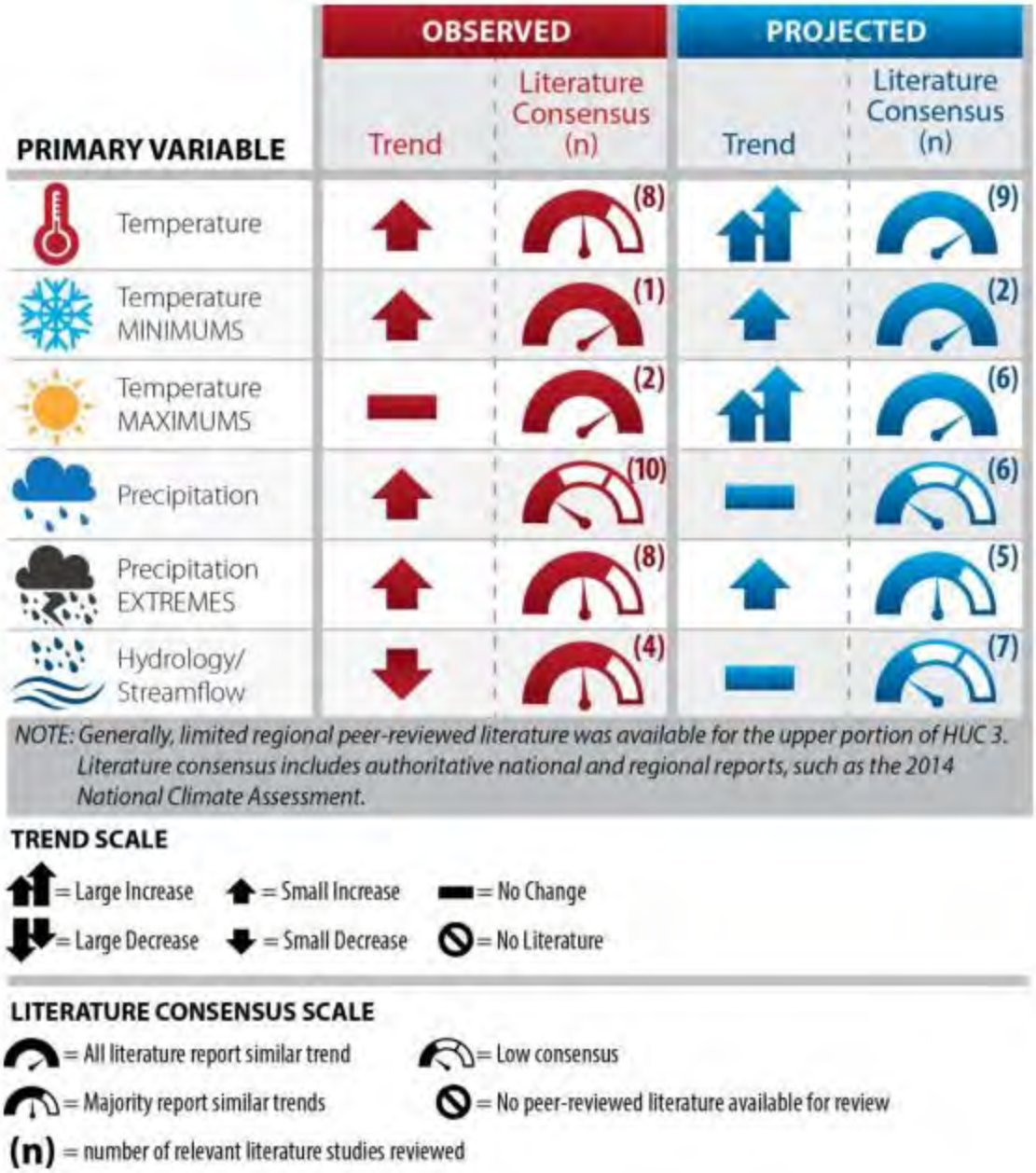

Figure 1. Summary matrix of observed and projected climate trends.

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 is 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.

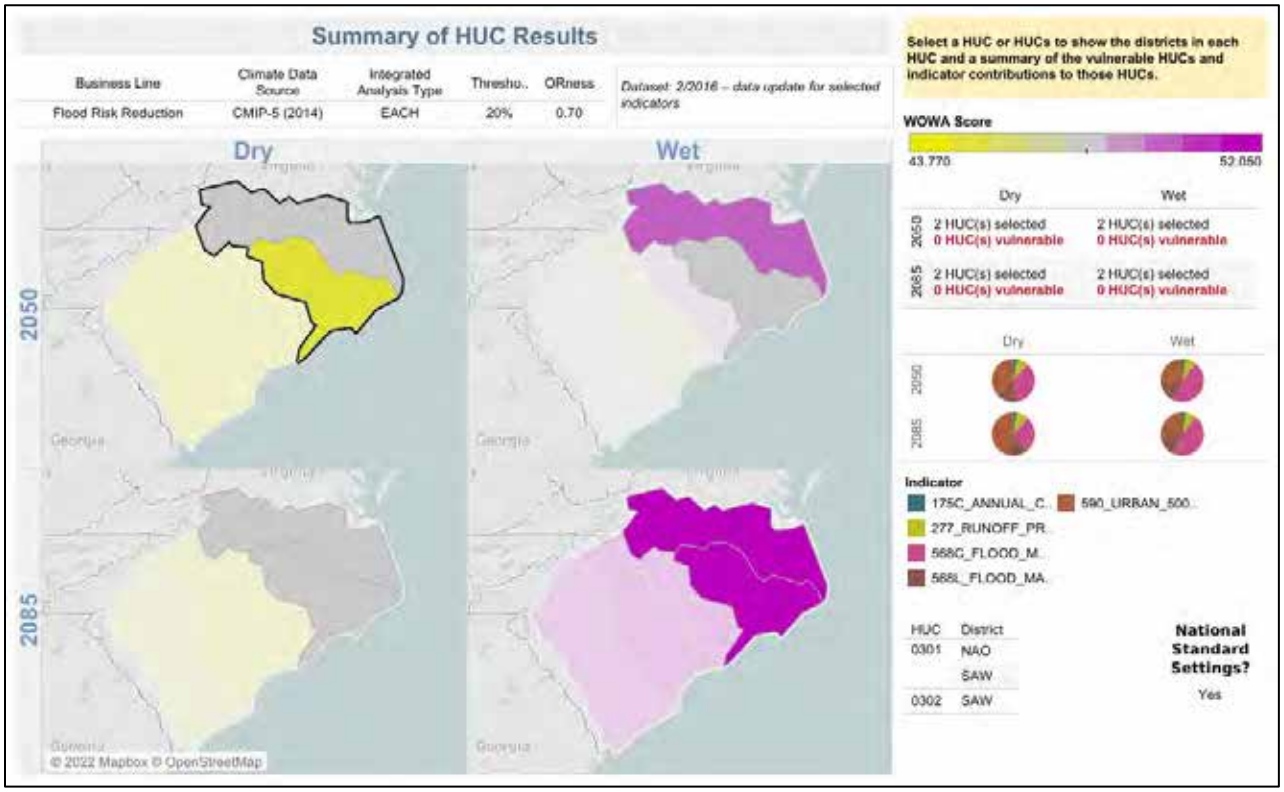

Figure 2. Projected Vulnerability for Chowan-Roanoke and Neuse-Pamlico Watersheds with respect to Flood Risk Reduction.

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 W/m^2 before 2100 and the RCP 8.5 scenario represents a rising radiative forcing pathway leading to 8.5 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.

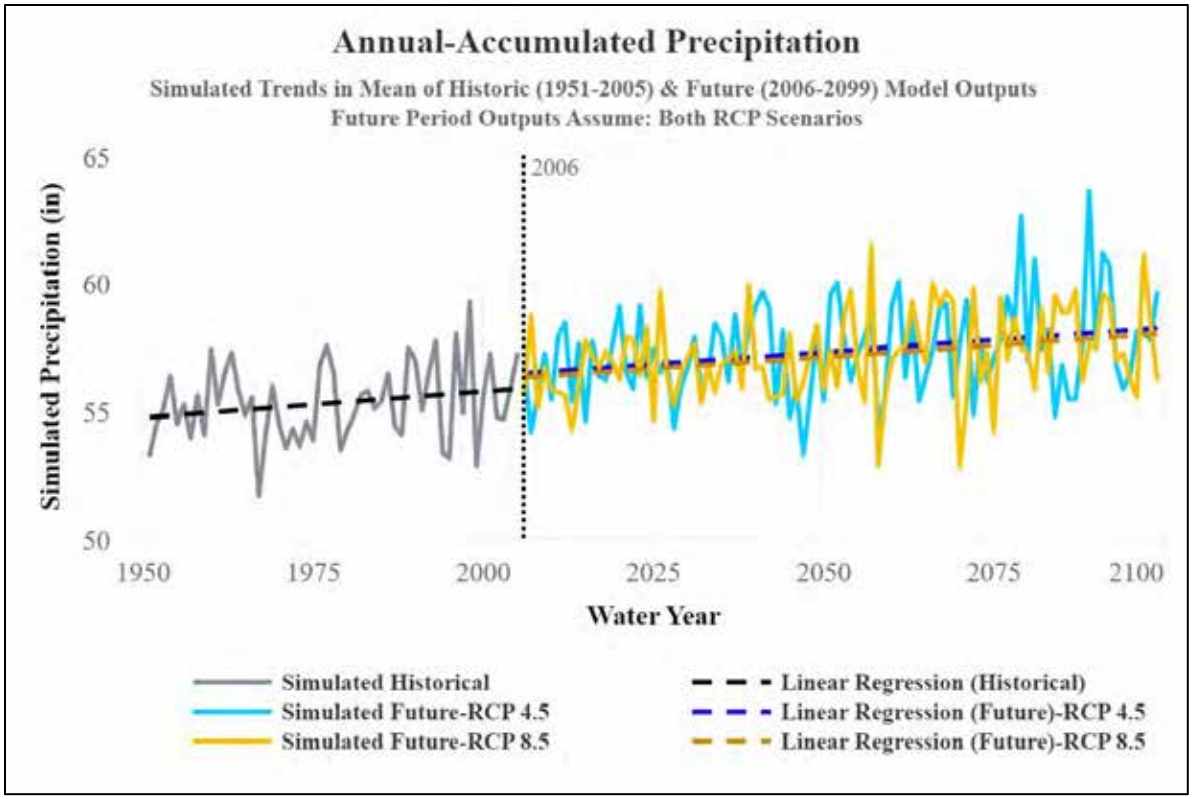

Figure 3. Trends in Projected Annual Accumulated Precipitation for the Bogue-Core Sounds Watershed.

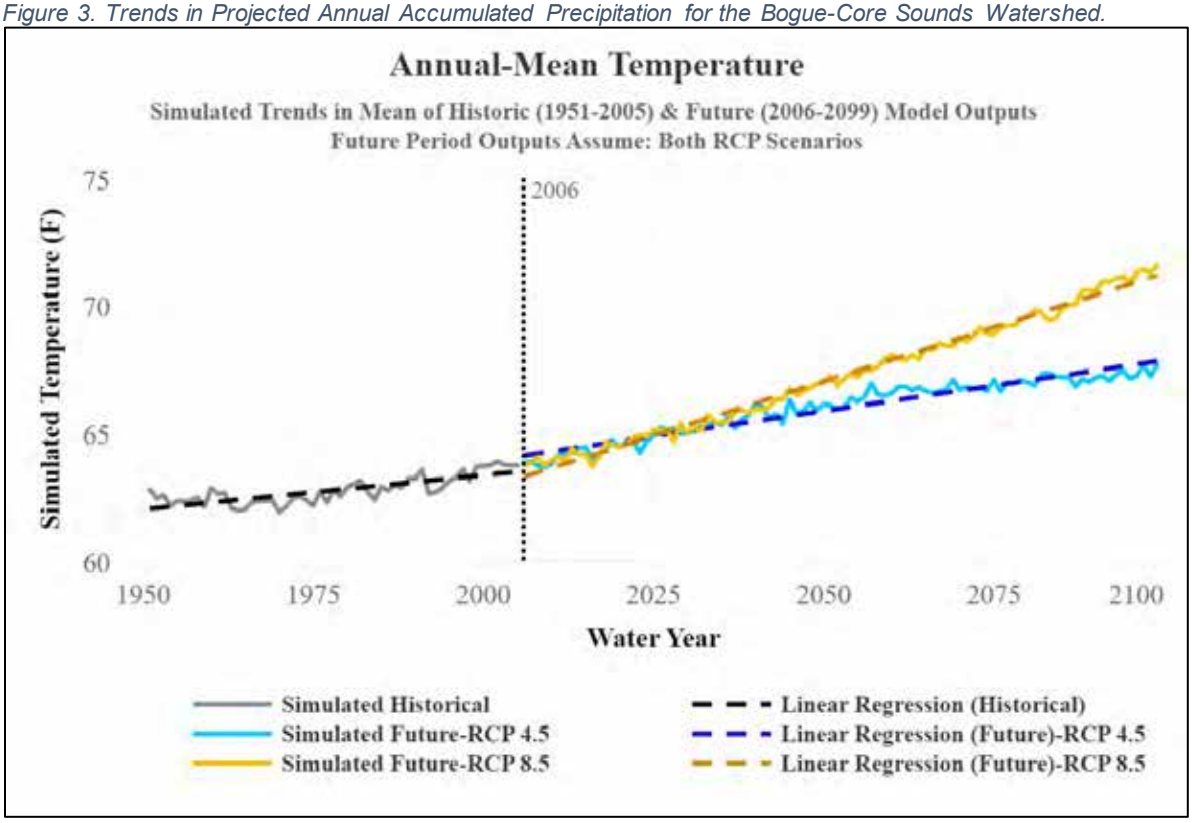

Figure 4. Trends in Projected Annual Mean Temperature for the Bogue-Core Sounds Watershed.

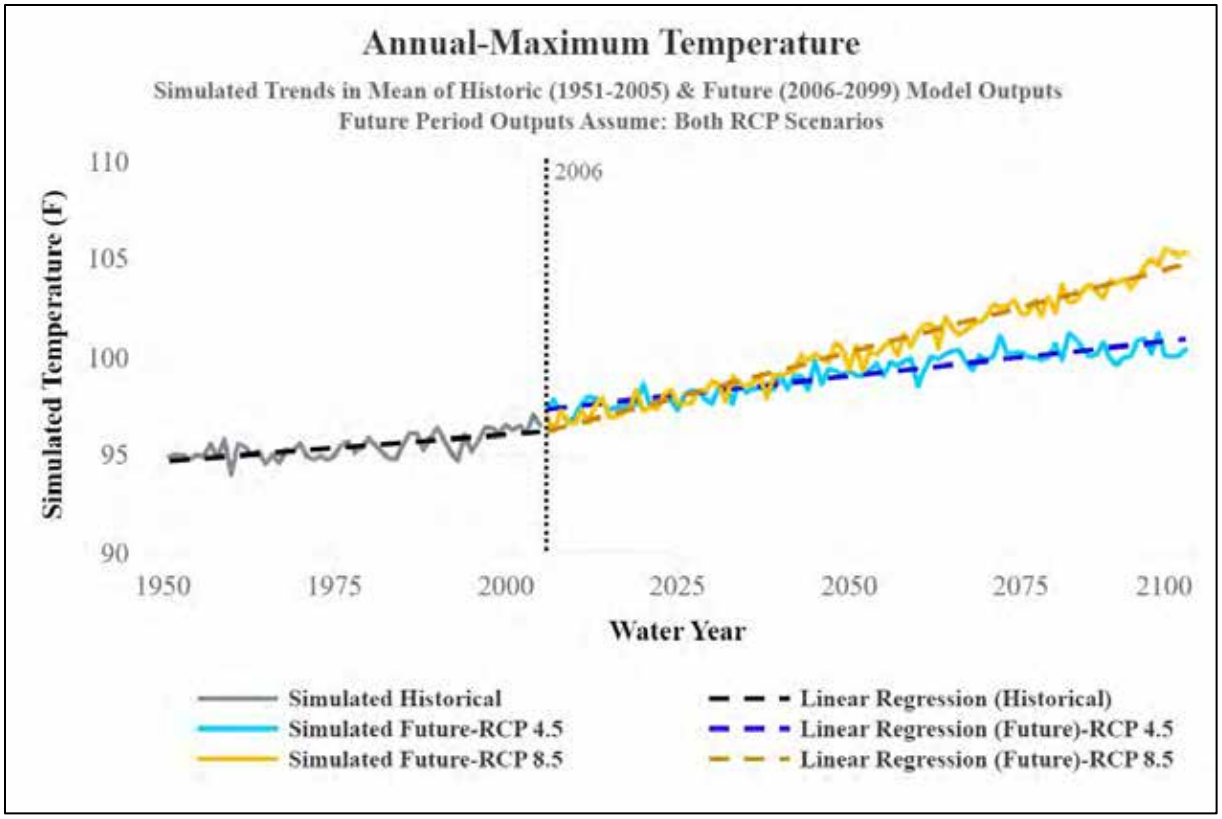

Figure 5. Trends in Projected Annual Maximum Temperature for the Bogue-Core Sounds Watershed.

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.

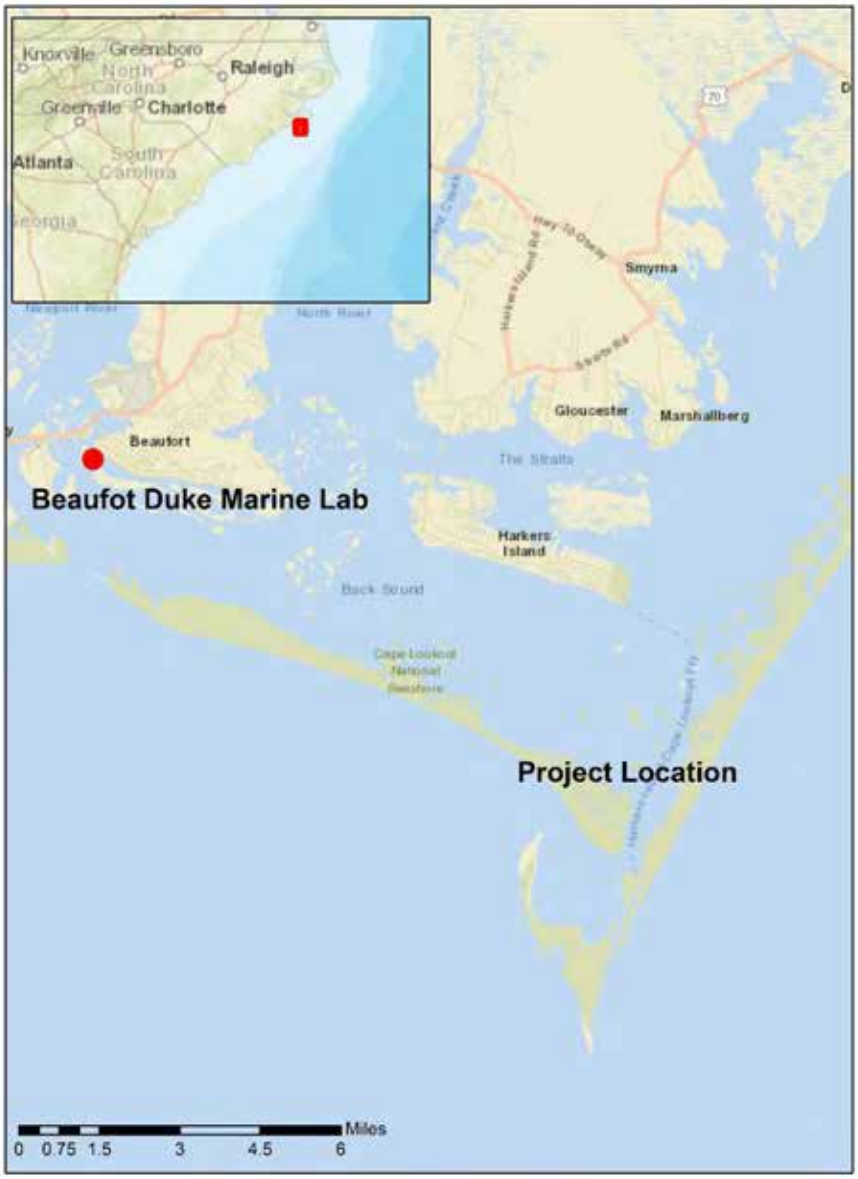

Figure 6. NOAA tidal station location.

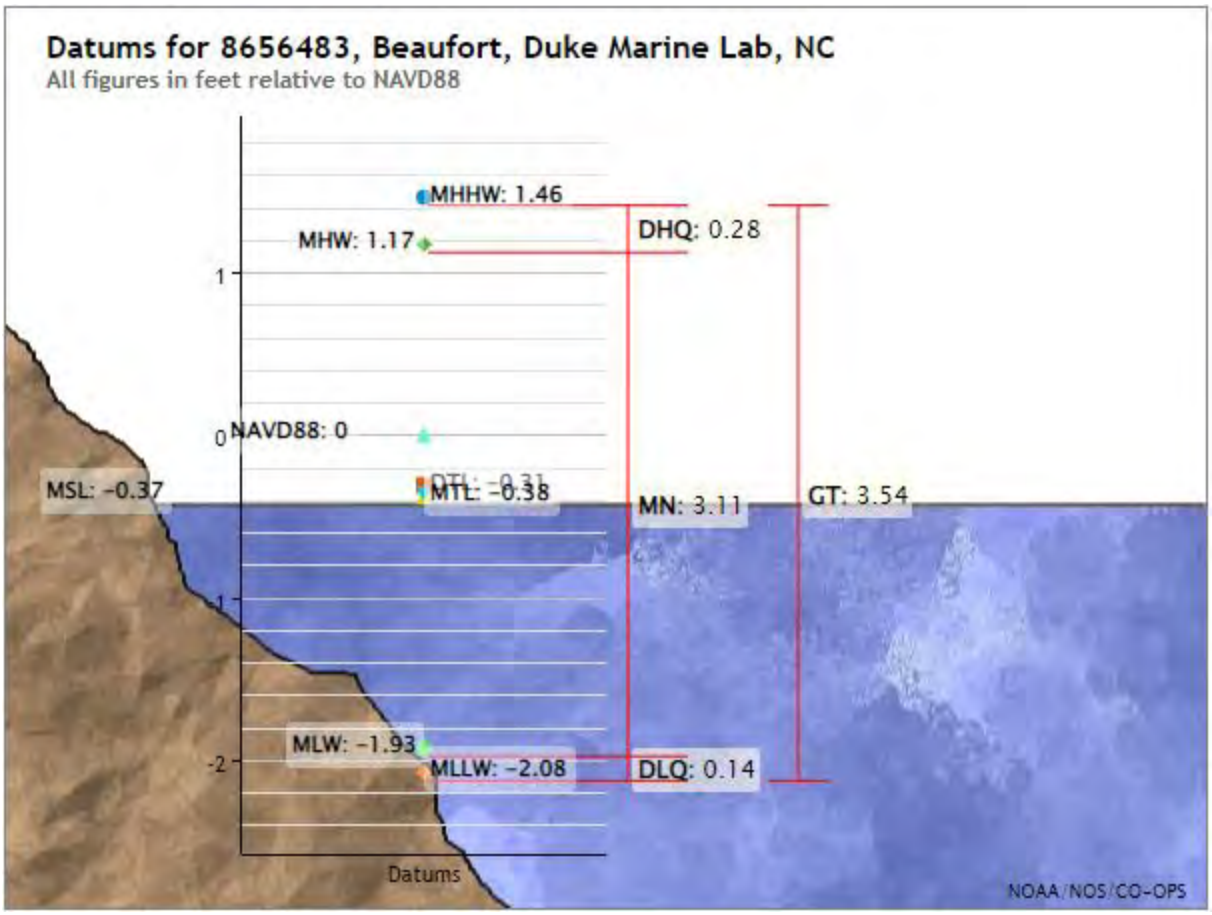

Figure 7. Beaufort Duke Marine lab gauge datum in reference to NAVD88.

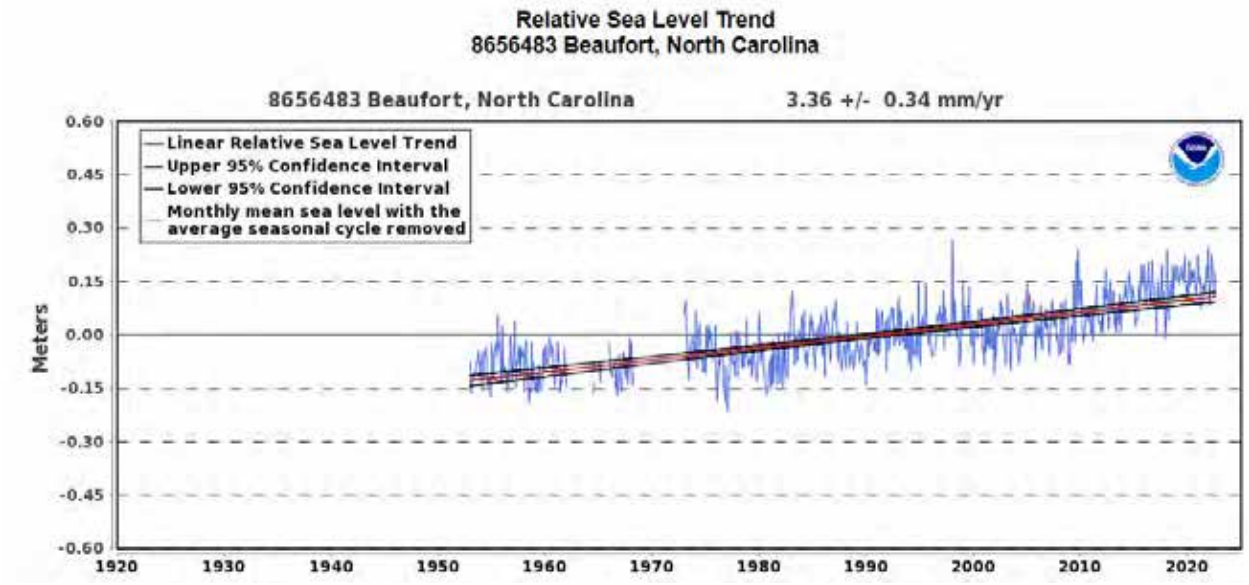

Figure 8. Beaufort Duke Marine Lab gauge RSLC.

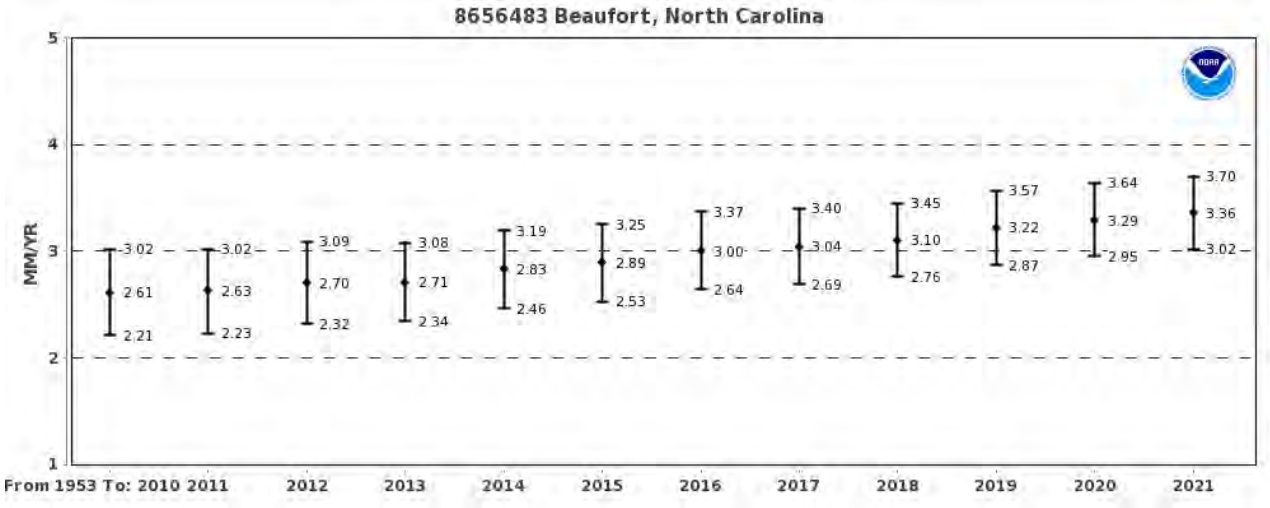

Figure 9. Historical linear SLC rates for the Beaufort Duke Marine Lab gauge.

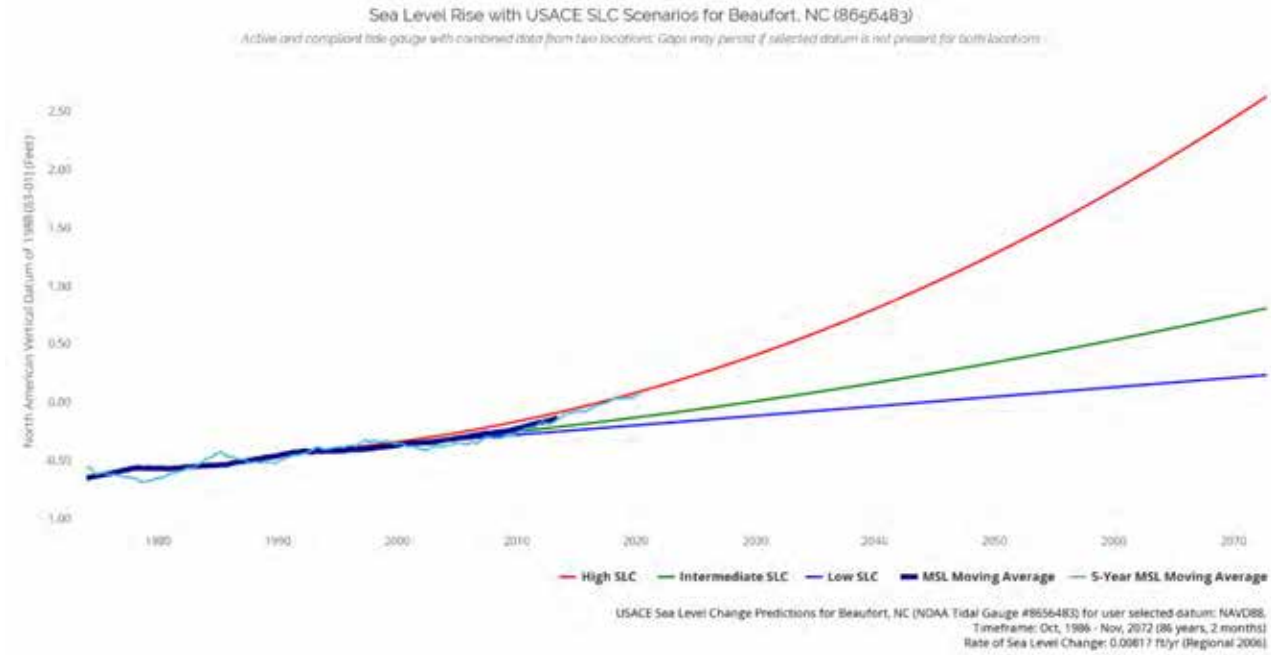

Figure 10. SLC scenarios for the Beaufort Duke Marine Lab gauge.

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 rise 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 leave 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

CHANNELS FROM BACK SOUND TO LOOKOUT BIGHT

EA MAILING LIST

BACK SOUND TO LOOKOUT BIGHT EA EMAIL LISTING		
Line No.	**Organization / Title**	**POC Name**
	ELECTED OFFICIALS	
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
	NON-PROFIT ORGANIZATIONS	
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
	RESOURCE AGENCIES	
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
	OTHER	
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