Appendix I
Geotechnical Engineering

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1. Geology.

a. Physiography and Geomorphology

The project study area is located in the Atlantic Coastal Plain Physiographic Province. This area is a small part of a barrier island complex known as the Outer Banks, which forms a large part of the eastern North Carolina coastline. The Outer Banks separate the Albemarle and Pamlico Sounds from the Atlantic Ocean. The geomorphology of the area is characterized by landforms typical of a barrier island complex and include beaches, berms, and dunes. Submerged just offshore are ridges and shoals oriented subparallel to the coast, which appear to have formed at lower sea level elevations.

b. Stratigraphy

The Atlantic Coastal Plain in this region is underlain by relatively flat-lying sedimentary units which thicken generally to the east-southeast. These sedimentary units overlie a crystalline basement rock.

In the shallow subsurface are Pleistocene and Holocene clastic sedimentary sequences which typically unconformably overlie Pliocene units including the Yorktown Formation. Blanketing the Pleistocene and Holocene sequences is a veneer of sand masses comprising the dunes, berms, and beaches on land and covering a significant portion of the adjacent ocean bottom. The thickness of this blanket is variable and generally up to approximately 30 feet with the exception of dune areas.

Offshore, lateral and vertical facies changes can be complex. Paleofluvial channel fill sequences have been created when river and stream channels of various sizes incised the Pleistocene and Holocene units and were in turn infilled with sediments. The project areas experiencing the highest rates of shoreline erosion are underlain by channels infilled with a significant amount of under consolidated fine-grained soils. Settlement due to the consolidation of this paleochannel fill contributes to the accelerated rate of erosion in these areas.

Several borrow areas have been delineated. The beachfill to be used to nourish the beach will come primarily from the seismically-transparent unit referred to below. This unit is Post-Pleistocene or Holocene in age.

2. Subsurface Investigation.

a. Geophysical Investigation

1) **General**. The geophysical investigation was conducted as a cooperative effort between the USACE Wilmington District, the North Carolina Geological Survey, and NC State University. Two separate surveys were conducted in July and August 1994, from the 105-foot R/V SEAWARD EXPLORER. Over 535 line miles of subbottom data were collected along 34 tracklines. Twenty-four (24) tracklines were shore-parallel to insure thorough coverage. Tie lines were run diagonally. (See Attachment 1.)

2) **Borrow Search Area.** Data was collected in the area between the 30-foot and 60-foot isobaths in a long rectangular area extending along the coast from the Outer Banks Fishing Pier in South Nags Head to the Kitty Hawk Fishing Pier on the Kitty Hawk-Southern Shores boundary. (See Plate I - 1.) In some shallow areas the 3-mile limit of North Carolina territorial waters was used as the eastern boundary of the survey area. A few geophysical survey tracklines extended from Oregon Inlet to the pier at Duck, NC.

3) **Geophysical Methods.** Two types of sub-bottom methods were used, high-resolution seismic reflection and CHIRP sonar. These were augmented with side-scan sonar and fathometer data. The geophysical survey data was groundtruthed with vibracores penetrating a maximum of 20 feet (see section on vibracores). The vibracore locations were chosen using the seismic data. No deep borings were performed for groundtruthing. In addition, 525 miles of digital side-scan sonar data was collected concurrent with subbottom imaging.

   Dr. Steven Shock of Precision Signal, Inc., provided a CHIRP-Sonar System which was used to collect approximately 55 miles of data until the towfish was severely damaged on a submerged hazard. Field repairs were made periodically until the topside unit also failed. Dr. Steven Snyder of NC State University then used his high–resolution seismic reflection system to provide the majority (480 miles) of the subbottom imaging.

4) **Survey Positioning.** A differential global positioning system was used to determine position along the survey lines. Equipment included a Trimble NavTrac XL and a Trimble NavBeacon XL. Navigation fixes were recorded on a laptop PC every 3-5 seconds. Loran positioning data was also recorded using a NorthStar 8000 System and a laptop computer.

5) **Depth Sounder.** Bathymetric data was collected at 3-5 second intervals using a FURUNO Model FCV-667 Precision Depth Recorder system with a dual-frequency transducer for 50 and 200 kHz. Tide data from the CERC facility at Duck, NC was used to correct the fathometer readings.

6) **CHIRP Sonar System.** The full-spectrum subbottom CHIRP- Sonar System was manufactured by Precision Signal, Inc. The towfish was a prototype low-frequency transducer unit for the next generation of EG&G EXSTAR. It was tuned so that most of the energy was in the 900 Hz to 2 kHz range. This CHIRP-Sonar system produced excellent submeter-scale resolution of the upper 30 to 70 feet of the subbottom stratigraphy.

7) **Seismic Reflection Profiling System.** A single-channel, high-resolution digital acquisition Delph2\ELICS Seismic Reflection System with an EG&G UNIBOOM Seismic Source was used to acquire the seismic data. This seismic reflection system penetrated 200 to 300 feet with good resolution of the subbottom reflectors.

8) **Summary of Results.**

   a) **Stratigraphy.** The geophysical surveys showed the shallow subbottom stratigraphy to be a stacked series of locally tabular sedimentary sequences dissected by small paleofluvial channels of limited lateral extent. One notable exception was the well-delineated 4 to 5 mile wide ancestral fluvial channel of the prehistoric Roanoke-Albemarle River System.

   A review of the processed seisections indicates a surficial seismically-transparent unit which generally exists on shoal features. The seismic transparence of this unit is likely the result of a combination of factors including internal homogeneity, frequencies used, and location just below the sea bottom. The seismically-transparent unit is also detectable as the light gray sonogram signature found in the side-scan data.

   b) **Vibracore Targets.** Drilling targets were identified on the seismic cross-sections. In the first round of drilling in 1995, 73 vibracores were recovered and analyzed from these features.

   c) **Borrow Areas.** The results of the 1995 vibracore drilling and the seismic cross-sections were subsequently used together to define the physical boundaries of the borrow search areas in preparation for the second vibracoring to "prove out" the sand resources.

b. Vibracore Investigation

1) **1995 Vibracoring.** The initial subsurface investigation was performed in 1995. The boring locations were based on the seismic data collected in the previous year by Professor Steve Snyder, of North Carolina State University, College of Physical and Mathematical Sciences, Department of Marine, Earth and Atmospheric Sciences. The criteria for the boring locations was between .5 and 3 miles from the beach, water depth of less than 50 feet, and change in seismic profile, which could represent differing soil types. Borings were prioritized to allow for obtaining samples from the most promising areas first.

   Borings were performed from the Snell using a 3 7/8 inch diameter, 20 foot long, Alpine vibracore drill machine. The sampler consists of a metal barrel in which a plastic cylinder is inserted. After the plastic tube was inserted, a metal shoe was screwed onto the plastic tube and then the metal barrel. The shoe provided a cutting edge for the sampler and retained the plastic tube. An air-powered vibrator was mounted at the upper-most end of the vibracore barrel, and the vibrator and the vibracore barrel was mounted to a stand. This stand was lowered to the ocean floor by the Snell's crane, the vibrator was activated and vibrated the vibracore barrel into the ocean sediment. The sediment sample is retained in the plastic cylinder. All borings were drilled to a depth of 20 feet below the ocean floor, unless vibracore refusal was encountered. Vibracore refusal was defined as a penetration rate of less than 0.1 feet in 10 seconds.

   Sampling began on August 13, 1995 and terminated on August 24, 1995. A total of 73 borings were performed during this time period. Poor weather limited the ability of the vessel to operate offshore. This had a great affect on the production during the time scheduled for drilling. Borings performed during this investigation are designated NDC-300 and NDC-400. See Plate I-1.

   The recovered vibracore tubes were turned over to the State of North Carolina for logging, testing and archiving as part of the cost share agreement. The cores were logged by Mr. Bill Hoffman, of the North Carolina Geological Survey, and Mr. Steve Boss, of North Carolina State University, College of Physical and Mathematical Sciences, Department of Marine, Earth and Atmospheric Sciences. Soils were visually classified in accordance with the Wentworth Classification System. Representative samples were taken of each material type. Grain size tests were performed on these samples by the North Carolina Department of Transportation, using ASTM D-422 procedures, with an eleven-sieve test. The sieves used in these tests were the #4, #10, #18, #20, #35, #40, #60, #100, #120, #200 and #230. Boring logs and grain size test results are in Attachment 2 and Attachment 3 respectively.
2) **1998 Vibracoring:** The secondary subsurface investigation was performed in 1998. The boring locations were based on the seismic data

and the results of the borings, performed in 1995. Borings, which were not performed in 1995 and appear to be in areas which may contain suitable borrow material, were performed first. Then borings which further define the extent of the suitable material were performed. The criteria for the borrow area boring locations was between .5 and 3 miles from the beach, water depth of less than 50 feet, and change in seismic profile, which could represent differing soil types. Borings were prioritized to allow for obtaining samples from the most promising areas first.

Borings were performed from the Snell using the same 3 7/8 inch diameter, 20 foot long, Alpine vibracore drill machine which was used in 1995. Sampling began on June 22, 1998 and was completed on July 15, 1998. A total of 132 borings were performed during this time period. Borings performed during this investigation are designated NDC-500, NDC-600 and NDC-700. Also, some additional borings designated NDC-400, which were not drilled in 1995, were performed at this time. See Plate I-1.

The recovered vibracore tubes were logged by Wilmington District personnel and the soil samples were visually classified in accordance with the Unified Soils Classification System. Representative samples were taken of each material type. Grain size tests were performed in accordance with ASTM D-422 using an eight-sieve test and visual classifications were performed in accordance with ASTM D-2488, by Catlin Engineers and Scientists, Inc. The sieves used in these tests were the 3/8-inch, #4, #10, #20, #40, #60, #100, and #200. Boring logs and grain size test results are in Attachment 2 and Attachment 3 respectively.

3. Borrow Areas.

a. General

Five borrow areas have been selected for the Dare County Project. Two of the areas are in Southern Kitty Hawk, areas N1 and N2, and three of the areas are in Southern Nags Head, areas S1, S2 and S3. These areas are typically between .5 and 3 miles offshore, have bottom depths between25 and 60 feet, contain material that has approximately 10% passing the #200 sieve or less, and contain material that is compatible with the existing material on the beaches. The predominate material types are clean sand (SP), slightly silty sand (SP-SM), and silty sand (SM), with minor amounts of very silty sand (SM), silt (MH and ML), and clay (CH). See Plate I-1.

Area S1 has such large volume of suitable material that it is the only borrow area that will be used at the south end of the project. Areas S2 and S3 do not contain material that is as suitable as Area S1, and therefore there are no plans to use these areas at the present time.

Between the North and South areas lies the old channel fill. This material is typically too fine to be satisfactory material for beach fill.

1) **Area N1.** This area is the northern most borrow area in Kitty Hawk. It is between .5 and 1.7 miles offshore, it is approximately 794 acres in area and contains approximately 5,192,000 cubic yards of material. The total amount of material in this borrow area passing the #200 sieve is approximately 9 %. The surface elevation in this area ranges from approximately -30 MLLW to -60 MLLW. See Plate I-2.

2) **Area N2.** This area is the southern most borrow area in Kitty Hawk. It is between .5 and 1.9 miles offshore, it is approximately 332 acres in area and contains approximately 2,353,000 cubic yards of material. The total amount of material in this borrow area passing the #200 sieve is approximately 6 %. The surface elevation in this area ranges from approximately -30 MLLW to -55 MLLW. See Plate I-2.

3) **Area S1.** This area is the southern most borrow area and the farthermost offshore in Nags Head. It is between .9 and 3.5 miles offshore, it is approximately 5,701 acres in area and contains approximately 104,454,000 cubic yards of material. The total amount of material in this borrow area passing the #200 sieve is approximately 5 %. The surface elevation in this area ranges from approximately -25 MLLW to -60 MLLW. See Plate I-3.

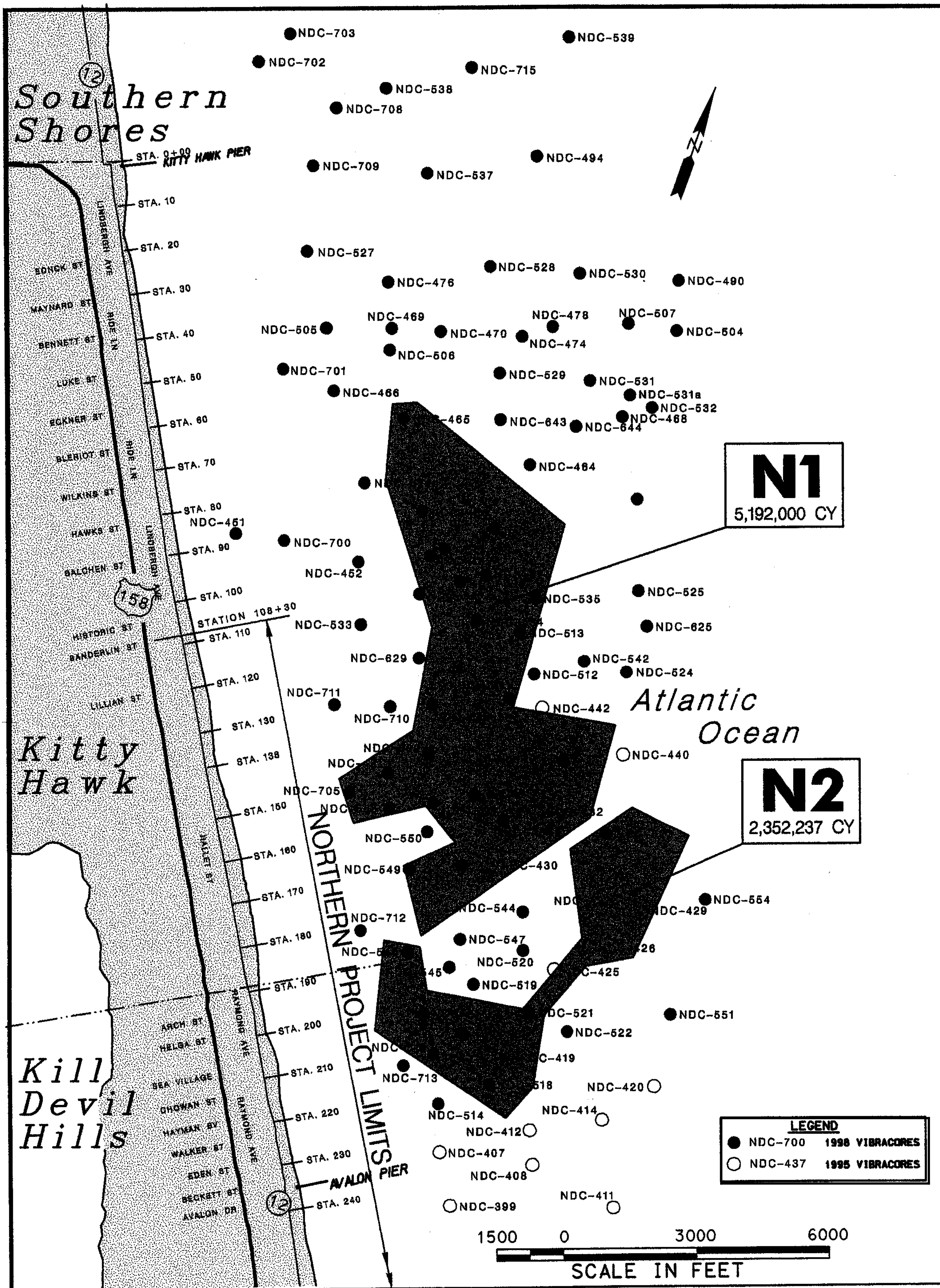
4) **Area S2.** This area is the southern most borrow area in Nags Head. It is between .8 and 1.8 miles offshore, it is approximately 986 acres in area and contains approximately 7,219,000 cubic yards of material. The total amount of material in this borrow area passing the #200 sieve is approximately 11 %. The surface elevation in this area ranges from approximately -40 MLLW to –60 MLLW. See Plate I-3.

5) **Area S3.** This area is the northern most borrow area in Nags Head. It is between .5 and 1.0 miles offshore, it is approximately 177 acres in area and contains approximately 1,388,000 cubic yards of material. The total amount of material in this borrow area passing the #200 sieve is approximately 13 %. The surface elevation in this area ranges from approximately -30 MLLW to -55 MLLW. See Plate I-3.

4. Conclusions.

There is an adequate quantity of suitable beach quality material to complete the full 50-year life of the project. For a complete description of the borrow area materials and the sand compatibility see Appendix D, Coastal Appendix and Appendix E, Sand Compatibility Analysis.

Areas to be used for borrow will be further defined during the plans and specification phase of this project. Additional borings will be performed to better delineate the borrow area boundaries and material types. Vibracore borings will be performed in a grid pattern, on a 500 foot to 1000 foot spacing, in any area prior to its use as a borrow source. Approximately 100 borings will be performed for the initial nourishment and each renourishment of the beach.



Northern Borrow Area Boring Locations

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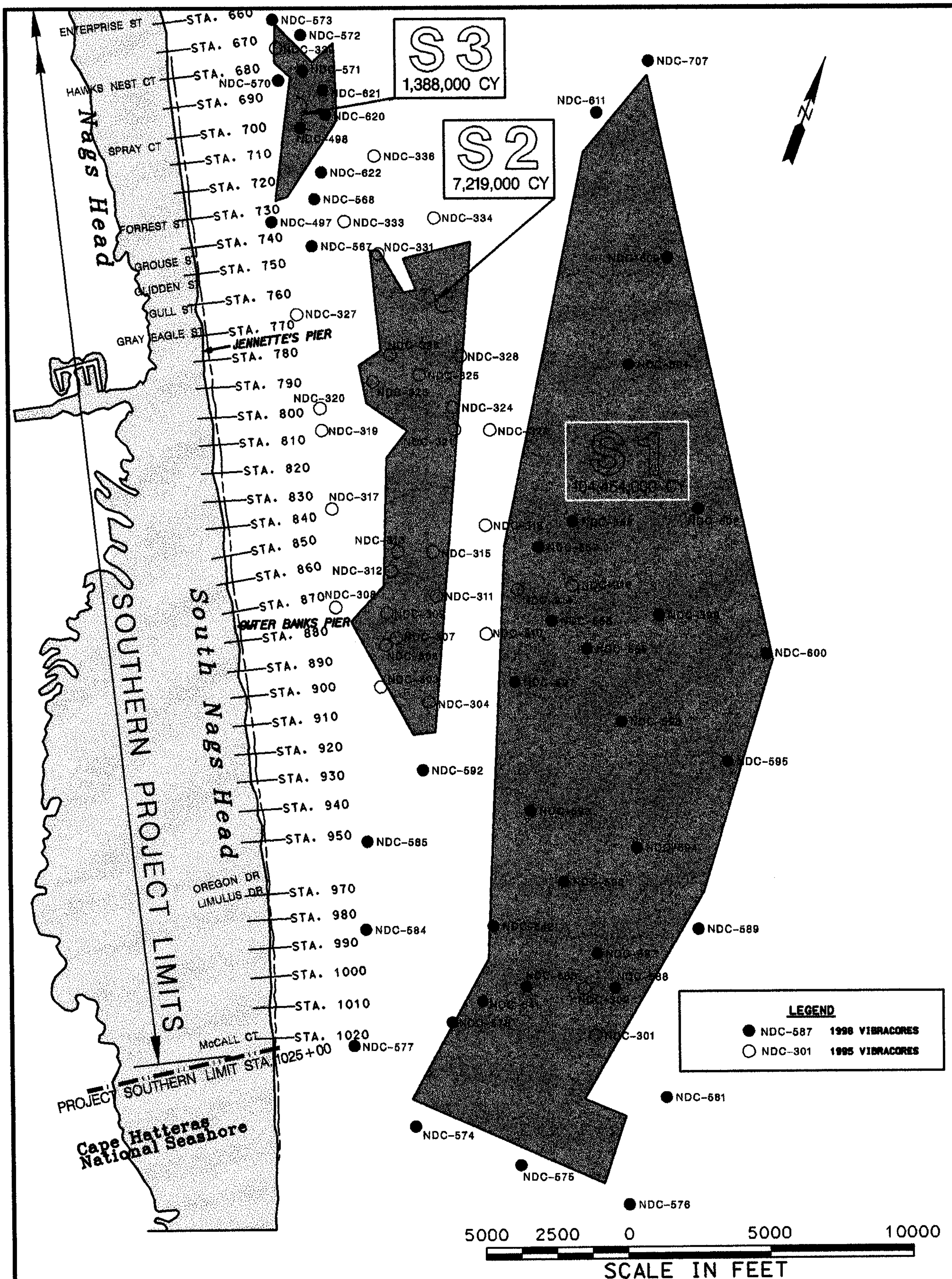
Plate I-2



Southern Borrow Area Boring Locations

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Plate I-3

Attachment 1
Evaluation of Potential Sand Resources for Beach Nourishment off the North Dare County Coastline
By
Dr. Stephen W. Snyder

Evaluation of Potential Sand Resources for Beach Nourishment off the North Dare County Coastline

Final Report

Submitted
July 1997

by

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FINAL REPORT

Evaluation of Potential Sand Resources for Beach Nourishment off the North Dare County Coastline

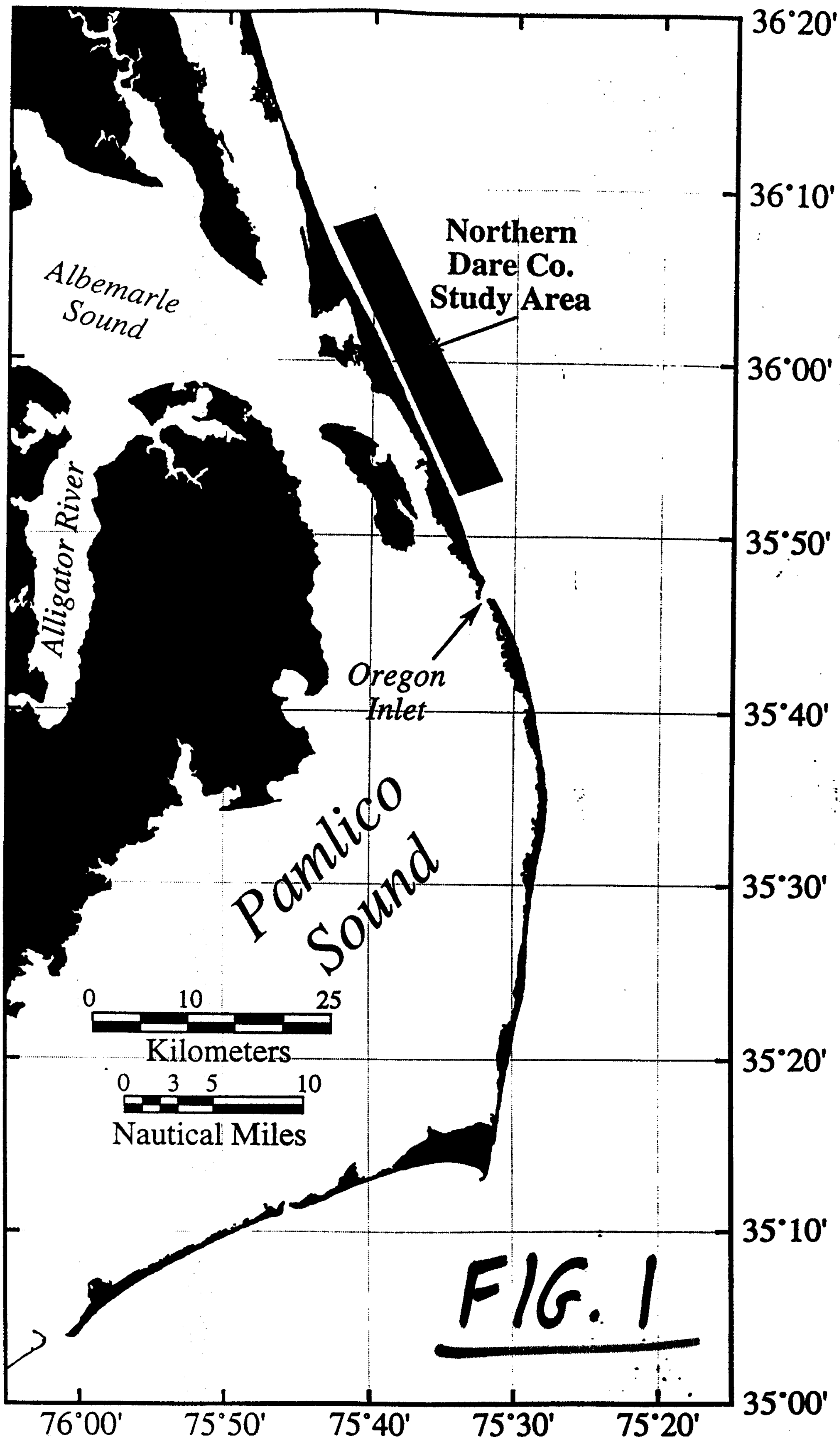
1.0 INTRODUCTION

NCSU was contracted by the State of North Carolina to initiate a sand resource investigation of the NC State territorial waters located off the northern Outer Banks coastline (Figure 1). This study is part of a Dare County Feasibility Study being conducted by the US Army Corps of Engineers (USACOE), Wilmington District.

Three areas along the northern Dare County coastline were identified as critical sites where severe damage is incurred annually due to destructive power of multiple storm events. The three sites are marked in Figure 2, which also depicts the local, long-term, shoreline-retreat rates as defined by the Division of Coastal Management (DCM) within the North Carolina Department of Environment, Health, and Natural Resources.

The purpose of the Dare County Feasibility Study is to define the costs verses benefits of initiating a beach nourishment program which could help mitigate the annual destruction of property along this segment of the coastline. This coastline is retreating landward at locally-variable rates (Figure 2) in response to a slow but persistent rise in sea-level, and the structural damage and erosion which occurs during severe storms is simply a natural consequence of the shoreline retreat process. The extreme variations in retreat rates likely reflects the geotechnical character of the geologic units underlying this coastline (Riggs, Cleary and Snyder, 1995).

Beach nourishment is one method by which the rate of shoreline retreat can be slowed. The beach and upper shoreface areas are artificially extended seaward by pumping-in beach-fill material. As the beach widens, an extended buffer zone is created between the ocean and existing properties. While the artificial beach-fill will


36°20'
36°10'
36°00'
35°50'
35°40'
35°30'
35°20'
35°10'
35°00'
76°00'
75°50'
75°40'
75°30'
75°20'
Northern
Dare Co.
Study Area
Albemarle
Sound
Alligator River
Oregon
Inlet
Pamlico
Sound
0
10
25
Kilometers
0
3
5
10
Nautical Miles
FIG. 1

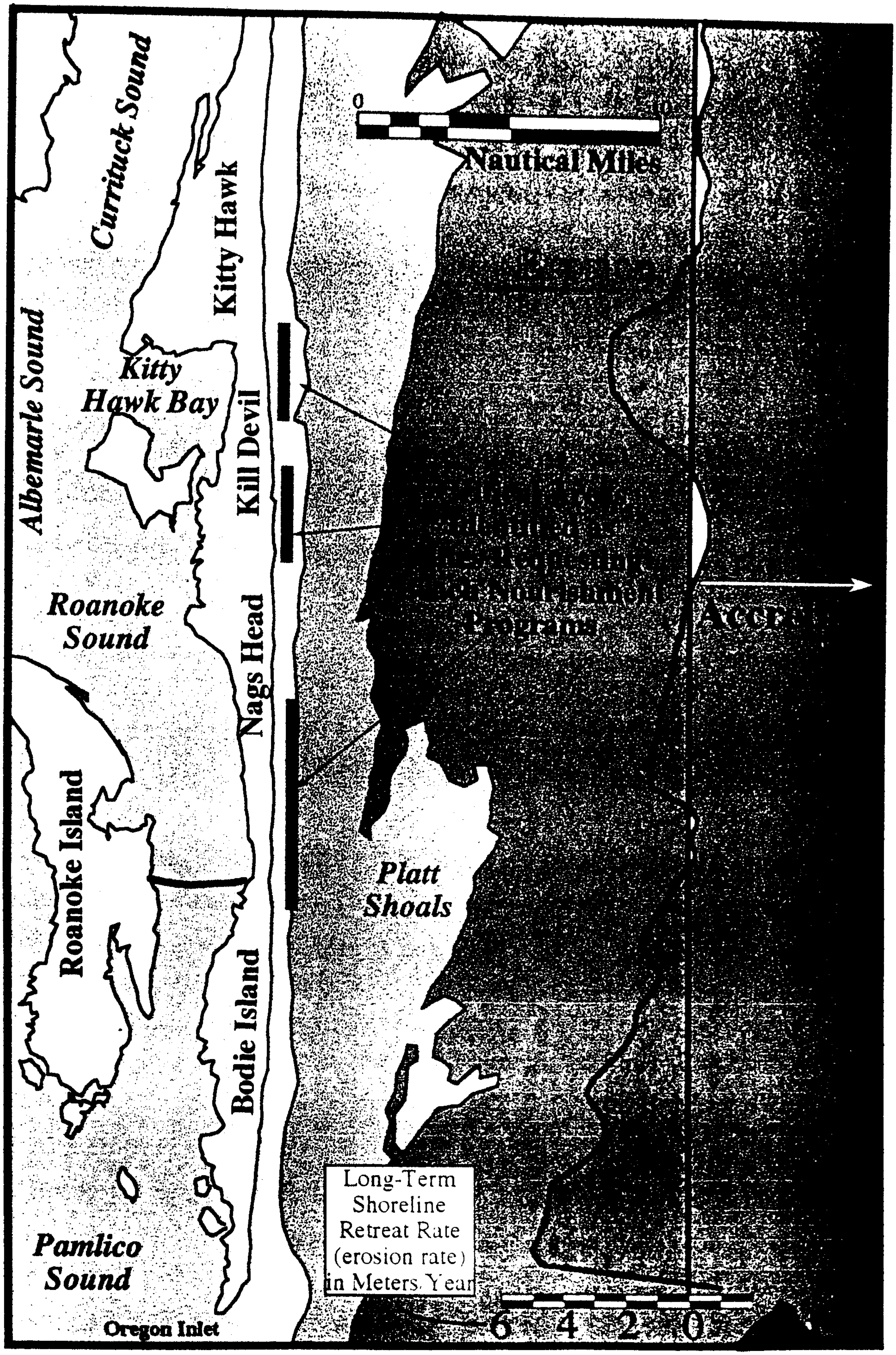

Currituck Sound
Kitty Hawk
Albemarle Sound
Kitty Hawk Bay
Kill Devil
Roanoke Sound
Nags Head
Roanoke Island
Bodie Island
Pamlico Sound
Oregon Inlet
Platt Shoals
0
10
Nautical Miles
Long-Term Shoreline Retreat Rate (erosion rate) in Meters/Year
6 4 2 0

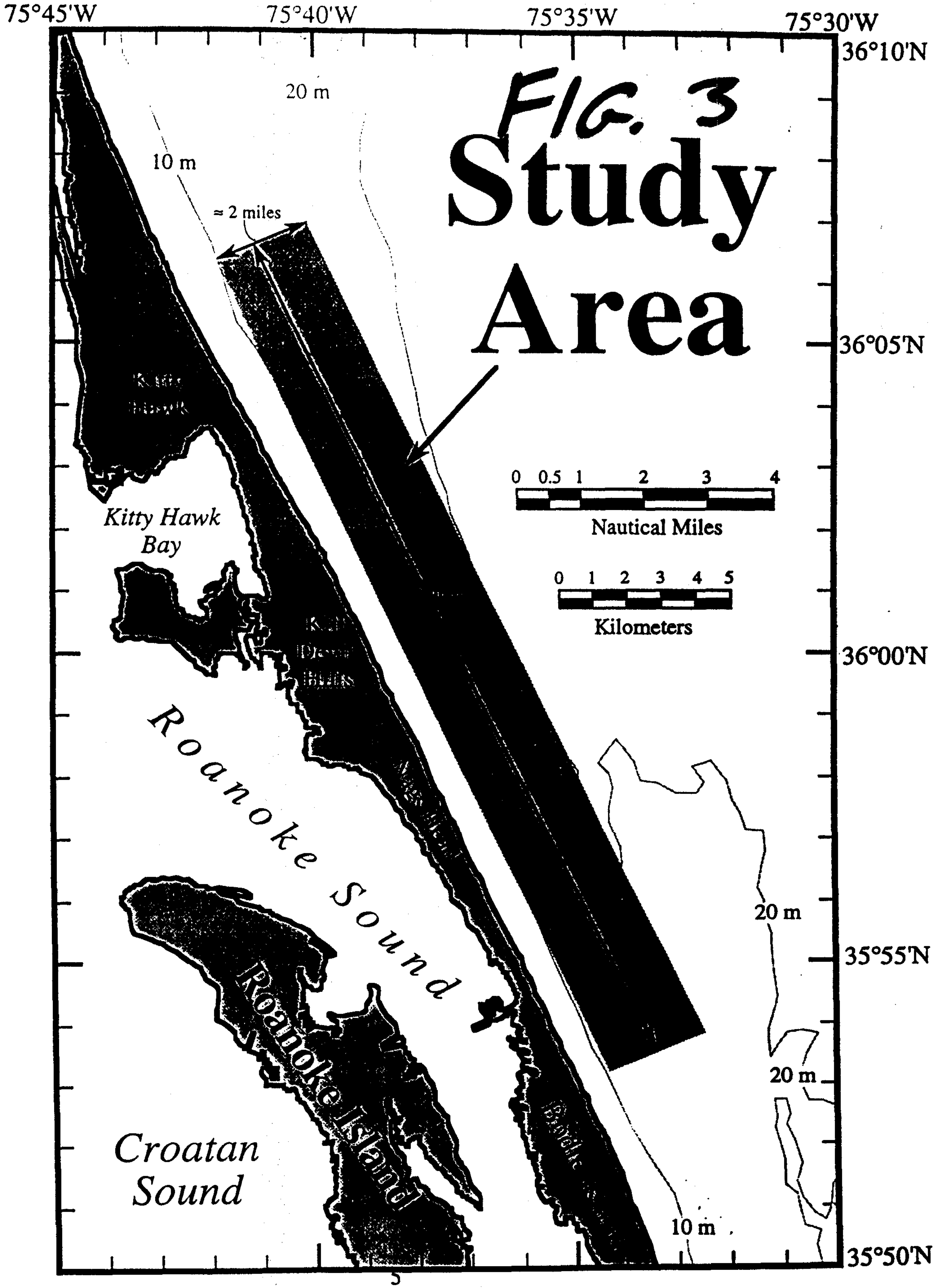
FIG. 2

ultimately be consumed by natural shoreline retreat processes, the newly created buffer will extend the life of the property that it is protecting. Hence, Beach nourishment programs are viewed as a valuable tool for temporarily mitigating damage forced by shoreline retreat processes. However, before beach nourishment can be considered as a viable option for any given shoreline, a sand resource of sufficient size and suitable character must be identified. Equally important, the site of the sand resource(s) must be known in order the accurately calculate the cost of transporting the beach-fill material to the site of the beach nourishment program.

The primary objectives of this reconnaissance study were to (1) identify any potential sand resources in the offshore areas adjacent to each of the 3 critical sites in northern Dare County (marked in Figure 2), and (2) define the spatial distribution and geometries of all potential beach-fill borrow areas. This was accomplished by first seismically imaging the subbottom stratigraphy. Cores were then recovered from specific stratigraphic features identified in the seismic data. Finally, the sediment recovered in the cores was evaluated in an effort to determine if it is compatible in character with the native beach sediment.

Following discussion with USACOE Wilmington District personnel, the study area was defined as an ≈2 mile-wide swath which extends from Outer Banks Fishing Pier (South Nags Head) to the Kitty Hawk Fishing Pier (Kitty Hawk-Southern Shores Boundary) in Northern Dare County, NC (Figure 3). This area was surveyed in July and August 1994 using subbottom profiling instruments. Vibracores were collected at selected stratigraphic targets in August 1995. Vibracore analyses, including quantitative sediment characterization, were completed in 1996. Integration of the vibracore and subbottom data was then utilized to identify 5 distinct Target Borrow Areas reported here. It should be noted, however, that the borrow target areas defined in this study will require detailed resource evaluation studies in order to verify the suitability of the borrow material as beach-fill sediment.

Northern Dare County Map



1.1 Project Summary

Over 860 kilometers (≈535 miles) of remotely-sensed subbottom data were collected along 34 distinct tracklines during two separate surveys in July and August 1994. A single-channel, high-resolution, digital-acquisition, seismic-reflection system was utilized to collect 772 kilometers (480 miles) of the trackline data; approximately 88 kilometers (55 miles) of frequency-modulated CHIRP-sonar data were also collected. All data were collected within NC State Territorial waters (inner 3 miles) between the Outer Banks Fishing Pier (South Nags Head) and the Kitty Hawk Fishing Pier (Kill Devil Hills) in Northern Dare County, NC (Figure 3 and Table 1). In addition. digital side-scan sonar images of the seafloor were recorded in concert with all seismic and CHIRP profiles (*i.e.,* 845 kilometers = 525 miles of trackline profiles).

The seismic data depict a stacked series of tabular sequences dissected by multiple, small, paleofluvial channels which do not exhibit much lateral continuity. The first continuous subbottom sequence below the seafloor is 3-6 meters thick, and portrays a seismic facies characterized by a high-frequency of discontinuous reflectors. This seismic facies is typical of a sedimentary section exhibiting constant lithologic changes, both laterally and vertically (e.g., extreme lithologic heterogeneity). A spectacularly-large ancestral fluvial channel (6-7 km wide) was identified running west-east across the northern section of the study area. This feature represents the ancestral channel of the Roanoke-Albemarle river system, and is herein referred to as the Roanoke/Albemarle Channel (RAC).

One-hundred and ninety-seven vibracore sites were targeted in order to penetrate specific stratigraphic features identified in the subbottom seismic data. In August 1995, seventy-three (73) vibracores were obtained aboard the D/V SNELL. The vibracores were transported to Raleigh, NC, were they subsequently split, described, logged and subsampled for textural analyses. The sediment characteristics of the core material were used to evaluate the suitability of the sediment as beach-fill.

Only 20 of the 73 vibracores were found to contain sediment compatible for beach-fill. These data, in conjunction with the subbottom stratigraphic information supplied by the seismic data, were used to define the physical boundaries of 5 Target Borrow Areas within the study area. Total volume of sediment contained within all 5 borrow areas exceeds 172 million cubic yards of sediment.

2.0 GEOPHYSICAL SURVEYS

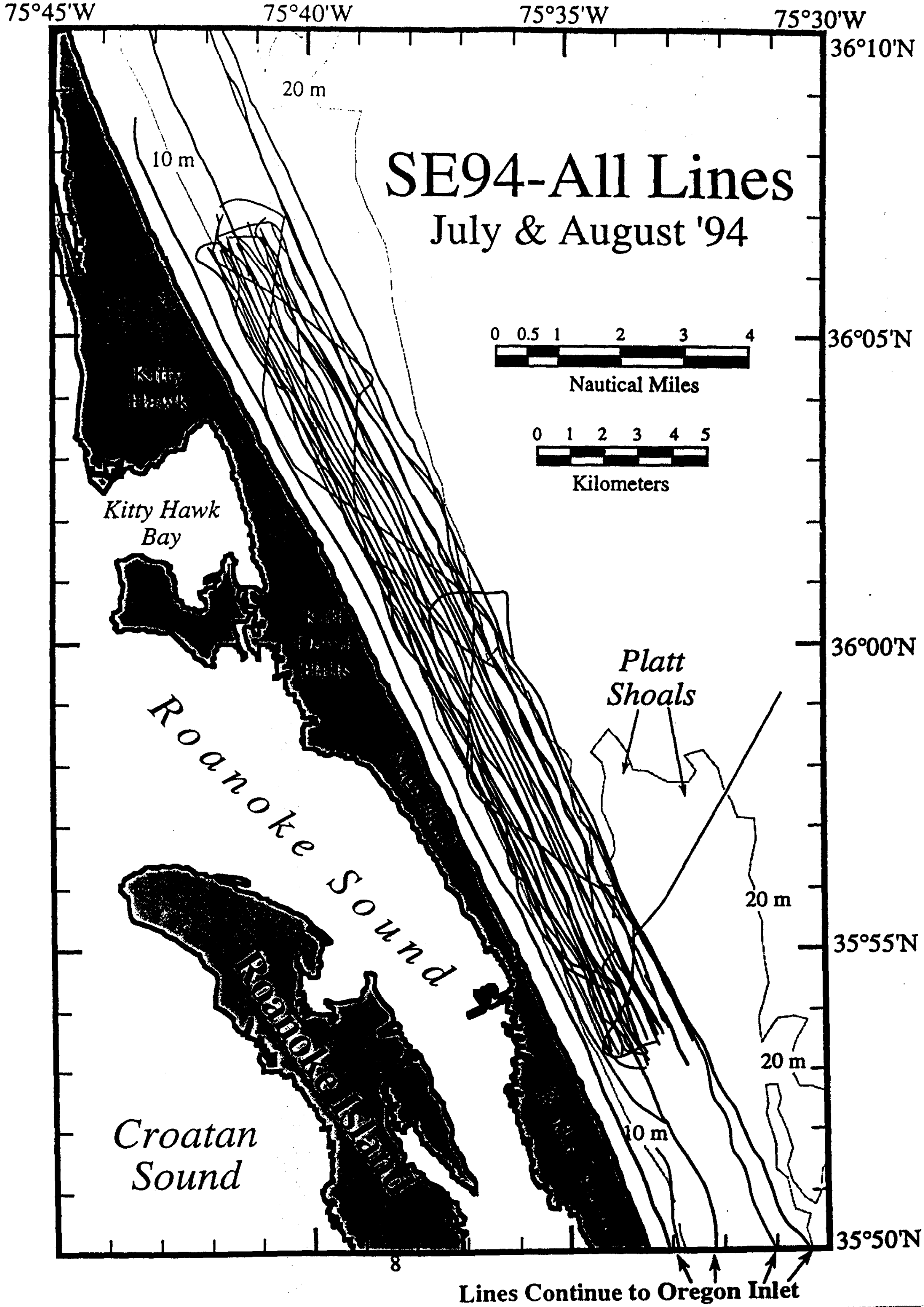
2.1 Survey Instrumentation

Three shore-parallel seismic-reflection profiles, each approximately 55 kilometers in length, were collected in July 1994 using a single-channel, digital (Delph2™\ELICS™), seismic-reflection system (Table 1, Figure 4 and Data Books I through V). These lines were collected in an effort to determine if the digital, boomer, seismic system was capable of resolving the details of the shallow subbottom stratigraphy within the Northern Dare County field area.

Each of the 3 profiles were reviewed by NCSU scientists and US Army Corps of Engineers (USACOE) geotechnical personnel at the Dept. of MEAS @ NCSU in mid-August 1994. The performance and resolution of the digital seismic system was judged at that time to be more than adequate to perform the survey, but the CHIRP sonar system was still considered to be the optimum tool of choice by the and US Army Corps of Engineers (USACOE) personnel.

Dr. Steven Shock at Precision Signal Inc. was subcontracted to provide a CHIRP-sonar system during the second survey (22-28 August 1994). The EXSTAR™ CHIRP sonar system, utilizing a new (prototype) low-frequency transducer, proved to be capable of penetrating the upper 10-25 meters of the subbottom stratigraphy while maintaining submeter-scaled vertical resolution. The CHIRP-sonar and digital-boomer seismic systems could not be run simultaneously due to severe electromagnetic interference (*i.e.*, cross-talk between the two profiling systems). Hence, it was agreed by Dr. Snyder, Dr. Shock and Mr. Ted Zielonka (USACOE) that the CHIRP sonar system be employed to complete the subbottom survey. However, during the first survey day, the CHIRP sonar towfish was severely damaged. The Delph2™\Elics™ system was used while

Northern Dare County Map



North Dare County ---> SE'94 Line Summary

TABLE 1

Test Lines During SE94 Leg I: Boomer and Digital SideScan Data

Line Number	TimeEvent Info		DGPS Coordinate Information				Total Distance/Line			
	Date\DMY	Time	Latitude	Longitude	DeciLatitude	DeciLongitude	Meters	Kilometers	Nautical Miles	Statute Miles
SE94-078										
StartOfLine	22071994	18:51:18	35 48.245	75 28.940	35.804083	75.482327				
EndOfLine	23071994	0:57:42	36 11.554	75 42.730	36.192566	75.712167	51282.389	51.282	27.675	31.865
SE94-093										
StartOfLine	24071994	21:37:36	36 11.777	75 43.921	36.196283	75.732017				
EndOfLine	25071994	1:02:06	35 59.930	75 37.466	35.998833	75.624433	24220.217	24.220	13.071	15.050
SE94-093A										
StartOfLine	25071994	2:00:45	35 59.773	75 36.001	35.996217	75.600017				
EndOfLine	25071994	6:02:49	35 48.138	75 31.453	35.802300	75.524217	30132.281	30.132	16.261	18.723
SE94-137										
StartOfLine	31071994	8:21:38	36 08.563	75 43.365	36.142717	75.722750				
EndOfLine	31071994	13:56:40	35 46.516	75 30.518	35.775267	75.508633	45434.241	45.434	24.519	28.232
							Totals	**151.069**	**81.527**	**93.870**

CHIRP Lines During SE94 Leg II

Line Number	TimeEvent Info		DGPS Coordinate Information				Total Distance/Line			
	Date\DMY	TimeUTC	Latitude	Longitude	DeciLatitude	DeciLongitude	Meters	Kilometers	Nautical Miles	Statute Miles
Chirp-2										
StartOfLine	23081994	18:10:13	35 57.479	75 36.603	35.957983	75.610050				
EndOfLine	23081994	21:11:02	36 05.480	75 40.728	36.091333	75.678800	23629.009	23.629	12.752	14.682
Chirp-3										
StartOfLine	25081994	2:54:17	35 53.100	75 32.652	35.885000	75.544200				
EndOfLine	25081994	3:34:14	35 54.552	75 33.436	35.909200	75.557267	3012.162	3.012	1.626	1.872
Chirp-4										
StartOfLine	25081994	4:05:02	35 55.559	75 34.033	35.925983	75.567217				
EndOfLine	25081994	7:10:01	36 02.397	75 37.934	36.039950	75.632233	14347.539	14.348	7.743	8.915
ND-1										
StartOfLine	23081994	13:21:28	36 06.001	75 41.166	36.100017	75.686100				
EndOfLine	23081994	17:00:04	35 54.256	75 34.068	35.904267	75.567800	29750.713	29.751	16.055	18.486

North Dare County ---> SE'94 Line Summary

ND-2										
StartOfLine	23081994	17:03:44	35 54.147	75 33.842	35.902450	75.564033				
EndOfLine	23081994	18:10:10	35 57.475	75 36.601	35.957917	75.610017	8312.167	8.312	4.486	5.165
ND-14										
StartOfLine	24081994	21:51:25	36 09.303	75 41.589	36.155050	75.693150				
EndOfLine	25081994	2:46:22	35 53.482	75 32.541	35.891367	75.542350	32780.825	32.781	17.691	20.369
							Totals	**88.203**	**47.600**	**54.807**

Survey Lines During SE94 Leg II: Boomer and Digital SideScan Data

Line	TimeEvent Info		DGPS Coordinate Information				Total Distance/Line			
Number	Date\DMY	TimeUTC	Latitude	Longitude	DeciLatitude	DeciLongitude	Meters	Kilometers	Nautical Miles	Statute Miles
SE94-202										
StartOfLine	00220894	16:13:28	36 11.378	75 42.593	36.189633	75.709883				
EndOfLine	00220894	22:34:52	35 46.232	75 29.807	35.770533	75.496783	51757.311	51.757	27.932	32.161
SE94-203										
StartOfLine	00220894	22:43:55	35 46.331	75 30.133	35.772183	75.502217				
EndOfLine	23081994	0:31:08	35 51.709	75 33.254	35.861817	75.554233	11736.938	11.737	6.334	7.293
SE94-204										
StartOfLine	23081994	1:14:09	35 52.121	75 33.080	35.868683	75.551333				
EndOfLine	23081994	3:13:04	35 58.445	75 37.182	35.974083	75.619700	13521.770	13.522	7.297	8.402
SE94-205										
StartOfLine	23081994	22:00:40	36 06.570	75 41.746	36.109500	75.695767				
EndOfLine	24081994	1:31:34	35 53.341	75 34.104	35.889017	75.568400	27551.153	27.551	14.868	17.120
SE94-206										
StartOfLine	24081994	1:33:49	35 53.227	75 34.012	35.887117	75.566867				
EndOfLine	24081994	5:37:43	36 06.611	75 41.617	36.110183	75.693617	28027.001	28.027	15.125	17.415
SE94-207										
StartOfLine	24081994	5:40:12	36 06.719	75 41.542	36.111983	75.692367				
EndOfLine	24081994	10:02:24	35 56.668	75 35.438	35.944467	75.590633	36050.165	36.050	19.455	22.401
SE94-208										
StartOfLine	24081994	10:54:55	35 56.663	75 34.607	35.944383	75.576783				
EndOfLine	24081994	11:31:19	35 53.102	75 33.440	35.885033	75.557333	6951.350	6.951	3.751	4.319
SE94-209										
StartOfLine	24081994	11:33:03	35 53.162	75 33.414	35.886033	75.556900				
EndOfLine	24081994	12:06:45	35 55.005	75 34.027	35.916750	75.567117	4095.012	4.095	2.210	2.545

North Dare County ---> SE'94 Line Summary

Line Number	TimeEvent Info		DGPS Coordinate Information						Total Distance/Line			
	Date\DMY	TimeUTC	Latitude		Longitude		DeciLatitude	DeciLongitude	Meters	Kilometers	Nautical Miles	Statute Miles
SE94-210ND												
StartOfLine	24081994	12:14:10	35	55.363	75	33.514	35.9227167	75.5585667				
EndOfLine	24081994	13:16:36	35	59.214	75	30.795	35.986900	75.513250	8302.745	8.303	4.481	5.159
SE94-212												
StartOfLine	25081994	9:59:15	35	53.499	75	32.893	35.891650	75.548217				
EndOfLine	25081994	13:54:08	36	06.861	75	40.751	36.114350	75.679183	27836.879	27.837	15.023	17.297
SE94-213												
StartOfLine	25081994	13:56:03	36	06.940	75	40.859	36.115667	75.680983				
EndOfLine	25081994	17:07:06	35	53.649	75	33.154	35.894150	75.552567	27786.147	27.786	14.995	17.266
SE94-214												
StartOfLine	25081994	23:38:24	35	53.421	75	33.203	35.890350	75.553383				
EndOfLine	26081994	3:03:46	36	06.704	75	41.038	36.111733	75.683967	27498.916	27.499	14.840	17.087
SE94-215												
StartOfLine	26081994	3:05:00	36	06.769	75	41.121	36.112817	75.685350				
EndOfLine	26081994	6:27:27	35	53.464	75	33.597	35.891067	75.559950	27867.261	27.867	15.039	17.316
SE94-216												
StartOfLine	26081994	6:30:51	35	53.311	75	33.711	35.888517	75.561850				
EndOfLine	26081994	9:42:55	36	06.515	75	41.590	36.108583	75.693167	27420.765	27.421	14.798	17.039
SE94-217												
StartOfLine	26081994	9:47:03	36	06.845	75	41.729	36.114083	75.695483				
EndOfLine	26081994	13:16:50	35	53.283	75	33.989	35.888050	75.566483	28743.727	28.744	15.512	17.861
SE94-218												
StartOfLine	26081994	13:19:06	35	53.230	75	34.090	35.887167	75.568167				
EndOfLine	26081994	16:20:13	36	06.417	75	41.779	36.106950	75.696317	27156.778	27.157	14.656	16.874
SE94-219												
StartOfLine	26081994	20:36:50	35	53.049	75	33.478	35.884150	75.557967				
EndOfLine	26081994	23:57:27	36	06.429	75	41.961	36.107150	75.699350	28479.050	28.479	15.369	17.696
SE94-220												
StartOfLine	27081994	0:01:52	36	06.638	75	41.767	36.110633	75.696117				
EndOfLine	27081994	3:28:52	35	53.716	75	33.019	35.895267	75.550317	28982.368	28.982	15.641	18.009
SE94-221												
StartOfLine	27081994	3:29:58	35	53.632	75	32.986	35.893867	75.549767				
EndOfLine	27081994	6:47:11	36	06.794	75	40.954	36.113233	75.682567	27408.085	27.408	14.791	17.031

North Dare County ---> SE'94 Line Summary

Line Number	TimeEvent Info		DGPS Coordinate Information							Total Distance/Line		
	Date\DMY	TimeUTC	Latitude		Longitude		DeciLatitude	DeciLongitude	Meters	Kilometers	Nautical Miles	Statute Miles
SE94-222												
StartOfLine	27081994	6:50:55	36	06.868	75	41.189	36.114467	75.686483				
EndOfLine	27081994	10:25:31	35	53.511	75	33.441	35.891850	75.557350	27720.501	27.721	14.960	17.225
SE94-223												
StartOfLine	27081994	10:29:11	35	53.346	75	33.566	35.889100	75.559433				
EndOfLine	27081994	13:48:48	36	06.526	75	41.415	36.108767	75.690250	27234.965	27.235	14.698	16.923
SE94-224												
StartOfLine	27081994	13:50:39	36	06.614	75	41.539	36.110233	75.692317				
EndOfLine	27081994	17:05:36	35	53.594	75	33.220	35.893233	75.553667	28137.407	28.137	15.185	17.484
SE94-225												
StartOfLine	27081994	17:07:10	35	53.493	75	33.227	35.891550	75.553783				
EndOfLine	27081994	21:16:55	36	07.104	75	41.743	36.118400	75.695717	35273.722	35.274	19.036	21.918
SE94-226												
StartOfLine	27081994	21:18:49	36	07.006	75	41.697	36.116767	75.694950				
EndOfLine	28081994	2:01:45	35	52.512	75	30.378	35.875200	75.506300	36121.444	36.121	19.493	22.445
									Totals	**621.661**	**335.489**	**386.283**
									Grand Totals	**860.934**	**464.616**	**534.961**

attempting to repair the CHIRP towfish. After many repairs to the CHIRP towfish, several additional CHIRP tracklines were completed before the CHIRP-sonar topside unit then failed, and the CHIRP system was abandoned. This limited the total CHIRP sonar profiling to 88 kilometers (55 miles) of total trackline data (Table 1 and Data Book V). The remainder of the survey was completed using the Delph2™\ELICS™ seismic system (Table 1 and Data Books I through IV). A total of 24 shore-parallel tracklines averaging 28 kilometers (≈17 miles) in length were collected. Two additional profiles were collected in a zigzag pattern such that they cut diagonally across the shore-parallel tracklines. The zigzag tie-lines were designed to facilitate subbottom correlations between all of the profiles (*i.e.*, reflector tracing across shore-parallel lines via the tie-lines).

2.1.1 *Survey Positioning*

A Differential Global Positioning System(DGPS) was utilized during the survey to record vessel position. The equipment included a **Trimble Nav*Trac*XL™ and Trimble Nav*Beacon*XL™** This DGPS system is rated to maintain an accuracy of ± 2-5 meters under normal field conditions. The *NavBeacon*XL™ continuously tracked a DGPS correction broadcast from the US Coast Guard facility at Cape Henry, VA. DGPS navigation fixes were recorded on a laptop PC computer at a user specified interval. The interval length was set at 3-5 seconds, which is equivalent to a horizontal spacing of approximately 10-15 meters between updates at an average vessel speed of 4 knots). In addition, LORAN C coordinate and Time Differential (TD) information were recorded at 1 minute intervals during each survey using a NorthStar™ 8000 system and a laptop PC computer. All DGPS horizontal control data are referenced to the North American Datum of 1983 (NAD 83). The positions of all trackline data are presented in Data Books I through V.

2.1.2 *Depth Sounder*

Bathymetric data was collected via a *FURUNO* (model FCV-667) Precision Depth Recorder (PDR) system equipped with a dual-frequency transducer (50 and 200 kHz).

The survey was completed by alternately firing both frequencies. The transducer was mounted to the starboard side of the survey vessel, and the offset between the position of the DGPS antenna and the depth transducer was accommodated during post-survey processing. Depth and position information were simultaneously recorded at 3 to 5 second intervals during the survey and continuously logged on a laptop computer. Tide data acquired from the Coastal Engineering Research Center's Field Research Facility (CERC-FRF) at Duck, North Carolina, were used to correct depth information to actual bathymetry relative to NGVD.

2.1.3 *Survey Vessel*

The *R/V SEAWARD EXPLORER* (105' LOA) served as the survey vessel, and was subcontracted through Seaward Explorer Services of Miami, FL. The vessel provided an inexpensive platform for continuos 24 hour operations.

2.1.4 *Seismic Reflection Profiling Systems*

The seismic-reflection equipment employed during the bulk of the survey consisted of a digital, high-resolution system with an EG&G UNIBOOM™ seismic source. This system demonstrated a vertical resolving power on the order of decimeters within the surveyed area, and penetration was typically on the order of 70-100 meters.

The Delph2™\ELICS™ software was set-up to trigger an EG&G model 234 power source which supplied a 300 joule pulse to an electromechanical transducer (EG&G UNIBOOM™) at a firing rate of 0.5 seconds. The transducer emitted a broad-spectrum of high-frequencies (400 Hz to 14 kHz), but most of the power was within 700-900 Hz frequency spectrum. The reflected energy was collected on a multi-element (8) hydrophone, which was amplified, and then digitized (AU 32000 Analog-to-Digital board) using the Delph2™\ELICS™ software on a 486 PC platform. The data were displayed on NEC color monitor (NEC 5fgp), graphically recorded on an OYO GeoSpace thermal recorder, and written to disc. All data were backed up on a

ExaByte™ 8 millimeter tape subsystem, as well as Flop-Optical discs, and subsequently archived on Compact Discs (CD's)

A full-spectrum, subbottom, CHIRP-sonar system was supplied under contract by Dr. Steven Shock of Precision Signal, Inc. (PSI). The towfish employed was a prototype for the next generation of EG&G EXSTAR™. It emitted a broad frequency spectrum, but was specifically tuned such that most of the energy was in the 900 Hz to 2 kHz range. CHRIP data were collected on a SunSparc20™ workstation and graphically recorded. The CHRIP data were backed-up on ExaByte™ tapes, which reside with Dr. Steven Shock.

3.0 VIBRACORES

3.1 Vibracore Targets

Vibracore targets were selected from a review of the seismic data. Specific stratigraphic features identified in the seismic-reflection profiles were selected as potential vibracore sites. The primary objective of the targeting exercise was to recover sedimentary sections from seismic features that could then be extrapolated to similar features observed within the study area.

One-hundred and ninety-seven (197) sites were targeted; each target was described and cataloged. The descriptions include the targets position (longitude and latitude) and the primary reason for selecting the target. See the Vibracore Logs Data Book for the catalog of information on each vibracore target.

3.2 Vibracore Acquisition

In August 1995, seventy-three (73) vibracores were obtained by the USACOE aboard the D/V SNELL (PLATE 1, Figure 5 and Table 2). The D/V SNELL utilized a 3-point anchoring system to stabilize the ship of the care target position. A pneumatically-driven, ALPINE GEOPHYSICAL™ vibracore system capable of penetrating a 10cm (4 inch diameter) core-barrel up to 6.1 meters (20 feet) below the seafloor was deployed

Northern Dare County Map

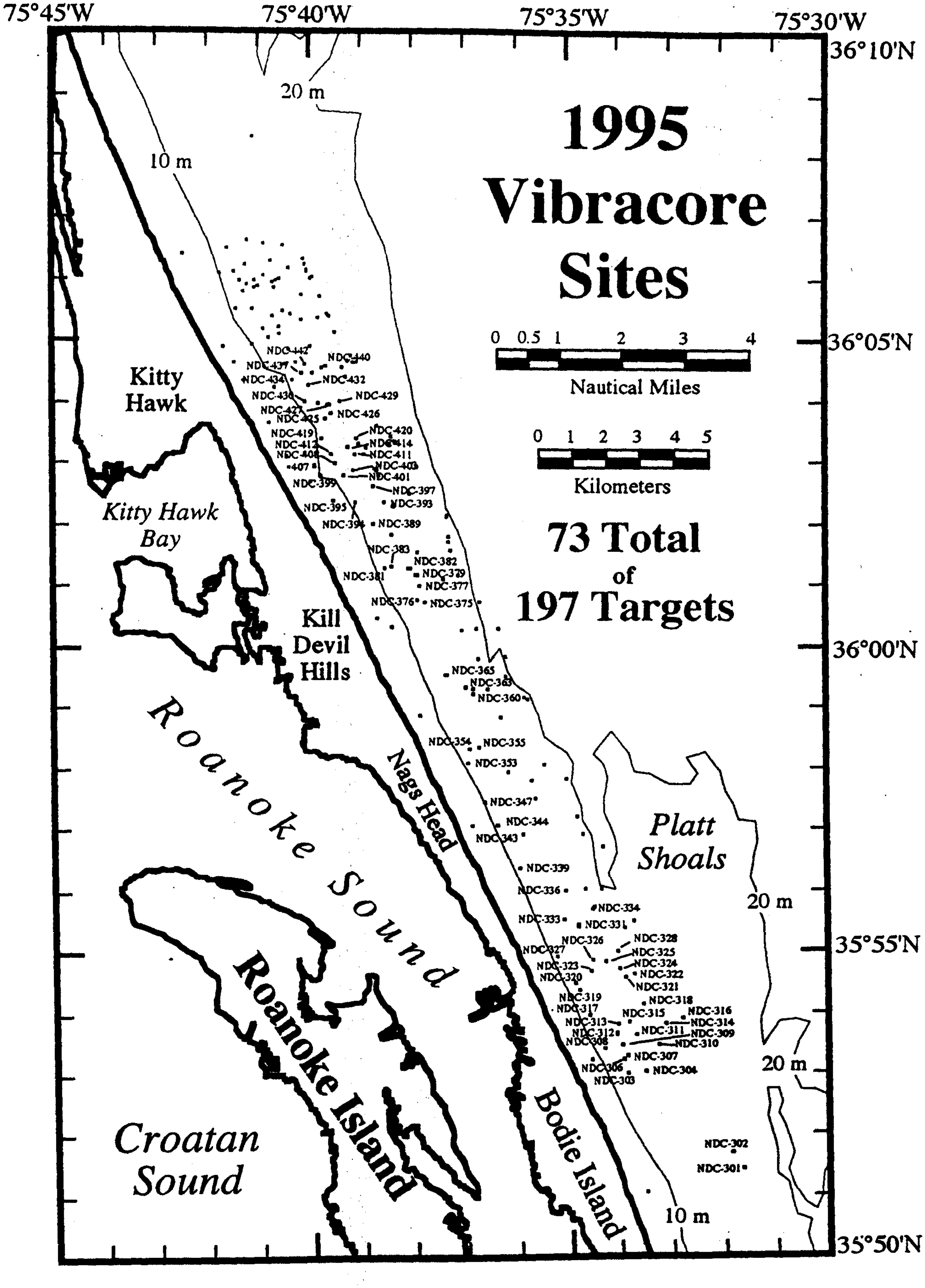


TABLE 2: Northern Dare County Vibracores: Summer 1995

DATE	USACOE #	LAT	LON	H2O z (m)	CORE z (m)	TOT z (m)	*H2O z (ft)*	*CORE z (ft)*	*TOTAL z (ft)*	SEIS REF	SITE DESCRIPTION
081395	NDC-301	35.8577	-75.5270	11.58	3.49	15.07	*38*	*11.45*	*49.45*	SE94-202	2 mi offshore, opposite Bodie Is. tower (strobe)
081395	NDC-302	35.8620	-75.5304	15.24	3.87	19.11	*50*	*12.69*	*62.69*	SE94-202	2 mi offshore, opposite Bodie Is. tower (strobe)
081395	NDC-304	35.8842	-75.5579	17.98	4.67	22.65	*59*	*15.32*	*74.32*	SE94-219	1 mi offshore Bodie Is., 3-4 mi south of Roanoke Is. bridge?
081395	NDC-303	35.8837	-75.5641	13.11	4.49	17.60	*43*	*14.73*	*57.73*	SE94-219	1 mi offshore Bodie Is., 3 mi south of Roanoke Is. bridge
081495	NDC-306	35.8877	-75.5651	13.11	1.65	14.76	*43*	*5.41*	*48.41*	SE94-225	1 mi offshore Roanoke Sound Channel
081495	NDC-307	35.8886	-75.5641	14.94	4.21	19.15	*49*	*13.81*	*62.81*	SE94-216	1 mi offshore Roanoke Sound Channel
081495	NDC-310	35.8915	-75.5538	19.20	5.22	24.42	*63*	*17.12*	*80.12*	SE94-225	2 mi offshore Roanoke Sound Channel
081495	NDC-316	35.8985	-75.5459	14.63	1.45	16.08	*48*	*4.76*	*52.76*	SE94-202	ca.3 mi offshore, Roanoke Sound Channel
081495	NDC-314	35.8974	-75.5515	16.76	2.81	19.57	*55*	*9.22*	*64.22*	SE94-220	ca. 2.5 mi offshore Roanoke Sound Channel
081495	NDC-311	35.8943	-75.5609	17.98	4.70	22.68	*59*	*15.42*	*74.42*	SE94-215	ca. 2.0 mi offshore Roanoke Sound Channel
081495	NDC-309	35.8913	-75.5656	17.07	1.77	18.84	*56*	*5.81*	*61.81*	SE94-216	ca. 2.0 mi offshore Roanoke Sound Channel
081495	NDC-308	35.8903	-75.5717	15.24	2.66	17.90	*50*	*8.72*	*58.72*	SE94-219	ca. 1.0 mi offshore Roanoke Sound Channel
081495	NDC-312	35.8946	-75.5674	16.15	4.47	20.62	*53*	*14.66*	*67.66*	SE94-216	unkown
081495	NDC-313	35.8972	-75.5670	15.85	1.73	17.58	*52*	*5.67*	*57.67*	SE94-225	unknown
081495	NDC-315	35.8975	-75.5635	19.20	1.85	21.05	*63*	*6.07*	*69.07*	SE94-223	ca. 2.0 mi offshore Roanoke Sound Channel
081495	NDC-318	35.9024	-75.5585	20.42	4.37	24.79	*67*	*14.33*	*81.33*	SE94-224	ca. 2.5 mi offshore Roanoke Sound Channel
081495	NDC-317	35.8994	-75.5763	14.33	5.47	19.80	*47*	*17.94*	*64.94*	SE94-219	ca 0.5 mi offshore, 1 mi S. of Whalebone Junction
081495	NDC-319	35.9063	-75.5796	13.11	5.00	18.11	*43*	*16.40*	*59.40*	SE94-219	unknown
081495	NDC-320	35.9082	-75.5812	14.63	4.08	18.71	*48*	*13.38*	*61.38*	SE94-219	unknown
081495	NDC-323	35.9118	-75.5760	17.68	6.02	23.70	*58*	*19.75*	*77.75*	SE94-216	unknown
081495	NDC-326	35.9147	-75.5752	17.98	1.80	19.78	*59*	*5.90*	*64.90*	SE94-223	ca. 0.5 mi offshore Whalebone Junction
081495	NDC-325	35.9142	-75.5712	17.07	6.05	23.12	*56*	*19.84*	*75.84*	SE94-215	ca. 1.5 mi offshore Whalebone Junction
081495	NDC-328	35.9169	-75.5671	17.98	4.90	22.88	*59*	*16.07*	*75.07*	SE94-224	unknown
081495	NDC-324	35.9121	-75.5661	17.98	4.57	22.55	*59*	*14.99*	*73.99*	SE94-214	unknown
081495	NDC-321	35.9100	-75.5646	18.59	4.47	23.06	*61*	*14.66*	*75.66*	SE94-214	unknown
082295	NDC-322	35.9110	-75.5614	19.51	1.77	21.28	*64*	*5.81*	*69.81*	SE94-225	somewhere off S. Nags Head
082295	NDC-327	35.9158	-75.5872	12.19	3.14	15.33	*40*	*10.30*	*50.30*	SE94-219	ca. 0.5 mi offshore Whalebone Junction (Sea Foam Hotel)
082295	NDC-331	35.9241	-75.5797	17.68	0.67	18.35	*58*	*2.20*	*60.20*	SE94-223	ca. 1 mi offshore, just N. of Jennette's Pier
082295	NDC-334	35.9286	-75.5750	17.68	1.07	18.75	*58*	*3.51*	*61.51*	SE94-224	ca. 1.38 mi offshore, just N. of Jennette's Pier
082295	NDC-333	35.9256	-75.5845	17.68	1.94	19.62	*58*	*6.36*	*64.36*	SE94-216	0.8 mi offshore, ca. 1 mi N. of Jennette's Pier
082295	NDC-336	35.9334	-75.5842	18.29	6.04	24.33	*60*	*19.81*	*79.81*	SE94-223	1 mi offshore, ca. 1.4 mi N. of Jennette's Pier
082395	NDC-339	35.9399	-75.5991	12.80	3.85	16.65	*42*	*12.63*	*54.63*	SE94-219	ca. 0.5 mi offshore, 1.76 miN. of Jennette's Pier
082395	NDC-343	35.9492	-75.5974	16.46	1.62	18.08	*54*	*5.31*	*59.31*	SE94-216	ca. 1 mi offshore, just S. of Jockey's Ridge
082395	NDC-344	35.9515	-75.6060	12.19	1.66	13.85	*40*	*5.44*	*45.44*	SE94-219	0.5 mi offshore, just S. of Jockey's Ridge (Outlaw House)
082395	NDC-347	35.9576	-75.6104	11.58	5.69	17.27	*38*	*18.66*	*56.66*	SE94-225	ca. 0.5 mi offshore Jockey's Ridge
082395	NDC-353	35.9681	-75.6152	11.89	6.03	17.92	*39*	*19.78*	*58.78*	SE94-219	ca. 0.6 mi offshoreJockey's Ridge
082395	NDC-354	35.9721	-75.6151	12.80	4.75	17.55	*42*	*15.58*	*57.58*	SE94-225	0.6 mi offshore Jockey's Ridge, Nags Head Pier
082395	NDC-355	35.9726	-75.6119	14.94	3.82	18.76	*49*	*12.53*	*61.53*	SE94-216	Just north of Jockey's Ridge
082395	NDC-363	35.9889	-75.6162	16.46	5.06	21.52	*54*	*16.60*	*70.60*	SE94-223	1.06 mi offshore Kill Devil Hills radio tower
082395	NDC-360	35.9872	-75.6138	16.76	5.34	22.10	*55*	*17.52*	*72.52*	SE94-215	ca. 1 mi offshore Nags Head Pier
082395	NDC-365	35.9922	-75.6223	14.63	3.20	17.83	*48*	*10.50*	*58.50*	SE94-216	0.9 mi offshore, 1 mi N. of Nags Head Pier
082395	NDC-375	36.0122	-75.6291	14.94	2.22	17.16	*49*	*7.28*	*56.28*	SE94-223	ca. 1 mi offshore Wright Bros. Monument
082395	NDC-376	36.0125	-75.6313	14.63	3.39	18.02	*48*	*11.12*	*59.12*	SE94-226	ca. 1 mi offshore Wright Bros. Monument
082395	NDC-377	36.0164	-75.6309	14.94	5.85	20.79	*49*	*19.19*	*68.19*	SE94-215	ca. 1 mi offshore Wright Bros. Monument
082395	NDC-379	36.0193	-75.6317	15.24	5.82	21.06	*50*	*19.09*	*69.09*	SE94-215	ca. 1.1 mi offshore Wright Bros. Monument
082395	NDC-382	36.0215	-75.6341	14.63	3.42	18.05	*48*	*11.22*	*59.22*	SE94-223	ca. 1.1 mi offshore, just N. of Wright Bros. Monument
082395	NDC-383	36.0219	-75.6397	12.80	3.14	15.94	*42*	*10.30*	*52.30*	SE94-216	0.85 mi offshore Wright Bros. Monument
082395	NDC-381	36.0213	-75.6423	12.19	2.36	14.55	*40*	*7.74*	*47.74*	SE94-226	0.7 mi offshore, just N. of Wright Bros. Monument
082395	NDC-389	36.0336	-75.6457	13.41	2.32	15.73	*44*	*7.61*	*51.61*	SE94-225	0.9 mi offshore, 1.5 mi S. of Avalon Pier

TABLE 2: Northern Dare County Vibracores: Summer 1995

DATE	USACOE #	LAT	LON	H2O z (m)	CORE z (m)	TOT z (m)	*H2O z (ft)*	*CORE z (ft)*	*TOTAL z (ft)*	SEIS REF	SITE DESCRIPTION
082395	NDC-393	36.0391	-75.6421	15.85	0.50	16.35	*52*	*1.64*	*53.64*	SE94-215	1.2 mi offshore, 1.5 mi S. of Avalon Pier
082395	NDC-397	36.0434	-75.6456	16.15	3.17	19.32	*53*	*10.40*	*63.40*	SE94-215	1.2 mi offshore of Sea Ranch
082395	NDC-394	36.0394	-75.6518	13.11	3.83	16.94	*43*	*12.56*	*55.56*	SE94-226	0.8 mi offshore the Sea Ranch
082395	NDC-395	36.0399	-75.6586	11.28	3.41	14.69	*37*	*11.18*	*48.18*	SE94-219	0.5 mi offshore, just S. of Avalon Pier
082395	NDC-401	36.0466	-75.6554	13.11	5.71	18.82	*43*	*18.73*	*61.73*	SE94-216	0.88 mi offshore Avalon Pier
082395	NDC-403	36.0481	-75.6520	14.94	4.76	19.70	*49*	*15.61*	*64.61*	SE94-223	0.9 mi offshore Avalon Pier
082495	NDC-411	36.0522	-75.6515	15.54	4.86	20.40	*51*	*15.94*	*66.94*	SE94-226	0.9 mi offshore Avalon Pier
082495	NDC-420	36.0566	-75.6512	16.46	5.97	22.43	*54*	*19.58*	*73.58*	SE94-226	1.3 mi offshore Avalon Pier
082495	NDC-414	36.0543	-75.6540	14.94	4.12	19.06	*49*	*13.51*	*62.51*	SE94-215	1.15 mi offshore Avalon Pier
082495	NDC-412	36.0523	-75.6595	15.85	5.57	21.42	*52*	*18.27*	*70.27*	SE94-216	1 mi offshore, just N. of Avalon Pier
082495	NDC-408	36.0501	-75.6579	11.89	1.00	12.89	*39*	*3.28*	*42.28*	SE94-216	0.9 mi offshore Avalon Pier
082495	NDC-399	36.0465	-75.6631	10.67	2.37	13.04	*35*	*7.77*	*42.77*	SE94-219	0.5 mi offshore, just N. of Avalon Pier
082495	NDC-407	36.0492	-75.6648	13.11	2.26	15.37	*43*	*7.41*	*50.41*	SE94-219	0.5 mi offshore Avalon Pier
082495	NDC-419	36.0565	-75.6623	12.50	2.30	14.80	*41*	*7.54*	*48.54*	SE94-219	0.9 mi offshore, just N. of Avalon Pier
082495	NDC-425	36.0618	-75.6609	13.11	1.96	15.07	*43*	*6.43*	*49.43*	SE94-223	1 mi offshore, 1.5 mi Avalon Pier
082495	NDC-426	36.0636	-75.6591	12.19	3.63	15.82	*40*	*11.91*	*51.91*	SE94-215	1.2 mi offshore, 1.2 mi N. of Avalon Pier
082495	NDC-429	36.0668	-75.6562	15.54	5.06	20.60	*51*	*16.60*	*67.60*	SE94-214	1.5 mi offshore, 1.5 mi N. of Avalon Pier
082495	NDC-427	36.0659	-75.6602	16.15	5.28	21.43	*53*	*17.32*	*70.32*	SE94-223	1.2 mi offshore, 1.4 mi N. of Avalon Pier
082495	NDC-430	36.0667	-75.6679	17.07	5.23	22.30	*56*	*17.15*	*73.15*	SE94-216	0.9 mi offshore, 1.3 mi N. of Avalon Pier
082495	NDC-432	36.0711	-75.6664	17.68	2.05	19.73	*58*	*6.72*	*64.72*	SE94-223	1 mi offshore, 1.6 mi N. of Avalon Pier
082495	NDC-440	36.0764	-75.6612	14.33	5.85	20.18	*47*	*19.19*	*66.19*	SE94-224	1.47 mi offshore, 2 mi N. of Avalon Pier
082495	NDC-442	36.0768	-75.6675	13.41	2.54	15.95	*44*	*8.33*	*52.33*	SE94-215	unknown
082495	NDC-437	36.0747	-75.6689	13.11	3.09	16.20	*43*	*10.14*	*53.14*	SE94-223	1.1 mi offshore, 1.76 mi N. of Avalon Pier
082495	NDC-434	36.0728	-75.6717	13.72	4.11	17.83	*45*	*13.48*	*58.48*	SE94-216	1 mi offshore, 2 mi N. of Avalon Pier
North Dare County Summaries											
TOTAL	73 Cores			1105.81	268.57	1374.38	3628.00	880.91	4508.91		
AVG.	4.05/Calendar Day			15.15	3.68	18.83	49.70	12.07	61.77		

and retrieved by a ship-mounted crane. Core liners were extruded, cut, capped and labeled, and notes were recorded in a deck log by NCSU personnel aboard the D/V SNELL. The deck logs are presented in the Vibracore Data Books.

No penetrometer was available to determine the depth of penetration during coring operations, and this may have influenced the average core length -- which was only 3.68 meters. A total of 1374.38 meters (≈ 3/4 of a mile) of core section were collected.

3.3 Vibracore Analyses

The vibracores were cut into 1 meter sections, capped, and cataloged before being transported to the North Carolina Geological Survey's Coastal Plain Office in Raleigh, NC. Each 1 meter section was then split length-wise. One half the core was described, logged and subsampled for textural analyses by NCSU personnel. The other half of the core was used to capture very high-resolution (1800 DPI), video images of the stratigraphy and sedimentary structures. Video images were captured at 20 cm intervals using a SVHS camcorder and video capture card. The video images were stored as TIFF files and archived on CD's. A continuous video log in which verbal descriptions of the core section in view were recorded as well (SVHS tapes). Once the video-logging was complete, the core section was sealed in plastic tubing and archived at the NCGS Coastal Plain Office.

Each vibracore was logged by both Dr. Stephen K. Boss and Dr. Stephen W. Snyder. Their descriptive logs are presented in the Vibracore Log Data Book.

Subsamples were collected from the other half of the core (non-archived half). Sediment samples for textural analysis were extracted at approximately 50 centimeter intervals; additional samples were collected at the contacts of distinctly different sedimentary layers. Each subsamples consisted of a 4 cm slice of sediment, which was bagged, labeled, cataloged and then forwarded to the NC State Department of Transportation Soils Testing Laboratory in Raleigh, NC, for textural analyses.

The samples were weighed, washed through a 230-mesh sieve, dried, and reweighed to determine the percent of sample that was less than mm in size. The remaining sediment was sieved through #4, #10, # 18, #20, #35, #40, #100, #120, #200 and #230 sieves. The weight retained by each sieve was recorded in written and ASC file format. The ASC files were then imported into MS Excel™ spreadsheet template that was designed to carry out statistical calculations and graphical presentations of the textural data. One MS Excel™ Workbook file was created for each core; the individual worksheets in each Workbook file present the textural data and relative analyses for each subsample extracted from that core. The MS Excel™ Workbook files were recorded on a CD and forwarded to Mr. David Tempy at the USACOE, Wilmington District Office for subsequent processing and analyzes (see Appendix I).

4.0 RESULTS

4.1 Bathymetry

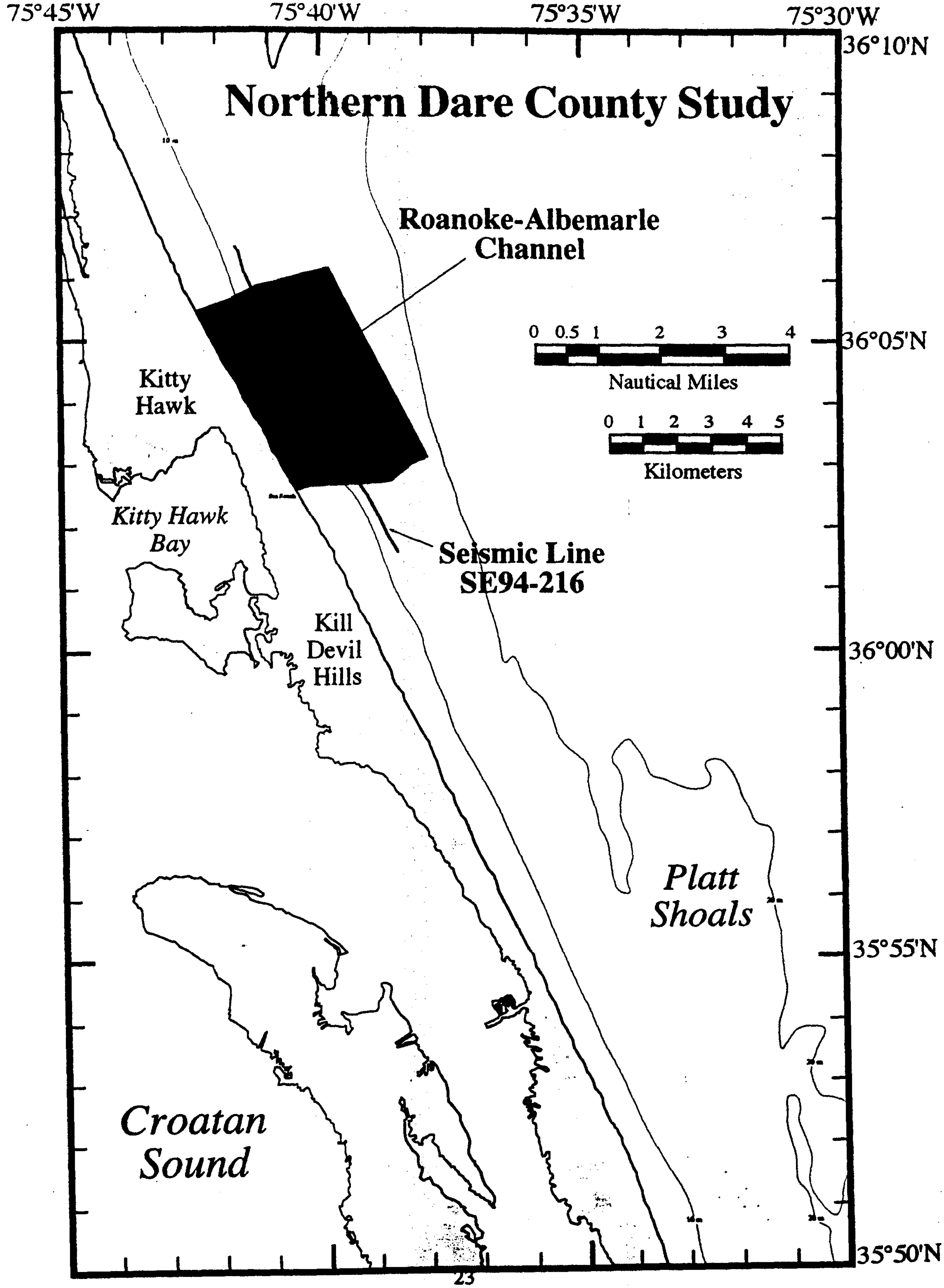
Tide-compensated bathymetric data are compiled in the Bathymetric Data Book. Fifty-eight thousand, two-hundred and twenty-six (58, 226) soundings were gridded using an inverse-distant squared algorithm. Grid cells were then weighted utilizing a 3 by 3 matrix; the center grid cell having a weighting of 5 and the adjacent 8 grid cells weighted as 1. These data were are plotted in Figure 6. Depths generally range between 10 and 19 meters (≈ 33 and 62 feet). The bathymetric contours are notable contorted off Kitty Hawk and Bodie Island, but exhibit relatively smooth gradients between these two areas. The anomalous contour patterns off Bodie Island are associated with the Platt Shoals complex, while the topographic variations identified of Kitty Hawk are related to subbottom stratigraphy as discussed below.

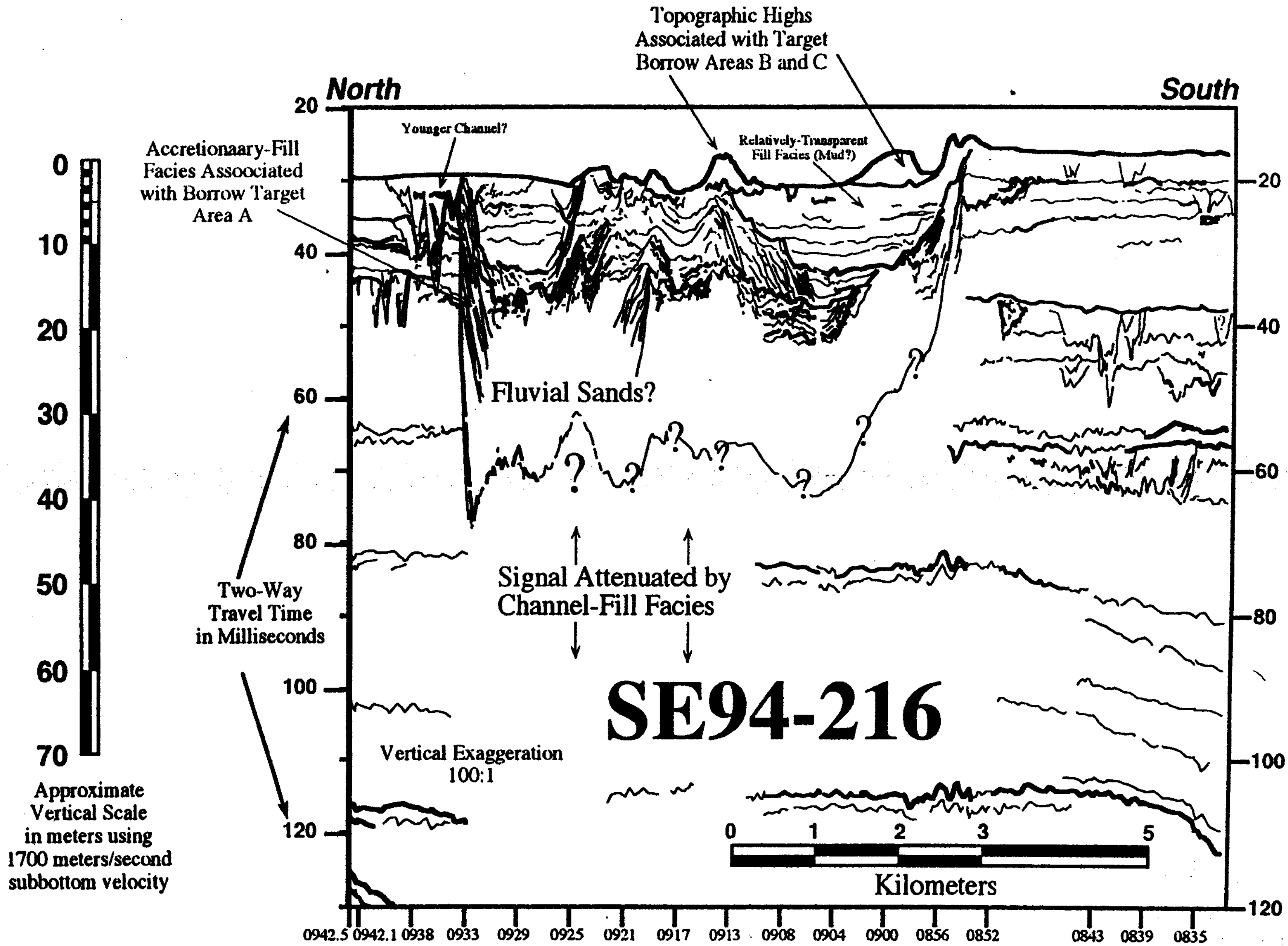
4.2 Shallow Seismic Stratigraphy

Interpretations of the seismic reflection data demonstrate the shallow subbottom stratigraphy consists of a vertically-stacked series of thin tabular sequences which are cut by a large number of small paleofluvial channels (PLATE 2). The upper-most sequences appear to be horizontal; lower sequences dip to the south-southeast. Previous studies have described a similar subbottom architecture for this area of the North Carolina continental shelf (Snyder, 1993; Riggs and others, 1992).

An extremely-large river channel was mapped across the study area in the vicinity of Kitty Hawk and Kitty Hawk Bay (Figures 7 and 8). This feature represents the ancestral channel of the Roanoke-Albemarle river system which was repeatedly entrenched by active fluvial processes during former low-stands of sea-level. The Roanoke-Albemarle Channel (RAC) is 6-7 km wide and 20 to 35 meters deep (PLATE 2 and Figure 8). Seismic facies of the RAC channel-fill indicate that it consists of both fluvial and estuarine sediments. Estuarine (mud) facies dominate the upper part of the channel-fill (3-10 meters thick). These sediments appear to crop-out directly on the seafloor. Fluvial seismic facies primarily underlie the muddy estuarine-fill facies. These interpretations were subsequently verified by the vibracore data. A sliver of a progradational fill-facies which is characteristic of fluvial sands and gravel appears to crop-out on the seafloor along the northern wall of the channel (Figure 8). Also note the topographic irregularities overlying the RAC in Figure 8. These features can account for the contorted bathymetric contours identified off Kitty Hawk in Figure 6.

A thin, tabular, stratigraphic sequence was traced through out the seismic data and was found to crop out across much of the study area. This sequence is highlighted in yellow in PLATE 2. It is 3-6 meters thick and is cut by may small channels (Figure 9 and PLATE 2) which do not exhibit consistent cross-shelf continuity. It also portrays a seismic facies which is characterized by a high-frequency of discontinuous reflectors (Figure 10). This facies is indicative of a stratigraphic section exhibiting extremely-variable lithologies. Vibracores recovered from this sequence confirm that the lithologic fabric is quite variable, and that lithofacies change in character both laterally and vertically even on a scale of meters to decimeters.


75°45'W
75°40'W
75°35'W
75°30'W
36°10'N
36°05'N
36°00'N
35°55'N
35°50'N
Northern Dare County Study
Roanoke-Albemarle
Channel
Seismic Line
SE94-216
0 0.5 1 2 3 4
Nautical Miles
0 1 2 3 4 5
Kilometers
Kitty
Hawk
Kitty Hawk
Bay
Kill
Devil
Hills
Platt
Shoals
Croatan
Sound


Topographic Highs
Associated with Target
Borrow Areas B and C
North
South
Younger Channel?
Relatively-Transparent
Fill Facies (Mud?)
Accretionaary-Fill
Facies Assoociated
with Borrow Target
Area A
Fluvial Sands?
Signal Attenuated by
Channel-Fill Facies
SE94-216
Two-Way
Travel Time
in Milliseconds
Vertical Exaggeration
100:1
Kilometers
0
1
2
3
5
0
10
20
30
40
50
60
70
Approximate
Vertical Scale
in meters using
1700 meters/second
subbottom velocity
20
40
60
80
100
120
0942.5 0942.1 0938 0933 0929 0925 0921 0917 0913 0908 0904 0900 0856 0852 0843 0839 0835

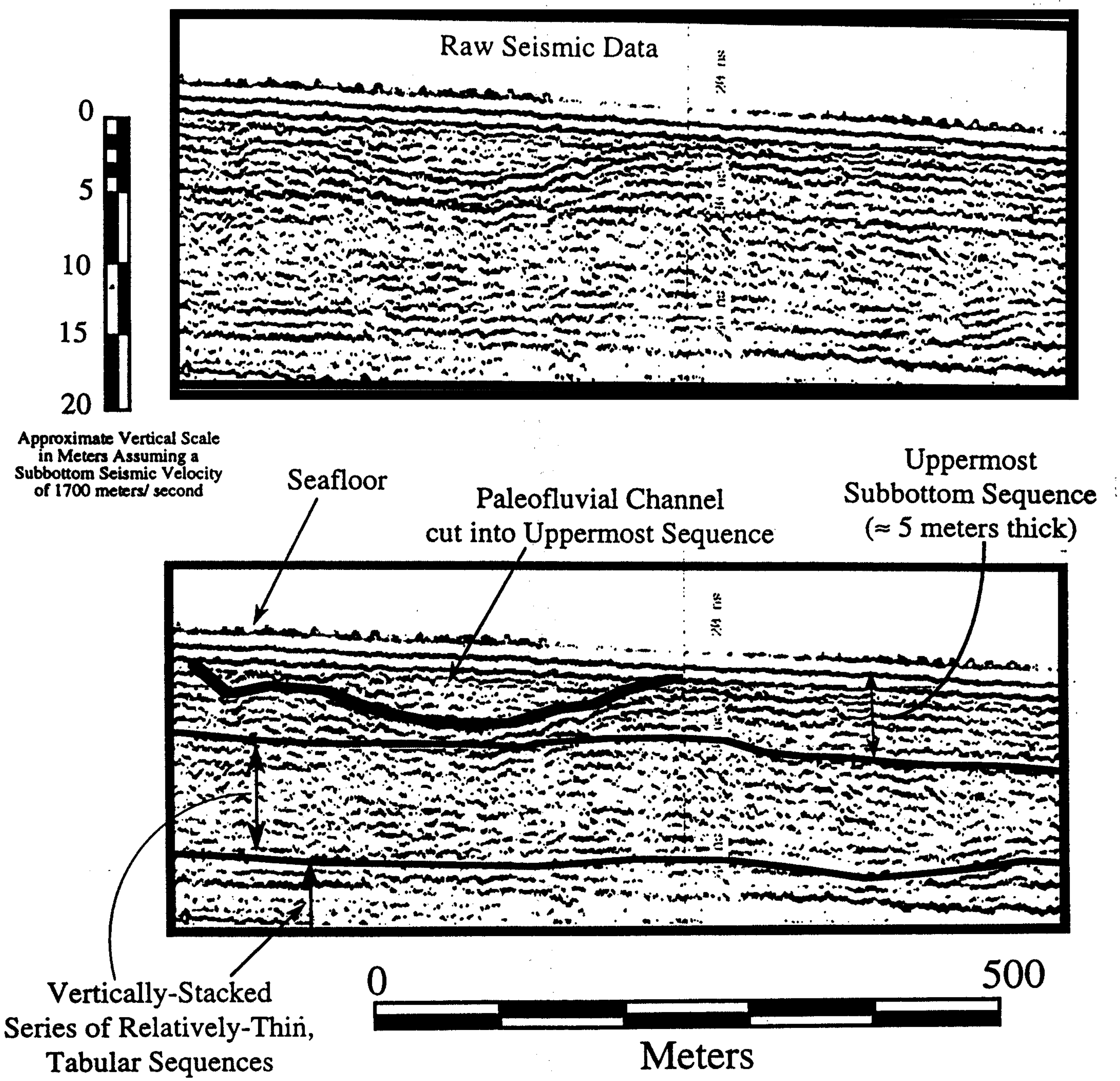


Figure 9: Seismic reflection profile illustrating a small channel which has cut into the uppermost sequence.

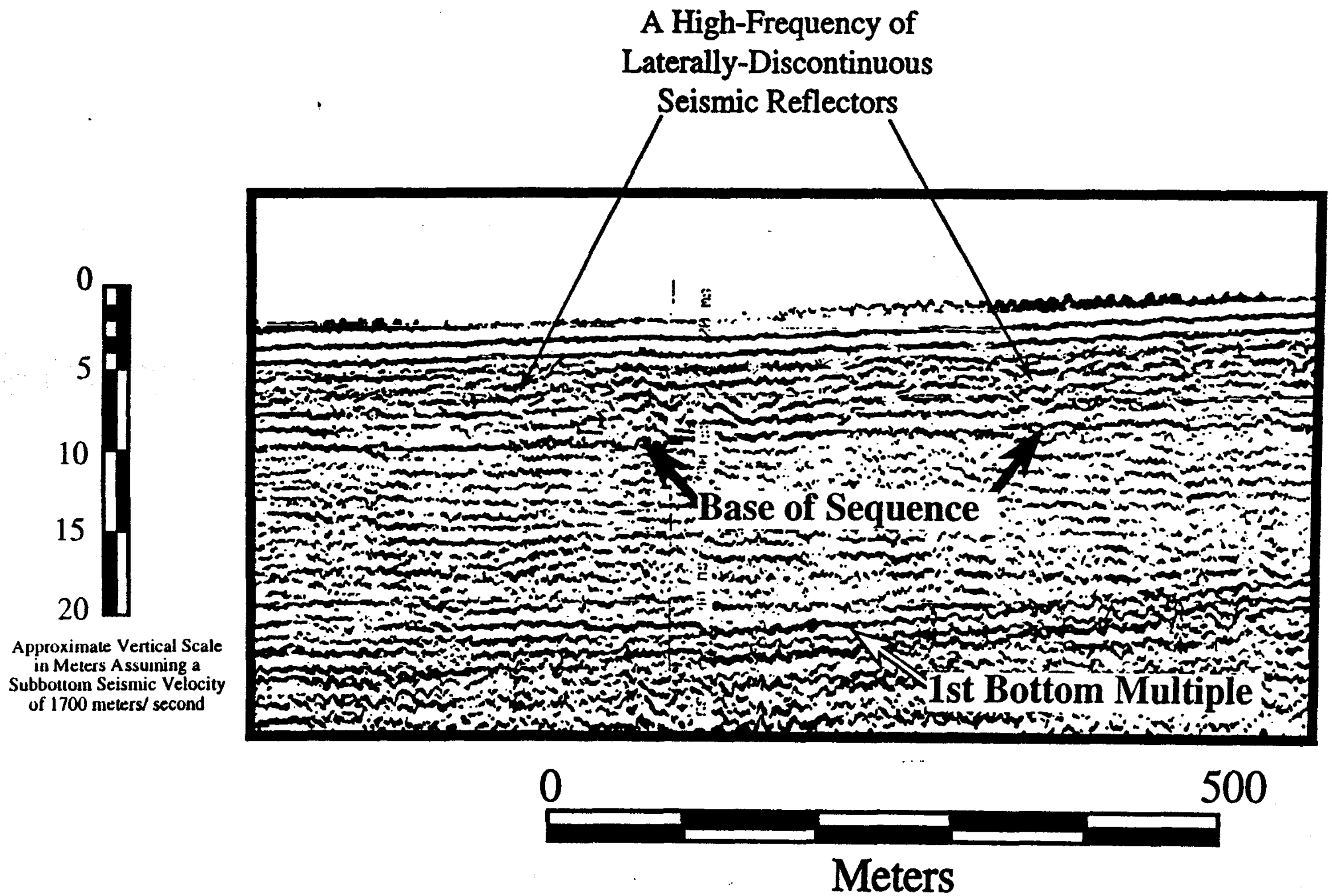


Figure 10: Seismic reflection profile illustrating the sesimic facies characteristic off the uppermost sequence.

4.3 Target Borrow Areas

Textural analyses of the 73 vibracore sections recovered from the study area demonstrated that only 20 were compatible beach-fill material. Still, five Target Borrow Areas were identified within the study area by carefully integrating the sediment and textural data from the vibracores with the subbottom seismic data. The textural data were used to identify the spatial distribution of compatible beach-fill material. The seismic data were used to trace-out the physical boundaries of these potential borrow areas, which are delimited in PLATE 3.

Target Borrow Area A contains a minimum of 1.3 million cubic yards of sediment. It is characterized by a progradational channel-fill seismic facies which is interpreted as being comprised of fluvial sands and gravel (Figure 8). No vibracores were recovered from this site. Hence, this interpretation will require verification via acquisition of additional vibracores

Target Borrow Areas B and C are estimated to have minimum volumes of 3.0 and 5.4 million cubic yards respectively. Both are irregularly-shaped topographic highs (Figure 8) that represent either a sand-rich channel-fill facies of the RAC, or the remnants of laterally-contiguous stratigraphic sequence which once unconformably overlaid the RAC. Vibracores from Borrow Target Areas B and C demonstrate the sediment comprising these borrow areas is compatible for use as beach fill. PLATE 3 demonstrates the integral relationship these irregularly-shaped Target Borrow Areas have with the bathymetry.

Target Areas D and E have minimum volumes of 28.8 and 42.1 million cubic yards. Both are defined from the upper-most, continuous, thin tabular sequence (*i.e.*, the yellow-highlighted sequence illustrated in PLATE 2). Vibracores penetrating this sequence confirmed the lithologic heterogeneity implied by the observed seismic facies. Hence, Target Borrow Areas B and C were defined by mapping out the spatial distribution of vibracores which meet the required beach-fill attributes, and then delimiting areas which appear to exhibit similar sediment characteristics.

Target Borrow Area F encompasses part of Platt Shoals, a topographic high lying offshore of Bodie Island (PLATE 3). This feature represents a minimum volume of 120.8 million cubic yards of sediment. Two vibracore penetrating this feature (NDC-300 and NDC-301) recovered fine sands suitable for beach-fill material; however, considering the aerial extent of this targeted borrow area, many additional vibracores are needed to demonstrate the lateral continuity of these sediment characteristics across this relatively-large feature.

5.0 SUMMARY

The shallow subbottom stratigraphy off the Northern Dare County coastline consists of a stacked-series of thin, tabular sequences containing multiple paleofluvial channel features. The upper-most sequence can be traced throughout the seismic data set and appears to crop out across the study area except where it has been excavated by ancestral riverine systems. This sequence exhibits a seismic facies characteristic of extreme lithologic heterogeneity. Two Target Borrow Areas were identified in this sequence (D and C). However, considering the heterogeneity implicit in the seismic facies, additional closely-spaced vibracores will be acquired to verify that a sufficient volume of sediment suitable for beach-fill is available.

A very-large, fluvial channel carved by the ancestral Roanoke-Albemarle riverine system was found to crop out across the northern segment of the study area. Locally, the channel-fill exhibits both fluvial and estuarine seismic facies. This interpretation was verified by subsequent collection and analyses of vibracore data. Unfortunately, most of the fluvial facies (sand and gravel) underlie a thick section of estuarine sediments (muds). The estuarine muds crop out directly on the seafloor. They are more easily eroded than adjacent sandy facies, which accounts for the localized -- extremely rapid -- shoreline retreat rates on the adjacent coastline (Figure 2), as well as the topographic irregularities expressed in the bathymetry (Figure 6). Three potential sand resource areas were identified in association with this enormous channel complex. Target Borrow Areas B and C follow topographic features which overlie the estuarine fill facies of the RAC. Vibracores have confirmed the suitability of the sediment from these sites for beach-fill material. The third Targeted Borrow

Area is based solely on the interpretation of a fluvial seismic facies which appear to crop out along the north wall of the RAC.

The largest potential borrow area (F) identified in this study encompasses a topographic high which is part of the Platt Shoals complex (PLATE 3). Only two vibracores were recovered from this feature, and additional vibracore information is required to verify lateral continuity of lithologies and therefore its suitability as beach-fill sediment.

Additional, sand resource studies are presently evaluating the area immediately offshore of the present study area (PLATE 4). Data from these studies overlaps the Northern Dare County area, and will likely provide additional critical information, especially with respect the Platt Shoals area.

6.0 REFERENCES CITED

Snyder, S.W., 1993, North Carolina Outer Banks Beach Nourishment Sand Resource Study, 1st Interim Report: Shallow, High-Resolution, Seismic Survey, Offshore Nags Head Area: NC Geological Survey Open-File Report 93-38, 47 pages.

Riggs, S.R., L.L. York, J.F. Wehmiller and S.W. Snyder, 1992, Depositional Patterns Resulting from High-Frequency Quaternary Sea-Level Fluctuations in Northeastern North Carolina: in: C.H. Fletcher and J.F. Wehmiller (eds.), Quaternary Coasts of the United States: Marine and Lacustrine Systems: SEPM Spec. Pub. #48, p. 141-153.

Riggs, S.R., W.R. Cleary and S.W. Snyder, 1995, Influence of Inherited Geologic Framework Upon Barrier Beach Morphology and Shoreface Dynamics:Marine Geology, V. 126, p. 213-234.

Appendix I

To Dr. Stephen W. Snyder Report

Target Borrow Area Characteristics
originally compiled by
Mr. Dave Timpy
USACOE, Wilmington District

Appendix I

Target Borrow Area Characteristics

originally complied by
Mr. David Tempy
USACOE, Wilmington NC District

BORROW SITE	AREA, FT (ft)	USABLE D (ft)	EST VOLUME cy	OVERFILL ratio
A	4,351,486	8.0	1,289,329	1.03
B	7,898,489	10.5	3,071,635	1.36
C	18,018,856	8.0	5,338,920	1.36
D	73,454,622	10.6	28,837,740	US
E	157,089,962	7.2	42,165,125	1.12
F	470,509,535	6.9	120,800,968	1.04
		Total (not including area D)	172,665,977	

VIBRACORES IN TARGET BORROW AREAS

AREA A: NO CORES BUT WILL ASSUME VALUES SIMILAR TO THE OTHER AREAS.

AREA B:	AREA C	AREA D	AREA DA	AREA DB	AREA E	AREAF	OTHER
434	419	381	411	375	303	301	306
437	425	382	414	376	304	302	307
442	426	383	397	377	310		308
	427	389	393	379	311		309
	440	392			314		312
		395			315		313
		398			316		317
		400			318		319
		406			321		320
		407			322		327
		408			323		339
		412			324		343
		12			325		344
					326		347
					328		353
					331		354
					333		355
					334		360
					336		363
							365
							420
							429
							430
							432
							24

NOTES

(shaded) Area identified as potentially viable borrow source base on seismic but did not result in a compatible fill ratio.

OTHER - Vibracore targets which are not in the indentified borrow areas.

Area	Hole	Thickness (cm)	Thickness (ft)	Weighted mean (phi)	Weighted Sdev (phi)	Sum Ra	Lackey *	Sb/Sn	1.9 mean, n 1.5 sdev,n (Mb-Mn)/Sn	Depth (ft)
B	434	350	11.6	1.86	1.10	1.24	Y	0.7	0.0	45
B	437	285	9.4	1.80	0.90	1.56	G	0.6	-0.1	43
B	442	254	8.4	2.27	0.71	US	Y	0.5	0.2	[illegible]
w/0 442		avg	10.5	1.83	1.00	1.36		0.7	0.0	44.0
w/ 442			[illegible]	[illegible]	[illegible]	[illegible]				[illegible]
C	419	230	7.6	0.89	1.14	1.00	G	0.8	-0.7	41
C	425	140	4.6	1.33	0.94	1.00	G	0.6	-0.4	43
C	426	285	9.4	2.10	3.02	1.60	Y	2.0	0.1	40
C	427	155	5.1	2.60	1.16	1.40	Y	0.8	0.5	53
C	440	400	13.2	2.59	0.85	US	Y	0.6	0.5	47
		avg	8.0	1.90	1.42	1.03		0.9	0.0	44.8
D	381	236	7.8	2.75	0.86	US	Y	0.6	0.6	40
D	382	340	11.2	2.48	0.90	12.8	Y	0.6	0.4	48
D	383	284	9.4	2.69	0.81	US	Y	0.5	0.5	42
D	389	232	7.7	2.34	1.05	2.7	Y	0.7	0.3	44
D	394	375	12.4	2.63	0.94	29.5	Y	0.6	0.5	49
D	395	341	11.3	3.09	0.78	US	Y	0.5	0.8	37
D	399					US	Y			
D	401	599	19.8	3.10	0.63	US	Y	0.6	0.8	43
D	403	470	15.5	3.02	0.73	US	Y	0.5	0.7	49
D	407	226	7.5	3.16	0.78	US	Y	0.5	0.8	43
D	408	100	3.3	2.40	0.87	11.0	Y	0.6	0.3	39
D	412	[illegible]	[illegible]	[illegible]	[illegible]	US	Y	[illegible]	[illegible]	[illegible]
	avg	avg	10.6	2.77	0.85	US		0.6	0.6	43.4
E	303	190	6.3	2.13	0.78	6.4	Y	0.5	0.2	43
E	304	466	15.4	2.31	1.76	1.3	Y	1.2	0.3	59
E	310	250	8.3	1.56	1.66	1.0	Y	1.1	-0.2	63
E	311	326	10.8	2.33	1.48	1.4	Y	1.0	0.3	59
E	314	136	4.5	1.97	0.99	1.7	Y	0.7	0.0	55
E	315	125	4.1	2.42	1.29	1.9	Y	0.9	0.3	63
E	316a	145	4.8	1.14	1.03	1.0	Y	0.7	-0.5	48
E	318	240	7.9	2.35	1.71	1.3	Y	1.1	0.3	67
E	321	187	6.2	2.15	1.49	1.2	Y	1.0	0.2	61
E	322	172	5.7	1.64	1.46	1.0	Y	1.0	-0.2	64
E	323	200	6.6	1.90	1.21	1.2	Y	0.8	0.0	58
E	324		7.6	1.67	1.05	1.4	Y	0.7	-0.2	59
E	325	200	6.6	1.64	1.19	1.0	Y	0.8	-0.2	56
E	326	175	5.8	2.84	1.81	1.8	Y	1.2	0.6	59
E	328	200	6.6	2.07	1.68	1.1	Y	1.1	0.1	59
E	331	68	2.2	0.12	1.23	1.0	Y	0.8	-1.2	58
E	333	190	6.3	1.77	1.14	1.1	Y	0.8	-0.1	58
E	334	76	2.5	1.75	0.92	1.4	Y	0.6	-0.1	58
E	336	604	19.9	3.38	1.19	US	Y	0.8	1.0	60
			7.3	1.95	1.32	1.12				58.3
F	301	349	11.5	1.52	0.78	1.36	Y	0.5	-0.3	38
F	302	205	2.3	0.84	0.84	U	Y	0.6	-0.7	50
			6.9	1.18	0.81	1.04				44.0

NOTES:
1. US is unstable or uncompatible beachfill material.
2. The Lackey scale are visual classifications of the vibracore sediment where green, yellow, red indicates good, acceptable, or poor beachfill, respectively.
3. In Area B, core NDC-440 is located on the edge of the bathymetric high based on seismic data.

AREA B

NDC Hole #	Top of Sample (cm)		Bottom of sample (cm)	Top of Layer (cm)	Bottom of Layer (cm)	Thick of Layer (cm)	WTD Mean (Ø)	WTD StDev (Ø)	Sample Mean (mm)	NCGS SAMPLE DATA Mean (Ø)	StDev (Ø)	Skew	Kurtosis	1.9 mean, n 1.5 sdev,n Sb/Sn	(Mb-Mn)/Sn	ACES or SPM Ra
434	0	–	10	0	10	10.0	16.6	8.8	0.32	1.7	0.9	-0.5	4.3	0.6	-0.2	
434	25	–	29	10	37	27.0	51.9	17.2	0.26	1.9	0.6	0.4	4.5	0.4	0.0	
434	37	–	41	37	42	5.0	7.0	4.7	0.38	1.4	0.9	-0.5	4.3	0.6	-0.3	
434	50	–	54	42	59	17.0	23.9	15.4	0.38	1.4	0.9	-0.2	4.8	0.6	-0.3	
434	75	–	79	59	100	41.0	81.9	28.3	0.25	2.0	0.7	0.0	5.2	0.5	0.1	
434	100	–	104	100	134	34.0	60.0	31.7	0.29	1.8	0.9	-0.3	4.4	0.6	-0.1	
434	150	–	154	134	175	41.0	100.7	27.7	0.18	2.5	0.7	0.3	3.9	0.5	0.4	
434	180	–	184	175	200	25.0	78.2	23.6	0.11	3.1	0.9	-1.8	7.7	0.6	0.8	
434	200	–	204	200	230	30.0	91.0	29.7	0.12	3.0	1.0	-1.9	7.2	0.7	0.8	
434	230	–	234	230	240	10.0	20.8	12.3	0.24	2.1	1.2	-0.4	3.4	0.8	0.1	
434	250	–	254	240	283	43.0	65.1	64.5	0.35	1.5	1.5	-0.3	2.1	1.0	-0.3	
434	290	–	294	283	290	7.0	22.9	8.4	0.10	3.3	1.2	-1.1	5.1	0.8	0.9	
434	300	–	304	290	350	60.0	31.2	112.9	0.70	0.5	1.9	0.8	2.1	1.3	-0.9	
434	350	–	354	350	400	50.0	162.0	33.7	0.11	3.2	0.7	-0.8	6.4	0.4	0.9	
434	400	–	404	400	404	4.0	12.7	2.9	0.11	3.2	0.7	-0.5	5.3	0.5	0.8	
434						350.0	1.86	1.10								1.24
437	0	–	4	0	15	15.0	23.7	14.0	0.33	1.6	0.9	-0.3	4.6	0.6	-0.2	
437	50	–	54	15	75	60.0	123.3	49.4	0.24	2.1	0.8	-0.8	5.7	0.5	0.1	
437	100	–	104	75	125	50.0	86.2	43.3	0.30	1.7	0.9	-0.3	4.9	0.6	-0.1	
437	150	–	154	125	175	50.0	113.0	37.9	0.21	2.3	0.8	0.0	5.9	0.5	0.2	
437	200	–	204	175	224	49.0	93.0	37.2	0.27	1.9	0.8	0.3	4.6	0.5	0.0	
437	250	–	254	224	265	41.0	42.8	51.8	0.49	1.0	1.3	-0.2	2.7	0.8	-0.6	
437	280	–	285	265	280	15.0	21.8	18.4	0.37	1.5	1.2	-0.2	3.1	0.8	-0.3	
437	305	–	309	300	305	5.0	10.3	4.5	0.24	2.1	0.9	-0.9	5.7	0.6	0.1	
						285.0	1.80	0.90								1.56
442	0	–	4	0	46	46.0	107.2	23.7	0.20	2.3	0.5	-0.3	7.0	0.3	0.3	
442	50	–	54	46	80	34.0	80.9	18.3	0.19	2.4	0.5	-0.8	9.5	0.4	0.3	
442	85	–	89	80	100	20.0	41.6	15.5	0.24	2.1	0.8	-0.5	5.5	0.5	0.1	
442	100	–	104	100	125	25.0	61.1	16.9	0.18	2.4	0.7	0.0	8.1	0.5	0.4	
442	150	–	154	125	175	50.0	112.7	35.3	0.21	2.3	0.7	0.0	6.3	0.5	0.2	
442	200	–	204	175	208	33.0	88.0	20.1	0.16	2.7	0.6	0.5	6.0	0.4	0.5	
442	250	–	254	208	254	46.0	84.1	50.9	0.28	1.8	1.1	-0.5	3.5	0.7	0.0	
						254.0	2.27	0.71								US

AREA C

NDC Hole #	Top of Sample (cm)		Bottom of sample (cm)	Top of Layer (cm)	Bottom of Layer (cm)	Thick of Layer (cm)	WTD Mean (Ø)	WTD StDev (Ø)	Sample Mean (mm)	NCGS SAMPLE DATA Mean (Ø)	StDev (Ø)	Skew	Kurtosis	1.9 mean, n 1.5 sdev,n Sb/Sn	(Mb-Mn)/Sn	ACES or SPM Ra
419	0	–	4	0	25	25.0	20.8	24.5	0.56	0.8	1.0	0.6	4.9	0.7	-0.7	
419	50	–	54	25	75	50.0	18.8	64.6	0.77	0.4	1.3	0.6	3.2	0.9	-1.0	
419	100	–	104	75	115	40.0	-4.2	53.3	1.08	-0.1	1.3	1.2	3.9	0.9	-1.3	
419	150	–	154	115	190	75.0	86.8	77.8	0.45	1.2	1.0	-0.3	4.5	0.7	-0.5	
419	200	–	204	190	215	25.0	55.1	25.2	0.22	2.2	1.0	-1.3	5.8	0.7	0.2	
419	226	–	230	215	230	15.0	28.2	17.1	0.27	1.9	1.1	-0.2	4.0	0.8	0.0	
419						230.0	0.89	1.14								1.00
425	0	–	4	0	30	30.0	34.8	27.3	0.45	1.2	0.9	-0.4	4.5	0.6	-0.5	
425	50	–	54	30	57	27.0	46.5	18.6	0.30	1.7	0.7	0.2	5.9	0.5	-0.1	
425	60	–	64	57	68	11.0	6.9	12.3	0.65	0.6	1.1	0.1	2.6	0.7	-0.8	
425	74	–	78	68	80	12.0	20.5	9.3	0.31	1.7	0.8	-0.2	5.5	0.5	-0.1	
425	85	–	89	80	96	16.0	9.1	20.9	0.68	0.6	1.3	0.2	2.5	0.9	-0.9	
425	100	–	104	96	113	17.0	22.3	16.2	0.40	1.3	1.0	0.0	4.9	0.6	-0.4	
425	130	–	134	113	140	27.0	45.6	27.6	0.31	1.7	1.0	-0.4	4.3	0.7	-0.1	
425	150	–	154	140	180	40.0	110.1	32.6	0.15	2.8	0.8	-0.7	6.2	0.5	0.6	
425	190	–	194	180	200	20.0	68.1	15.6	0.09	3.4	0.8	-2.0	11.0	0.5	1.0	
425						140.0	1.33	0.94								1.00
426	0	–	4	0	23	23.0	51.9	16.4	0.21	2.3	0.7	-0.1	5.6	0.5	0.2	
426	50	–	54	23	59	36.0	85.1	21.6	0.19	2.4	0.6	0.6	6.9	0.4	0.3	
426	70	–	74	59	61	2.0	4.1	1.7	0.25	2.0	0.9	1.3	4.9	0.6	0.1	
426	90	–	94	61	90	29.0	34.1	35.8	0.44	1.2	1.2	0.3	3.2	0.8	-0.5	
426	100	–	104	90	119	29.0	38.0	38.5	0.40	1.3	1.3	-0.1	2.8	0.9	-0.4	
426	150	–	154	119	185	66.0	141.0	54.8	0.23	2.1	0.8	1.0	4.4	0.6	0.2	
426	185	–	189	185	189	4.0	9.8	2.5	0.18	2.4	0.6	-0.4	8.6	0.4	0.4	
426	191	–	195	189	200	11.0	18.4	11.4	0.31	1.7	1.0	0.0	4.2	0.7	-0.2	
426	200	–	204	200	220	20.0	39.0	18.5	0.26	1.9	0.9	-0.3	5.0	0.6	0.0	
426	250	–	254	220	250	30.0	86.3	23.3	0.14	2.9	0.8	-0.1	4.5	0.5	0.7	
426	280	–	284	250	285	35.0	91.1	36.5	0.16	2.6	1.0	-1.3	6.6	0.7	0.5	
426	290	–	294	285	300	15.0	50.9	10.3	0.10	3.4	0.7	-0.8	7.1	0.5	1.0	
426	300	–	304	300	325	25.0	88.1	14.9	0.09	3.5	0.6	-1.0	9.1	0.4	1.1	
426	350	–	354	325	350	25.0	89.5	11.9	0.08	3.6	0.5	-1.0	13.1	0.3	1.1	
426	360	–	363	350	363	13.0	45.4	16.3	0.09	3.5	0.5	-0.3	5.7	0.3	1.1	
						285.0	2.10	3.02								1.60

AREA C

NDC Hole #	Top of Sample (cm)		Bottom of sample (cm)	Top of Layer (cm)	Bottom of Layer (cm)	Thick of Layer (cm)	WTD Mean (Ø)	WTD StDev (Ø)	Sample Mean (mm)	NCGS SAMPLE DATA Mean (Ø)	StDev (Ø)	Skew	Kurtosis	1.9 mean, n Sb/Sn	1.5 sdev,n (Mb-Mn)/Sn	ACES or SPM Ra
427	0	–	4	0	50	50.0	132.8	53.3	0.16	2.7	1.1	-0.6	3.3	0.7	0.5	
427	50	–	54	50	74	24.0	81.4	16.5	0.10	3.4	0.7	-1.3	8.8	0.5	1.0	
427	100	–	104	74	112	38.0	131.9	32.1	0.09	3.5	0.8	-3.3	18.0	0.6	1.0	
427	117	–	121	112	130	18.0	12.2	39.1	0.63	0.7	2.2	0.6	1.7	1.4	-0.8	
427	130	–	134	130	140	10.0	34.9	7.5	0.09	3.5	0.7	-3.3	21.6	0.5	1.1	
427	143	–	147	140	155	15.0	10.3	31.1	0.62	0.7	2.1	0.7	1.7	1.4	-0.8	
427	200	–	204	155	230	75.0	272.2	31.3	0.08	3.6	0.4	0.2	11.6	0.3	1.2	
427	250	–	254	230	288	58.0	215.9	30.9	0.08	3.7	0.5	-0.8	11.8	0.4	1.2	
427	300	–	304	288	320	32.0	117.1	13.7	0.08	3.7	0.4	0.1	11.2	0.3	1.2	
427	350	–	354	320	378	58.0	214.1	27.9	0.08	3.7	0.5	0.2	6.1	0.3	1.2	
427	380	–	384	378	400	22.0	63.9	28.3	0.13	2.9	1.3	0.1	1.4	0.9	0.7	
427	400	–	404	400	425	25.0	96.4	14.9	0.07	3.9	0.6	-1.0	7.9	0.4	1.3	
427	450	–	454	425	460	35.0	133.1	19.4	0.07	3.8	0.6	-0.8	8.7	0.4	1.3	
427	500	–	504	460	500	40.0	155.2	22.5	0.07	3.9	0.6	-0.8	7.6	0.4	1.3	
427	524	–	528	500	524	24.0	194.0	14.0	0.07	3.9	0.6	-1.1	8.2	0.4	1.3	
						155.0	2.60	1.16								1.40
440	000	–	004	0	10	10.0	23.7	6.9	0.19	2.37	0.69	-0.53	5.85	0.5	0.3	
440	050	–	054	10	100	90.0	207.6	69.0	0.20	2.31	0.77	-0.33	4.43	0.5	0.3	
440	100	–	104	100	130	30.0	73.4	20.5	0.18	2.45	0.68	-0.73	7.99	0.5	0.4	
440	150	–	154	130	160	30.0	81.6	24.7	0.15	2.72	0.82	-0.89	7.16	0.5	0.5	
440	200	–	204	160	205	45.0	113.2	34.3	0.17	2.52	0.76	-1.40	9.86	0.5	0.4	
440	250	–	254	205	275	70.0	171.9	64.4	0.18	2.46	0.92	-1.27	7.01	0.6	0.4	
440	300	–	304	275	301	26.0	72.2	24.6	0.15	2.78	0.95	-0.90	6.53	0.6	0.6	
440	350	–	354	301	350	49.0	163.5	28.8	0.10	3.34	0.59	-0.93	7.75	0.4	1.0	
440	385	–	389	350	400	50.0	127.2	65.2	0.17	2.54	1.30	-1.40	4.82	0.9	0.4	
440	400	–	404	400	450	50.0	149.7	55.0	0.13	2.99	1.10	-1.62	6.88	0.7	0.7	
440	450	–	454	450	490	40.0	140.3	20.5	0.09	3.51	0.51	-1.40	14.90	0.3	1.1	
440	500	–	504	490	500	10.0	28.3	19.7	0.14	2.83	1.97	-1.16	2.89	1.3	0.6	
440	525	–	529	500	534	34.0	102.1	37.8	0.12	3.00	1.11	-0.99	4.11	0.7	0.7	
440	540	–	544	534	547	13.0	55.6	7.7	0.05	4.28	0.59	-3.75	22.18	0.4	1.6	
440	580	–	584	547	580	33.0	399.8	26.7	0.12	3.02	0.81	-0.27	4.43	0.5	0.7	
						400.0	2.59	0.85								US

AREA D

NDC Hole #	Top of Sample (cm)		Bottom of sample (cm)	Top of Layer (cm)	Bottom of Layer (cm)	Thick of Layer (cm)	WTD Mean (Ø)	WTD StDev (Ø)	Sample Mean (mm)	NCGS SAMPLE DATA Mean (Ø)	StDev (Ø)	Skew	Kurtosis	1.9 mean, n 1.5 sdev,n Sb/Sn	(Mb-Mn)/Sn	ACES or SPM Ra
381	0	-	4	0	34	34.0	96.6	30.5	0.14	2.8	0.9	-1.6	8.9	0.6	0.6	
381	50	-	54	34	72	38.0	126.8	26.3	0.10	3.3	0.7	-1.8	11.5	0.5	1.0	
381	100	-	104	72	112	40.0	133.6	28.4	0.10	3.3	0.7	-1.1	6.8	0.5	1.0	
381	150	-	154	112	150	38.0	99.0	38.7	0.16	2.6	1.0	-0.6	3.6	0.7	0.5	
381	170	-	174	150	190	40.0	112.1	37.3	0.14	2.8	0.9	-0.8	4.6	0.6	0.6	
381	200	-	204	190	232	42.0	72.6	38.3	0.30	1.7	0.9	-0.3	6.2	0.6	-0.1	
381	232	-	236	232	236	4.0	8.2	3.2	0.24	2.0	0.8	0.7	5.6	0.5	0.1	
						236.0	2.75	0.86								US
382	0	-	4	0	25	25.0	79.2	18.2	0.11	3.2	0.7	-1.3	9.0	0.5	0.8	
382	50	-	54	27	75	48.0	144.7	34.9	0.12	3.0	0.7	-0.3	5.3	0.5	0.7	
382	100	-	104	75	133	58.0	192.7	42.1	0.10	3.3	0.7	-1.4	9.2	0.5	0.9	
382	150	-	154	133	170	37.0	77.7	33.2	0.23	2.1	0.9	0.2	4.2	0.6	0.1	
382	180	-	184	170	190	20.0	53.6	25.1	0.16	2.7	1.3	0.1	2.3	0.8	0.5	
382	200	-	204	190	225	35.0	91.3	42.7	0.16	2.6	1.2	0.4	2.2	0.8	0.5	
382	250	-	254	225	250	25.0	59.7	24.0	0.19	2.4	1.0	-0.3	3.7	0.6	0.3	
382	300	-	304	250	330	80.0	125.2	74.6	0.34	1.6	0.9	0.3	4.5	0.6	-0.2	
382	338	-	342	330	342	12.0	20.4	11.5	0.31	1.7	1.0	0.0	4.7	0.6	-0.1	
						340.0	2.48	0.90								US
383	0	-	4	0	25	25.0	76.3	18.4	0.12	3.1	0.7	-0.7	6.8	0.5	0.8	
383	50	-	54	25	75	50.0	166.4	32.6	0.10	3.3	0.7	-0.9	7.6	0.4	1.0	
383	100	-	104	100	125	25.0	76.0	24.9	0.12	3.0	1.0	-1.8	8.1	0.7	0.8	
383	150	-	154	125	160	35.0	117.9	20.9	0.10	3.4	0.6	-1.6	9.6	0.4	1.0	
383	175	-	179	160	200	40.0	90.5	37.4	0.21	2.3	0.9	-0.2	3.3	0.6	0.2	
383	200	-	204	200	207	7.0	19.1	5.6	0.15	2.7	0.8	-0.2	3.9	0.5	0.6	
383	215	-	219	207	215	8.0	26.5	8.7	0.10	3.3	1.1	-0.9	3.8	0.7	0.9	
383	228	-	232	220	235	15.0	20.7	25.4	0.38	1.4	1.7	0.3	2.2	1.1	-0.3	
383	250	-	254	235	280	45.0	108.5	27.4	0.19	2.4	0.6	-0.8	11.4	0.4	0.3	
383	300	-	304	280	300	20.0	37.3	17.6	0.27	1.9	0.9	0.7	4.8	0.6	0.0	
383	310	-	314	300	314	14.0	24.4	11.3	0.30	1.7	0.8	0.3	5.4	0.5	-0.1	
						284.0	2.69	0.81								US
389	0	-	4	0	30	30.0	76.5	29.7	0.17	2.6	1.0	-1.0	5.9	0.7	0.4	
389	35	-	39	30	40	10.0	31.9	8.5	0.11	3.2	0.8	-0.9	5.5	0.6	0.9	
389	50	-	54	40	60	20.0	55.1	20.0	0.15	2.8	1.0	-1.2	6.4	0.7	0.6	
389	80	-	84	60	100	40.0	135.8	26.3	0.10	3.4	0.7	-0.6	4.6	0.4	1.0	
389	100	-	104	100	130	30.0	93.0	25.2	0.12	3.1	0.8	-1.2	6.0	0.6	0.8	
389	150	-	154	130	168	38.0	103.7	45.9	0.15	2.7	1.2	-1.1	3.7	0.8	0.6	
389	175	-	179	168	175	7.0	9.1	7.7	0.41	1.3	1.1	0.1	3.9	0.7	-0.4	
389	200	-	204	175	232	57.0	38.8	79.8	0.62	0.7	1.4	0.9	3.7	0.9	-0.8	

AREA D

NDC Hole #	Top of Sample (cm)	Bottom of sample (cm)	Top of Layer (cm)	Bottom of Layer (cm)	Thick of Layer (cm)	WTD Mean (Ø)	WTD StDev (Ø)	Sample Mean (mm)	NCGS SAMPLE DATA Mean (Ø)	StDev (Ø)	Skew	Kurtosis	1.9 mean, n Sb/Sn	1.5 sdev,n (Mb-Mn)/Sn	ACES or SPM Ra
					232.0	2.34	1.05								US
394	0 –	4	0	10	10.0	29.0	8.7	0.13	2.9	0.9	-1.1	7.3	0.6	0.7	
394	50 –	54	10	75	65.0	221.2	48.0	0.09	3.4	0.7	-1.9	13.0	0.5	1.0	
394	100 –	104	75	125	50.0	158.4	32.2	0.11	3.2	0.6	-0.9	5.3	0.4	0.8	
394	150 –	154	125	190	65.0	180.0	59.1	0.15	2.8	0.9	-0.6	3.8	0.6	0.6	
394	200 –	204	190	210	20.0	37.0	30.7	0.28	1.9	1.5	-0.4	2.3	1.0	0.0	
394	210 –	214	210	225	15.0	19.6	24.5	0.40	1.3	1.6	0.3	1.9	1.1	-0.4	
394	230 –	234	225	240	15.0	50.9	10.5	0.10	3.4	0.7	-1.2	7.0	0.5	1.0	
394	250 –	254	240	275	35.0	94.7	38.6	0.15	2.7	1.1	-0.3	3.1	0.7	0.5	
394	280 –	284	275	290	15.0	25.2	23.6	0.31	1.7	1.6	-0.2	2.2	1.0	-0.1	
394	290 –	294	290	300	10.0	20.1	7.7	0.25	2.0	0.8	1.1	5.5	0.5	0.1	
394	300 –	304	300	316	16.0	40.4	13.7	0.17	2.5	0.9	0.8	3.9	0.6	0.4	
394	330 –	334	316	343	27.0	48.4	26.9	0.29	1.8	1.0	0.9	4.4	0.7	-0.1	
394	350 –	354	343	360	17.0	29.1	16.5	0.31	1.7	1.0	0.8	[illegible]	0.6	-0.1	
394	375 –	379	360	375	15.0	32.1	12.6	0.23	2.1	[illegible]	0.8	[illegible]	[illegible]	0.2	
					290.0	2.81	0.95								US
395	0 –	4	0	20	20.0	54.0	20.2	0.15	2.7	1.0	-1.6	7.1	0.7	0.5	
395	50 –	54	20	60	40.0	126.0	29.5	0.11	3.2	0.7	-1.4	9.4	0.5	0.8	
395	100 –	104	60	125	65.0	197.5	49.9	0.12	3.0	0.8	-2.3	14.6	0.5	0.8	
395	150 –	154	125	175	50.0	165.6	32.1	0.10	3.3	0.6	-3.1	22.4	0.4	0.9	
395	200 –	204	175	210	35.0	117.6	21.9	0.10	3.4	0.6	-1.5	10.2	0.4	1.0	
395	212 –	216	210	222	12.0	9.2	23.5	0.59	0.8	2.0	0.5	1.7	1.3	-0.8	
395	250 –	254	222	275	53.0	172.5	38.1	0.10	3.3	0.7	-1.7	10.7	0.5	0.9	
395	300 –	304	275	332	57.0	193.8	38.5	0.09	3.4	0.7	-0.8	5.5	0.4	1.0	
395	335 –	339	332	341	9.0	16.0	10.8	0.29	1.8	1.2	0.9	3.3	0.8	-0.1	
					341.0	3.09	0.78								US
399	0 –	4						0.19	2.43	0.89	-0.80	5.12	0.6	0.4	
399	50 –	54						0.15	2.78	0.96	-1.86	8.89	0.6	0.6	
399	100 –	104						0.12	3.08	0.78	-1.04	6.22	0.5	0.8	
399	140 –	144						0.46	1.11	1.95	0.07	1.39	1.3	-0.5	
399	150 –	154						0.09	3.44	0.61	-2.24	17.04	0.4	1.0	
399	200 –	204						0.10	3.32	0.67	-0.83	5.69	0.4	0.9	
399	232 –	236						0.09	3.48	0.48	-0.25	5.17	0.3	1.1	
			NOT EVALUATED FOR COMPATIBILITY												US

AREA D

NDC Hole #	Top of Sample (cm)		Bottom of sample (cm)	Top of Layer (cm)	Bottom of Layer (cm)	Thick of Layer (cm)	WTD Mean (Ø)	WTD StDev (Ø)	Sample Mean (mm)	NCGS SAMPLE DATA Mean (Ø)	StDev (Ø)	Skew	Kurtosis	1.9 mean, n Sb/Sn	1.5 sdev,n (Mb-Mn)/Sn	ACES or SPM Ra
401	0	–	004	0	15	15.0	40.3	9.7	0.16	2.7	0.6	-0.4	8.4	0.4	0.5	
401	50	–	054	15	75	60.0	196.6	37.0	0.10	3.3	0.6	-0.7	7.4	0.4	0.9	
401	100	–	104	75	125	50.0	169.1	31.3	0.10	3.4	0.6	-1.4	11.4	0.4	1.0	
401	150	–	154	125	175	50.0	151.7	34.1	0.12	3.0	0.7	-1.0	7.1	0.5	0.8	
401	200	–	204	175	205	30.0	83.3	33.0	0.15	2.8	1.1	-1.8	6.8	0.7	0.6	
401	250	–	254	205	256	51.0	124.8	65.4	0.18	2.4	1.3	-1.3	4.5	0.9	0.4	
401	258	–	262	256	263	7.0	14.4	10.9	0.24	2.1	1.6	-0.8	2.6	1.0	0.1	
401	280	–	284	263	290	27.0	79.4	24.3	0.13	2.9	0.9	-1.8	8.7	0.6	0.7	
401	300	–	304	290	325	35.0	75.8	64.8	0.22	2.2	1.9	-0.7	2.1	1.2	0.2	
401	350	–	354	325	375	50.0	180.7	26.9	0.08	3.6	0.5	-0.3	5.8	0.4	1.1	
401	400	–	404	375	420	45.0	161.2	20.5	0.08	3.6	0.5	0.0	6.7	0.3	1.1	
401	450	–	454	420	450	30.0	112.3	15.8	0.07	3.7	0.5	-1.1	6.5	0.4	1.2	
401	500	–	504	422	500	78.0	276.6	49.7	0.09	3.5	0.6	-1.8	11.5	0.4	1.1	
401	538	–	542	500	542	42.0	146.0	44.5	0.09	3.5	1.1	-1.2	4.2	0.7	1.1	
401	550	–	554	542	560	18.0	28.5	17.6	0.33	1.6	1.0	1.4	5.3	0.7	-0.2	
401	567	–	571	560	571	11.0	18.6	11.3	0.31	1.7	1.0	1.5	5.2	0.7	-0.1	
						599.0	3.10	0.83								US
403	0	–	4	0	10	10.0	25.6	10.1	0.17	2.6	1.0	-1.6	7.8	0.7	0.4	
403	50	–	54	10	75	65.0	202.0	51.4	0.12	3.1	0.8	-1.2	7.4	0.5	0.8	
403	100	–	104	75	125	50.0	163.5	28.1	0.10	3.3	0.6	-0.7	4.3	0.4	0.9	
403	150	–	154	125	175	50.0	147.1	32.6	0.13	2.9	0.7	-0.4	3.7	0.4	0.7	
403	200	–	204	175	224	49.0	130.0	48.0	0.16	2.7	1.0	-1.1	4.6	0.7	0.5	
403	250	–	254	224	275	51.0	175.0	33.8	0.09	3.4	0.7	-1.8	12.2	0.4	1.0	
403	300	–	304	275	325	50.0	179.1	28.3	0.08	3.6	0.6	-1.2	11.6	0.4	1.1	
403	350	–	354	325	387	62.0	226.8	35.2	0.08	3.7	0.6	-1.0	9.0	0.4	1.2	
403	400	–	404	387	416	29.0	76.5	37.7	0.16	2.6	1.3	0.4	1.7	0.9	0.5	
403	450	–	454	416	445	29.0	50.1	21.6	0.30	1.7	0.7	1.1	6.3	0.5	-0.1	
403	470	–	474	445	470	25.0	43.8	18.5	0.30	1.8	0.7	0.7	5.7	0.5	-0.1	
						470.0	3.02	0.73								US
407	0	–	4	0	10	10.0	26.9	8.3	0.16	2.7	0.8	-1.0	6.3	0.6	0.5	
407	50	–	54	10	89	79.0	232.8	68.7	0.13	2.9	0.9	-0.9	5.1	0.6	0.7	
407	92	–	96	89	102	13.0	47.8	12.9	0.08	3.7	1.0	-2.1	9.4	0.7	1.2	
407	105	–	109	102	111	9.0	3.8	17.0	0.74	0.4	1.9	0.8	2.0	1.3	-1.0	
407	150	–	154	111	175	64.0	217.6	41.4	0.09	3.4	0.6	-1.2	10.1	0.4	1.0	
407	200	–	204	175	200	25.0	92.2	12.1	0.08	3.7	0.5	0.2	5.1	0.3	1.2	
407	220	–	224	200	226	26.0	93.1	15.0	0.08	3.6	0.6	-0.7	7.0	0.4	1.1	
						226.0	3.16	0.78								US

AREA D

NDC Hole #	Top of Sample (cm)	Bottom of sample (cm)	Top of Layer (cm)	Bottom of Layer (cm)	Thick of Layer (cm)	WTD Mean (Ø)	WTD StDev (Ø)	Sample Mean (mm)	NCGS SAMPLE DATA Mean (Ø)	StDev (Ø)	Skew	Kurtosis	1.9 mean, n Sb/Sn	1.5 sdev,n (Mb-Mn)/Sn	ACES or SPM Ra
408	0 –	4	0	30	30.0	68.2	27.9	0.21	2.3	0.9	-0.7	5.1	0.6	0.2	
408	50 –	54	30	56	26.0	60.7	21.6	0.20	2.3	0.8	-1.1	6.4	0.6	0.3	
408	96 –	100	56	100	44.0	110.8	37.3	0.17	2.5	0.8	-0.6	5.7	0.6	0.4	
					100.0	2.40	0.87								US
412	0 –	4						0.11	3.20	0.79	-2.01	11.67	0.5	0.9	
412	50 –	54						0.07	3.89	0.91	-2.74	13.58	0.6	1.3	
412	80 –	84						0.10	3.32	0.55	-1.84	13.25	0.4	0.9	
412	100 –	104						0.09	3.41	0.61	-0.86	8.16	0.4	1.0	
412	150 –	154						0.09	3.54	0.50	-0.62	9.19	0.3	1.1	
412	200 –	204						0.08	3.63	0.51	-0.95	14.26	0.3	1.2	
412	250 –	254						0.08	3.60	0.58	-0.46	5.79	0.4	1.1	
412	300 –	304						0.09	3.55	0.51	-1.23	15.15	0.3	1.1	
412	350 –	354						0.07	3.81	0.53	-0.13	4.05	0.4	1.3	
412	380 –	384						0.07	3.83	0.59	-0.95	7.88	0.4	1.3	
412	400 –	404						0.07	3.88	0.59	-0.96	7.50	0.4	1.3	
412	450 –	454						0.07	3.86	0.59	-1.04	7.95	0.4	1.3	
412	500 –	504						0.08	3.68	0.70	-0.79	4.71	0.5	1.2	
412	550 –	554						0.09	3.40	0.81	-0.82	4.77	0.5	1.0	
															US

AREA DB

NDC Hole #	Top of Sample (cm)		Bottom of sample (cm)	Top of Layer (cm)	Bottom of Layer (cm)	Thick of Layer (cm)	WTD Mean (Ø)	WTD StDev (Ø)	Sample Mean (mm)	NCGS SAMPLE DATA Mean (Ø)	NCGS SAMPLE DATA StDev (Ø)	NCGS SAMPLE DATA Skew	NCGS SAMPLE DATA Kurtosis	1.9 mean, n Sb/Sn	1.5 sdev,n (Mb-Mn)/Sn	ACES or SPM Ra
375	0	–	4						0.13	2.96	0.75	-0.68	4.21	0.5	0.7	
375	50	–	54						0.14	2.82	0.96	-0.89	4.36	0.6	0.6	
375	100	–	104						0.16	2.64	1.61	-0.84	3.13	1.1	0.5	
375	150	–	154						0.17	2.57	1.07	-0.02	3.64	0.7	0.4	
375	200	–	204						0.07	3.80	1.15	-1.35	3.51	0.8	1.3	
375	218	–	222						0.16	2.60	1.27	0.30	2.04	0.8	0.5	
				NOT EVALUATED FOR COMPATIBILITY												
376	0	–	4						0.13	2.95	0.80	-1.73	9.83	0.5	0.7	
376	50	–	54						0.12	3.06	0.71	-1.69	10.75	0.5	0.8	
376	100	–	104						0.09	3.53	0.98	-1.78	7.24	0.7	1.1	
376	107	–	111						0.69	0.53	1.66	0.69	2.60	1.1	-0.9	
376	150	–	154						0.07	3.80	1.22	-1.59	4.63	0.8	1.3	
376	200	–	204						0.09	3.49	1.09	-0.42	1.71	0.7	1.1	
376	215	–	219						0.12	3.04	1.03	0.34	1.83	0.7	0.8	
376	250	–	254						0.30	1.73	0.83	0.26	4.25	0.6	-0.1	
376	300	–	304						0.23	2.11	0.89	-0.49	4.33	0.6	0.1	
376	334	–	338						0.21	2.28	0.73	0.17	4.87	0.5	0.3	
				NOT EVALUATED FOR COMPATIBILITY												
377	0	–	4						0.11	3.21	0.87	-1.83	10.00	0.6	0.9	
377	50	–	54						0.11	3.21	0.82	-1.92	10.62	0.5	0.9	
377	100	–	104						0.05	4.30	0.70	-4.27	22.49	0.5	1.6	
377	150	–	154						0.05	4.23	0.74	-3.44	17.66	0.5	1.6	
377	200	–	204						0.05	4.46	0.25	-8.13	84.21	0.2	1.7	
377	250	–	254						0.05	4.43	0.38	-7.31	77.39	0.3	1.7	
377	300	–	304						0.05	4.46	0.33	-12.56	193.01	0.2	1.7	
377	350	–	354						0.05	4.45	0.37	-9.79	120.48	0.2	1.7	
377	400	–	404						0.05	4.44	0.46	-9.58	103.73	0.3	1.7	
377	450	–	454						0.05	4.45	0.37	-9.64	115.05	0.2	1.7	
377	500	–	504						0.05	4.37	0.61	-5.34	33.74	0.4	1.6	
377	550	–	554						0.06	3.99	1.21	-2.19	6.49	0.8	1.4	
377	575	–	579						0.39	1.36	1.00	1.18	6.73	0.7	-0.4	
				NOT EVALUATED FOR COMPATIBILITY												

AREA DB

NDC Hole #	Top of Sample (cm)		Bottom of sample (cm)	Top of Layer (cm)	Bottom of Layer (cm)	Thick of Layer (cm)	WTD Mean (Ø)	WTD StDev (Ø)	Sample Mean (mm)	NCGS SAMPLE DATA Mean (Ø)	StDev (Ø)	Skew	Kurtosis	1.9 mean, n 1.5 sdev,n Sb/Sn	(Mb-Mn)/Sn	ACES or SPM Ra
379	0	–	4						0.11	3.21	0.87	-1.88	10.00	0.6	0.9	
379	50	–	54						0.11	3.21	0.82	-1.92	10.62	0.5	0.9	
379	100	–	104						0.05	4.30	0.70	-4.27	22.49	0.5	1.6	
379	150	–	154						0.05	4.23	0.74	-3.44	17.66	0.5	1.6	
379	200	–	204						0.05	4.46	0.25	-8.13	84.21	0.2	1.7	
379	250	–	254						0.05	4.43	0.38	-7.31	77.39	0.3	1.7	
379	300	–	304						0.05	4.46	0.33	-12.56	193.01	0.2	1.7	
379	350	–	354						0.05	4.45	0.37	-9.79	120.48	0.2	1.7	
379	400	–	404						0.05	4.44	0.46	-9.58	103.73	0.3	1.7	
379	450	–	454						0.05	4.45	0.37	-9.64	115.05	0.2	1.7	
379	500	–	504						0.05	4.37	0.61	-5.34	33.74	0.4	1.6	
379	550	–	554						0.06	3.99	1.21	-2.19	6.49	0.8	1.4	
379	575	–	579						0.39	1.36	1.00	1.18	6.73	0.7	-0.4	

NOT EVALUATED FOR COMPATIBILITY

AREA E

NDC Hole #	Top of Sample (cm)		Bottom of sample (cm)	Top of Layer (cm)	Bottom of Layer (cm)	Thick of Layer (cm)	WTD Mean (Ø)	WTD StDev (Ø)	Sample Mean (mm)	NCGS SAMPLE DATA Mean (Ø)	StDev (Ø)	Skew	Kurtosis	1.9 mean, n 1.5 sdev,n Sb/Sn	(Mb-Mn)/Sn	ACES or SPM Ra
303	0	–	4	0	30	30	64.71	20.72	0.22	2.16	0.69	-0.12	5.12	0.5	0.2	U
303	50	–	54	30	50	20	41.18	12.31	0.24	2.06	0.62	0.26	4.62	0.4	0.1	U
303	100	–	104	50	100	50	96.69	32.55	0.26	1.93	0.65	1.33	5.94	0.4	0.0	12.30
303	150	–	154	100	150	50	105.16	39.80	0.23	2.10	0.80	0.82	4.78	0.5	0.1	4.60
303	180	–	184	150	190	40	96.30	42.35	0.19	2.41	1.06	0.21	2.98	0.7	0.3	3.07
303	200	–	204	190	204	14	47.81	18.40	0.09	3.42	1.31	-0.81	2.47	0.9	1.0	U
303	250	–	254	204	254	50	180.81	42.29	0.08	3.62	0.85	-1.50	6.47	0.6	1.1	U
303	300	–	304	254	304	50	181.62	33.45	0.08	3.63	0.67	-1.52	10.74	0.4	1.2	U
303	350	–	354	304	354	50	179.17	29.90	0.08	3.58	0.60	-0.91	7.25	0.4	1.1	U
303	400	–	404	354	404	50	190.61	30.19	0.07	3.81	0.60	-0.67	4.70	0.4	1.3	U
303	445	–	449	404	449	45	169.31	28.67	0.07	3.70	0.64	-0.90	[illegible]	0.4	1.2	U
303					TOP 1.9M	190	2.13	0.78								6.40
304	0	–	4	1	36	35	93.34	39.10	0.16	2.67	1.12	-1.12	5.92	0.7	0.5	4.57
304	40	–	44	36	47	11	1.23	16.88	0.93	0.11	1.53	1.27	3.82	1.0	-1.2	1.00
304	50	–	54	47	79	32	90.07	50.84	0.14	2.81	1.59	-1.44	4.11	1.1	0.6	2.10
304	80	–	84	79	94	15	19.31	29.01	0.41	1.29	1.93	0.39	1.85	1.3	-0.4	1.03
304	100	–	104	94	110	16	55.07	23.46	0.09	3.44	1.47	-2.14	6.84	1.0	1.0	7.13
304	150	–	154	110	155	45	102.72	98.63	0.21	2.28	2.19	-0.47	1.68	1.5	0.3	1.31
304	200	–	204	155	250	95	106.43	204.16	0.46	1.12	2.15	0.50	1.79	1.4	-0.5	1.05
304	250	–	254	250	285	35	42.69	84.59	0.43	1.22	2.42	0.37	1.43	1.6	-0.5	1.11
304	300	–	304	285	335	50	178.63	82.19	0.08	3.57	1.64	-1.65	4.45	1.1	1.1	5.21
304	350	–	354	335	390	55	206.39	63.83	0.07	3.75	1.16	-2.80	12.04	0.8	1.2	U
304	400	–	404	390	435	45	98.94	95.18	0.22	2.20	2.12	-0.44	1.82	1.4	0.2	1.27
304	450	–	454	435	454	19	47.13	18.85	0.18	2.48	0.99	-0.30	4.58	0.7	0.4	5.07
304	463	–	467	454	467	13	34.52	12.94	0.16	2.66	1.00	-0.22	4.05	0.7	0.5	10.56
304						466	2.31	1.76								1.27
310	0	–	4	0	50	50	10.07	66.12	0.87	0.20	1.32	0.69	3.26	0.9	-1.1	1.00
310	50	–	54	50	79	29	56.80	60.24	0.26	1.96	2.08	-0.15	1.61	1.4	0.0	1.18
310	80	–	84	79	88	9	37.74	5.68	0.05	4.19	0.63	-3.55	22.88	0.4	1.5	U
310	90	–	94	88	100	12	-4.20	21.23	1.27	-0.35	1.77	1.99	5.45	1.2	-1.5	1.00
310	100	–	104	100	130	30	9.38	64.93	0.81	0.31	2.16	1.02	2.40	1.4	-1.1	1.00
310	150	–	154	130	190	60	217.76	51.86	0.08	3.63	0.86	-1.32	6.52	0.6	1.2	U
310	200	–	204	190	250	60	61.25	143.80	0.49	1.02	2.40	0.44	1.49	1.6	-0.6	1.00
310	250	–	254	250	264	14	53.30	20.44	0.07	3.81	1.46	-2.06	6.15	1.0	1.3	U
310	300	–	304	264	348	84	359.88	70.35	0.05	4.28	0.84	-4.73	25.85	0.6	1.6	U
310	350	–	354	348	400	52	198.37	58.13	0.07	3.81	1.12	-3.03	13.48	0.7	1.3	U
310	400	–	404	400	450	50	148.33	65.92	0.13	2.97	1.32	-0.84	3.42	0.9	0.7	4.34
310	450	–	454	450	500	50	140.55	70.74	0.14	2.81	1.41	-0.75	3.13	0.9	0.6	2.69
310	500	–	504	500	622	22	45.62	30.18	0.24	2.07	[illegible]	0.20	[illegible]	[illegible]	[illegible]	1.20

AREA E

NDC Hole #	Top of Sample (cm)		Bottom of sample (cm)	Top of Layer (cm)	Bottom of Layer (cm)	Thick of Layer (cm)	WTD Mean (Ø)	WTD StDev (Ø)	Sample Mean (mm)	NCGS SAMPLE DATA Mean (Ø)	StDev (Ø)	Skew	Kurtosis	1.9 mean, n Sb/Sn	1.5 sdev,n (Mb-Mn)/Sn	ACES or SPM Ra
325	0	–	4	0	30	30	48.31	25.94	0.33	1.61	0.86	0.22	5.41	0.6	-0.2	
325	50	–	54	30	75	45	84.33	34.78	0.27	1.87	0.77	0.40	6.27	0.5	0.0	
325	100	–	104	75	124	49	49.80	68.52	0.49	1.02	1.40	-0.31	2.57	0.9	-0.6	
325	135	–	139	124	150	26	-4.37	38.47	1.12	-0.17	1.48	1.22	3.53	1.0	-1.4	
325	150	–	154	150	168	18	37.02	36.11	0.24	2.06	2.01	-0.72	1.91	1.3	0.1	
325	150	–	154	168	200	32	113.74	33.88	0.09	3.55	1.06	-1.91	7.68	0.7	1.1	
325	200	–	204	200	250	50	171.10	58.39	0.09	3.42	1.17	-2.09	8.12	0.8	1.0	
325	250	–	254	250	275	25	96.94	15.55	0.07	3.88	0.62	-1.46	10.77	0.4	1.3	
325	300	–	304	275	310	35	109.87	59.09	0.11	3.14	1.69	-1.44	4.18	1.1	0.8	
325	350	–	354	310	370	60	169.90	126.02	0.14	2.83	2.10	-0.88	2.24	1.4	0.6	
325	390	–	394	370	390	20	87.10	12.83	0.05	4.36	0.64	-5.68	38.09	0.4	1.6	
325	400	–	404	390	425	35	142.73	32.49	0.06	4.08	0.93	-3.16	14.79	0.6	1.5	
325	450	–	454	425	470	45	195.15	29.33	0.05	4.34	0.65	-5.75	42.51	0.4	1.6	
325	500	–	504	470	500	30	106.85	30.59	0.08	3.56	1.02	-2.31	10.97	0.7	1.1	
325	550	–	554	500	604	104	370.77	77.25	0.08	3.57	0.74	-0.32	2.83	0.5	1.1	
325					TOP 2M	200	1.64	1.19								1.03
					WHOLE	604	2.95	1.12								U
326	0	–	4	0	40	40	78.91	93.45	0.25	1.97	2.34	-0.45	1.43	1.6	0.0	
326	50	–	54	46	100	54	146.01	110.75	0.15	2.70	2.05	-1.08	2.65	1.4	0.5	
326	100	–	104	100	150	50	167.10	68.88	0.10	3.34	1.38	-2.13	7.54	0.9	1.0	
326	150	–	154	150	176	26	84.87	37.42	0.10	3.26	1.44	-2.07	6.98	1.0	0.9	
326	176	–	180	176	181	5	19.42	5.67	0.07	3.88	1.13	-3.21	14.41	0.8	1.3	
326						175	2.84	1.81								1.81
328	0	–	4	0	5	5	12.99	7.29	0.17	2.60	1.46	-0.45	2.56	1.0	0.5	
328	10	–	14	5	19	14	21.79	14.59	0.34	1.56	1.04	-0.08	4.03	0.7	-0.2	
328	30	–	34	19	50	31	76.95	54.38	0.18	2.48	1.75	-0.64	2.46	1.2	0.4	
328	50	–	54	50	75	25	-8.82	34.72	1.28	-0.35	1.39	1.86	6.04	0.9	-1.5	
328	75	–	79	75	100	25	88.24	36.13	0.09	3.53	1.45	-2.06	6.50	1.0	1.1	
328	100	–	104	100	150	50	178.74	74.79	0.08	3.57	1.50	-2.25	7.45	1.0	1.1	
328	150	–	154	150	200	50	44.59	114.43	0.54	0.89	2.29	0.56	1.68	1.5	-0.7	
328	200	–	204	200	250	50	185.45	83.36	0.08	3.71	1.67	-2.08	5.89	1.1	1.2	
328	250	–	254	250	300	50	180.46	76.18	0.08	3.61	1.52	-2.16	7.05	1.0	1.1	
328	300	–	304	300	350	50	169.97	78.64	0.09	3.40	1.57	-1.23	3.46	1.0	1.0	
328	350	–	354	350	40	-310	-938.30	-421.63	0.12	3.03	1.36	-1.30	4.54	0.9	0.8	
328	400	–	404	400	450	50	142.01	68.21	0.14	2.84	1.36	-1.01	3.83	0.9	0.6	
328	450	–	454	450	485	35	94.65	51.64	0.15	2.70	1.48	-0.75	3.02	1.0	0.5	
328	485	–	489	485	491	6	-17.46	16.12	0.13	2.91	1.35	-1.14	3.97	0.9	0.7	
328					TOP 2M	200	2.07	1.68								1.12

AREA E

NDC Hole #	Top of Sample (cm)		Bottom of sample (cm)	Top of Layer (cm)	Bottom of Layer (cm)	Thick of Layer (cm)	WTD Mean (Ø)	WTD StDev (Ø)	Sample Mean (mm)	NCGS SAMPLE DATA Mean (Ø)	StDev (Ø)	Skew	Kurtosis	1.9 mean, n 1.5 sdev,n Sb/Sn	(Mb-Mn)/Sn	ACES or SPM Ra
310					TOP 2.5 M	250	1.56	1.66								1.00
					5.2 M	522	2.56	1.40								1.98
311	0	–	4	0	21	21	42.83	16.81	0.24	2.04	0.80	-1.25	5.82	0.5	0.1	3.75
311	30	–	34	21	40	19	46.43	13.65	0.18	2.44	0.72	-0.74	7.31	0.5	0.4	U
311	50	–	54	40	50	10	11.44	14.22	0.45	1.14	1.42	0.08	2.33	0.9	-0.5	1.00
311	80	–	84	50	92	42	141.42	25.33	0.10	3.37	0.60	-1.50	9.27	0.4	1.0	U
311	95	–	99	92	100	8	10.21	14.70	0.41	1.28	1.84	0.31	1.87	1.2	-0.4	1.00
311	100	–	104	100	110	10	13.18	18.38	0.40	1.32	1.84	0.52	2.10	1.2	-0.4	1.00
311	120	–	124	110	140	30	126.08	25.68	0.05	4.20	0.86	-3.24	13.36	0.6	1.5	U
311	140	–	144	140	149	9	17.43	19.04	0.26	1.94	2.12	-0.35	1.58	1.4	0.0	1.18
311	150	–	154	148	170	22	71.60	38.63	0.10	3.25	1.76	-1.71	4.69	1.2	0.9	2.75
311	170	–	174	170	200	30	108.03	34.17	0.08	3.60	1.14	-2.52	10.39	0.8	1.1	U
311	200	–	204	200	220	20	75.17	20.60	0.07	3.76	1.03	-2.57	11.41	0.7	1.2	U
311	250	–	254	220	295	75	50.98	164.28	0.62	0.68	2.19	0.79	2.03	1.5	-0.8	1.03
311	300	–	304	295	325	30	44.82	75.73	0.36	1.49	2.52	0.15	1.24	1.7	-0.3	1.12
311	350	–	354	325	360	35	151.56	27.94	0.05	4.33	0.80	-5.28	31.20	0.5	1.6	U
311	400	–	404	360	450	90	310.29	161.34	0.09	3.45	1.79	-1.58	4.15	1.2	1.0	U
311	450	–	454	450	471	21	62.40	17.07	0.13	2.97	0.81	-0.36	[illegible]	0.5	0.7	U
311					4.7M	472	2.72	1.46								2.25
					TOP 3.3 M	326	2.33	1.48								1.44
314	0	–	4	0	30	30	43.84	25.68	0.36	1.46	0.86	-0.61	6.01	0.6	-0.3	1.15
314	50	–	54	30	78	48	85.91	32.17	0.29	1.79	0.67	0.64	6.26	0.4	-0.1	3.74
314	80	–	84	78	92	14	31.08	21.47	0.21	2.22	1.53	-0.17	2.35	1.0	0.2	1.27
314	95	–	99	92	100	8	18.61	10.44	0.20	2.33	1.31	-0.64	3.77	0.9	0.3	1.67
314	100	–	104	100	125	25	59.91	24.27	0.19	2.40	0.97	-0.50	5.43	0.6	0.3	4.38
314	125	–	129	125	136	11	27.97	21.11	0.17	2.54	1.92	-0.62	2.12	1.3	0.4	1.42
314	150	–	154	136	180	44	164.08	21.64	0.08	3.73	0.49	-0.14	7.64	0.3	1.2	U
314	180	–	184	180	200	20	84.62	12.58	0.05	4.23	0.63	-3.17	16.07	0.4	1.6	U
314	200	–	204	200	250	50	205.75	30.81	0.06	4.11	0.62	-2.32	13.17	0.4	1.5	U
314	250	–	254	250	270	20	77.57	10.63	0.07	3.88	0.53	-0.15	3.09	0.4	1.3	U
314	277	–	281	270	277	7	25.78	4.85	0.08	3.68	0.69	-1.42	[illegible]	0.5	1.2	U
314					TOP 1.3M	136	1.97	0.99								1.67
315	000	–	004	0	27	27	46.02	21.89	0.31	1.70	0.81	-0.31	6.46	0.5	-0.1	
315	050	–	054	27	67	40	123.71	42.24	0.12	3.09	1.06	-1.04	4.83	0.7	0.8	
315	070	–	074	67	77	10	25.28	16.25	0.17	2.53	1.62	-0.93	3.19	1.1	0.4	
315	085	–	089	77	85	8	29.52	7.11	0.08	3.69	0.89	-2.19	11.14	0.6	1.2	
315	100	–	104	85	125	40	77.80	73.40	0.26	1.95	1.83	-0.18	1.94	1.2	0.0	
315	150	–	154	125	180	55	179.87	82.96	0.10	3.27	1.51	-1.91	5.87	1.0	0.9	
315	180	–	184	180	186	6	23.96	3.45	0.06	3.99	0.58	-1.05	[illegible]	[illegible]	1.4	

AREA E

NDC Hole #	Top of Sample (cm)		Bottom of sample (cm)	Top of Layer (cm)	Bottom of Layer (cm)	Thick of Layer (cm)	WTD Mean (Ø)	WTD StDev (Ø)	Sample Mean (mm)	NCGS SAMPLE DATA Mean (Ø)	StDev (Ø)	Skew	Kurtosis	1.9 mean, n 1.5 sdev,n Sb/Sn	(Mb-Mn)/Sn	ACES or SPM Ra
315					TOP 1M	125	2.42	1.29								1.9
					1.9M	186	2.72	1.33								
316a	0	–	4	0	50	50	46.28	53.85	0.53	0.93	1.08	-0.06	3.89	0.7	-0.6	1.00
316a	50	–	54	50	100	50	65.82	47.95	0.40	1.32	0.96	-0.47	4.66	0.6	-0.4	1.02
316a	100	–	104	100	140	40	45.93	43.27	0.45	1.15	1.08	0.22	4.06	0.7	-0.5	1.00
316a	140	–	145	140	145	5	7.86	4.98	0.34	1.57	1.00	0.40	4.88	0.7	-0.2	1.10
316a						145	1.14	1.03								1.00
318	0	–	4	0	30	30	56.88	22.33	0.27	1.90	0.74	0.00	4.63	0.5	0.0	3.00
318	50	–	54	30	60	30	103.49	33.87	0.09	3.45	1.13	-1.20	4.49	0.8	1.0	U
318	70	–	74	60	77	17	6.32	35.75	0.77	0.37	2.10	0.91	2.21	1.4	-1.0	1.00
318	90	–	94	77	95	18	67.20	23.10	0.08	3.73	1.28	-2.01	6.63	0.9	1.2	U
318	100	–	104	95	110	15	50.27	24.17	0.10	3.35	1.61	-1.56	4.62	1.1	1.0	3.97
318	150	–	154	110	193	83	253.10	173.16	0.12	3.05	2.09	-1.09	2.64	1.4	0.8	1.84
318	200	–	204	193	240	47	26.97	97.90	0.67	0.57	2.08	0.94	2.45	1.4	-0.9	1.00
318	250	–	254	240	250	10	41.76	8.06	0.06	4.18	0.81	-3.04	13.60	0.5	1.5	U
318	300	–	304	250	332	82	309.25	123.34	0.07	3.77	1.50	-2.17	6.90	1.0	1.2	U
318	350	–	354	332	370	38	94.44	19.18	0.18	2.49	0.50	1.10	9.80	0.3	0.4	U
318	400	–	404	375	433	58	127.68	43.32	0.22	2.20	0.75	1.12	[illegible]	0.5	0.2	U
318	433	–	437	433	437	4	9.66	3.18	0.19	2.41	0.78	[illegible]	[illegible]	0.5	0.3	U
318					TOP 2.4M	240	2.35	1.71								1.31
					4.8M	432	2.66	1.41								2.21
321	0	–	4	0	22	22	39.94	20.71	0.28	1.82	0.94	-0.66	5.70	0.6	-0.1	
321	23	–	27	0	30	30	6.64	48.85	0.86	0.22	1.63	0.95	2.99	1.1	-1.1	
321	35	–	39	30	40	10	-0.49	18.96	1.03	-0.05	1.90	1.46	3.69	1.3	-1.3	
321	50	–	54	40	70	30	113.96	32.35	0.07	3.80	1.08	-2.83	12.68	0.7	1.3	
321	70	–	74	70	100	30	116.75	24.60	0.07	3.89	0.82	-2.75	15.41	0.5	1.3	
321	100	–	104	100	113	13	51.93	10.66	0.06	3.99	0.82	-2.65	13.65	0.5	1.4	
321	150	–	154	113	165	52	73.47	122.09	0.38	1.41	2.35	0.17	1.41	1.6	-0.3	
321	200	–	204	165	250	85	351.48	97.92	0.06	4.14	1.15	-3.71	16.18	0.8	1.5	
321	250	–	254	250	289	39	166.30	37.52	0.05	4.26	0.96	-4.87	26.50	0.6	1.6	
321	300	–	304	289	350	61	160.23	67.59	0.16	2.63	1.11	-0.13	3.88	0.7	0.5	
321	350	–	354	350	400	50	156.11	50.71	0.11	3.12	1.01	-0.01	2.55	0.7	0.8	
321	400	–	404	400	443	43	110.03	34.31	0.17	2.56	0.80	0.48	4.94	0.5	0.4	
321	443	–	447	443	448	5	11.39	5.72	0.21	2.28	1.14	-0.57	[illegible]	0.8	0.3	
321					TOP 1.7M	187	2.15	1.49								1.22
					4.5M	470	2.89	1.22								5.22

AREA E

NDC Hole #	Top of Sample (cm)		Bottom of sample (cm)	Top of Layer (cm)	Bottom of Layer (cm)	Thick of Layer (cm)	WTD Mean (Ø)	WTD StDev (Ø)	Sample Mean (mm)	NCGS SAMPLE DATA Mean (Ø)	StDev (Ø)	Skew	Kurtosis	1.9 mean, n 1.5 sdev,n Sb/Sn	(Mb-Mn)/Sn	ACES or SPM Ra
322	0	–	4	0	20	20	-0.69	31.41	1.02	-0.03	1.57	1.25	3.65	1.0	-1.3	
322	50	–	54	20	50	30	66.45	42.80	0.22	2.21	1.43	-0.43	3.18	1.0	0.2	
322	100	–	104	50	100	50	92.06	80.11	0.28	1.84	1.60	-0.02	2.55	1.1	0.0	
322	150	–	154	100	172	72	123.93	96.56	0.30	1.72	1.34	0.01	3.40	0.9	-0.1	
322						172	1.64	1.46								1.00
323	0	–	4	0	46	46	39.35	42.07	0.55	0.86	0.91	0.04	4.60	0.6	-0.7	
323	46	–	50	46	50	4	9.09	5.11	0.21	2.27	1.28	0.23	2.75	0.9	0.2	
323	80	–	84	50	100	50	13.68	98.85	0.83	0.27	1.98	0.96	2.32	1.3	-1.1	
323	100	–	104	100	115	15	3.86	26.19	0.84	0.26	1.75	1.06	3.15	1.2	-1.1	
323	150	–	154	115	200	85	313.16	68.92	0.08	3.68	0.81	-1.86	9.87	0.5	1.2	
323	200	–	204	200	250	50	180.38	45.34	0.08	3.61	0.91	-2.04	10.81	0.6	1.1	
323	250	–	254	250	300	50	193.31	39.81	0.07	3.87	0.80	-3.00	18.85	0.5	1.3	
323	300	–	304	300	350	50	188.62	59.88	0.07	3.77	1.20	-2.20	7.61	0.8	1.2	
323	350	–	354	350	400	50	210.75	34.19	0.05	4.22	0.68	-3.60	18.53	0.5	1.5	
323	400	–	404	400	420	20	40.43	45.29	0.25	2.02	2.26	-0.19	1.48	1.5	0.1	
323	450	–	454	420	490	70	191.49	145.90	0.15	2.74	2.08	-0.78	2.15	1.4	0.6	
323	500	–	504	490	543	53	216.37	46.04	0.06	4.08	0.87	-3.39	17.93	0.6	1.5	
323	550	–	554	543	590	47	24.42	93.52	0.70	0.52	1.99	0.73	2.10	1.3	-0.9	
323	596	–	600	590	596	6	15.74	[illegible]	0.52	0.96	1.82	0.27	[illegible]	1.3	-0.6	
323					TOP 2M	200	1.90	1.21								1.16
					6.0M	596	2.74	1.28								3.15
324	0	–	4	0	40	40	48.05	40.45	0.43	1.20	1.01	0.24	4.84	0.7	-0.5	
324	50	–	54	40	65	25	42.62	16.84	0.31	1.70	0.67	0.87	7.66	0.4	-0.1	
324	80	–	84	65	85	20	8.60	30.02	0.74	0.43	1.50	0.36	2.07	1.0	-1.0	
324	90	–	94	85	100	15	-1.89	26.76	1.09	-0.13	1.78	1.58	4.35	1.2	-1.4	
324	100	–	104	100	150	50	151.13	88.33	0.12	3.02	1.77	-1.51	4.06	1.2	0.7	
324	150	–	154	150	170	20	62.51	33.71	0.11	3.13	1.69	-1.75	4.98	1.1	0.8	
324	190	–	194	190	200	10	23.36	22.49	0.20	2.34	2.25	-0.49	1.65	1.5	0.3	
324	200	–	204	200	250	50	191.63	72.77	0.07	3.83	1.46	-2.25	7.02	1.0	1.3	
324	250	–	254	250	300	50	214.87	45.84	0.05	4.30	0.92	-4.97	27.49	0.6	1.6	
324	300	–	304	300	350	50	185.81	74.35	0.08	3.72	1.49	-1.99	6.03	1.0	1.2	
324	350	–	354	350	400	50	131.44	56.76	0.16	2.63	1.14	0.14	2.46	0.8	0.5	
324	400	–	404	400	450	50	111.32	57.60	0.21	2.23	1.15	0.34	3.12	0.8	0.2	
324	450	–	454	450	458	8	18.23	9.35	0.21	2.28	1.17	0.26	3.38	0.8	0.3	
324					TOP 2.5 M	230	2.29	1.44								1.42
					4.6M	438	2.71	1.31								2.80

AREA E

NDC Hole #	Top of Sample (cm)		Bottom of sample (cm)	Top of Layer (cm)	Bottom of Layer (cm)	Thick of Layer (cm)	WTD Mean (Ø)	WTD StDev (Ø)	Sample Mean (mm)	NCGS SAMPLE DATA Mean (Ø)	StDev (Ø)	Skew	Kurtosis	1.9 mean, n Sb/Sn	1.5 sdev,n (Mb-Mn)/Sn	ACES or SPM Ra
331	0	–	4	0	35	35	-14.52	40.83	1.33	-0.41	1.17	1.58	5.85	0.8	-1.5	
331	13	–	17	35	50	15	-4.63	26.74	1.24	-0.31	1.78	1.87	5.04	1.2	-1.5	
331	40	–	44	50	68	18	27.54	15.89	0.35	1.53	0.88	0.38	7.34	0.6	-0.2	
331						68	0.12	1.23								1.00
333	0	–	4	0	30	30	9.85	39.64	0.80	0.33	1.32	0.57	3.27	0.9	-1.0	
333	30	–	34	30	40	10	22.63	22.62	0.21	2.26	2.26	-0.29	1.44	1.5	0.2	
333	45	–	49	40	50	10	20.88	20.57	0.24	2.09	2.06	-0.15	1.53	1.4	0.1	
333	50	–	54	50	70	20	-1.96	30.61	1.07	-0.10	1.53	1.72	5.38	1.0	-1.3	
333	80	–	84	70	100	30	48.46	22.45	0.33	1.62	0.75	1.64	10.73	0.5	-0.2	
333	100	–	104	100	151	51	84.57	43.06	0.32	1.66	0.84	1.27	8.40	0.6	-0.2	
333	155	–	159	151	170	19	72.14	16.97	0.07	3.80	0.89	-1.95	9.25	0.6	1.3	
333	190	–	194	170	190	20	79.10	21.08	0.06	3.95	1.05	-2.35	9.45	0.7	1.4	
333						190	1.77	1.14								1.14
334	0	–	4	0	30	30	33.66	32.72	0.46	1.12	1.09	-0.51	3.12	0.7	-0.5	
334	50	–	54	60	60	0	0.00	0.00	0.27	1.88	0.63	0.76	5.09	0.4	0.0	
334	100	–	104	60	106	46	99.18	36.90	0.22	2.16	0.80	0.14	4.41	0.5	0.2	
334						76	1.75	0.92								1.41
336	0	–	50	0	25	25	70.92	40.70	0.14	2.84	1.63	-0.46	2.02	1.1	0.6	
336	50	–	54	25	54	29	107.16	29.42	0.08	3.70	1.01	-1.73	7.13	0.7	1.2	
336	100	–	104	54	104	50	188.66	53.13	0.07	3.77	1.06	-2.85	13.15	0.7	1.2	
336	150	–	154	104	154	50	196.24	36.45	0.07	3.92	0.73	-1.97	10.82	0.5	1.3	
336	200	–	204	154	204	50	197.43	37.27	0.06	3.95	0.75	-2.11	10.96	0.5	1.4	
336	250	–	254	204	254	50	213.20	37.90	0.05	4.26	0.76	-5.21	34.71	0.5	1.6	
336	280	–	284	254	284	30	53.38	66.64	0.29	1.78	2.22	-0.09	1.54	1.5	-0.1	
336	300	–	304	284	304	20	43.36	43.79	0.22	2.17	2.19	-0.34	1.64	1.5	0.2	
336	350	–	354	304	354	50	155.91	70.76	0.12	3.12	1.42	-0.83	3.33	0.9	0.8	
336	400	–	404	354	404	50	201.11	51.42	0.06	4.02	1.03	-2.48	9.41	0.7	1.4	
336	450	–	454	404	454	50	217.35	29.70	0.05	4.35	0.59	-5.36	37.24	0.4	1.6	
336	490	–	494	454	494	40	99.49	52.64	0.18	2.49	1.32	-0.25	3.48	0.9	0.4	
336	500	–	504	494	504	10	23.75	13.85	0.19	2.38	1.38	-0.81	4.24	0.9	0.3	
336	550	–	554	504	554	50	151.34	71.69	0.12	3.03	1.43	-0.78	3.45	1.0	0.8	
336	600	–	604	554	604	50	124.50	85.08	0.18	2.49	1.70	-0.69	2.93	1.1	0.4	
336						604	3.38	1.19								US

A LOG WAS NOT USED FOR 336

OTHER CORES

NDC Hole #	Top of Sample (cm)		Bottom of sample (cm)	Top of Layer (cm)	Bottom of Layer (cm)	Thick of Layer (cm)	WTD Mean (Ø)	WTD StDev (Ø)	Sample Mean (mm)	NCGS SAMPLE DATA Mean (Ø)	StDev (Ø)	Skew	Kurtosis	1.9 mean, n Sb/Sn	1.5 sdev,n (Mb-Mn)/Sn	ACES or SPM Ra
306	0	–	4	0	20	20	39.13	15.35	0.26	1.96	0.77	-0.55	4.49	0.5	0.0	3.43
306	50	–	54	20	90	70	144.98	48.25	0.24	2.07	0.69	-0.62	6.79	0.5	0.1	U
306	100	–	104	90	126	36	68.76	30.34	0.27	1.91	0.84	-0.34	3.80	0.6	0.0	2.20
306	150	–	154	126	166	40	114.50	32.67	0.14	2.86	0.82	-0.50	5.24	0.5	0.6	U
306						166	2.21	0.76								U
307	0	–	4	0	30	30	71.10	18.25	0.19	2.37	0.61	-0.26	5.79	0.4	0.3	U
307	50	–	54	30	70	40	96.31	25.37	0.19	2.41	0.63	-0.65	9.17	0.4	0.3	U
307	100	–	104	70	140	70	177.70	47.49	0.17	2.54	0.68	-0.13	6.14	0.5	0.4	U
307	150	–	154	140	180	40	84.77	37.64	0.23	2.12	0.94	-1.00	5.36	0.6	0.1	2.45
307	200	–	204	180	210	30	83.68	23.45	0.14	2.79	0.78	-0.79	7.07	0.5	0.6	U
307	250	–	254	210	280	70	225.39	45.75	0.11	3.22	0.65	-0.07	4.01	0.4	0.9	U
307	300	–	304	280	330	50	160.80	33.90	0.11	3.22	0.68	-1.14	8.80	0.5	0.9	U
307	350	–	354	330	390	60	210.29	31.72	0.09	3.50	0.53	-0.25	4.84	0.4	1.1	U
307	400	–	404	390	410	20	-11.57	29.06	1.49	-0.58	1.45	2.32	7.38	1.0	-1.7	1.00
307	415	–	419	410	419	9	19.37	21.56	0.22	2.15	2.40	-0.42	1.44	1.6	0.2	1.30
307						419	2.67	0.75								U
308	0	–	4	0	50	50	149.92	32.49	0.13	3.00	0.65	-0.28	5.15	0.4	0.7	U
308	50	–	54	54	100	46	160.85	38.11	0.09	3.50	0.83	-1.77	9.44	0.6	1.1	U
308	100	–	104	100	150	50	174.23	22.62	0.09	3.48	0.45	-1.32	15.60	0.3	1.1	U
308	150	–	154	150	180	30	105.63	17.04	0.09	3.52	0.57	-0.39	4.69	0.4	1.1	U
308	180	–	184	180	200	20	77.43	10.92	0.07	3.87	0.55	-0.08	2.22	0.4	1.3	U
308	200	–	204	200	204	4	15.32	2.35	0.07	3.83	0.59	-0.31	2.89	0.4	1.3	U
308	245	–	249	245	249	4	13.92	2.27	0.09	3.48	0.57	-0.11	3.56	0.4	1.1	U
308						204	3.42	0.62								U
309	0	–	4	0	20	20	29.71	28.04	0.36	1.49	1.40	0.02	3.20	0.9	-0.3	1.00
309	35	–	39	20	41	21	12.39	32.24	0.66	0.59	1.54	0.34	2.29	1.0	-0.9	1.00
309	50	–	54	41	80	39	151.98	33.55	0.07	3.90	0.86	-2.67	13.68	0.6	1.3	U
309	100	–	104	80	105	25	89.72	15.72	0.08	3.59	0.63	-0.30	3.85	0.4	1.1	U
309	150	–	154	132	173	41	157.83	25.27	0.07	3.85	0.62	-0.85	6.45	0.4	1.3	U
309					WHOLE	146	3.02	0.92								3.25
					TOP .41M	41	1.03	1.47								1.00

OTHER CORES

NDC Hole #	Top of Sample (cm)		Bottom of sample (cm)	Top of Layer (cm)	Bottom of Layer (cm)	Thick of Layer (cm)	WTD Mean (Ø)	WTD StDev (Ø)	Sample Mean (mm)	NCGS SAMPLE DATA Mean (Ø)	StDev (Ø)	Skew	Kurtosis	1.9 mean, n Sb/Sn	1.5 sdev,n (Mb-Mn)/Sn	ACES or SPM Ra
312	0	–	4	0	43	43	46.48	42.54	0.47	1.08	0.99	-0.52	4.02	0.7	-0.5	1.00
312	50	–	54	43	90	47	72.23	34.32	0.34	1.54	0.73	0.23	7.51	0.5	-0.2	1.02
312	100	–	104	90	114	24	30.70	26.95	0.41	1.28	1.12	0.11	3.98	0.7	-0.4	1.00
312	150	–	154	114	168	54	169.29	71.92	0.11	3.13	1.33	-1.85	6.26	0.9	0.8	6.00
312	180	–	184	168	180	12	27.44	10.76	0.20	2.29	0.90	0.47	3.58	0.6	0.3	4.62
312	200	–	204	180	220	40	94.11	39.81	0.20	2.35	1.00	0.47	2.67	0.7	0.3	3.32
312	250	–	254	220	250	30	94.82	26.97	0.11	3.16	0.90	-0.95	4.56	0.6	0.8	U
312	300	–	304	250	300	50	166.23	47.34	0.10	3.32	0.95	-2.63	13.11	0.6	0.9	U
312	350	–	354	300	350	50	161.56	82.10	0.11	3.23	1.64	-1.58	4.56	1.1	0.9	3.00
312	370	–	374	350	400	50	33.49	104.54	0.63	0.67	2.09	0.66	1.86	1.4	-0.8	3.12
312	400	–	404	400	430	30	48.15	69.36	0.33	1.60	2.31	-0.13	1.29	1.5	-0.2	1.15
312	440	–	444	430	440	10	30.09	18.27	0.12	3.01	1.83	-1.29	3.33	1.2	0.7	2.07
312						440	2.21	1.31								1.45
313	0	–	4	0	50	50	54.81	46.25	0.47	1.10	0.92	-0.31	4.24	0.6	-0.5	
313	50	–	54	50	85	35	50.68	32.24	0.37	1.45	0.92	-0.79	5.39	0.6	-0.3	
313	100	–	104	85	114	29	39.48	26.75	0.39	1.36	0.92	-0.10	5.27	0.6	-0.4	
313	150	–	154	114	173	59	191.82	143.34	0.11	3.25	0.73	-1.04	2.49	0.5	0.9	
313				WHOLE CORE		173	1.95	0.86								2.24
				TOP 1.04 M		114	1.27	0.92								1.02
317	0	–	4	0	90	90	248.59	69.87	0.15	2.76	0.78	-1.08	8.68	0.5	0.6	U
317	50	–	54	50	100	50	148.77	50.66	0.13	2.98	1.01	-2.03	9.83	0.7	0.7	U
317	100	–	104	100	140	40	125.08	34.31	0.11	3.13	0.86	-1.89	10.11	0.6	0.8	U
317	150	–	154	140	200	60	217.16	34.44	0.08	3.62	0.57	-0.11	3.51	0.4	1.1	U
317	200	–	204	200	250	50	185.76	25.32	0.08	3.72	0.51	0.29	3.20	0.3	1.2	U
317	250	–	254	250	300	50	188.96	31.08	0.07	3.78	0.62	-0.37	2.96	0.4	1.3	U
317	300	–	304	300	350	50	172.08	37.72	0.09	3.44	0.75	-1.68	7.91	0.5	1.0	U
317	350	–	354	350	385	35	123.09	33.20	0.09	3.52	0.95	-1.64	6.55	0.6	1.1	U
317	385	–	389	385	400	15	32.52	20.20	0.22	2.17	1.35	0.21	2.06	0.9	0.2	1.34
317	400	–	404	400	415	15	26.21	23.05	0.30	1.75	1.54	0.29	2.44	1.0	-0.1	1.00
317	415	–	419	415	430	15	62.99	14.29	0.05	4.20	0.95	-3.48	14.63	0.6	1.5	1.00
317	430	–	434	430	447	17	8.40	31.33	0.71	0.49	1.84	1.15	3.25	1.2	-0.9	U
317	450	–	454	447	458	11	22.76	27.36	0.24	2.07	2.49	-0.42	1.35	1.7	0.1	1.00
317	465	–	469	458	475	17	9.02	35.45	0.69	0.53	2.09	0.98	2.43	1.4	-0.9	1.01
317	500	–	504	475	500	25	99.10	26.51	0.06	3.96	1.08	-3.51	16.94	0.7	1.4	U
317	540	–	544	500	540	40	156.55	22.02	0.07	3.91	0.55	-0.88	[illegible]	0.7	1.3	U
317					TOP 5 M	515	3.05	0.91								U
					385-475	90	1.80	1.69								1.04

OTHER CORES

NDC Hole #	Top of Sample (cm)		Bottom of sample (cm)	Top of Layer (cm)	Bottom of Layer (cm)	Thick of Layer (cm)	WTD Mean (Ø)	WTD StDev (Ø)	Sample Mean (mm)	NCGS SAMPLE DATA Mean (Ø)	NCGS SAMPLE DATA StDev (Ø)	NCGS SAMPLE DATA Skew	NCGS SAMPLE DATA Kurtosis	1.9 mean, n Sb/Sn	1.5 sdev,n (Mb-Mn)/Sn	ACES or SPM Ra
319	0	–	4	0	54	54	127.42	40.83	0.19	2.36	0.76	-1.11	7.17	0.5	0.3	U
319	50	–	54	54	104	50	132.94	32.55	0.16	2.66	0.65	-0.70	9.39	0.4	0.5	U
319	100	–	104	104	148	44	113.96	19.91	0.17	2.59	0.45	1.34	10.49	0.3	0.5	U
319	150	–	154	148	170	22	82.87	17.90	0.07	3.77	0.81	-1.86	10.14	0.5	1.2	U
319	200	–	204	170	250	80	303.68	59.30	0.07	3.80	0.74	-1.42	7.79	0.5	1.3	U
319	250	–	254	250	300	50	191.68	31.08	0.07	3.83	0.62	-0.69	4.70	0.4	1.3	U
319	300	–	304	300	350	50	183.79	30.85	0.08	3.68	0.62	-0.69	6.74	0.4	1.2	U
319	350	–	354	350	400	50	176.89	38.36	0.09	3.54	0.77	-1.07	5.96	0.5	1.1	U
319	400	–	404	400	450	50	89.11	63.38	0.29	1.78	1.27	0.42	2.72	0.8	-0.1	1.04
319	450	–	454	450	464	14	13.68	15.75	0.51	0.98	1.12	0.27	3.95	0.7	-0.6	1.00
319	490	–	494	464	490	26	17.93	56.02	0.62	0.69	2.15	0.52	1.61	1.4	-0.8	1.02
319					WHOLE	490	2.93	0.83								U
					TOP 3M	190	2.53	1.08								3.77
320	0	–	4	0	50	50	163.66	81.26	0.10	3.27	1.63	-1.74	5.17	1.1	0.9	
320	50	–	54	50	100	50	204.06	28.13	0.06	4.08	0.56	-1.30	6.39	0.4	1.5	
320	100	–	104	100	150	50	195.71	34.96	0.07	3.91	0.70	-1.71	10.23	0.5	1.3	
320	150	–	154	150	189	39	141.29	29.20	0.08	3.62	0.75	-0.88	4.88	0.5	1.1	
320	200	–	204	189	250	61	93.66	76.94	0.34	1.54	1.26	0.72	3.20	0.8	-0.2	
320	250	–	254	250	272	22	29.53	16.37	0.39	1.34	0.74	1.78	10.34	0.5	-0.4	
320	300	–	304	272	304	32	32.61	43.27	0.49	1.02	1.35	0.49	3.53	0.9	-0.6	
320	350	–	354	304	370	66	83.47	84.35	0.42	1.26	1.28	0.18	3.78	0.9	-0.4	
320	400	–	404	370	404	34	43.16	66.49	0.41	1.27	1.96	0.13	1.70	1.3	-0.4	
320						404	2.44	1.14								2.56
324	0	–	4	0	40	40	48.05	40.45	0.43	1.20	1.01	0.24	4.84	0.7	-0.5	
324	50	–	54	40	65	25	42.62	16.84	0.31	1.70	0.67	0.87	7.66	0.4	-0.1	
324	80	–	84	65	85	20	8.60	30.02	0.74	0.43	1.50	0.36	2.07	1.0	-1.0	
324	90	–	94	85	100	15	-1.89	26.76	1.09	-0.13	1.78	1.58	4.35	1.2	-1.4	
324	100	–	104	100	150	50	151.13	88.33	0.12	3.02	1.77	-1.51	4.06	1.2	0.7	
324	150	–	154	150	170	20	62.51	33.71	0.11	3.13	1.69	-1.75	4.98	1.1	0.8	
324	190	–	194	190	200	10	23.36	22.49	0.20	2.34	2.25	-0.49	1.65	1.5	0.3	
324	200	–	204	200	250	50	191.63	72.77	0.07	3.83	1.46	-2.25	7.02	1.0	1.3	
324	250	–	254	250	300	50	214.87	45.84	0.05	4.30	0.92	-4.97	27.49	0.6	1.6	
324	300	–	304	300	350	50	185.81	74.35	0.08	3.72	1.49	-1.99	6.03	1.0	1.2	
324	350	–	354	350	400	50	131.44	56.76	0.16	2.63	1.14	0.14	2.46	0.8	0.5	
324	400	–	404	400	450	50	111.32	57.60	0.21	2.23	1.15	0.34	3.12	0.8	0.2	
324	450	–	454	450	458	8	18.23	9.35	0.21	2.28	1.17	0.26	3.38	0.8	0.3	
324					WHOLE	438	2.71	1.31								2.80
					TOP 2.5 M	230	2.29	1.44								1.42

OTHER CORES

NDC Hole #	Top of Sample (cm)	Bottom of sample (cm)	Top of Layer (cm)	Bottom of Layer (cm)	Thick of Layer (cm)	WTD Mean (Ø)	WTD StDev (Ø)	Sample Mean (mm)	NCGS SAMPLE DATA Mean (Ø)	StDev (Ø)	Skew	Kurtosis	1.9 mean, n 1.5 sdev,n Sb/Sn	(Mb-Mn)/Sn	ACES or SPM Ra
327	0 –	4	0	50	50	128.53	39.93	0.17	2.57	0.80	-0.99	6.46	0.5	0.4	
327	50 –	54	50	100	50	142.26	50.05	0.14	2.85	1.00	-2.01	9.67	0.7	0.6	
327	100 –	104	100	120	20	58.38	15.60	0.13	2.92	0.78	-1.46	11.12	0.5	0.7	
327	150 –	154	120	196	76	211.16	39.12	0.15	2.78	0.51	0.71	6.25	0.3	0.6	
327	200 –	204	196	245	49	95.52	48.87	0.26	1.95	1.00	0.70	4.03	0.7	0.0	
327	250 –	254	245	260	15	40.81	12.33	0.15	2.72	0.82	0.69	3.30	0.5	0.5	
327	300 –	304	260	292	32	94.73	24.29	0.13	2.96	0.76	0.85	3.07	0.5	0.7	
327	310 –	314	292	314	22	60.20	13.33	0.15	2.74	0.61	1.36	5.30	0.4	0.6	
327					314	2.65	0.78								U
339	0 –	4	0	30	30	86.63	27.07	0.14	2.89	0.90	-0.97	5.31	0.6	0.7	
339	50 –	54	30	90	60	163.33	104.91	0.15	2.72	1.75	-1.12	3.38	1.2	0.5	
339	100 –	104	90	120	30	97.12	35.16	0.11	3.24	1.17	-0.73	3.26	0.8	0.9	
339	150 –	154	120	165	45	84.70	42.65	0.27	1.88	0.95	-0.40	4.64	0.6	0.0	
339	200 –	204	165	220	55	53.32	85.58	0.51	0.97	1.56	0.36	2.45	1.0	-0.6	
339	250 –	254	220	290	70	52.68	99.47	0.59	0.75	1.42	0.54	2.76	0.9	-0.8	
339	290 –	294	290	300	10	29.39	14.05	0.13	2.94	1.40	-1.25	3.89	0.9	0.7	
339	300 –	304	300	310	10	22.81	15.38	0.21	2.28	1.54	-0.07	1.85	1.0	0.3	
339	350 –	354	310	380	70	-0.96	78.46	1.01	-0.01	1.12	1.18	4.87	0.7	-1.3	
339	380 –	384	380	385	5	1.18	7.85	0.85	0.24	1.57	1.17	3.63	1.0	-1.1	
339					385	1.53	1.33								1.00
343	0 –	4	0	40	40	134.04	22.55	0.10	3.35	0.56	-2.20	11.74	0.4	1.0	
343	45 –	49	40	50	10	35.21	5.47	0.09	3.52	0.55	-2.33	19.79	0.4	1.1	
343	60 –	64	50	70	20	22.03	20.77	0.47	1.10	1.04	-0.03	4.07	0.7	-0.5	
343	72 –	76	70	85	15	42.81	27.10	0.14	2.85	1.81	-0.89	2.62	1.2	0.6	
343	90 –	94	85	100	15	35.36	23.88	0.20	2.36	1.59	-0.41	2.58	1.1	0.3	
343	100 –	104	100	120	20	38.85	41.04	0.26	1.94	2.05	-0.11	1.63	1.4	0.0	
343	150 –	154	120	163	43	103.95	30.66	0.19	2.42	0.71	0.45	6.48	0.5	0.3	
343					163	2.53	1.05								4.29
344	0 –	4	0	20	20	61.26	13.28	0.12	3.06	0.66	-0.89	5.84	0.4	0.8	
344	30 –	34	20	40	20	2.94	36.34	0.90	0.15	1.82	1.05	2.62	1.2	-1.2	
344	50 –	54	40	100	60	110.33	43.20	0.28	1.84	0.72	-0.22	6.25	0.5	0.0	
344	100 –	104	100	130	30	19.50	48.19	0.64	0.65	1.61	0.11	1.85	1.1	-0.8	
344	150 –	154	130	156	26	14.03	33.43	0.69	0.54	1.29	0.46	3.31	0.9	-0.9	
344					156	1.33	1.12								1.00

OTHER CORES

NDC Hole #	Top of Sample (cm)	Bottom of sample (cm)	Top of Layer (cm)	Bottom of Layer (cm)	Thick of Layer (cm)	WTD Mean (Ø)	WTD StDev (Ø)	Sample Mean (mm)	NCGS SAMPLE DATA Mean (Ø)	StDev (Ø)	Skew	Kurtosis	1.9 mean, n Sb/Sn	1.5 sdev,n (Mb-Mn)/Sn	ACES or SPM Ra
347	0 –	4	0	35	35	102.27	24.34	0.13	2.92	0.70	-1.10	9.60	0.5	0.7	
347	50 –	54	35	55	20	-2.43	36.79	1.09	-0.12	1.84	1.21	2.67	1.2	-1.3	
347	80 –	84	55	100	45	173.11	30.41	0.07	3.85	0.68	-1.78	12.82	0.5	1.3	
347	100 –	104	100	140	40	149.32	27.59	0.08	3.73	0.69	-1.50	11.16	0.5	1.2	
347	150 –	154	140	200	60	231.31	45.38	0.07	3.86	0.76	-2.56	16.72	0.5	1.3	
347	200 –	204	200	250	50	196.14	35.13	0.07	3.92	0.70	-2.73	19.44	0.5	1.3	
347	250 –	254	250	300	50	189.08	37.04	0.07	3.78	0.74	-1.87	10.96	0.5	1.3	
347	300 –	304	300	350	50	186.75	47.01	0.08	3.74	0.94	-1.42	5.15	0.6	1.2	
347	350 –	354	350	390	40	156.31	38.96	0.07	3.91	0.97	-1.73	5.66	0.6	1.3	
347	390 –	394	390	400	10	30.63	12.42	0.12	3.06	1.24	-0.21	2.17	0.8	0.8	
347	400 –	404	400	415	15	48.45	18.24	0.11	3.23	1.22	-0.44	2.35	0.8	0.9	
347	450 –	454	415	480	65	134.33	59.68	0.24	2.07	0.92	1.22	4.65	0.6	0.1	
347	500 –	504	480	530	50	114.31	52.73	0.21	2.29	1.05	0.11	4.14	0.7	0.3	
347	550 –	554	530	569	39	61.94	42.27	0.33	1.59	1.08	0.19	4.70	0.7	-0.2	
347				whole	569	3.1	0.9								U
353	0 –	4	0	20	20	56.02	24.25	0.14	2.80	1.21	-1.83	6.61	0.8	0.6	
353	25 –	29	20	45	25	6.40	46.16	0.84	0.26	1.85	0.93	2.30	1.2	-1.1	
353	50 –	54	45	75	30	82.17	28.83	0.15	2.74	0.96	-1.23	6.67	0.6	0.6	
353	75 –	79	75	100	25	73.38	23.94	0.13	2.94	0.96	-0.60	3.93	0.6	0.7	
353	100 –	104	100	142	42	95.69	38.56	0.21	2.28	0.92	-0.48	4.47	0.6	0.3	
353	140 –	144	142	150	8	2.54	13.56	0.80	0.32	1.70	0.76	2.26	1.1	-1.1	
353	150 –	154	150	190	40	94.71	34.20	0.19	2.37	0.86	-1.83	10.83	0.6	0.3	
353	190 –	194	190	200	10	27.73	11.43	0.15	2.77	1.14	-0.93	5.23	0.8	0.6	
353	200 –	204	200	250	50	158.99	54.24	0.11	3.18	1.08	-0.87	4.41	0.7	0.9	
353	250 –	254	250	300	50	195.91	41.44	0.07	3.92	0.83	-3.18	19.08	0.6	1.3	
353	300 –	304	300	350	50	185.05	30.45	0.08	3.70	0.61	-0.84	7.63	0.4	1.2	
353	350 –	354	350	400	50	184.82	40.48	0.08	3.70	0.81	-1.34	6.46	0.5	1.2	
353	400 –	404	400	450	50	200.18	41.70	0.06	4.00	0.83	-1.98	7.24	0.6	1.4	
353	450 –	454	450	500	50	192.52	54.82	0.07	3.85	1.10	-1.68	5.21	0.7	1.3	
353	500 –	504	500	540	40	105.75	61.79	0.16	2.64	1.54	-0.46	2.77	1.0	0.5	
353	550 –	554	540	585	45	90.78	49.94	0.25	2.02	1.11	-0.28	3.79	0.7	0.1	
353	585 –	590	585	604	19	36.40	21.43	0.26	1.92	1.13	-0.18	3.30	0.8	0.0	
353				TOP 2M	200	2.19	1.10								1.87

OTHER CORES

NDC Hole #	Top of Sample (cm)	Bottom of sample (cm)	Top of Layer (cm)	Bottom of Layer (cm)	Thick of Layer (cm)	WTD Mean (Ø)	WTD StDev (Ø)	Sample Mean (mm)	NCGS SAMPLE DATA Mean (Ø)	StDev (Ø)	Skew	Kurtosis	1.9 mean, n Sb/Sn	1.5 sdev,n (Mb-Mn)/Sn	ACES or SPM Ra
354	0 –	4	0	30	30	69.44	37.18	0.20	2.31	1.24	-0.70	3.49	0.8	0.3	
354	50 –	54	30	85	55	146.06	66.94	0.16	2.66	1.22	-0.90	3.73	0.8	0.5	
354	85 –	89	85	100	15	52.98	15.21	0.09	3.53	1.01	-1.78	8.00	0.7	1.1	
354	100 –	104	100	150	50	185.48	36.12	0.08	3.71	0.72	-1.49	9.24	0.5	1.2	
354	150 –	154	150	200	50	186.56	40.09	0.08	3.73	0.80	-1.60	8.08	0.5	1.2	
354	200 –	204	200	250	50	201.19	44.13	0.06	4.02	0.88	-2.18	8.21	0.6	1.4	
354	250 –	254	250	280	30	114.81	30.77	0.07	3.83	1.03	-1.39	4.12	0.7	1.3	
354	300 –	304	280	310	30	69.79	31.73	0.20	2.33	1.06	0.33	3.39	0.7	0.3	
354	350 –	354	310	400	90	151.03	76.10	0.31	1.68	0.85	0.65	5.86	0.6	-0.1	
354	400 –	404	400	450	50	69.24	59.55	0.38	1.38	1.19	-0.22	3.67	0.8	-0.3	
354	450 –	454	450	474	24	39.32	22.39	0.32	1.64	0.93	-0.19	5.67	0.6	-0.2	
354				WHOLE	474	2.71	0.97								U
355	0 –	4	0	26	26	81.00	18.39	0.12	3.12	0.71	-1.26	7.72	0.5	0.8	
355	30 –	34	26	40	14	54.72	14.01	0.07	3.91	1.00	-1.55	4.40	0.7	1.3	
355	50 –	54	40	100	60	169.91	71.60	0.14	2.83	1.19	0.36	1.73	0.8	0.6	
355	100 –	104	100	150	50	165.89	63.86	0.10	3.32	1.28	-0.43	1.86	0.9	0.9	
355	150 –	154	150	200	50	222.01	15.92	0.05	4.44	0.32	-5.80	38.06	0.2	1.7	
355	200 –	204	200	240	40	166.36	30.96	0.06	4.16	0.77	-2.24	7.40	0.5	1.5	
355	250 –	254	240	270	30	79.01	23.81	0.16	2.63	0.79	1.12	4.45	0.5	0.5	
355	300 –	304	270	320	50	120.75	52.17	0.19	2.42	1.04	0.67	3.14	0.7	0.3	
355	350 –	354	320	350	30	62.09	31.72	0.24	2.07	1.06	0.88	3.76	0.7	0.1	
355	378 –	382	350	382	32	27.00	60.24	0.56	0.84	1.88	0.52	2.22	1.3	-0.7	
355				WHOLE	382	3.01	1.00								U
360	0 –	4	0	25	25	81.39	18.37	0.10	3.26	0.73	-1.26	6.67	0.5	0.9	
360	50 –	54	25	75	50	138.81	56.05	0.15	2.78	1.12	-1.16	4.47	0.7	0.6	
360	80 –	84	75	90	15	52.83	15.36	0.09	3.52	1.02	-1.24	4.82	0.7	1.1	
360	100 –	104	90	150	60	233.74	60.19	0.07	3.90	1.00	-1.91	6.76	0.7	1.3	
360	150 –	154	150	200	50	218.93	24.73	0.05	4.38	0.49	-4.95	30.59	0.3	1.7	
360	200 –	204	200	250	50	220.94	19.74	0.05	4.42	0.39	-6.25	49.78	0.3	1.7	
360	250 –	254	250	280	30	129.21	22.21	0.05	4.31	0.74	-5.12	32.40	0.5	1.6	
360	285 –	289	280	290	10	12.16	21.75	0.43	1.22	2.18	0.30	1.62	1.5	-0.5	
360	300 –	304	290	330	40	28.84	82.04	0.61	0.72	2.05	0.64	2.04	1.4	-0.8	
360	330 –	334	330	350	20	50.31	43.79	0.17	2.52	2.19	-0.52	1.70	1.5	0.4	
360	350 –	354	350	380	30	11.91	52.48	0.76	0.40	1.75	1.02	3.17	1.2	-1.0	
360	380 –	384	380	390	10	26.86	21.91	0.16	2.69	2.19	-0.79	2.00	1.5	0.5	
360	390 –	394	390	400	10	3.22	18.68	0.80	0.32	1.87	1.14	3.14	1.2	-1.1	
360	400 –	404	400	450	50	21.28	84.57	0.74	0.43	1.69	0.89	2.99	1.1	-1.0	
360	450 –	454	450	490	40	106.99	33.25	0.16	2.67	0.83	0.77	3.33	0.6	0.5	
360	500 –	504	490	515	25	72.29	18.73	0.13	2.89	0.87	[illegible]	[illegible]	0.4	0.7	

OTHER CORES

NDC Hole #	Top of Sample (cm)	Bottom of sample (cm)	Top of Layer (cm)	Bottom of Layer (cm)	Thick of Layer (cm)	WTD Mean (Ø)	WTD StDev (Ø)	Sample Mean (mm)	NCGS SAMPLE DATA Mean (Ø)	StDev (Ø)	Skew	Kurtosis	1.9 mean, n 1.5 sdev,n Sb/Sn	(Mb-Mn)/Sn	ACES or SPM Ra
360	530 –	534	515	530	15	45.39	11.34	0.12	3.03	0.76	0.53	3.22	0.5	0.8	
360				WHOLE	530	2.75	1.14								5.19
				TOP 4.5M	450	2.73	1.20								3.88
363	000 –	004	0	40	40	120.71	34.46	0.12	3.02	0.86	-1.26	5.28	0.6	0.7	
363	050 –	054	40	70	30	92.74	41.84	0.12	3.09	1.39	-0.93	3.52	0.9	0.8	
363	080 –	084	70	100	30	100.25	34.64	0.10	3.34	1.15	-1.27	4.91	0.8	1.0	
363	100 –	104	100	120	20	80.85	16.97	0.06	4.04	0.85	-2.36	9.52	0.6	1.4	
363	150 –	154	120	150	30	78.91	41.10	0.16	2.63	1.37	-0.39	3.12	0.9	0.5	
363	190 –	194	150	190	40	112.21	41.87	0.14	2.81	1.05	0.35	2.36	0.7	0.6	
363	200 –	204	190	210	20	59.60	23.21	0.13	2.98	1.16	-0.29	3.21	0.8	0.7	
363	250 –	254	210	300	90	96.33	71.43	0.48	1.07	0.79	0.95	7.28	0.5	-0.6	
363	300 –	304	300	310	10	18.33	21.10	0.28	1.83	2.11	0.05	1.62	1.4	0.0	
363	350 –	354	310	400	90	343.70	109.97	0.07	3.82	1.22	-1.84	5.74	0.8	1.3	
363	400 –	404	400	440	40	165.73	29.08	0.06	4.14	0.73	-2.47	10.36	0.5	1.5	
363	450 –	454	440	470	30	95.30	51.73	0.11	3.18	1.72	-1.29	3.53	1.1	0.9	
363	480 –	484	470	500	30	4.16	45.75	0.91	0.14	1.52	1.28	4.29	1.0	-1.2	
363	500 –	504	500	506	6	16.36	4.77	0.15	2.73	0.80	0.53	4.62	0.5	0.6	
363				WHOLE	506	2.74	1.12								5.59
				TOP 3.1M	310	2.45	1.05								3.50
365	000 –	004	0	40	40	121.74	25.96	0.12	3.04	0.65	-0.38	5.02	0.4	0.8	
365	050 –	054	40	90	50	179.37	59.59	0.08	3.59	1.19	-1.41	5.01	0.8	1.1	
365	100 –	104	90	120	30	83.41	44.75	0.15	2.78	1.49	-0.57	3.14	1.0	0.6	
365	125 –	129	120	125	5	13.65	5.67	0.15	2.73	1.13	0.26	2.35	0.8	0.6	
365	150 –	154	125	170	45	99.24	42.11	0.22	2.21	0.94	0.45	4.22	0.6	0.2	
365	175 –	179	170	190	20	46.12	18.46	0.20	2.31	0.92	0.31	4.76	0.6	0.3	
365	200 –	204	190	230	40	111.35	23.81	0.15	2.78	0.60	1.08	5.30	0.4	0.6	
365	250 –	254	230	280	50	85.80	52.95	0.30	1.72	1.06	-0.06	3.03	0.7	-0.1	
365	300 –	304	280	317	37	6.82	46.99	0.88	0.18	1.27	0.76	3.41	0.8	-1.1	
365	317 –	321	317	321	4	4.38	3.66	0.47	1.10	0.92	0.53	5.81	0.6	-0.5	
365				WHOLE	321	2.34	1.01								3.12
399	0	4	0	24	24	58.3	21.4	0.15	2.43	0.89	-0.8	5.12	0.59	0.35	
399	50 –	54	24	63	39	108.4	37.4	0.15	2.78	0.96	-1.86	8.89	0.64	0.59	
399	100 –	104	63	132	69	212.5	53.8	0.12	3.08	0.78	-1.04	6.22	0.52	0.79	
399	140 –	144	132	140	8	8.9	15.6	0.46	1.11	1.95	0.07	1.39	1.30	-0.53	
399	150 –	154	140	200	60	206.4	36.6	0.09	3.44	0.61	-2.24	17.04	0.41	1.03	
399	200 –	204	200	225	25	83.0	16.8	0.10	3.32	0.67	-0.83	5.69	0.45	0.95	
399	232 –	236	225	232	7	24.4	3.4	0.09	3.48	0.48	-0.25	5.17	0.32	1.05	
399					232	3.03	0.80								US

OTHER CORES

NDC Hole #	Top of Sample (cm)		Bottom of sample (cm)	Top of Layer (cm)	Bottom of Layer (cm)	Thick of Layer (cm)	WTD Mean (Ø)	WTD StDev (Ø)	Sample Mean (mm)	NCGS SAMPLE DATA Mean (Ø)	NCGS SAMPLE DATA StDev (Ø)	NCGS SAMPLE DATA Skew	NCGS SAMPLE DATA Kurtosis	1.9 mean, n Sb/Sn	1.5 sdev,n (Mb-Mn)/Sn	ACES or SPM Ra
430	000	–	004						1.04	-0.05	1.84	1.37	3.25			
430	016	–	020						0.98	0.03	1.85	1.25	2.95			
430	020	–	024						0.13	2.99	1.48	-2.10	6.08			
430	050	–	054						0.09	3.50	0.86	-3.55	19.71			
430	100	–	104						0.08	3.63	0.88	-3.30	18.75			
430	150	–	154						0.07	3.76	0.61	-2.07	18.74			
430	225	–	229						0.06	3.98	0.60	-1.26	6.98			
430	275	–	279						0.06	4.09	0.55	-1.34	6.90			
430	295	–	300						0.08	3.72	0.50	-0.15	8.36			
430	325	–	329						0.07	3.85	0.52	-0.01	4.03			
430	360	–	365						0.07	3.81	0.59	-1.48	13.74			
430	385	–	389						0.07	3.85	0.54	-0.44	6.56			
430	400	–	404						0.06	3.94	0.54	-0.41	3.81			
430	450	–	454						0.06	4.03	0.56	-1.13	6.34			
430	485	–	489						0.07	3.85	0.99	-1.87	6.61			
430	500	–	504						0.19	2.37	1.37	0.29	1.86			
430																
432	0	–	4						0.12	3.12	1.00	-0.22	3.21			
432	50	–	54						0.08	3.60	0.54	-0.68	8.11			
432	100	–	104						0.12	3.12	1.07	-1.18	4.00			
432	150	–	154						0.38	1.39	1.07	0.67	4.74			
432	200	–	204						0.35	1.51	1.60	0.50	2.46			
432																