

US Army Corps
Of Engineers
Wilmington District

PUBLIC NOTICE

Issue Date: September 23, 2008
Comment Deadline: October 23, 2008
Corps Action ID #: SAW-2008-02722

The Wilmington District, Corps of Engineers (Corps) has received an application from the North Carolina Department of Transportation seeking Department of the Army authorization to impact approximately 2 acres of Department of Army jurisdictional waters (Atlantic Ocean) below the high tide line on the beach face on Pea Island National Wildlife Refuge at the location known as the S-Curves just north of Rodanthe, Dare County, North Carolina. Specific plans and location information are described below and shown on the attached plans. This Public Notice and all attached plans are also available on the Wilmington District Web Site at www.saw.usace.army.mil/wetlands

Applicant: North Carolina Department of Transportation
113 Airport Drive, Suite 100
Edenton, North Carolina 27932

AGENT: Mr. Clay Willis
NCDOT Environmental Officer, Division One
113 Airport Drive, Suite 100
Edenton, North Carolina 27932

Authority

The Corps will evaluate this application and a decide whether to issue, conditionally issue, or deny the proposed work pursuant to applicable procedures of Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbors Act.

Location

The proposed project is located at the southern tip of the Pea Island National Wildlife Property and continues north from Rodanthe approximately 1500 feet, in Dare County, North Carolina. The beach restoration (beach habitat restoration) would start from an approximate elevation of 5.5 feet and extend seaward approximately 85 feet within the 1500 feet project area. The project is located adjacent to the Atlantic Ocean, Hydrologic Unit 03020105. Latitude 35.608352N, Longitude -75.464370W

Existing Site Conditions

Land use in the project area is part of the Pea Island National Wildlife Refuge and can be described as ocean beach and dunes. The refuge was established in 1938 for the protection of wildlife, especially migratory waterfowl. The refuge objectives include: a) providing nesting, resting, and wintering habitat for migratory birds including the greater snow geese and other migratory waterfowl, shorebirds, wading birds, raptors and neotropical migrants b) provide habitat and protection for endangered and threatened species c) provide opportunities for public enjoyment of wildlife and wildlands resources. The topography in the study area is characterized by man-made beach dunes (sand bags under the dunes in 900 feet of the 1500 feet project area) with an average approximate elevation of 15.5 feet above sea level gently sloping and draining along the beach face into the Atlantic Ocean. The “lower beach” is characterized as the exposed portion of beach between the mean high tide line and mean low tide lines and is unvegetated and subject to diurnal tidal flooding. The substrate consists of unconsolidated sand and variable shell fragment content and is considered a dynamic community subject to the effects of tidal swash twice daily. The “upper beach” is the area above the mean high tide line up to the toe-of-slope for the frontal dune or berm and consists of unconsolidated sand and shell fragments and is constantly changing due to wind and tidal surges during storm events. The study area is located in the lower Atlantic Coastal Plain physiographic region of North Carolina.

The primary water body adjacent to the project area is the Atlantic Ocean. West of the project area is the Pamlico Sound.

Based on the US Natural Resource Conservation Service (NRCS) survey of Dare County, the soils found on the Atlantic Ocean side of the Outer banks are mostly well-drained sand beaches with sparse vegetation. The soil associations present in the project area is the Newhan-Duckston-Corolla associations. Soils within the study area are mapped as Corolla fine sand and Newland fine sand and are well-drained soils that occur under the dunes. Descriptions of these soil series associations can be found in the Dare County Soil Survey.

Applicant’s Stated Purpose

The purpose of this proposed project is to mitigate for the loss of beach habitat as directed by the U.S. Fish and Wildlife Service (USFWS) (Pea Island National Wildlife Refuge) Special Use Permit # 2006-014.

Background

This project is being pursued in an effort to restore beach habitat as directed by USFWS Special Use Permit # 2006-014 issued to the North Carolina Department of Transportation (NCDOT) on 12/11/2006. The Special Use Permit was issued for the installation of 900 linear feet of sandbags adjacent to NC Highway 12 in the NCDOT

right-of-way to increase the protection of the highway from washing out during storm events. The action was necessary to provide temporary protection of the roadway as a result of beach erosion from the Thanksgiving Northeaster storm that occurring during the November 21-22, 2006 timeframe. The U.S. Army Corps of Engineers issued Regional General Permit 198000048 (Action I.D. # SAW-2007-485-128) to NCDOT on February 13, 2007, to reconstruct 900 linear feet of primary dune and place sandbags filled by excavation from areas waterward of the mean high tide line (MHW) elevation contour of the Atlantic Ocean and to construct a temporary work berm approximately 50 feet from the edge of pavement along the project area to facilitate construction of the primary dune. The North Carolina Division of Coastal Management also issued on March 15, 2007, a General Permit (GP # A46816) authorizing the work with the condition that the sandbags could remain in place for up to five years after the date of permit. The project was completed in early spring of 2007.

Project Description

The project is identified as the Beach Habitat Restoration Project at the S-curves location on the Pea Island National Wildlife Refuge. The following description of work is taken from data provided by the applicant. The applicant has proposed to place approximately 200,000 cubic yards of sand along an area 1,500 feet long starting at approximate elevation 5.5 feet MSL extending seaward approximately 85 feet on the beach face. Of this approximate 2.9 acre project area, approximately 2 acres will be placed below the mean high tide line (MHW). The beach profile was surveyed to establish a proposed cross-section with mean high and low tide water marks showing the existing and proposed beach face. The beach face is proposed to be raised 1 to 5 feet and it is assumed that the natural wave process will taper the slope below the mean low water line carrying material beyond the 85 foot point to an assumed additional distance of 30 to 40 feet. This profile is depicted on the enclosed permit drawings at three different cross sections. At the northern and southern ends of the project the elevated beach face will be tapered to match the existing beach profile to create a transition. The sand will be placed on the beach by creating a breach in the existing dune and trucking material onto the beach face. The sand will then be pushed to the proposed profile by bulldozers and frontend loaders. The location of the dune breach will be established through coordination with CAMA and the USFWS biologist. The location will be established based on minimal impacts to vegetated dunes. The sand source for the beach habitat restoration is located approximately 12 miles north at the terminal groin location on the southern end of Oregon Inlet and the adjacent state owned land property where the Old Coast Guard Station is located. The proposed mining area behind the terminal groin is approximately 13 acres in size and was recommended by the USFWS. This area was previously mined in the late 1990's under supervision by USFWS. The mining was conducted, so that shallow areas of excavation created pools that improved foraging habitat for shore birds using the area. These pools have filled in over the years and there is only one remnant pool area, which will not be impacted by the proposed project. The current project is proposing to accomplish the same result and will follow the direction of the USFWS refuge staff during the excavation. The mining will not go beyond 6-8 feet below the existing surface and will only extend within the area shown on the enclosed

location map. This area currently is located above the normal high tide water mark and consists of an open sand flat with no vegetation. This area will be accessed through existing State Road 1257. Beyond the end of SR 1257 is the second mining area that is approximately 10 acres in size. This area consists of established dunes that lie approximately 700-800 feet from the high tide line. Sand will also be removed from SR 1257 that leads onto state property. Sand removal from the roadway will stay within NCDOT right-of-way and excavated down to the old pavement elevation. Once sand is removed from the roadway and access is gained to the Old Coast Guard Station Property, excavation around the remnant parking areas of the Old Coast Guard Station will begin. Coordination with the state property owners will be conducted prior to any sand removal to establish a safe boundary around the Coast Guard building. Once the Old Coast Guard Station area is complete, then the area behind the terminal groin will be accessed and sand mining will begin there. NCDOT has conducted a sand analysis within the proposed mining areas and the receiving beach area. The sand was analyzed for grain size, percent calcium carbonate and heavy mineral content. This information can be accessed on our web site. In order to prevent potential impacts to protected shorebirds and nesting sea turtles NCDOT will conduct the proposed work outside of applicable moratoriums and under supervision of the USFWS managing biologist and direction from the North Carolina Wildlife Resources Commission (NCWRC). Overall plans showing the location of the proposed project and impact sites are included with this public notice. Additional detailed plans and findings for the project may be reviewed at the U.S. Army Corps of Engineers Regulatory Field Office at 107 Union Drive, Suite 202, Washington, North Carolina 27889.

Other Required Authorizations

This notice and all applicable application materials are being forwarded to the appropriate State agencies for review. The Corps will generally not make a final permit decision until the North Carolina Division of Water Quality (NCDWQ) issues, denies, or waives State certification required by Section 401 of the Clean Water Act (PL 92-500). The receipt of the application and this public notice combined with appropriate application fee at the North Carolina Division of Water Quality central office in Raleigh will constitute initial receipt of an application for a 401 Water Quality Certification. A waiver will be deemed to occur if the NCDWQ fails to act on this request for certification within sixty days of the date of the receipt of this notice in the NCDWQ Central Office. Additional information regarding the Clean Water Act certification may be reviewed at the NCDWQ Transportation Permitting Unit, 2321 Crabtree Boulevard, Raleigh, North Carolina 27604-2260. All persons desiring to make comments regarding the application for certification under Section 401 of the Clean Water Act should do so in writing delivered to the North Carolina Division of Water Quality (NCDWQ), 1650 Mail Service Center, Raleigh, North Carolina 27699-1650 Attention: Mr. Brian Wrenn by June 5, 2008.

The applicant has not provided to the Corps, a certification statement that his/her proposed activity complies with and will be conducted in a manner that is consistent with the approved North Carolina Coastal Zone Management Program. Pursuant to 33 CFR

325.2(b)(2), the Corps can not issue a permit for the proposed work until the applicant submits such a certification to the Corps and the North Carolina Division of Coastal Management (NCDCM), and the NCDCM notifies the Corps that it concurs with the applicant's consistency certification. The applicant has indicated they are in the process of applying for a CAMA Major Development Permit, a State Water Quality Certification, and a USFWS Special Use Permit in conjunction with this application.

Essential Fish Habitat

This notice initiates the Essential Fish Habitat (EFH) consultation requirements of the Magnuson-Stevens Fishery Conservation and Management Act. The Corps' initial determination is that the proposed project may adversely impact EFH or associated fisheries managed by the South Atlantic or Mid Atlantic Fishery Management Councils or the National Marine Fisheries Service. Due to the relatively small size of the project and that the project activities will occur during periods of decreased biological activity, we expect minimal impacts within the intertidal and subtidal bottom habitats.

Cultural Resources

The Corps has consulted the latest published version of the National Register of Historic Places and has determined that registered properties, or properties listed as being eligible for inclusion therein are located within the project area and/or will be affected by the proposed work. The Old Coast Guard Station is located in the proposed area being used for borrow. Natural processes have deposited large amounts of sand around the perimeter of the structure. Our preliminary determination is that the undertaking will have "no adverse effect" on the Old Coast Guard Station. The applicant has stated they will consult with the state property owners prior to any sand removal in the area to create a safe boundary around the Coast Guard Building during the removal of sand.

Endangered Species

The Corps has reviewed the project area, examined all information provided by the applicant and consulted the latest North Carolina Natural Heritage Database. Based on available information, the Corps has determined pursuant to the Endangered Species Act of 1973 (ESA), that the proposed project may affect federally listed endangered or threatened species or their formally designated critical habitat. Potential impacts exist to the piping plover and nesting sea turtles. The applicant has stated they will conduct the proposed work outside applicable moratoriums and under the supervision of the USFWS biologist and direction of the NCWRC. Consultation under Section 7 of the ESA will be initiated and no permit will be issued until the consultation process is complete.

Evaluation

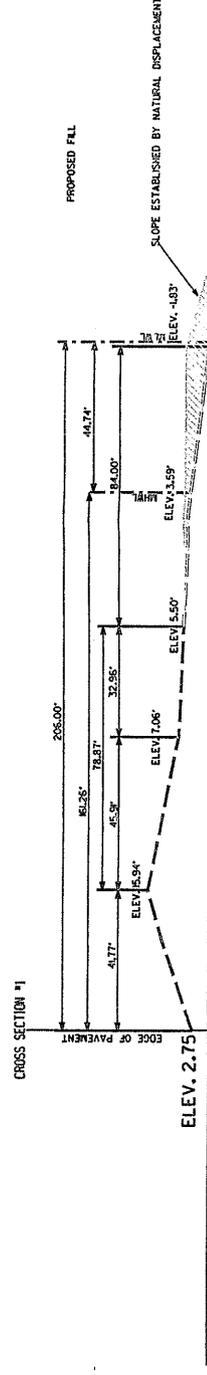
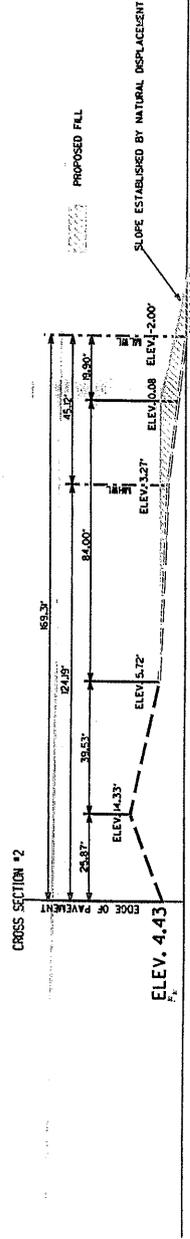
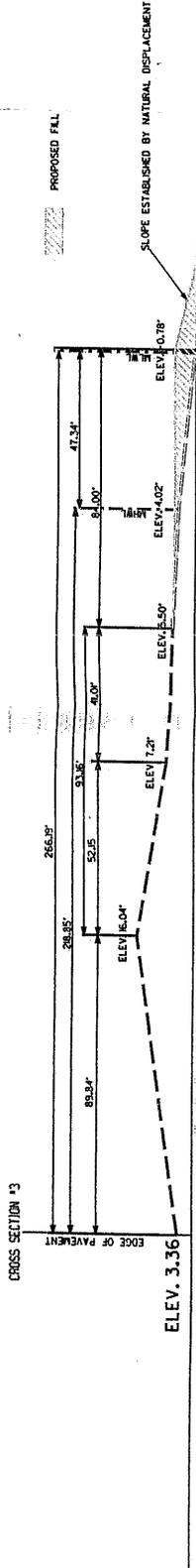
The decision whether to issue a permit will be based on an evaluation of the probable impacts, including cumulative impacts, of the proposed activity on the public interest. That decision will reflect the national concern for both protection and utilization of important resources. The benefit which reasonably may be expected to accrue from the proposal must be balanced against its reasonably foreseeable detriments. All factors which may be relevant to the proposal will be considered including the cumulative effects thereof; among those are conservation, economics, aesthetics, general environmental concerns, wetlands, historic properties, fish and wildlife values, flood hazards, flood plain values (in accordance with Executive Order 11988), land use, navigation, shoreline erosion and accretion, recreation, water supply and conservation, water quality, energy needs, safety, food and fiber production, mineral needs, considerations of property ownership, and, in general, the needs and welfare of the people. For activities involving the discharge of dredged or fill materials in waters of the United States, the evaluation of the impact of the activity on the public interest will include application of the Environmental Protection Agency's 404(b)(1) guidelines.

Commenting Information

The Corps of Engineers is soliciting comments from the public; Federal, State and local agencies and officials, including any consolidate State Viewpoint or written position of the Governor; Indian Tribes and other interested parties in order to consider and evaluate the impacts of this proposed activity. Any comments received will be considered by the Corps of Engineers to determine whether to issue, modify, condition or deny a permit for this proposal. To make this decision, comments are used to assess impacts on endangered species, historic properties, water quality, general environmental effects and the other public interest factors listed above. Comments are used in the preparation of an Environmental Assessment (EA) and/or an Environmental Impact Statement (EIS) pursuant to the National Environmental Policy Act (NEPA). Comments are also used to determine the need for a public hearing and to determine the overall public interest of the proposed activity.

Any person may request, in writing, within the comment period specified in this notice, that a public hearing be held to consider the application. Requests for public hearings shall state, with particularity, the reasons for holding a public hearing. Requests for a public hearing shall be granted, unless the District Engineer determines that the issues raised are insubstantial or there is otherwise no valid interest to be served by a hearing. Written comments pertinent to the proposed work, as outlined above, will be received by the Corps of Engineers, Wilmington District, until 5pm, October 23, 2008. Comments should be submitted to: Mr. William Biddlecome, P.O. Box 1000, Washington, North Carolina 27889, Telephone (252) 975-1616, extension 26.

CROSS SECTION VIEW DETAILED DRAWING





NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
 DIVISION 1
 113 AIRPORT DR.
 EDENTON, NC 27932 (252) 482-7977

COUNTY: DARE
 QUAD: RODANTHE
 BASIN: PASCUOTANK

WBS#: N/A
 DATE: JULY 30, 2008
 SHEET#: 2 OF 2

SUBJECT: BEACH HABITAT RESTORATION

LAT. = 35.814501 N
 LONG. = 75.465271 W

DRAWN BY: A.L. MULDER
 SCALE: 1" = 40'

PLAN VIEW DETAILED DRAWING

8

25

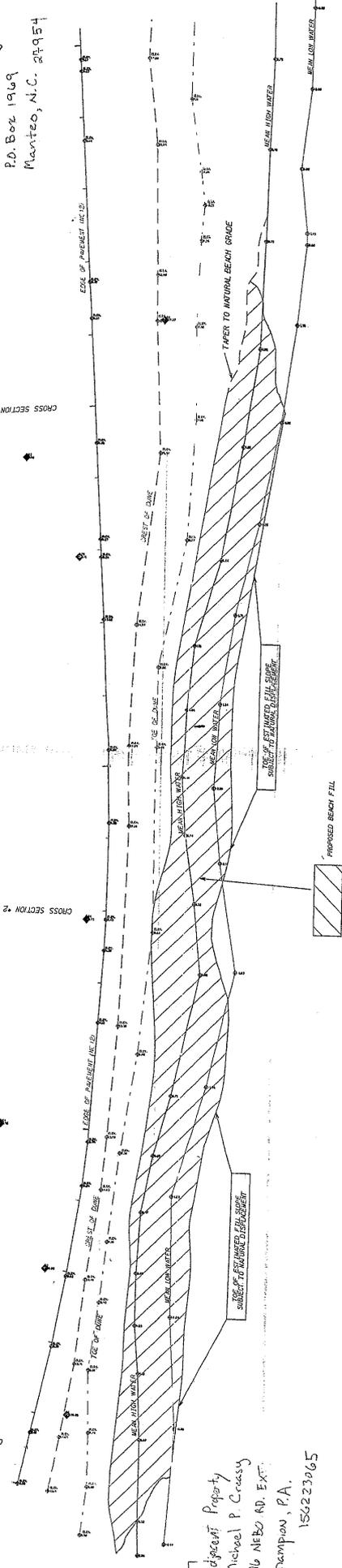
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CROSS SECTION 1

CROSS SECTION 2

CROSS SECTION 3

Sea Island Refuge
P.O. Box 1969
Manteo, N.C. 27954



Adjacent Property
Michael P. Crassy
516 NEBO RD. EXT.
Champion, P.A.
15623065



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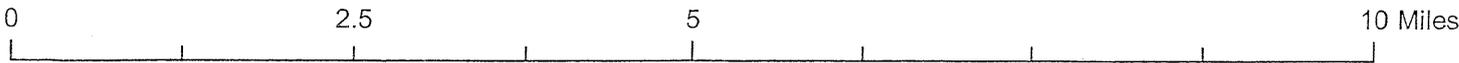
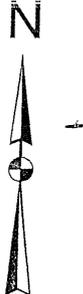
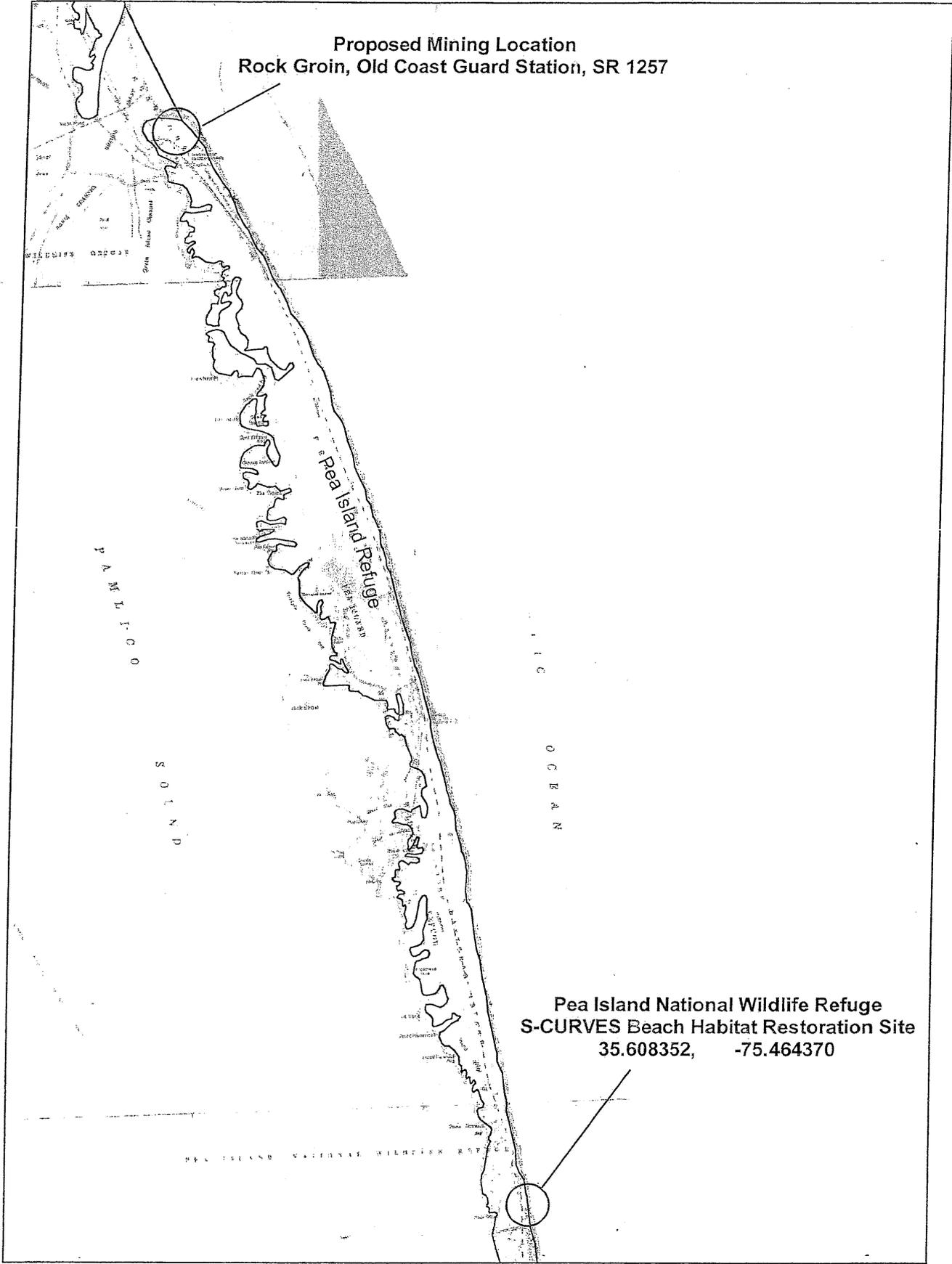
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DRAWN BY: A.L. MULDER
SCALE: 1" = 150'

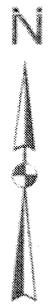
ATLANTIC OCEAN

S-Curves Beach Habitat Restoration Project Pea Island Refuge, Dare County

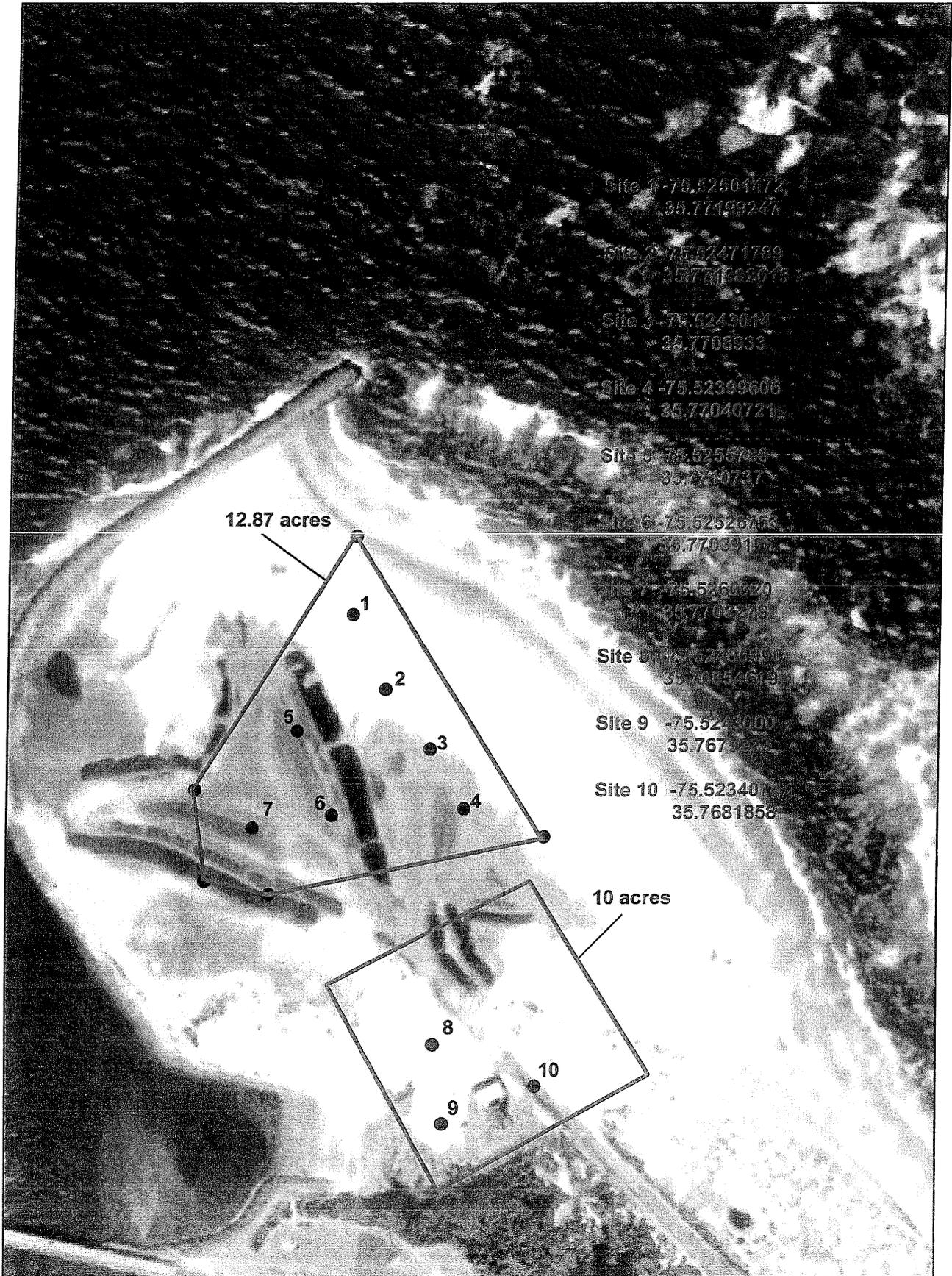
Proposed Mining Location
Rock Groin, Old Coast Guard Station, SR 1257



Proposed Beach Habitat Restoration Pea Island Dare County



Groin Area and Old Coast Guard Station Proposed Sand Mining Location

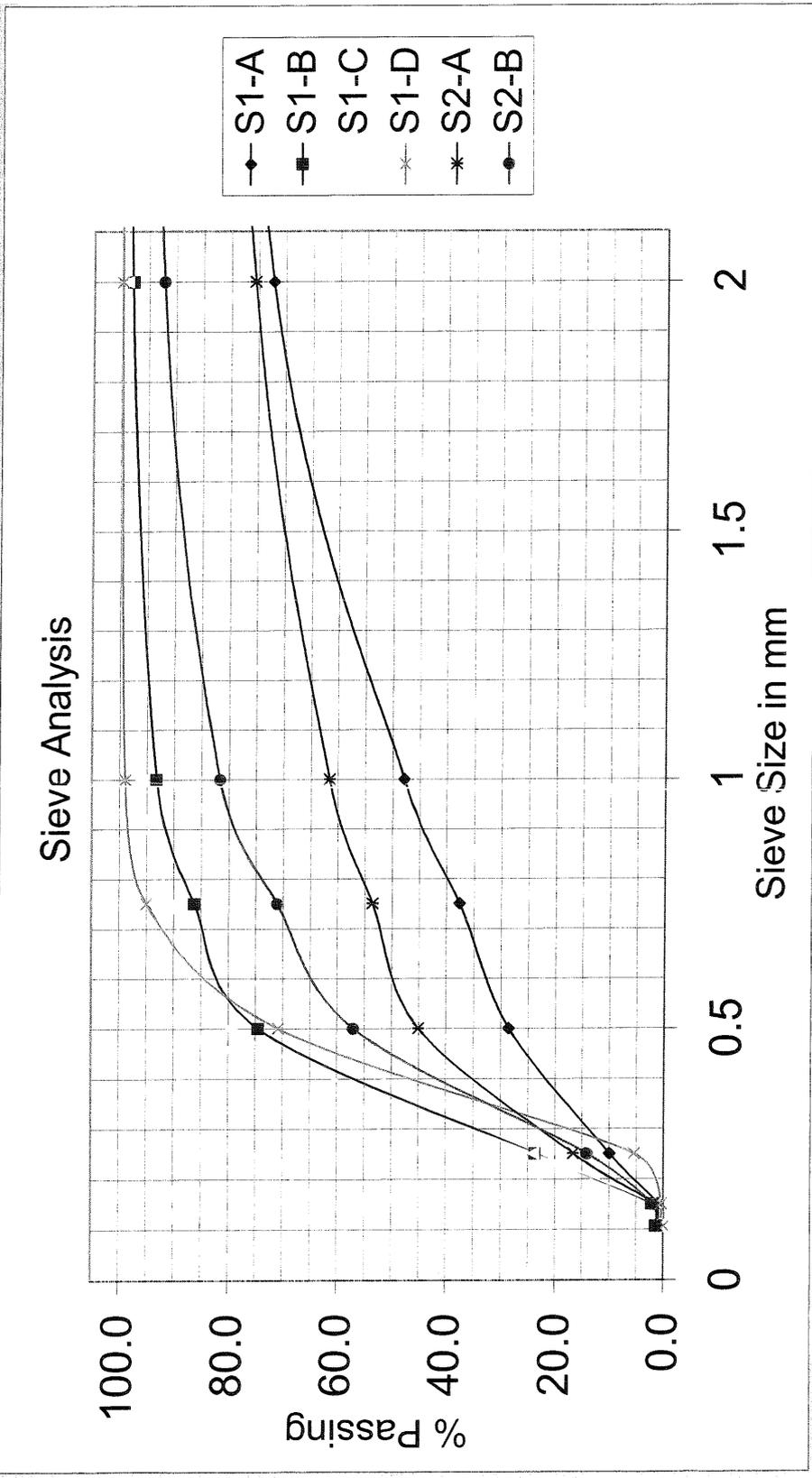


**SAND GRAIN ANALYSIS
S-CURVES**

Sand Bag S-Curves Data Sand Grain Analysis		Mean Low Water Location "A"	Mid Tide Location "B"	Mean High Water Location "C"	Dune Toe Location "D"	Transect Mean	S-curves Combined Mean
Transect S-1							
fines	less than 0.8 %	less than 1.4 %	less than 0.8 %	0%	less than 0.75 %		less than 0.958 %
sand	71.40%	96.60%	98.10%	99.80%	91.48%		93.72%
granular	20.90%	1.50%	0.60%	0%	5.75%		3.84%
gravel	6.90%	0.50%	0.50%	0.20%	2.03%		1.48%
Transect S-2							
fines	less than 1.1 %	less than 1.3 %	less than 0.7 %	less than 0.4 %	less than 0.875 %		
sand	74.50%	91.00%	98.70%	99.30%	90.88%		
granular	16.10%	5.80%	0.40%	0.10%	5.60%		
gravel	8.30%	1.90%	0.20%	0.20%	2.65%		
Transect S-3							
fines	less than 0.8 %	less than 1.4 %	less than 0.6 %	less than 0 %	less than 0.7 %		
sand	94.50%	94.70%	98.90%	99.60%	96.93%		
granular	3.40%	3.10%	0.30%	0.20%	1.75%		
gravel	1.30%	0.80%	0.20%	0.20%	0.63%		
Transect S-4							
fines	less than 2.1 %	less than 2.1 %	less than 1.9 %	less than 0.2 %	less than 1.575 %		
sand	95.00%	97.20%	97.70%	99.40%	97.33%		
granular	2.40%	0.50%	0.20%	0.10%	0.80%		
gravel	0.50%	0.20%	0.20%	0.30%	0.30%		
Transect S-5							
fines	less than 0.7 %	less than 1.1 %	less than 1.7 %	less than 0.9 %	less than 1.1 %		
sand	88.10%	95.20%	97.50%	98.00%	94.70%		
granular	9.00%	2.90%	0.60%	0.90%	3.35%		
gravel	2.20%	0.80%	0.20%	0.20%	0.85%		
Transect S-6							
fines	less than 0.6 %	less than 1.1 %	less than 1.1 %	less than 0.2 %	less than 0.75 %		
sand	74.10%	93.40%	98.50%	98.20%	91.05%		
granular	17.20%	4.60%	0.20%	1.20%	5.80%		
gravel	8.10%	0.90%	0.20%	0.40%	2.40%		

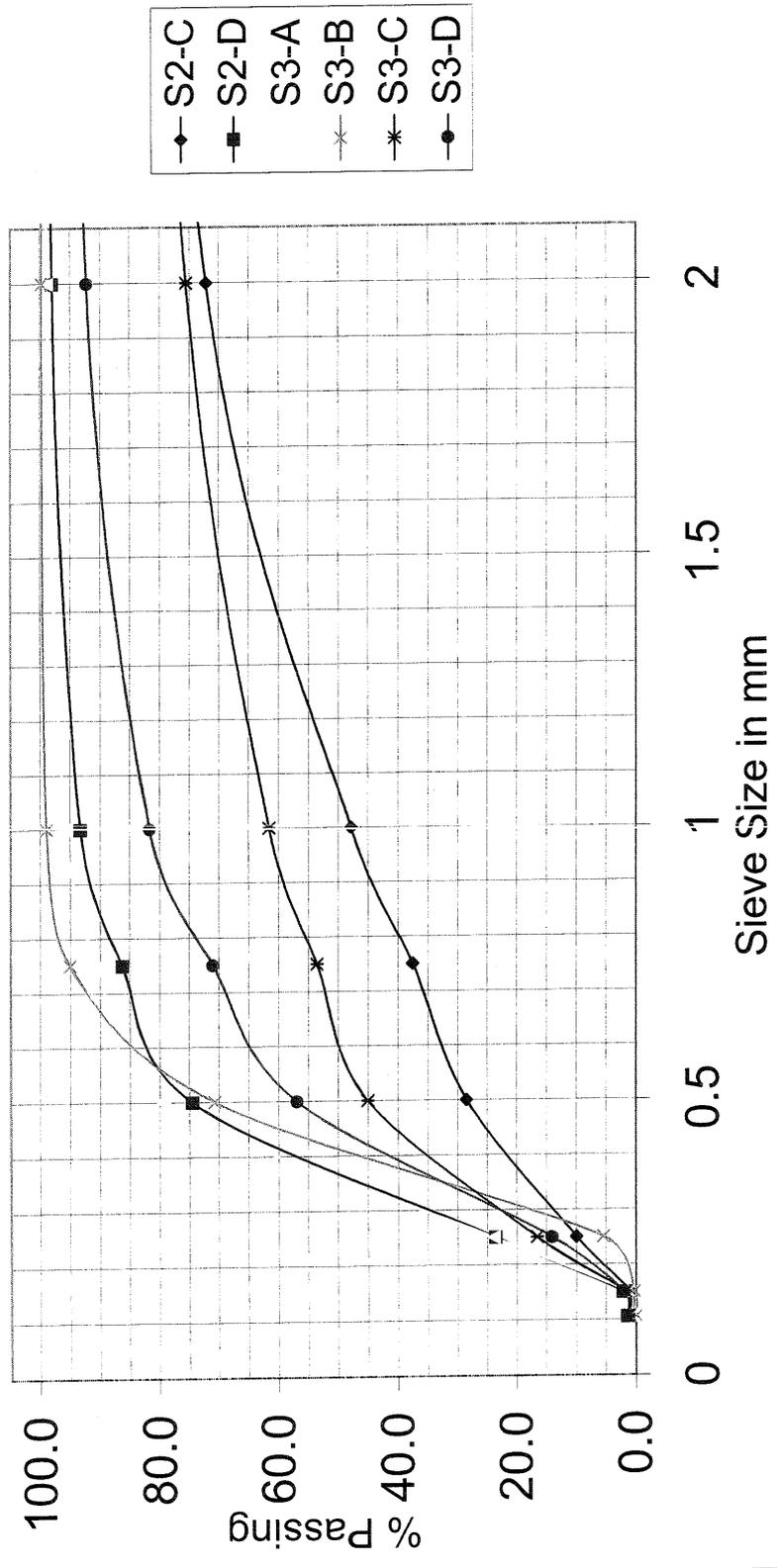
D = Dune Toe
 C = MEAN High Water
 B = Mid Tide
 A = MEAN Low Water

SIEVE	SIEVE SIZE	S1A		S1B		S1C		S1D		S2A		S2B		SAMPLE NUMBER											
		S1A	S1B	S1C	S1D	S1A	S1B	S1C	S1D	S2A	S2B	S1-A	S1-B	S1-C	S1-D	S2-A	S2-B	PROJECT	COUNTY	SAMPLED	RECEIVED	REPORTED	SUBMITTED BY		
#1	4.75	93.1	99.5	99.5	99.8	91.7	98.1	98.1	98.1	91.7	98.1	98.1	98.1	S1-A	S1-B	S1-C	S1-D	S2-A	S2-B	11701.1028012	DARE	7/23/08	7/25/2008	8/4/2008	CYRUS PARKER
#2	2	72.2	98.0	98.9	99.8	75.6	92.3	92.3	92.3	75.6	92.3	92.3	92.3	S1-A	S1-B	S1-C	S1-D	S2-A	S2-B						
#18	1	47.9	93.3	95.9	99.0	61.6	81.7	81.7	81.7	61.6	81.7	81.7	81.7	S1-A	S1-B	S1-C	S1-D	S2-A	S2-B						
#30	0.75	37.6	86.3	90.3	95.1	53.6	71.1	71.1	71.1	53.6	71.1	71.1	71.1	S1-A	S1-B	S1-C	S1-D	S2-A	S2-B						
#50	0.5	28.6	74.5	79.3	70.8	45.1	57.0	57.0	57.0	45.1	57.0	57.0	57.0	S1-A	S1-B	S1-C	S1-D	S2-A	S2-B						
#100	0.25	10.0	23.6	23.9	5.5	16.6	14.1	14.1	14.1	16.6	14.1	14.1	14.1	S1-A	S1-B	S1-C	S1-D	S2-A	S2-B						
#200	0.15	1.0	2.1	1.6	0.4	1.7	2.0	2.0	2.0	1.7	2.0	2.0	2.0	S1-A	S1-B	S1-C	S1-D	S2-A	S2-B						
#400	0.106	0.8	1.4	0.8	0.0	1.1	1.3	1.3	1.3	1.1	1.3	1.3	1.3	S1-A	S1-B	S1-C	S1-D	S2-A	S2-B						



SIEVE SIZE	S2C	S2D	S3A	S3B	S3C	S3D	SAMPLE NUMBER							
4.75	99.8	99.8	98.7	99.2	99.8	99.8	S2-C	S2-D	S3-A	S3-B	S3-C	S3-D	PROJECT	11701.1028012
2	99.4	99.7	95.3	96.1	99.5	99.6	S2-C	S2-D	S3-A	S3-B	S3-C	S3-D	COUNTY	DARE
1	98.5	97.6	86.0	87.6	98.3	92.7	S2-C	S2-D	S3-A	S3-B	S3-C	S3-D	SAMPLED	7/23/08
0.75	96.5	87.9	76.7	77.8	94.9	73.0	S2-C	S2-D	S3-A	S3-B	S3-C	S3-D	RECEIVED	7/25/2008
0.5	90.9	63.1	65.4	61.5	86.0	45.3	S2-C	S2-D	S3-A	S3-B	S3-C	S3-D	REPORTED	8/4/2008
0.25	32.5	6.2	22.9	15.4	30.6	5.0	S2-C	S2-D	S3-A	S3-B	S3-C	S3-D	SUBMITTED BY	CYRUS PARKER
0.15	2.2	0.9	1.6	1.8	2.5	0.2	S2-C	S2-D	S3-A	S3-B	S3-C	S3-D		
0.106	0.7	0.4	0.8	1.4	0.6	0.0	S2-C	S2-D	S3-A	S3-B	S3-C	S3-D		

Sieve Analysis

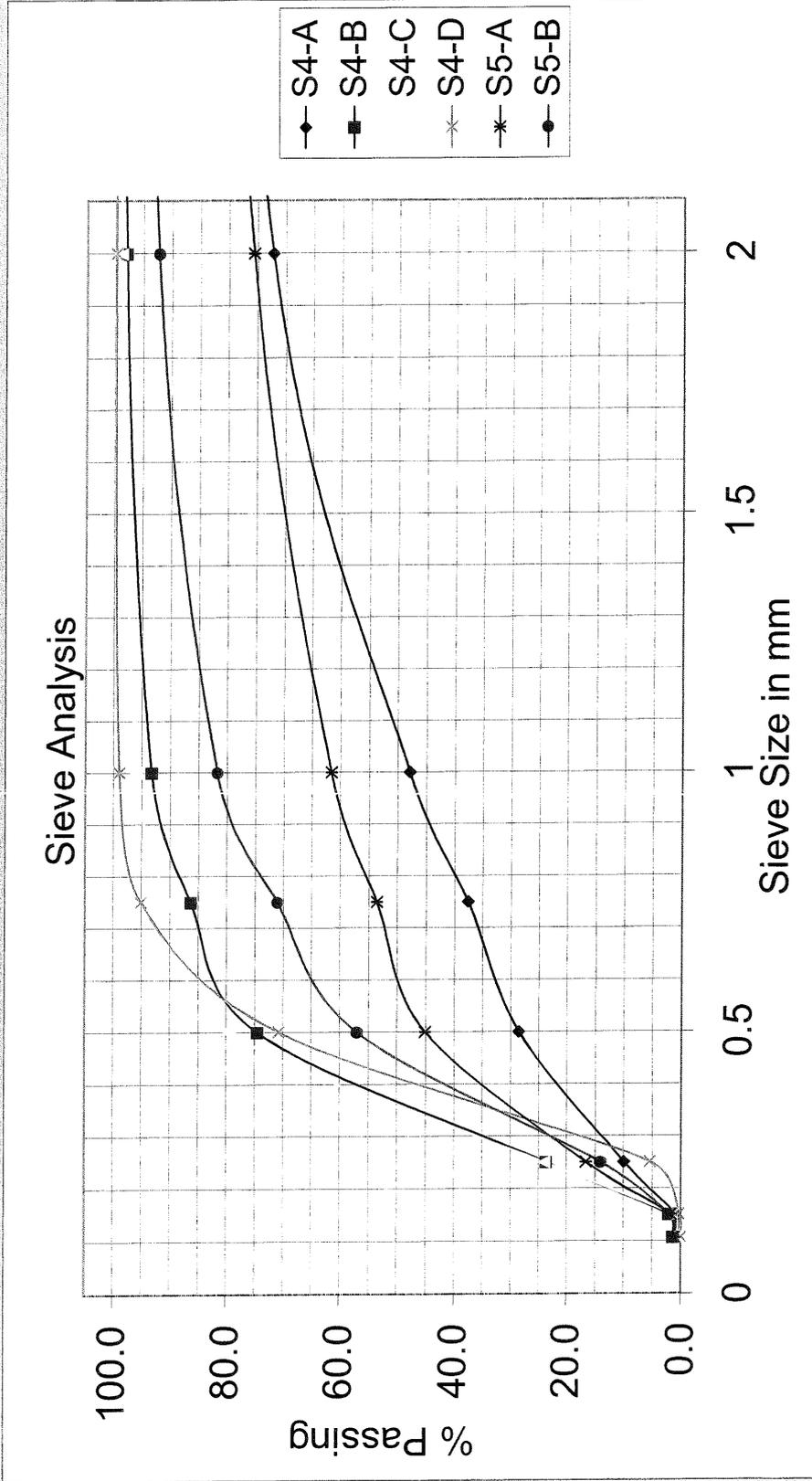


SIEVE SIZE	S4A	S4B	S4C	S4D	S5A	S5B
4.75	99.5	99.8	99.8	99.7	97.8	99.2
2	97.1	99.3	99.6	99.6	88.8	96.3
1	85.2	97.1	99.2	97.2	76.6	88.0
0.75	72.3	92.0	97.9	90.9	68.1	78.1
0.5	56.2	80.2	93.3	68.5	57.9	63.7
0.25	18.2	26.3	36.2	6.4	22.4	15.8
0.15	2.4	2.7	2.7	0.9	1.9	1.6
0.106	2.1	2.1	1.9	0.2	0.7	1.1

SAMPLE NUMBER

S4-A	11701.1028012
S4-B	DARE
S4-C	7/23/08
S4-D	7/25/2008
S5-A	8/4/2008
S5-B	CYRUS PARKER

PROJECT	11701.1028012
COUNTY	DARE
SAMPLED	7/23/08
RECEIVED	7/25/2008
REPORTED	8/4/2008
SUBMITTED BY	CYRUS PARKER



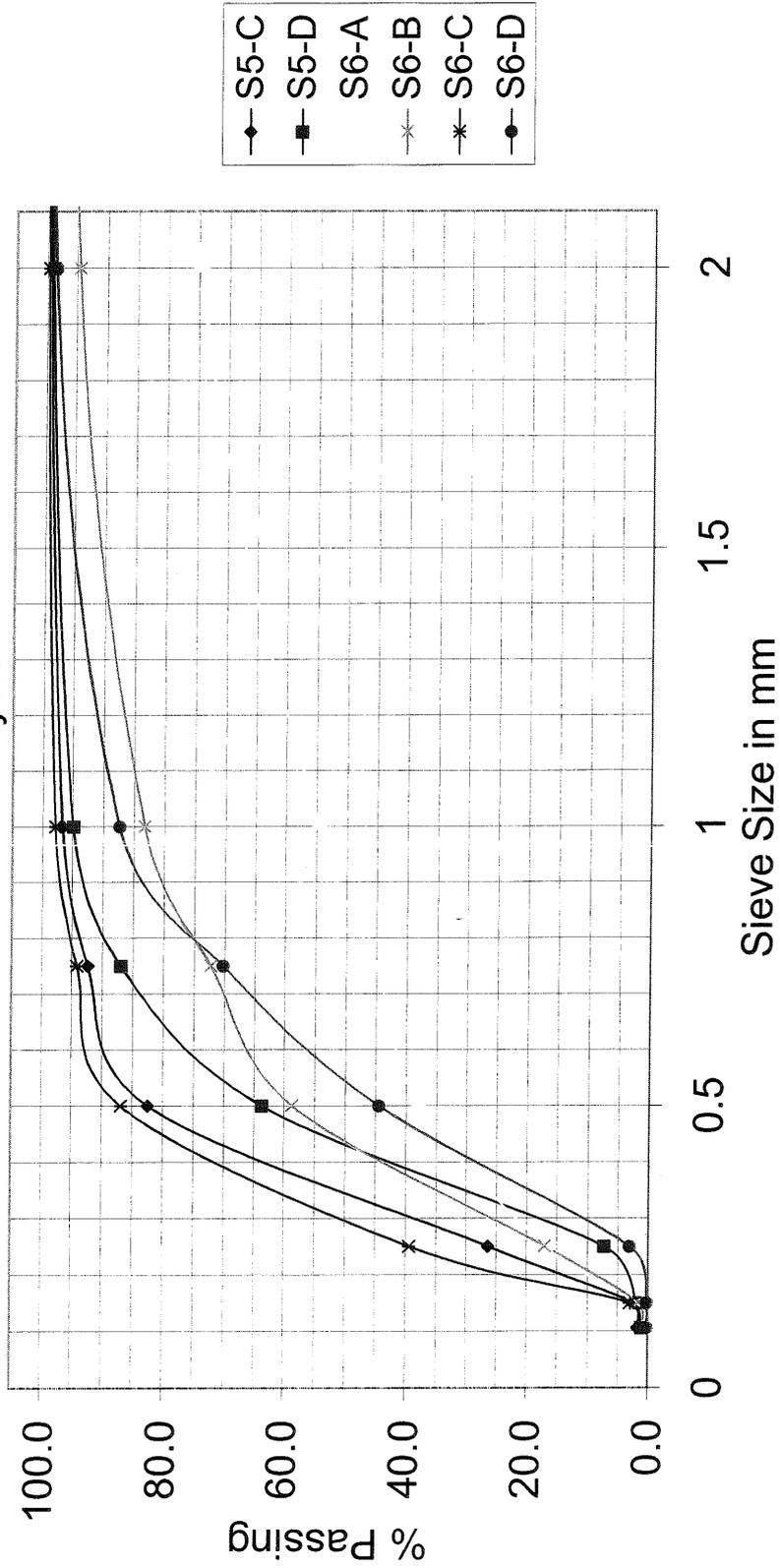
SIEVE SIZE	S6A						S6B						S6C						S6D					
	S5C	S5D	S5E	S5F	S5G	S5H	S6A	S6B	S6C	S6D	S6E	S6F	S6G	S6H	S6I	S6J	S6K	S6L	S6M	S6N				
4.75	99.8	99.8	99.8	99.8	99.8	99.8	91.9	99.1	99.8	99.6	99.6	99.6	99.6	99.6	99.6	99.6	99.6	99.6	99.6	99.6				
2	99.2	98.9	98.9	98.9	98.9	98.9	74.7	94.5	99.6	99.6	99.6	99.6	99.6	99.6	99.6	99.6	99.6	99.6	99.6	99.6				
1	96.7	94.9	94.9	94.9	94.9	94.9	54.6	83.3	97.9	97.9	97.9	97.9	97.9	97.9	97.9	97.9	97.9	97.9	97.9	97.9				
0.75	92.4	87.0	87.0	87.0	87.0	87.0	45.2	72.3	94.2	94.2	94.2	94.2	94.2	94.2	94.2	94.2	94.2	94.2	94.2	94.2				
0.5	82.5	63.7	63.7	63.7	63.7	63.7	37.9	58.8	86.9	86.9	86.9	86.9	86.9	86.9	86.9	86.9	86.9	86.9	86.9	86.9				
0.25	26.4	7.2	7.2	7.2	7.2	7.2	16.8	17.1	39.4	39.4	39.4	39.4	39.4	39.4	39.4	39.4	39.4	39.4	39.4	39.4				
0.15	2.5	1.9	1.9	1.9	1.9	1.9	1.2	1.6	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0				
0.106	1.7	0.9	0.9	0.9	0.9	0.9	0.6	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1				

SAMPLE NUMBER

S5-C
S5-D
S6-A
S6-B
S6-C
S6-D

PROJECT	11701.1028012
COUNTY	DARE
SAMPLED	7/23/08
RECEIVED	7/25/2008
REPORTED	8/4/2008
SUBMITTED BY	CYRUS PARKER

Sieve Analysis



**CALCIUM CARBONATE ANALYSIS
S-CURVES**

**HEAVY MINERAL ANALYSIS
S-CURVES**

C = CONTROL SITE

S = SANDBAG SURVEY LOCATION

Pea Island National Wildlife Refuge, number of heavy minerals, collected 1/22/2007

Sample	No. HMs Field 1	No. HMs Field 2	No. HMs Field 3	No. HMs Field 4	No. HMs Field 5	No. HMs Field 6	No. HMs Field 7	No. HMs Field 8	No. HMs Field 9	Average No. HMs	STDEV
C-1-A	0	0	1	0	0	0	0	0	0	0.1	0.33
C-1-B	1	0	0	1	1	0	0	1	0	0.4	0.53
C-1-C	2	6	5	3	6	3	7	4	2	4.2	1.86
C-1-D	53	109	136	27	13	26	32	82	56	59.3	41.77
S-1-A	0	0	1	0	0	2	0	0	0	0.3	0.71
S-1-B	2	0	1	2	1	0	3	1	2	1.3	1.00
S-1-C	61	52	97	39	57	83	61	29	77	61.8	21.32
S-1-D	122	62	37	83	133	106	85	126	79	92.6	31.93
C-2-A	0	4	1	0	3	1	2	2	8	2.3	2.50
C-2-B	0	1	1	2	5	0	2	7	2	2.2	2.33
C-2-C	7	10	6	4	4	1	11	7	14	7.1	4.01
C-2-D	49	61	38	40	28	31	39	62	67	46.1	14.27
S-2-A	29	31	47	59	43	19	16	63	49	39.6	16.76
S-2-B	13	23	31	27	15	21	22	16	26	21.6	6.00
S-2-C	16	9	27	31	25	36	14	3	26	20.8	10.86
S-2-D	24	34	41	51	37	22	57	32	53	39.0	12.55
C-3-A	0	0	0	0	1	0	0	0	0	0.1	0.33
C-3-B	2	1	4	0	1	0	1	1	1	1.2	1.20
C-3-C	3	4	3	5	5	0	2	2	2	2.9	1.62
C-3-D	61	64	72	77	102	87	56	56	88	73.7	16.12
S-3-A	11	16	21	13	10	31	24	24	29	19.9	7.75
S-3-B	27	31	16	13	17	7	9	9	16	16.1	8.18
S-3-C	13	17	4	21	36	20	7	7	21	16.2	9.88
S-3-D	96	156	107	111	88	103	127	127	92	111.9	21.58
C-4-A	16	22	37	28	13	10	29	29	5	21.0	10.61
C-4-B	2	3	1	3	1	3	5	5	2	2.8	1.48
C-4-C	4	5	6	11	1	7	6	6	2	5.3	2.92
C-4-D	127	101	131	87	97	157	110	110	137	117.4	22.22
S-4-A	1	4	6	5	3	3	1	1	1	2.8	1.92
S-4-B	16	23	26	31	17	20	31	31	11	22.9	7.41
S-4-C	56	31	51	40	29	47	33	33	35	39.4	9.67
S-4-D	137	111	129	101	93	141	97	97	133	115.4	19.44
C-5-A	6	3	1	8	1	1	5	1	7	3.7	2.87

C-5-B	1	1	0	1	5	2	0	7	1	2.0	2.40
C-5-C	11	4	2	13	8	2	3	5	9	6.3	4.06
C-5-D	66	71	57	83	51	47	42	67	50	59.3	13.29
S-5-A	6	1	2	1	8	6	2	6	2	3.8	2.68
S-5-B	1	1	1	2	2	1	2	3	2	1.7	0.71
S-5-C	1	23	9	5	4	3	2	6	16	7.7	7.31
S-5-D	97	124	69	131	109	107	99	137	121	110.4	20.82
C-6-A	0	0	1	0	2	1	0	0	1	0.6	0.73
C-6-B	1	0	0	4	2	3	3	1	1	1.7	1.41
C-6-C	4	3	0	6	3	2	0	2	2	2.4	1.88
C-6-D	82	101	72	86	91	49	83	77	67	78.7	14.99
S-6-A	2	1	1	0	1	0	1	0	0	0.7	0.71
S-6-B	3	0	1	2	1	2	2	0	3	1.6	1.13
S-6-C	6	2	1	1	4	4	7	6	2	3.7	2.29
S-6-D	157	146	161	132	155	148	169	149	152	152.1	10.40

C= CONTROL SITE

S= SAMPLING S-CURVES LOCATION

Pea Island National Wildlife Refuge, percentage of heavy minerals, collected 1/22/2007

Sample	% HMs Field 1	% HMs Field 2	% HMs Field 3	% HMs Field 4	% HMs Field 5	% HMs Field 6	% HMs Field 7	% HMs Field 8	% HMs Field 9	Average % HMs	STDEV
C-1-A	0	0	0.5	0	0	0	0	0	0	0.1	0.17
C-1-B	0.5	0	0	0.5	0.5	0	0	0.5	0	0.2	0.26
C-1-C	0.5	1	1	0.5	1	0.5	1	0.5	0.5	0.7	0.26
C-1-D	10	15	20	5	3	5	7	15	10	10.0	5.68
S-1-A	0	0	0.5	0	0	0.5	0	0	0	0.1	0.22
S-1-B	0.5	0	0.5	0.5	0.5	0	0.5	0.5	0.5	0.4	0.22
S-1-C	10	10	15	10	12	15	12	7	12	11.4	2.55
S-1-D	17	12	7	15	20	17	15	20	15	15.3	4.03
C-2-A	0	0.5	0.5	0	0.5	0.5	0.5	0.5	1	0.4	0.30
C-2-B	0	0.5	0.5	0.5	1	0	0.5	1	0.5	0.5	0.35
C-2-C	1	1	1	0.5	0.5	0.5	2	1	2	1.1	0.58
C-2-D	10	15	10	10	7	7	10	15	15	11.0	3.24
S-2-A	7	7	10	12	10	7	5	15	10	9.2	3.07
S-2-B	3	5	7	5	3	5	5	3	7	4.8	1.56
S-2-C	3	2	7	7	7	7	3	1	7	4.9	2.57
S-2-D	7	7	10	10	10	7	12	10	12	9.4	2.01
C-3-A	0	0	0	0	0.5	0	0	0	0	0.1	0.17
C-3-B	0.5	0.5	0.5	0	0.5	0	0.5	0.5	0.5	0.4	0.22
C-3-C	0.5	1	0.5	1	1	0	0.5	0	0.5	0.6	0.39
C-3-D	15	15	17	17	20	20	15	20	20	17.7	2.35
S-3-A	2	3	3	2	2	5	5	2	5	3.2	1.39
S-3-B	5	5	3	3	3	2	2	3	3	3.2	1.09
S-3-C	3	3	1	5	5	3	1	5	5	3.4	1.67
S-3-D	15	25	20	20	15	20	22	22	15	19.3	3.61
C-4-A	3	3	5	3	2	2	3	2	1	2.7	1.12
C-4-B	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.00
C-4-C	0.5	0.5	1	2	0.5	1	1	0.5	0.5	0.8	0.50
C-4-D	25	20	25	20	20	30	20	17	25	22.4	4.03
S-4-A	0.5	1	1	1	0.5	0.5	0.5	1	0.5	0.7	0.26
S-4-B	3	5	5	5	3	3	7	5	3	4.3	1.41
S-4-C	7	5	7	7	3	5	5	3	5	5.2	1.56
S-4-D	25	20	25	20	20	25	20	20	25	22.2	2.64
C-5-A	1	0.5	0.5	1	0.5	0.5	1	0.5	1	0.7	0.26

C-5-B	0.5	0.5	0	0.5	1	0.5	0	1	0.5	0.5	0.35
C-5-C	2	0.5	0.5	2	1	0.5	0.5	1	2	1.1	0.70
C-5-D	15	15	10	15	10	10	7	15	10	11.9	3.10
S-5-A	1	0.5	0.5	0.5	1	1	0.5	1	0.5	0.7	0.26
S-5-B	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.00
S-5-C	0.5	3	2	1	1	0.5	0.5	1	2	1.3	0.87
S-5-D	15	20	10	25	20	20	20	25	20	19.4	4.64
C-6-A	0	0	0.5	0	0.5	0.5	0	0	0.5	0.2	0.26
C-6-B	0.5	0	0	0.5	0.5	0.5	0.5	0.5	0.5	0.4	0.22
C-6-C	0.5	0.5	0	1	0.5	0.5	0	0.5	0.5	0.4	0.30
C-6-D	15	17	12	15	17	7	15	15	10	13.7	3.35
S-6-A	0.5	0.5	0.5	0	0.5	0	0.5	0	0	0.3	0.26
S-6-B	0.5	0	0.5	0.5	0.5	0.5	0.5	0	0.5	0.4	0.22
S-6-C	1	0.5	0.5	0.5	1	1	1	1	0.5	0.8	0.26
S-6-D	25	25	25	20	25	25	25	25	25	24.4	1.67

Pea Island National Wildlife Refuge, percentage of heavy mineral species, collected 1/22/2007

Sample	Epidote	Staurolite	Garnet	Kyanite	Ilmenite	Magnetite	Zircon	Tourmaline	Rutile	Pyroxene/ amphibole	Others	Total
C-3-D	18	27	37	4	234	27	3	17	2	12	0	381
%	4.7	7.1	9.7	1.0	61.4	7.1	0.8	4.5	0.5	3.1	0.0	100.0
S-5-D	31	29	41	2	213	22	0	19	0	21	0	378
%	8.2	7.7	10.8	0.5	56.3	5.8	0.0	5.0	0.0	5.6	0.0	100.0

Pea Island National Wildlife Refuge, QC of heavy mineral analysis, collected 1/22/2007

Sample	Average									Original count		
	No. HMs Field 1	No. HMs Field 2	No. HMs Field 3	No. HMs Field 4	No. HMs Field 5	No. HMs Field 6	No. HMs Field 7	No. HMs Field 8	No. HMs Field 9		No. HMs in QC	STDEV
C-3-A	1	1	1	0	0	0	1	0	0	0.4	0.53	0.1
S-1-A	0	0	3	1	0	0	1	1	1	0.8	0.97	0.3
S-5-C	6	4	8	1	12	1	7	2	13	6.0	4.47	7.7
C-3-C	5	4	0	1	3	7	0	1	1	2.4	2.46	2.9
Sample	% HMs Field 1	% HMs Field 2	% HMs Field 3	% HMs Field 4	% HMs Field 5	% HMs Field 6	% HMs Field 7	% HMs Field 8	% HMs Field 9	Average % HMs in QC	STDEV	Original %
C-3-A	0.5	0.5	0.5	0	0	0	0.5	0	0	0.2	0.26	0.1
S-1-A	0	0	0.5	0.5	0	0	0.5	0.5	0.5	0.3	0.26	0.1
S-5-C	1	1	1	0.5	2	0.5	1	0.5	2	1.1	0.58	1.3
C-3-C	1	1	0	0.5	0.5	1	0	0.5	0.5	0.6	0.39	0.6

Shell Material greater than 3 inches on the receiving beach

- * The “background” value of shell material greater than three inches in diameter between mean low water and the dune toe, within a 50,000 sq. ft. area of the beach habitat restoration site is 75.

**SAND GRAIN ANALYSIS
GROIN AREA AND OLD COAST GUARD STATION**

Groin Mining Location Sand Grain Analysis	Depth (0 - 5 feet)	Depth (5 - 10 feet)	Sample Point SB 01 thru SB 07 Mean Depth (0 - 5 feet)	Sample Point SB 01 thru SB 07 Mean Depth (5 - 10 feet)
Sample Point SB-01				
fines	less than 1.3 %	less than 1.4 %	less than 1.385 %	less than 1.74 %
sand	97.33%	90.50%	97.13%	96.54%
granular	0.58%	5.20%	0.67%	0.94%
gravel	0.80%	2.90%	0.73%	0.74%
Sample Point SB-02				
fines	less than 1.4 %	less than 1.7 %		
sand	97.20%	97.90%		
granular	0.80%	0.00%		
gravel	0.60%	0.40%		
Sample Point SB-03				
fines	less than 0.7 %	less than 1.5 %		
sand	98.70%	98.00%		
granular	0.20%	0.10%		
gravel	0.40%	0.40%		
Sample Point SB-04				
fines	less than 1.2 %	less than 2.3 %		
sand	98.30%	97.10%		
granular	0.10%	0.20%		
gravel	0.40%	0.40%		
Sample Point SB-05				
fines	less than 1.5 %	less than 1.5 %		
sand	97.10%	97.90%		
granular	1.00%	0.20%		
gravel	0.40%	0.40%		
Sample Point SB-06				
fines	less than 1.7 %	less than 1.8 %		
sand	95.10%	97.10%		
granular	1.60%	0.60%		
gravel	1.60%	0.50%		
Sample Point SB-07				
fines	less than 1.9 %	less than 2 %		
sand	96.20%	97.30%		
granular	0.40%	0.30%		
gravel	1.50%	0.40%		

Old Coast Guard Location	Depth (0 - 5 feet)	Depth (5 - 10 feet)	Depth (10 - 15 feet)	Depth (15 - 20 feet)
Sand Grain Analysis				
Sample Point SB-08				
fines	less than 0.3 %	less than 1.3 %	less than 5.8 %	less than 2.2 %
sand	99.20%	98.30%	93.80%	97.40%
granular	0.10%	0.00%	0.00%	0.00%
gravel	0.40%	0.40%	0.40%	0.40%
Sample Point SB-09				
fines	less than 0.4 %	less than 0.7 %	less than 4.1 %	less than 20.6 %
sand	99.20%	98.90%	88.10%	78.70%
granular	0.00%	0.00%	4.80%	0.30%
gravel	0.40%	0.40%	3.00%	0.40%
Sample Point SB-10				
fines	less than 5.5 %	less than 1.7 %	less than 24.4 %	less than 7.2 %
sand	93.20%	97.70%	75.20%	92.40%
granular	0.70%	0.20%	0.00%	0.00%
gravel	0.60%	0.40%	0.40%	0.40%
	Sample Point SB 08 thru SB 10 Mean Depth (0 - 5 feet)	Sample Point SB 08 thru SB 10 Mean Depth (5 - 10 feet)	Sample Point SB 08 thru SB 10 Mean Depth (10 - 15 feet)	Sample Point SB 08 thru SB 10 Mean Depth (15 - 20 feet)
fines	less than 2.06 %	less than 1.23 %	less than 11.43 %	less than 10.00 %
sand	97.20%	98.30%	85.70%	89.50%
granular	0.26%	0.06%	1.60%	0.10%
gravel	0.46%	0.40%	1.26%	0.40%

M & T Form 500

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
MATERIALS & TEST UNIT
SOILS LABORATORY

Ref Proj:

REPORT ON SAMPLES OF:
DETAILED SAND SIEVE ANALYSIS

PROJECT: 11701.1028 COUNTY Dare
DATE SAMPLED: 12/11/2007 RECEIVED: 12/28/2007 REPORTED: 1/3/2008
SAMPLED FROM: BEACH SOURCE: PEA ISLAND
SUBMITTED BY: CYRUS PARKER 1995 STD. SPECIFICATIONS

TEST RESULTS

Proj. Sample No.	PI-SB01	PI-SB01	PI-SB02	PI-SB02	PI-SB03	PI-SB03
Lab. Sample No.	742776	742777	742778	742779	742780	742781
Sieve No.	%Passing	%Passing	%Passing	%Passing	%Passing	%Passing
#4 (100 mm) 4.75	99.2	97.1	99.4	99.6	99.6	99.6
#10 (2 mm)	97.4	91.9	98.6	99.6	99.4	99.5
#60 (0.25mm)	44.2	56.2	43.8	54.3	43.6	53.5
#200 (.075 mm)	1.3	1.4	1.4	1.7	0.7	1.5

PI-SB04 742782	PI-SB04 742783	PI-SB05 742784	PI-SB05 742785	PI-SB06 742786	PI-SB06 742787	PI-SB07 742788
Passing	%Passing	%Passing	%Passing	%Passing	%Passing	%Passing
99.6	99.6	99.6	99.6	98.4	99.5	98.5
99.5	99.4	98.6	99.4	96.8	98.9	98.1
51.3	65.5	55.6	88.5	55.2	77	44.8
1.2	2.3	1.5	1.5	1.7	1.8	1.9

PI-SB09 742796	PI-SB09 742797	PI-SB10 742798	PI-SB10 742799	PI-SB10 742800	PI-SB10 742801
%Passing	%Passing	%Passing	%Passing	%Passing	%Passing
97	99.6	99.4	99.6	99.6	99.6
92.2	99.3	98.7	99.4	99.6	99.6
45	95.4	41.2	46.5	78.9	99.4
4.1	20.6	5.5	1.7	24.4	7.2

PI-SB07	PI-SB08	PI-SB08	PI-SB08	PI-SB08	PI-SB09	PI-SB09
742789	742790	742791	742792	742793	742794	742795
%Passing						
99.6	99.6	99.6	99.6	99.6	99.6	99.6
99.3	99.5	99.6	99.6	99.6	99.6	99.6
88.6	55.8	49.8	91.4	92.3	50.9	44.5
2	0.3	1.3	5.8	2.2	0.4	0.7

**CALCIUM CARBONATE ANALYSIS
GROIN AREA AND OLD COAST GUARD STATION**

TABLE 1
SUMMARY OF SOIL LABORATORY RESULTS
PERCENT CALCIUM CARBONATE

Analytical Methods: EPA Methods 6010B and 3050B
 Site Name: NCDOT-North End of Pea Island

Sample ID	Parameter →		Percent Calcium Carbonate
	Date Collected	Sample Depth (ft. BGS)	
PI-SB01 (0-5)	12/11/2007	0-5	0.14
PI-SB01 (5-10)	12/11/2007	5-10	0.32
PI-SB02 (0-5)	12/11/2007	0-5	0.32
PI-SB02 (5-10)	12/11/2007	5-10	0.16
PI-SB03 (0-5)	12/11/2007	0-5	0.08
PI-SB03 (5-10)	12/11/2007	5-10	0.45
PI-SB04 (0-5)	12/11/2007	0-5	0.05
PI-SB04 (5-10)	12/11/2007	5-10	0.24
PI-SB05 (0-5)	12/11/2007	0-5	0.15
PI-SB05 (5-10)	12/11/2007	5-10	0.30
PI-SB06 (0-5)	12/11/2007	0-5	0.35
PI-SB06 (5-10)	12/11/2007	5-10	0.13
PI-SB07 (0-5)	12/11/2007	0-5	0.23
PI-SB07 (5-10)	12/11/2007	5-10	0.09
PI-SB08 (0-5)	12/12/2007	0-5	0.04
PI-SB08 (5-10)	12/12/2007	5-10	0.05
PI-SB08 (10-15)	12/12/2007	10-15	0.09
PI-SB08 (15-20)	12/12/2007	15-20	0.06
PI-SB09 (0-5)	12/12/2007	0-5	0.11
PI-SB09 (5-10)	12/12/2007	5-10	0.05
PI-SB09 (10-15)	12/12/2007	10-15	6.24
PI-SB09 (15-20)	12/12/2007	15-20	0.17
PI-SB09 (20-25)	12/12/2007	20-25	0.09
PI-SB10 (0-5)	12/12/2007	0-5	0.15
PI-SB10 (5-10)	12/12/2007	5-10	0.09
PI-SB10 (10-15)	12/12/2007	10-15	0.15
PI-SB10 (15-20)	12/12/2007	15-20	0.06

GRAIN AVERAGE
0.215

OLD COAST GUARD STA AVERAGE
0.0925

All results in percent maximum CaCO₃ available from total calcium analysis.
 ft. BGS = feet below ground surface

**HEAVY MINERAL ANALYSIS
GROIN AREA AND OLD COAST GUARD STATION**

HEAVY MINERAL Content

Sample No.	Depth	Pea Island National Wildlife Refuge, counts of opaque mineral grains										Average No. opaque grains	
		No. opaque grains Field 1	No. opaque grains Field 2	No. opaque grains Field 3	No. opaque grains Field 4	No. opaque grains Field 5	No. opaque grains Field 6	No. opaque grains Field 7	No. opaque grains Field 8	No. opaque grains Field 9			
SB-01	0 - 5 ft	4	5	3	1	7	3	2	2	3	2	3	3.33
	5 - 10 ft	5	6	4	4	3	5	6	3	0	3	4.00	
SB-02	0 - 5 ft	1	16	14	14	24	21	5	4	11	12.22		
	5 - 10 ft	4	3	2	7	1	5	7	7	3	4.33		
SB-03	0 - 5 ft	6	9	4	4	11	8	8	3	6	6.56		
	5 - 10 ft	4	11	6	3	4	22	10	2	3	7.22		
SB-04	0 - 5 ft	4	4	4	5	6	7	6	4	8	5.33		
	5 - 10 ft	11	3	12	11	5	9	7	1	13	8.00		
SB-05	0 - 5 ft	12	5	3	12	6	15	7	16	11	9.67		
	5 - 10 ft	19	22	24	28	13	16	25	15	23	20.56		
SB-06	0 - 5 ft	28	84	48	36	26	25	32	68	50	44.11		
	5 - 10 ft	24	12	15	22	20	38	14	32	18	21.67		
SB-07	0 - 5 ft	42	35	24	11	23	39	7	12	21	23.78		
	5 - 10 ft	33	28	13	27	22	19	34	26	27	25.44		
SB-08	0 - 5 ft	51	39	53	40	46	50	29	36	35	42.11		
	5 - 10 ft	43	55	51	62	16	30	47	68	82	50.44		
SB-09	0 - 5 ft	107	83	96	107	37	62	67	71	98	80.89		
	5 - 10 ft	57	28	26	37	33	38	46	68	66	44.33		
SB-10	0 - 5 ft	32	36	42	56	33	42	37	32	51	40.11		
	5 - 10 ft	30	28	36	19	24	37	50	41	37	33.56		
SB-10	10 - 15 ft	83	61	95	79	31	101	57	33	79	68.78		
	15 - 20 ft	31	69	42	40	46	71	36	28	47	45.56		

Sample No.	Depth	Pea Island National Wildlife Refuge, percent of opaque mineral grains										Average percent opaque grains	
		Percent opaque grains Field 1	Percent opaque grains Field 2	Percent opaque grains Field 3	Percent opaque grains Field 4	Percent opaque grains Field 5	Percent opaque grains Field 6	Percent opaque grains Field 7	Percent opaque grains Field 8	Percent opaque grains Field 9			
SB-01	0 - 5 ft	1	2	3	1	5	2	3	3	1	3	3	2.33
	5 - 10 ft	3	5	7	2	1	3	3	3	3	5	5	3.56
SB-02	0 - 5 ft	3	2	1	3	2	3	3	3	2	2	2	2.33
	5 - 10 ft	2	2	2	1	3	3	2	2	2	2	2	2.33
SB-03	0 - 5 ft	3	3	2	2	3	3	2	2	2	3	3	2.56
	5 - 10 ft	2	3	3	3	2	5	3	2	2	2	2	2.78
SB-04	0 - 5 ft	3	5	5	3	5	3	3	3	3	3	3	3.89
	5 - 10 ft	2	3	1	2	1	3	3	2	2	1	1	2.00
SB-05	0 - 5 ft	3	3	3	3	5	3	3	3	3	3	3	3.44
	5 - 10 ft	5	7	5	5	5	1	3	5	5	5	5	4.56
SB-06	0 - 5 ft	7	7	10	10	7	10	7	7	10	10	10	8.67
	5 - 10 ft	5	3	3	3	3	1	7	5	5	5	5	3.89
SB-07	0 - 5 ft	7	7	5	3	5	3	5	5	5	5	5	5.44
	5 - 10 ft	7	5	7	5	5	5	5	7	7	5	5	5.67
SB-08	0 - 5 ft	7	10	10	10	7	10	10	10	7	15	15	9.56
	5 - 10 ft	15	15	10	15	15	10	10	15	15	15	15	13.33
	10 - 15 ft	5	7	5	7	10	7	15	5	5	15	15	8.44
	15 - 20 ft	15	5	10	10	15	5	5	15	15	10	10	10.00
SB-09	0 - 5 ft	15	15	15	20	10	10	10	10	15	15	15	13.89
	5 - 10 ft	10	7	10	15	10	10	7	10	10	10	10	9.89
	10 - 15 ft	15	10	10	7	7	15	15	15	15	10	10	11.56
	15 - 20 ft	10	10	7	7	10	10	15	10	10	7	7	9.56
SB-10	0 - 5 ft	7	10	7	10	10	15	7	7	10	7	7	9.22
	5 - 10 ft	15	15	10	7	15	10	7	10	10	10	10	11.00
	10 - 15 ft	10	10	15	10	20	15	15	15	15	15	15	13.89
	15 - 20 ft	15	10	10	10	15	15	10	10	10	7	7	11.33

Pea Island National Wildlife Refuge, QC counts of opaque mineral grains											
Sample No.	Depth	No. opaque grains Field 1	No. opaque grains Field 2	No. opaque grains Field 3	No. opaque grains Field 4	No. opaque grains Field 5	No. opaque grains Field 6	No. opaque grains Field 7	No. opaque grains Field 8	No. opaque grains Field 9	Average No. opaque grains
SB-01	5 - 10 ft	4	4	9	2	3	5	8	3	1	4.33
SB-05	0 - 5 ft	18	20	6	3	11	15	8	11	10	11.33
SB-10	5 - 10 ft	27	33	16	55	24	41	48	38	29	34.56