

FINAL REPORT

***Post-Isabel*
Emergency Dune Restoration
Project at Nags Head**

Prepared for:

Town of Nags Head
PO Box 99 Nags Head NC 27959

Prepared by:

Coastal Science & Engineering (CSE)
PO Box 1643 Morehead City NC 28557-1643

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TABLE OF CONTENTS

	PAGE
1.0 INTRODUCTION	1
1.1 Project Sponsor	1
1.2 Project Setting	1
1.3 Purpose and Need	1
1.4 Project Objectives	2
1.5 Permits Obtained	2
2.0 PROJECT DESCRIPTION	3
3.0 PROJECT SEQUENCE	5
4.0 TRUCK COUNT SUMMARY	7
5.0 FINAL PROFILES	8
6.0 FINAL PROJECT COSTS	9
7.0 PHOTOGRAPHIC DOCUMENTATION	10
8.0 MAINTENANCE AND MONITORING RECOMMENDATIONS	10
Figure 1 Project Location Maps	
Figure 2 Project Plan	
Figure 3 Design Fill Profile (reaches 1-9)	
Figure 4 Design Fill Profile (reaches 10-18)	
Figure 5 Design Fill Profile (reaches 19-23)	
APPENDIX A Truck Haul Records	
APPENDIX B Beach Profile Surveys (pre and postproject)	
APPENDIX C Project Photographs	

1.0 INTRODUCTION

This report is prepared following the completion of the post-*Isabel* emergency dune restoration project undertaken by the Town of Nags Head. It provides a summary of the project completed between March 2004 and May 2005 by the contractor, RPC Contracting Inc (RPC) of Kitty Hawk (NC). Coastal Science & Engineering (Morehead City) was the project engineer.

The present report includes:

- Brief summary of the project setting, purpose, and project description.
- Project time line.
- Summary of beach changes and fill volumes.
- Monitoring and maintenance recommendations.

The work described herein was completed during two phases under a single construction contract between the Town of Nags Head and RPC.

1.1 Project Sponsor

The post-*Isabel* emergency dune restoration project was sponsored by the Town of Nags Head. Project financing was by issuance of emergency funds from FEMA. No other funding assistance was included in the financing scheme.

1.2 Project Setting

With the exception of a significant “no-work” area between Ocean Watch Court and East Dowitcher Street and other smaller “no-work” areas, the project area encompassed the oceanfront of the Town of Nags Head, extending approximately 43,000 feet (ft) from the northern border of the Cape Hatteras National Seashore to the Kill Devil Hills town limit. Nags Head is located on the northeast facing, northern portion of the Outer Banks. Located to the east of Nags Head is the Atlantic Ocean and to the west is Pamlico Sound (Fig 1). The nearest inlet, Oregon Inlet, is situated approximately 5 miles south of Nags Head.

1.3 Purpose and Need

In 2003, Nags Head sustained serious damage from Hurricane *Isabel*. The result was a substantial loss of the existing, protective oceanfront dunes. Numerous oceanfront property owners incurred significant costs cleaning up debris, restoring the foredune, and making repairs to or replacing dune walkovers and other access structures. The Town of Nags Head suffered loss of oceanfront infrastructure and beachfront properties at Sea Gull

Drive, Surfside Drive, and McCall Court in south Nags Head. These areas incurred a complete loss of protective dunes, destruction or damage to buildings and septic tank systems, loss of access streets, and near loss of town-owned water lines. Overwash during the storm deposited beach sand on public streets and threatened public, water-system infrastructure. In several locations, the beach line was pushed inland to a line landward of house locations. From an economic perspective, a dune restoration project was needed to protect and restore property and oceanfront infrastructure of the Town of Nags Head.

1.4 Project Objectives

In undertaking the post-*Isabel* emergency dune restoration project, the Town of Nags Head had several objectives that needed to be met. Those objectives are summarized as follows:

- Restore a protective dune that was destroyed by erosion during Hurricane *Isabel*.
- Provide protection of oceanfront property and publicly and privately owned street and utility infrastructure.

1.5 Permits Obtained

To implement the project objectives, it was necessary to obtain permits from the North Carolina State Division of Coastal Management, the North Carolina Division of Land Resources, and the US Army Corps of Engineers. The following permits were required and were obtained by the Town of Nags Head or RPC.

- 1) CAMA Major Permit #37-04 issued 26 February 2004. The permit set forth conditions for construction of the emergency dune project.
- 2) The following mining pits were approved for use in the project:
 - Barnhill-McPherson Mines (Currituck) Permit #27-20
 - RPC Mines (Currituck) Permit #27-24
 - Coastal Contractors of the Outer Banks (Manteo) Permit #28-23

2.0 PROJECT DESCRIPTION

The post-*Isabel* emergency dune restoration project was completed in two phases. The first phase (Project 2004) was implemented between 22 March and 30 April 2004, and called for:

- Relocation, screening, and placement of 10,200 cubic yards (cy) of stockpiled sand over 8,250 linear feet (1.6 miles) of beach.
- Beach scraping and finish grading of berm and dune of ~5 cubic yards per linear foot over approximately 7,317 linear feet (1.4 miles) of beach.
- Hauling of beach-quality sand from the RPC mines in Currituck to be placed along the continuous shoreline reaches within the project areas.

The second phase (Project 2005) of the project (implemented between 1 December 2004 and 30 April 2005) consisted of hauling and placement of 210,300 cy from the RPC mines in Currituck County to be placed along various shoreline reaches within the specified project areas. As shown in Figure 2, the project area was divided into 23 separate reaches with reaches 4, 7, 9, 13, and 22 being “no-work” areas. Figure 2 also shows the location of each reach, quantity of sand placed, method of placement and locations of stockpiles of sand cleaned from streets after Hurricane *Isabel*.

On average, the dunes were constructed to a height of +16 ft NGVD and a width of 10 ft, with the exception being reaches 1, 2, 3, and 8. (These reaches were constructed to a height of +17 ft NGVD.) The top of berm grade for the project was set close to the existing grade of the dry beach (approximately +10 ft NGVD). Figures 3, 4, and 5 show the design profiles of the dunes constructed in each reach. The dunes were shaped to these profiles by earthmoving equipment operating in and above the surf zone. Operations were able to move an average of ~2,000 cy per day during Project 2005.

As construction progressed, sections were graded to final contours, dressed to eliminate low areas, and opened for use by the community. Support equipment was shifted out of completed sections as soon as practicable, such that construction activities in a given reach would disrupt normal beach use for only a short period along any particular reach.

Table 1 summarizes the work accomplished between 1 March 2004 and 30 April 2005.

TABLE 1. Summary of work accomplished for the post-*Isabel* emergency dune restoration project, Town of Nags Head.
 [cy = cubic yards / lft = linear foot / cy/lft = cubic yards per linear foot]

SUMMARY

Date project started:	March 1, 2004
Date project completed:	April 30, 2005

TOTALS

Contracted Volumes:

Screening and relocation of stockpiled sand	10,200 cy
Dune Construction Volume	310,300 cy

Lengths Completed (ft):

Scraped Beach (5 cy/lft segment)	7,317 lft
Stockpiled Sand (6 cy/lft segment)	750 lft
Stockpiled & Hauled Sand (10 cy/lft segment)	6,500 lft
Stockpiled & Hauled Sand (8 cy/lft segment)	1,000 lft
Hauled Sand (10 cy/lft)	14,350 lft
Hauled Sand (8 cy/lft)	12,540 lft
Total length	42,457 lft

Completed Segment Stations

Project northern limit, Kill Devil Hills town limit	436+83
Scraped Beach (5 cy/lft segment)	436+83 to 485+00
Scraped Beach (5 cy/lft segment)	575+00 to 600+00
Stockpiled Sand (6 cy/lft segment)	619+00 to 626+50
Stockpiled & Hauled Sand (8 cy/lft segment)	770+00 to 780+00
Stockpiled & Hauled Sand (10 cy/lft segment)	840+00 to 890+00
Stockpiled & Hauled Sand (10 cy/lft segment)	905+00 to 920+00
Stockpiled & Hauled Sand (10 cy/lft segment)	720+00 to 770+00
Stockpiled & Hauled Sand (10 cy/lft segment)	920+00 to 996+50
Stockpiled & Hauled Sand (10 cy/lft segment)	1004+00 to 1021+00

Contractor:	RPC Contracting Inc
Approved Borrow Site	RPC Mines (Currituck)

Gross Volume Hauled Phase I (March-April 2004)	56,666 cy
Gross Volume Hauled Phase II (December 2004 - April 2005)	249,741 cy
Total Gross Volume Hauled Phases I and II	306,407 cy

3.0 PROJECT SEQUENCE

Project implementation was initiated in March 2004 (Table 2). The first task included screening and then relocating the stockpiled sand. Upon completion of this task, the next step was to haul the approved sand for placement and scrape the dunes where necessary. Since the majority of the project area was a low-tide beach, high tides and inclement weather often hampered production. Overall, three days were lost in Phase I and 20 days were lost in Phase II due to weather conditions. The primary weather condition causing delays was northeasters. An extension of the construction period (permitted under the CAMA major permit) was obtained that allowed construction to continue until 30 April 2005 in both the 2004 and 2005 projects, thus allowing the project to be completed. This also ensured that no penalties were incurred by the contractor.

TABLE 2. Project time line for Town of Nags Head (Post Isabel Emergency Dune Restoration Project)

2003	September 18	Town of Nags Head sustains major damage from Hurricane <i>Isabel</i>	
	Sep 28	FEMA authorizes funds for the dune restoration project under PW 299	
	December 3 Dec	Town of Nags Head contracts with CSE for coastal engineering services CSE performs condition survey of dunes and dry beach	
2004	February	Town of Nags Head solicits bids for project	
	Feb 17	Bid opening	
	Feb 17	Project awarded to RPC	
	Feb 26	CAMA permit 37-04 issued to Town of Nags Head	
	March 22	Notice to Proceed issued to RPC to start work	
	Mar 22	RPC mobilizes equipment to start work on Phase I	
	Mar 29	High surf, NE winds cannot get to work area	1 day lost
	Mar 30	High surf, NE winds obstructed access to work area	1 day lost
	April 1	NNE winds, high surf (could not turn trucks) Phase I construction completed, beach equipment removed	1 day lost
	November	Phase II plans revised and issued to contractor	
	December 1	RPC mobilizes equipment to start work on Phase II	
	Dec 15	High surf, tides, and winds	1 day lost
	Dec 20	Winds at low tide, high surf and water	1 day lost
	Dec 24	High winds/surf had to suspend operations	½ day lost
	Dec 25	Christmas holiday	1 day lost
	Dec 27-28	Snow/Icy road conditions	2 days lost
	Dec 28-31	Out-of-town subcontracted truckers home for holidays	3 days lost
2005	January 1	New Year's Day	1 day lost
	Jan 14,15,17	Rain winds strong cold front	2½ day lost
	Jan 19	High surf & North winds	1 day lost
	Jan 24	High surf & wind conditions on beach	½ day lost
	Jan 25	High tide cycle & high winds	½ day lost
	Jan 27	NNW winds high tides	½ day lost
	Jan 28-29	Tidal cycles and north winds	1½ days lost
	Jan 31	Strong winds, high surf	½ day lost
	Feb 1	High surf advisory	½ day lost
	Feb 4	Afternoon lost due to high tides	½ day lost
	Feb 5	High winds & surf in work area	1 day lost
	Feb 7	High AM tides in work areas	½ day lost
	Feb 8	Tides too high to work	½ day lost
	Feb 14	High tides and wind	½ day lost
	Mar 13	CAMA granted an extension that allowed construction until April 30	
	April 30	Phase II completed and beach equipment removed	
	May 1-10	Punch list completed	

4.0 TRUCK COUNT SUMMARY

The contract between the owner and the contractor specified that the contractor would be paid based upon the number of truck loads delivered to the beach in accordance with the truck identification and measurement system. This system stipulated that the hopper of each truck be measured to the estimated fill line established and the truck marked properly. A system (displayed in Table 3) was established between the engineer and the contractor which identified the quantity of sand carried in each truck or class of trucks (classified according to number of axles). For each truck that left the borrow site, the time, date, truck number, and fill level were recorded on a ticket by both the representative from the contractor and a representative of the engineer. At the end of each day, these representatives reconciled their tickets to ensure that both sides agreed on the amount of sand that had been delivered that day. All discrepancies were reconciled. Tables displaying the number of loads delivered for each day of the project are found in Appendix A.

TABLE 3. Truck classification system based on truck-bed measurements and agreed upon by the owner, engineer, and contractor prior to construction.

Truck Type	Cubic Yards Per Load
Tandem (2 axles)	14
Triaxle (3 axles)	16
Quad (4 axles)	18
Quint (5 axles)	20
Cent (6 axles)	22

5.0 FINAL PROFILES

CSE surveyed cross sections of the beach and dune line before and after dune placement. This was performed in all areas of the project including areas where dunes were constructed by bulldozing, placement of stockpiled sand, and placement of sand from the off-site borrow source. Plots are provided in Appendix B showing the preconstruction and postconstruction beach and dune profiles. At nearly every station, a wider, taller dune and berm now exist. The profiles also show that the amount of sand placed was well within the contract limits. Nags Head was also fortunate to receive extra sand by natural processes during the course of the project. Favorable wave conditions occurred late in the spring of 2005 which caused sand to accrete on the beach, widening the berm significantly at the northern end of the project and some other areas. At the locations fortunate enough to receive sand from offshore, the elevation of the berm is much higher than originally anticipated. This excess sand gives the appearance of a lower dune; however, this is an illusion as the dunes are substantially higher than before the project.

6.0 FINAL PROJECT COSTS

The following table provides a breakdown of project costs for each type of dune construction, beach scraping, relocation of stockpiled sand, and hauling and placement from an off-site borrow source. The data shown in the table are based on actual payments to the contractor.

ITEM	UNIT	QUANTIT Y*	UNIT COST	TOTAL COST
A. RELOCATION, SCREENING AND GRADING				
1. E. Curlew Street	Lump Sum	1	\$5,151.00	\$5,151.00
2. E. Dove Street	LS	1	\$13,617.00	\$13,617.00
3. E. Dixie Street	LS	1	\$19,737.00	\$19,737.00
4. Jennettes Pier	LS	1	\$12,332.00	\$12,332.00
5. E. Isabel Street	LS	1	\$12,587.00	\$12,587.00
6. E. Islington Street	LS	1	\$7,874.00	\$7,874.00
7. E. Indigo Street	LS	1	\$9,925.00	\$9,925.00
8. E. June Street	LS	1	\$7,589.00	\$7,589.00
9. McCall Court	LS	1	\$15,728.00	\$15,728.00
10. Baltic Court**	LS	1	\$9,180.00	<u>\$9,180.00</u>
			TOTAL	\$113,220.00
B. BEACH SCRAPING				
1. Reach 1	linear feet	4,817	\$3.50	\$16,859.50
2. Reach 2	linear feet	2,500	\$3.50	<u>\$8,750.00</u>
			TOTAL	\$25,609.00
C. PLACE & GRADE FROM OFF-SITE BORROW SITE				
1. (Project 2004)	cubic yards	56,666	\$16.10	\$912,322.60
2. (Project 2005)	cubic yards	249,741	\$16.10	<u>\$4,020,830.10</u>
			TOTAL	\$4,933,152.70
			PROJECT TOTAL	\$5,071,982.20

* Quantities estimated by Town of Nags Head and CSE prior to construction for Items A (above) total approximately 10,700 cubic yards for all sites combined.

** Not part of FEMA-financed project

7.0 PHOTOGRAPHIC DOCUMENTATION

CSE documented the condition of the beach prior to the dune restoration project using digital photography. The preproject photographs were taken in December 2003 prior to project construction. Following completion of the project, the same locations were photographed in 2005. Representative, before-and-after project photos are provided in Appendix C.

8.0 MAINTENANCE AND MONITORING RECOMMENDATIONS

Following completion of dune construction, the Town of Nags Head planted dune grass along the completed sections of dune. This measure and protection from foot traffic are the main actions that can be taken to preserve the constructed dunes. Erosion of the toe remains a problem in locations where there is no berm (dry beach) of significant width between the ocean and the dune toe. Without a protective berm in front of the dunes, erosion of the dune can be expected as a result of high-tide and wave conditions, such as those seen during northeasters. This problem is particularly acute along the southernmost reaches of the project area. By contrast, many of the northern and central reaches have maintained stable dunes since the initial scraping or sand hauling and placement in spring 2004.

CSE recommends at least once-yearly surveys be performed in spring each year using the project baseline and representative profiles. The condition of the dune should be compared with preproject surveys and documented via photographs. This will aid in identifying sections of Nags Head where there are major sand deficits along the beach.