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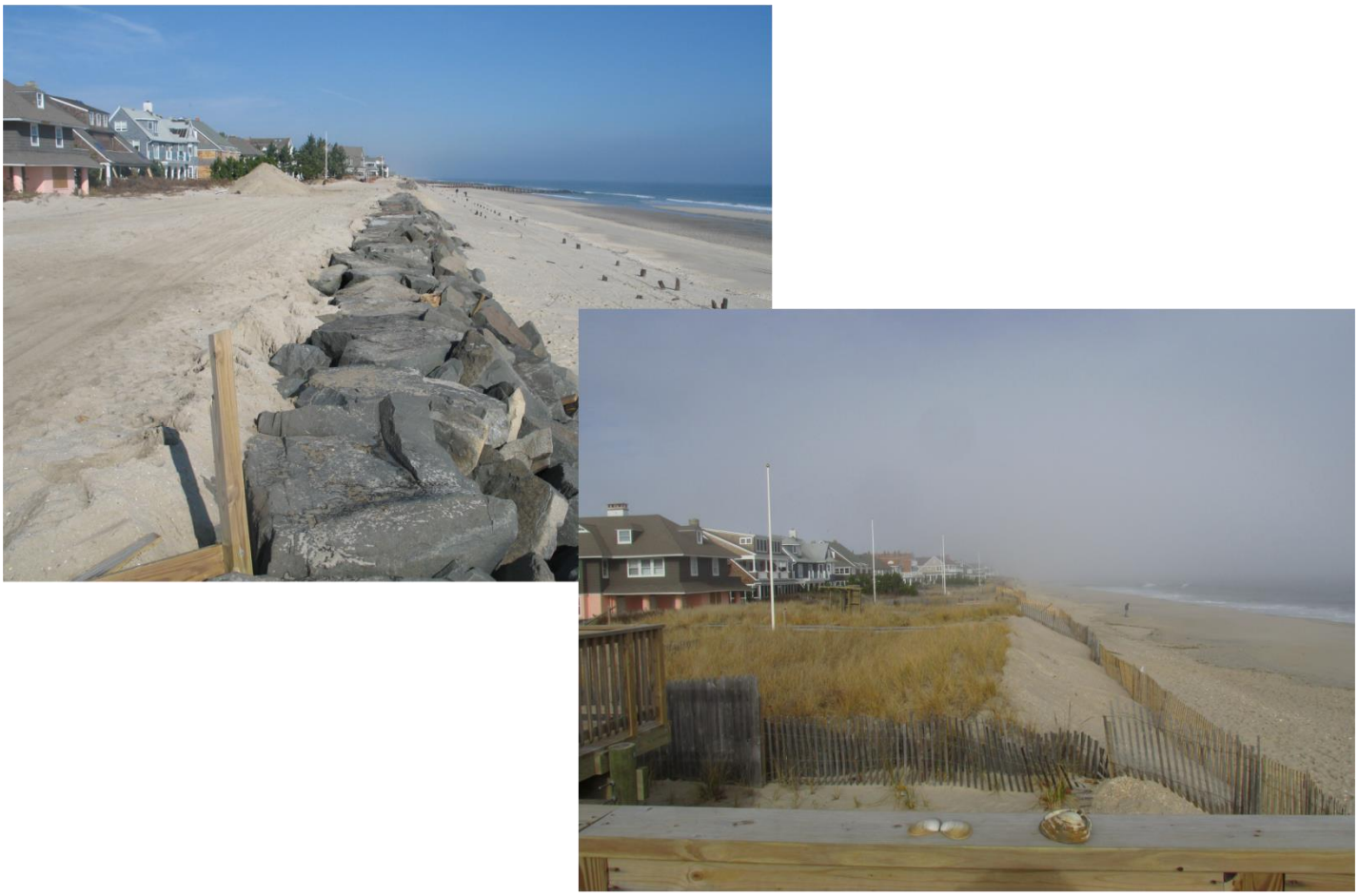

Johnson Avenue, Bay Head, NJ comparing a view from the Dune Crest north November 12, 2012 with the same view taken December 14, 2015 three years following Hurricane Sandy. The rock revetment reduced, but did not eliminate the damages to properties landward. Sand from overwash was picked up and returned to the beach/dune system.

New Jersey Beach Profile Network 2015 Annual Report on Shoreline Changes in New Jersey's Four Coastal Counties Raritan Bay to Delaware Bay Spring of 2014 Through Fall of 2015

Prepared for:
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May 31, 2016

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New Jersey Beach Profile Network
2015 Annual Report
On
Shoreline Changes In New Jersey
In the Four Coastal Counties
Raritan Bay to Delaware Bay

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EXECUTIVE SUMMARY

The New Jersey Department of Environmental Protection (NJDEP) initially authorized the New Jersey Beach Profile Network (NJBPN) project in 1986. With Hurricane Sandy now three years behind us, the continued challenges are examined as major State and Federal projects have gone to completion and been exposed to a few storm events since Sandy. The report is divided into four coastal county segments and provides a summary of beach changes for each county.

The US Army Corps of Engineers (ACOE) undertook the restoration to design specifications all federally authorized, and constructed shore protection projects in the State. Funding under Public Law 113-2 allowed 100% federal payment to do restoration of existing projects in Monmouth, Ocean, Atlantic, Cape May Counties, and the tidal Delaware Bay/River shoreline. While the direct impact of Hurricane Sandy was published on the Coastal Research Center (CRC) website as soon as it was complete in December 2012, it has taken several years to follow both the direct sand placement as well as the slower rate of natural accretion. The report is also found on the website at www.stockton.edu/crc.

Shoreline Management Endeavors since Sandy:

State-wide the average beach profile gained 16.14 yds^3/ft. between the spring of 2014 and the fall of 2015, while the average shoreline position advanced 25.3 feet seaward. This magnitude continues to be influenced by the massive federally funded effort along the NJ coast, but even the reaches where only natural changes occurred (northern Ocean County) the beach/dune system gained 5.02 yds^3/ft. while the shoreline retreated 4.5 feet. On Long Beach Island where almost half the shoreline is under federal management the values were 36.89 yds^3/ft. in sand volume gain with a 72.8-foot shoreline advance.

Natural recovery from Hurricane Sandy appears to have reached to within 80% of the maximum possible in the absence of counting the federal project impacts. The winter of 2014 to 2015 saw an average loss in Northern Ocean County of 2.40 yds^3/ft. and a 2.0-foot shoreline retreat. Where no intervention has yet occurred on any major scale, the shoreline has reached a new equilibrium.

The survey data was analyzed to show changes in the four county shorelines and sand volume changes for the 18-month study interval. The three-month seasonal average sand volume changes for each county plus the 18-month summary are shown below. Beach nourishment projects in Monmouth, Long Beach Island (Ocean County), and Atlantic Counties produced the extensive sand volume increases previously.

Monmouth and Ocean Counties maintained a positive sand volume gain during the study interval while both Atlantic and Cape May Counties lost material during part of the interval. Atlantic County was the only county to lose sand for the entire study interval. Cape May County bounced back during the summer and fall of 2015, reversing two periods of losses. The recovery during the summer of 2015 was considerably greater than both the Cape May County seasonal losses combined. Since the completion of the majority of the post-Sandy beach restoration efforts, the rate of sand accretion declined across the entire NJ coast. Past storm events have demonstrated a logarithmic sand recovery rate where the majority returns in 18 months followed by a slow process that does not return an un-artificially nourished shoreline to its pre-storm sand volume by year five. The amount of permanent sand loss due to a storm is variable between 0 and 10% for major storms.

Sand Volume Changes at the NJ Oceanfront

	S 14 – F 14 Cu. yds/ft.	F 14 – S 15 Cu. yds/ft.	S 15 – F 15 Cu. yds/ft.	S 14 – F 15 Cu. yds/ft.
Monmouth County	**3.94**	**2.68**	**6.06**	**11.76**
Ocean County	**0.74**	**5.45**	**14.92**	**20.77**
Atlantic County	**12.56**	**-9.34**	**-14.21**	**-14.76**
Cape May County	**-0.67**	**-7.86**	**32.25**	**23.89**

The shoreline change values represent the derived difference in horizontal distance to the zero elevation position (NAVD88) from the reference monument on the two profiles being compared. Advances seaward are positive and retreats landward are negative. Each number shown below is the average change for all the sites in each county.

Shoreline Position Shifts Landward (-) or Seaward (+) at the NJ Oceanfront

	S 14 – F 14 Feet	F 14 – S 15 Feet	S 15 – F 15 Feet	S 14 – F 15 Feet
Monmouth County	**2.31**	**12.95**	**-7.31**	**7.96**
Ocean County	**7.88**	**7.42**	**19.05**	**34.36**
Atlantic County	**-3.91**	**-0.45**	**-13.28**	**-29.04**
Cape May County	**3.74**	**-13.26**	**57.16**	**47.64**

Shoreline changes declined dramatically from last reporting due to the completion of most of the large federal projects in 2013. Continuing work in Deal, Elberon and Allenhurst provided an average advance value for Monmouth County during the summer of 2015. Ocean County had the most advance seaward of the shoreline position for naturally occurring reasons. Atlantic County was the most recessional of the four counties with Cape May County adding a summer into fall advance that was the largest of all intervals for all four counties.

Following the 1992 northeaster, the subsequent survey data supported a 4-year time span for the natural recovery process to restore the amount of sand returning via cross-shore transport by waves to complete the observed rebuilding of the beach berm. Dune damage was frequently restored by municipal efforts with either their front end loading or bulldozing capabilities. The post-storm wave transfer of the offshore storm deposit back toward the beach is far faster than wind transport of sand from the beach into the dunes to replace storm losses in the dunes. The former happens in 4-5 years while depending on the wind for the rebuilding of a dune system of size, uniformity with vegetation takes at least 20 years.

ACKNOWLEDGEMENTS

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INTRODUCTION:

The New Jersey Beach Profile Network (NJBPN) project provides local and regional information on coastal zone changes and is designed to document seasonal and storm-related damage assessments of the New Jersey shoreline. Each site has been visited annually in the fall since 1986. Semiannual visits, each spring and fall, began in 1994 following the passage of Public Law 93. The program was expanded to take surveys every spring following the winter northeasters and in the fall following summer beach accretion. In addition, new sites were established in the gaps of coverage and at all adjacent tidal inlet shorelines. The information collected consists of photographs of the beach/dune system at each site, a topographic profile of the dune, beach and seafloor to a minimum depth of 15-18 feet, and field notes on significant geologic changes. Also, construction activity is noted and necessary information regarding quantity and duration of such activity is gathered. The field data are used to generate graphical cross section plots, which can be used for comparison across the width of the active coastal zone. The cross section is also used to calculate sand volume and shoreline position changes. The 2015 report is focused on exactly how and where beach recovery has met expectations and what transpired to exceed expectations in terms of beach width and dune recovery. Continued focus on post-Sandy recovery showed that the hundreds of millions spent by the federal government, augmented by NJ shore protection money and some local enhancements did produce a better set of coastal shore protection conditions than existed prior to Sandy where such restoration work occurred. Recovery rates where no restoration effort was expended are less, arrayed in a pattern related to the general site's sand retention that developed over time. The information is arranged by county and sequential profile site location, and includes the survey cross sections, site photographs, and the description of significant changes. The tables of beach volume and shoreline change data are found after the county site descriptions for Cape May County in the appendix. A summary of each county's coastal zone activities follows the county profile site location diagram at the start of each county discussion. Conclusions on the study interval appear at the end of each county section.

THE NEW JERSEY COASTAL ZONE:

The northern coast in Monmouth County is considered a headland beach (carved into older geologic sedimentary units that created a sandy beach backed by a bluff of the older sediments) which erodes during serious storm events. Hurricane Sandy produced a marker among the centuries of this sort of erosion which has created two major sand spits, one to the north from Long Branch (Sandy Hook), and the other to the south from Bay Head (Mantoloking to Barnegat Inlet). To the south of Barnegat Inlet, barrier islands compose the remainder of the NJ coastline where individual islands are separated from the mainland by a series of bays and tidal lagoons. The general geomorphological relationship among the coastal features between Sandy Hook and Barnegat Inlet was detailed by Fisher (1968), but the individual barrier islands had a different and unrelated origin as sea level rose and storms, tides and waves winnowed sand from continental shelf deposits forming the barrier island chain south of Barnegat Inlet. Hicks (1953) showed that the dark, denser minerals present in beach sand still had Monmouth County traits on Long Beach Island, but from Little Beach Island south to Cape May City, the sand was finer, with different dark minerals (magnetite/illmenite) from northern beaches (glauconite and garnet).

STORM RECOVERY AND BEACH PROJECT EFFECTIVENESS:

While a sizable fraction of the sand eroded from the pre-Sandy shoreline was moved offshore into at least 10 feet of water, the rate of return was reassuring that similar results would come to pass similar to the post-1992 northeast storm recovery where 3-5 years after the event, much of the lost sand had returned. The combination of work completed by the US Army Corps and natural events has greatly enhanced the storm-damaged beaches.