Coastal Research Center: Beach Monitoring & Assessment Projects

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New Jersey Coastal Zone Overview

The New Jersey Beach Profile Network (NJBPN)
- Objectives
- Profile Locations
- Data Collection
- Analyzing NJBPN Data
- Examples

3 Dimensional Assessments
- Methodology
- Examples

Quantifying Shoreline Migration

Conclusions
Monmouth County headlands consist of beaches backed by a bluff of older sediments and two major sand spits:

- One to the north from Long Branch (Sandy Hook)
- One to the south from Bay Head (Mantoloking to Island Beach State Park)

The barrier island segmented shoreline covers the remainder of the NJ coastline where individual islands are separated from the mainland by a series of bays and tidal lagoons.

NJ Atlantic Ocean coastline is roughly 130 miles in length.
New Jersey’s Longshore Current Pattern by Gail M. Ashley et al. 1986

Direction of longshore currents on oceanic coasts varies both seasonally and with passing weather systems.

Local variations in longshore current pattern:
- Inlet-wave Refraction Cells
- Rip Current Circulation Cells
Established in 1986 as a result of Hurricane Gloria

Created out of a need to quantify the amount of damage and severity of the storm losses

Lack of data prevented the State from determining any damage for reimbursement from the Federal Emergency Management Agency (FEMA)
New Jersey Beach Profile Network

- Funded by the State of New Jersey Department of Environmental Protection, Division of Construction and Engineering

- Under the Shore Protection Legislation authorizing the stable funding of coastal projects (NJ PL 93 Chapter 155)
Determine areas of potential erosion problems

Aid in implementing policies to protect erosion hazard areas

Quantify beach/dune erosion due to significant storm events

Make effective and efficient use of local/State resources by identifying specific beaches with the greatest need of maintenance or nourishment

Assist local municipal governments in developing policies or plans for dealing with coastal erosion or improving storm preparedness.
NJBPN consists of 105 beach profile sites along the entire shoreline, including the Raritan and Delaware Bays.

- Quantifies shoreline and volume changes along New Jersey’s coast
Profile Locations

- Each location represented typical community beach conditions.
- Each shoreline community would have at least one site.
- The profile sites are spaced approximately one mile apart.
- Where possible, sites utilized positions with prior survey data.
The dune, beach, and nearshore are surveyed at each profile site twice a year (fall and spring), and analyzed for seasonal and multiyear changes in shoreline position and sand volume.

- **Survey grade total station transit technology**
- **X, Y, and Z data is collected to create a topographic profile of the dune, beach, and nearshore to a minimum depth of 12 feet**
- **Photographic record is kept of the beach/dune system at each site**
The same methodology is applied to some municipal monitoring assessments.

Profiles are surveyed more frequently and spaced closer together to minimize uncertainty.

This methodology is used to assess shoreline conditions in 6 municipalities in New Jersey.
Analyzing NJBPN Data: Cross Sectional Assessment

- Cross sectional assessment is used to determine volume and shoreline changes for each NJBPN site

- The Coastal Research Center continues to add to the 25 year database

- Annual reports can be found at: www.stockton.edu/crc
Barnegat Light has seen significant advancement from 1986 to 2006.

The Barnegat Inlet jetty was constructed between 1988 and 1991, and upon completion it began trapping sand.
Barnegat Light Cross Section

- 119ft shoreline advancement
- 121 yds$^3$/ft gain

**Figure 103**: The 26th Street site is 1.4 miles south of the Barnegat Inlet south jetty, but still within the depositional fillet of sand that followed jetty reconstruction. The volume gain between 1986 and 2006 within the distance covered by the 1986 survey was 121.08 yds$^3$/ft. The shoreline also advanced 119 feet over that time. This is way beyond any other change envelope observed along the Ocean County shoreline. Adding the ending point for the 2006 survey to the 1986 survey would add another 20 cubic yards of sand per foot as an estimate of offshore sand volume increase.
Barnegat Light
Shoreline Trends

Shoreline Trends at 26th Street, Barnegat Light Borough, NJ

Year

Feet from Reference Position
-200 -100 0 100 200 300 400 500 600 700

Annual Shoreline Position
Shoreline Position Trend
Poly. (Shoreline Position Trend)

Largest Annual Retreat in the Shoreline
Peak Year in Shoreline Position
The North Wildwood site has seen the greatest retreat of all profiles.
- 1055ft retreat of the shoreline position
- 513 yds³/ft loss

Figure 181: In North Wildwood, the worst erosional episode along the New Jersey shoreline is visible. This site commenced eroding and retreating in 1998 at high rates until 2006. The beach berm in 1986 was further seaward than the -11 foot depth distance offshore in 2006. The sand volume loss amounted to 513.79 yds³/ft with an astounding 1055-foot shoreline retreat.
North Wildwood Shoreline Trends

Shoreline Trends at 15th Street, North Wildwood, NJ

A Long-term Trend of Beach Loss and Shoreline Retreat Begins in 1990

1998 to 2003 Saw 100 ft. plus Retreat in the Shoreline Each Year

Loss Trend Abates by 2005

- Pumped 25 million yds³ from a mile offshore across 21 miles of shoreline
- Constructed a 100’ wide beach berm at an elevation of 10’ above MLW
- Project also called for notching existing stone groins and extending storm water outfall pipelines
- Shoreline is open to free littoral sand transport
- Narrow beach width and extensive development limit dune development and storm protection
- Large advances around Barnegat inlet were due to jetty reconstruction
- State conducted large truck-fill in Harvey Cedars (1994 - 1995)
- First substantial Federally funded beach restoration project in Surf City, L.B.I (2007)
- Undeveloped area in Holgate lies down-drift from the 97-groin field along L.B.I and has been impacted by long-term shoreline change
Brigantine Island
- Placed ~1 million yds³ along the northern shoreline (1997)
- Performed maintenance to the initial project, placing 615,000 yds³ on the north end shoreline (2001)
- The ACOE completed its Federal project for Brigantine in 2006 adding about 638,000 yds³

Absecon Island
- In 1997 Atlantic City added 640,000 yds³
- The ACOE Absecon Island Beach Restoration Project (2004)
  - 3.2 million yds³ placed on Atlantic City constructing a 200’ wide beach with a dune (2-3’ above boardwalk)
  - 1.3 million yds³ placed on Ventnor constructing a 100’ wide beach with a dune (1’ above boardwalk)
Ocean City, Avalon/Stone Harbor, Cape May City and Cape May Point received Federal shore protection projects since 1989-90.

The northern portions of the barrier islands advance immediately following each beach nourishment, but retreat as the sand supply derived from the fill declines.

Loss and gain in North Wildwood due to tidal channel changes of Hereford Inlet.
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Areas experiencing significant erosion require a more detailed assessment to more accurately quantify erosion or assess shoreline stability initiatives.

Typically used to monitor beach nourishment projects and areas identified as erosional “hotspots”
Profile lines are typically ran a few hundred feet apart

Data is collected further offshore

Significant beach features are delineated

RTK GPS, total station transit, and single beam acoustic sounder technologies are used

With additional and more densely spaced point data continuous elevation data can be interpolated throughout an area of study
Digital Elevation Models (DEM) are created in a Geographic Information System (GIS).

Different surveys are compared to determine elevation change and volume change throughout an area of study.

Areas of interests and trends are identified.

Vicinity of high waterline to shore protection features or other structures is quantified.
This map was created with December 2010 data, collected by the Coastal Research Center. Contour lines are at 2 foot intervals. Base aerial photography is from 2007.
Oblique View of Before & After Strathmere Dredge

Immediate Post Fill, August 2009

18 Months Post Fill, December 2010
18 Month Elevation Change

Upper Township Elevation Change:
Post August 2009 Beach Fill to December 2010

This map was created by comparing August 2009 data collected by the Coastal Research Center, and December 2010 data collected by the Coastal Research Center. The portion of the study area not noted as State owned land is owned by Upper Township. Base aerial photography is from 2007.
18 Month Volume Change

Upper Township Volume Change:
Post August 2009 Beach Fill to December 2010

This map was created by comparing August 2009, post debris data, collected by the Coastal Research Center, and December 2010 data collected by the Coastal Research Center. Base aerial photography is from 2007.
Strathmere, NJ: Beach Nourishment Project

February 2009
Quantifying Shoreline Migration

- Waterline are extracted from:
  - DEMs,
  - Aerial photography
  - Physically delineated using GPS technology

- Analyzed in GIS using a transect base approach

- Data provides justification for implementing shoreline stability initiatives
• The New Jersey Beach Profile Network provides a broad overview of shoreline conditions throughout the State

• The Coastal Research Center continues to build on its 25 year database of shoreline change

• A 3 dimensional assessment approach is used in more detailed studies when continuous elevation data is needed throughout an area

• Shoreline migration studies can provide justification for implementing shoreline stability initiatives
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