

U.S. Army Corps uses GIS for storm preparedness

—by JoAnne Castagna, Ed.D.

The 2009 Atlantic Ocean Hurricane Season is winding down as it officially ends November 30, but the U.S. Army Corps of Engineers based in Philadelphia and Baltimore continues to work on safeguarding coastal states in the Northeast from dangerous storm events past and future.

The Army Corps is using geographic information system (GIS) to help predict and mitigate storm related problems such as flooding, beach erosion (loss of sand), damage to homes and businesses, and potential loss of life.

GIS has been chosen for this work because it makes it possible to capture, store, analyze, and display relevant information.

GIS takes information from various sources, such as aerial photographs and electronic data, and combines these layers of information in various ways to perform analysis. The tool enables the production of electronic maps, reports, and charts which show the results of the analysis desired.

Dealing with beach erosion

Reducing beach erosion caused by Hurricane Isabel in 2003 and subsequent major storms along New Jersey's 125-mile shoreline is a major task for the Philadelphia District Army Corps of Engineers. One of the activities which could help restore the New Jersey beaches and protect the shoreline from future storms is to replace the washed-away sand. Beach nourishment is, however, a costly process which involves offshore dredging of many tons of sand and spreading it along the retreating shoreline.

To minimize the cost and better manage the sand replenishment work,

the Army Corps of Engineers and the State of New Jersey initiated the New Jersey Long Term Nourishment Study to address New Jersey's beach nourishment issues on a multi-project level.

"Planning beach nourishment projects with a system-wide, regional mindset (which includes the use of GIS) helps to minimize environmental impacts with fewer shore protection resources and lower costs," said project manager J. Bailey Smith. Alternative shore protection strategies for the New Jersey coast will be identified and compared. Results will be shared with other Army Corps districts and the public through the New Jersey Regional Sediment Management website.

The website shows an interactive base map of the New Jersey coast created using ArcMap and published to the web using ArcGIS. Superimposed on the area's base map are layers of data, such as aerial photos, bathymetry, and

environmental and geotechnical data, to name just a few. The link to the website is, <https://w3.map.usace.army.mil/NJALTN/default.aspx>.

The interactive nature of the map helps engineers, scientists, and stakeholders visually review, manage, and analyze geographically referenced data from multiple perspectives. Using the website, they can zoom in on boundaries and waterways in New Jersey and access coastal data on additional map layers, including:

- Surf clams & fishery data: Project managers use this information to identify where sea life resides in the ocean. This will determine where sand can be dredged without harming sea life.
- Archaeological data: Project managers use this information to locate ship wrecks and other historical artifacts. This will help determine where sand can be dredged without harming histori-



Erosion caused by Hurricane Isabel in 2003. [Source: USGS; <http://coastal.geology.ecu.edu>]



Eroded dune. [Source: <http://coastal-er.usgs.gov>]

cally valuable sites and marine life habitats.

- Sediment samples: Project managers use this information to identify the properties of sand sediment, such as its size, so that enough sand is removed to replenish the shore. This information can also be used to track sand movement along the beaches and inlets on the New Jersey coast.
- Bathymetry data (ocean depth measurements): Project managers use this information to identify areas of the ocean with potentially large quantities of sand.
- Borrow areas (dredging areas): Project managers use this information to identify consistent, reliable sources of sand.

Users can adjust their map views by panning in and out and magnifying features. They can also measure land and submerged features using a measuring tool.

In the near future, the website will include data from additional coastal projects in the Philadelphia District. Historic data will be converted, as needed.

Safely evacuating communities

One of Hurricane Isabel's worst victims was the Chesapeake Bay shoreline in Maryland and Virginia. Waves in the Bay peaked at eight feet above normal, causing severe flooding which destroyed homes, vehicles, boats, businesses, and

caused millions of gallons of raw sewage to run into the Bay.

If another hurricane of Isabel's strength were to hit the Bay, the communities living along its shores will be better prepared because of the work being accomplished by the U.S. Army Corps of Engineers Baltimore District in close collaboration with the Army Corps' Planning Center of Expertise for Coastal

Part of that work is to create GIS maps of storm surge inundation for the Federal Emergency Management Agency's (FEMA) National Hurricane Program (NHP).

"The storm surge inundation maps have brought hurricane evacuation plans for coastal communities into the 21st century," said Jared Scott, a GIS Analyst with the Army Corps' Baltimore District.

In the past, flood maps were crafted in multiple ways, including calculating the pertinent data and drawing a map by hand. "Creating and updating these maps took months or even years," said Scott. "With GIS, they can be updated instantly with new information and quickly used to alleviate emergency situations."

Storm surge inundation maps are a critical part of the NHP's assessments of hurricane hazard and evacuation plans. Using these maps with overlays of population data and aerial photography, community leaders working with the NHP will be able to determine which communities may be vulnerable to flooding during different categories of hurricane and how to quickly evacuate the population.

The Army Corps Baltimore District's GIS staff have developed worst case scenario storm surge inundation maps for the State of Maryland (Chesapeake Western Shore), the District of Columbia, and Northern Virginia (counties located along the Potomac River).

These maps have proved to be extremely useful in reducing the possibility of disastrous flooding as a result of recent storms, beach erosion, and the inevitable danger to people and property due to these storm-related hazards.

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Chesapeake Bay [Source: <http://axisoflogic.com>]



Chesapeake Bay [Source: <http://Landsat.gsfc.nasa.gov>]

Storm Damage Reduction based at the Army Corps North Atlantic Division and the National Oceanic and Atmospheric Administration.