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NEW JERSEY TIDE TELEMETRY SYSTEM

Each summer the population of the barrier-island communities of New Jersey increases by tens of thousands. When a hurricane threatens these communities, the few bridges and causeways that connect the islands with the mainland become overcrowded, making evacuations from the barrier islands to the mainland difficult. Timely evacuation depends on well-defined emergency evacuation plans used in conjunction with accurate flood forecasting and up to the minute (real-time) tide-level information.

The "Nor'easter" storm that struck the coastal areas of New Jersey on December 11, 1992, caused about \$270 million in insured damages to public and private property (Dorr and others, 1995). Most of the damage was due to tidal flooding and storm surge, which were especially severe along the back bays where bay tide levels often exceed ocean tide levels. Comprehensive and reliable tide-level and meteorological data for the back bays are needed to make accurate flood forecasts.

A tide-level data collection network is needed to provide real-time automatic monitoring of tide levels along the New Jersey coast. The real-time tide-level data can be used by State, county, and municipal agencies to determine the best evacuation routes during a flood, and the National Weather Service (NWS) can use this data to make flood forecasts. The data also can be used by the New Jersey Department of Transportation (NJDOT) when designing roads and bridges.

The U.S. Geological Survey (USGS), in cooperation with the NJDOT, has designed and installed the New Jersey Tide Telemetry System (NJTTS). This system supplies comprehensive, reliable real-time tide-level and meteorological data for the most flood-prone areas along the New Jersey shore and back bays. These data are transmitted to the NWS, New Jersey State

Police (NJSP), NJDOT, and county emergency management agencies. This fact sheet describes the NJTTS and identifies its benefits.

DESCRIPTION OF STUDY AREA

The study area includes the coastal regions of New Jersey, including the barrier islands, the back bays, the near-shore environment from Newark to Cape May, the Delaware Bay, and the Delaware River (fig. 1).

Most of the area lies within the Coastal Plain Physiographic Province, which is characterized by elevations typically less than 100 feet above mean sea level and by marshes bordering numerous streams and estuaries (Wolfe, 1977)(fig. 1). A small portion of the study area, in northeast New Jersey, lies within the Piedmont Physiographic Province (Wolfe, 1977).

NEW JERSEY TIDE TELEMETRY SYSTEM

The NJTTS consists of 27 tide gages, 30 tidal crest-stage gages and 4 new weather sensors in 15 New Jersey counties, along the New Jersey shore and nearby areas (fig. 1). The tide gages record detailed tide-elevation measurements and transmit them to the base stations by telephone, radio, or satellite links. The weather sensors transmit tide-elevations and meteorological data -- rainfall, windspeed and direction, air and water

temperature, relative humidity, and barometric pressure--by the same links. The tidal crest-stage gages, which can only be read manually, record the peak tide elevation following the last manual reading. In addition, the NJTTS receives data from nine previously installed weather sensors in New Jersey, New York, Pennsylvania, Delaware, and Virginia that are operated by the National Ocean Service.

A precise land-surface elevation has

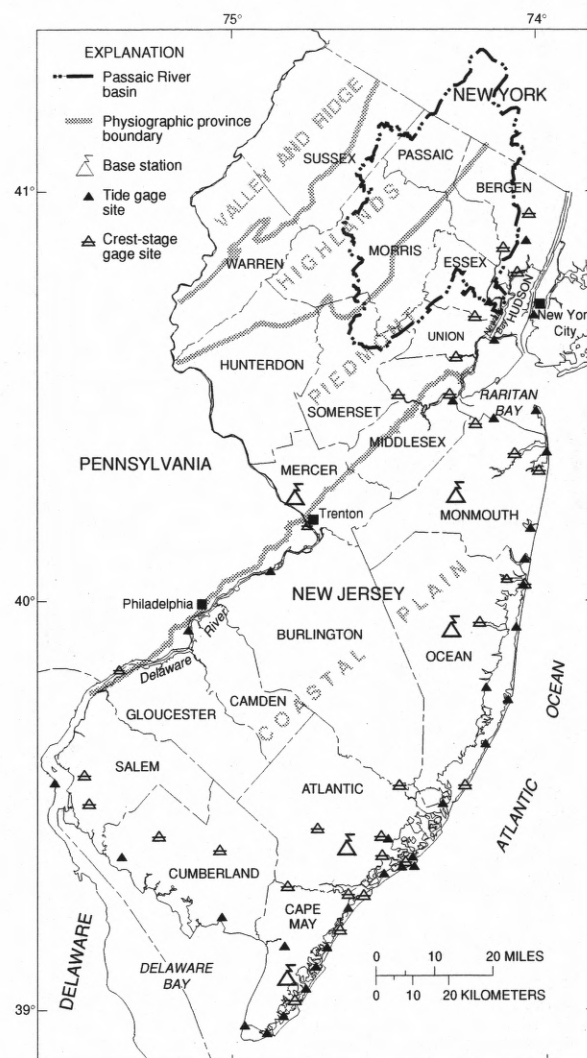


Figure 1. Locations of gages and base stations included in the New Jersey Tide Telemetry System.

been established at each location in the NJTTS. The elevations are part of a network of benchmarks, which are permanent markers on which a known elevation is established. The benchmarks are referenced to the North American Vertical Datum of 1988.

The base stations consist of computers and peripheral equipment, which receive, store, and translate the data transmitted by the gages. Each base station receives data from, and transmits data to, other base stations. They are located in State, county, or municipal offices where they are available to emergency management personnel who use the real-time data to make immediate decisions about evacuation routes. The base stations associated with the NJTTS are located in the Offices of Emergency Management of Cape May, Atlantic, Ocean, and Monmouth Counties, as well as the NJDOT office in Trenton, N.J. (fig.1).

The NJTTS uses the Integrated Flood Observations and Warning System (IFLOWS) software package, which was designed for the NWS, along with a proprietary software package called Data-Command¹; DataCommand is an enhanced version of ALERT (a NWS software package) that allows the exchange of data between base stations and IFLOWS. IFLOWS enables the two-way transfer of messages, forecasts, warnings, guidance, and data between the NWS internal communications systems and the computer base stations.

LINKS WITH OTHER SYSTEMS

At present (1998), two local flood-warning systems, in addition to the NJTTS, are in operation in New Jersey--the Passaic Flood Warning System (PFWS) and the Somerset County Flood Information System (SCFIS).

The NJTTS is linked to the PFWS and the SCFIS through IFLOWS. The current PFWS, which has been in operation since August 1988, uses 21 streamflow and 35 precipitation gages to monitor stream levels and rainfall in the Passaic River Basin (fig.1). The SCFIS, which has been in use since February 1990, consists of 23

streamflow and 19 precipitation gages in Somerset County, 1 precipitation gage in Union County, and 1 precipitation gage in Morris County. Each system consists of automated stream gages and rain gages that are linked to computer base stations by telephone, radio, or satellite link.

BENEFITS OF THE NJTTS

Tide-level and precipitation data collected and transmitted by the NJTTS can be used immediately or stored and later retrieved by Federal, State, county, and municipal agencies, as well as the public, for a variety of purposes that benefit the residents of New Jersey.

- Tide-level data from the back bays can be used to determine conditions that would necessitate evacuations during coastal storms and hurricanes, allowing emergency management personnel to prepare emergency routes and responses well in advance of a storm.
- Real-time tide-level data from the back-bays could be used to determine road and causeway closures and emergency evacuation routes for immediate use during coastal storms or hurricanes.
- Real-time knowledge of back-bay tide-level can allow commercial business and industry to take actions to reduce inventory and structural losses during storm events.
- Tide-level and rainfall data can be used as historical data by future planners to determine peak water elevations, mean high water (MHW), and 100-year flood elevations.
- Peak water levels and MHW data can be used for the design of bridges. Roads and culverts can be located in areas that are not prone to flooding and where they are not likely to cause flooding in adjacent areas.
- MHW and 100-year flood elevations can be used to determine appropriate permitting requirements of the NJDEP, and other State and federal agencies.
- MHW data and 100-year flood elevations can be used to determine whether surface-water levels have changed as a result of a change in sea level, land subsidence, or changes in channel geometry.
- Precise land-surface elevations obtained from the network of benchmarks will be incorporated into the NJDOT's Geodetic Control Survey data base.

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USGS "Home Page":

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New Jersey District's "Water Resources Home Page":

<http://nj.usgs.gov>

• Partners in project:

NOAA "Home Page":

<http://www.noaa.gov>



NJDOT "Home Page":

<http://www.state.nj.us/transportation>



¹Use of a trade name in this fact sheet is for identification purposes only and does not constitute endorsement by the U.S. Geological Survey.