

PROCEDURE FOR CONDUCT OF THE  
NEW ENGLAND HURRICANE SURVEY

The following paragraphs give in detail the proposed procedures for the actual work on the hurricane survey.

Two basic methods of proceeding with the survey are proposed.

a. Complete the entire survey as one operation. This would meet local desires for fast action. However, it is believed desirable not to rush the study because of the many difficult problems involved.

b. Complete the study by coastal area units set up in order of priority, and submit reports for these areas as work is completed. This would permit giving first attention to the most urgent cases.

Coastal areas:

a. The New England coast would be divided generally according to the following areas:

<u>Zone</u>	<u>Priority</u>
(Narragansett Bay vicinity, Providence, R. I.	1 & 2
(Narragansett Bay below Providence, R. I.	"
Connecticut River to Pawcatuck River, Conn.	3
Pawcatuck River to Narragansett Pier, R. I.	4
So. Dartmouth to West Island, Mass.	5
New York Line to Housatonic River, Conn.	6
Shores Buzzards Bay, West Is. to Woods Hole, Mass.	7
Cape Cod Area, Woods Hole to Sagamore, Mass.	8
Housatonic River to Connecticut River, Conn.	9
Coastal Area Newport, R.I. to South Dartmouth, Mass.	10
Cape Cod Canal to Mass. - New Hampshire State Line	11
Mass. - New Hampshire State Line to Portland, Maine	12
East of Portland, Maine to St. Croix River	13

b. Zone Priorities 1 and 2 - Narragansett Bay Area, Vicinity of and below Providence, R. I. The entire Narragansett Bay area should be studied as a unit as the problem of protecting one section of the area affects other areas within the bay. This section, with an estimated report cost of \$800,000, includes the area which suffered major damages from tidal flooding in 1938 and in 1954. Several plans will be investigated for protecting all or portions of this area. Foundation investigations are expected to be costly as protective barriers will be considered in areas of deep water where drilling is expensive. A model study of Narragansett Bay will be necessary.

The entire study of the bay area will be complex and difficult due to the intense navigational and recreational use of shores and waters. The study will require 30 months for completion.

c. Zones Priorities 3-13. All of these sections of the New England coast will entail similar investigative procedure. Damage surveys, and topographical and hydrographic surveys will be necessary to provide basic data for consideration of protective structures. The task of collecting basic information will be lengthy and costly due to the length of coastline involved. Some worthwhile projects may probably be found to be justified in each section considered. Model studies will probably be limited to the New Bedford area. In addition, meteorologic studies will be made for the entire area and separate allotments will not be required for each section of the coastal area.

Initial steps. The following initial steps would be taken:

- a. Conference will be held with the Weather Bureau and other Federal agencies to explain the requirements and to coordinate the work to be accomplished by them.
- b. Additional engineers would be required and obtained for field survey work and office studies and investigations.
- c. Assembly of all pertinent data, including newspaper accounts and reports by others.
- d. Meetings will be held with State and local officials to arrange a basis for their assistance on the study.
- e. Hold public hearings in each of the states. Possibly 15 or more hearings would be required. Locations of hearings would be selected in manner to afford each of the 250 or more waterfront communities in New England an equal and convenient opportunity to present their problems.

Tidal damage surveys. The work accomplished for the NENYIAC forms the background for the more detailed investigations which will be necessary. The NENYIAC survey determined the damage areas where future work will be concentrated. In view of the magnitude of the work it will be necessary to organize and train a group of engineers. Eight or more damage survey teams will be employed in the field to determine the magnitude of experienced damages during past hurricanes and to estimate the damage that would be inflicted by future storms of varying intensities. Office engineers will summarize the information, tabulate tidal damages by zone and type and prepare state-damage curves for each zone. It is anticipated that about 70 man-months will be required for the collection and compilation of basic damage data for all areas.

Field surveys. Survey parties will be utilized to make topographic and hydrographic surveys, augmenting aerial surveys. A considerable mileage of aerial surveys will be flown in order to minimize the more costly ground surveys. These parties will work in cooperation with the damage parties to establish the normal shore line, delineate the extent of flooding, and fix the location of structures. Detailed site surveys will also be made at locations where further investigations appear warranted. It would be desirable to contract some of this survey work. It is anticipated that the project would necessitate the preparation of approximately 600 drawings in order to show the extent of flooding in all the coastal communities in the area. This work would require at least one year to complete.

Model studies. Model studies will be required of Narragansett Bay and New Bedford Harbor. These studies may be accomplished at the Vicksburg Waterways Experiment Station or at local hydraulic laboratories. Tide and wind conditions will be simulated to determine the effect of structures in various locations under all types of conditions. Particular emphasis will be given to the effects of structures on navigation, pollution, and other uses, under normal and storm conditions. It is anticipated that preparation of the models, the conduct of tests, and interpretation of results will consume 12 to 18 months. It is not proposed to require models which exactly reproduce all the topographical and hydrographical features of the study area. It is believed that conditions can be simulated with less exact models from which valuable information can be derived.

Foundation investigations. Drilling and sampling to determine foundation characteristics and the most feasible locations for structures will be concentrated in those areas indicated to be economically practicable of protection. It is anticipated that the major part of this work will be undertaken in the Narragansett Bay and New Bedford areas. Deep water drilling will be required in Narragansett Bay. Drilling will be required to a lesser extent in all zones, necessitating frequent moving of men and equipment. Actual field work will be accomplished insofar as possible by contract. Interpretation of results and testing of soil and rock samples will be accomplished in the New England Division Soils Laboratory.

Design of structures. In view of the magnitude of the investigation, design will be handled by several project engineers. Each engineer will be responsible for varying sections of the coast dependent on the anticipated workload. He will coordinate all work in a particular area and will supervise the actual design work to be accomplished by a design unit composed of experienced engineers. All design work will be done in accordance with standard design criteria, consistent with requirements for report purposes. The location of structures will be based on the most economical sites consistent with suitability and protective possibilities. Various types of structures will be investigated to determine the type best suited for site conditions as determined by topographic surveys and subsurface investigations. Tidal barriers, dikes, walls,

bulkheads, breakwaters, replacements of sand to raise beaches, are included in the types of work which will be considered. Pumping stations for the removal of interior drainage will be considered at some locations. Various sizes of navigation locks will be investigated depending on the class and volume of navigation using a waterway under consideration.

Effects of proposed structures on other uses. Where major structures are proposed on navigable waters such as in Narragansett Bay and New Bedford Harbor, studies will be required to determine the effects of these structures on navigation, pollution, recreation, and existing fisheries. Some of this work will be accomplished by other Federal agencies with allotted funds. Where adverse effects on other uses will result from the construction of protective work, studies will be made to determine what project modifications could be made to lessen these adverse effects. Navigation studies are expected to be of major importance in the Narragansett Bay area with its concentration of heavy shipping and important recreational usage.

Special studies. This item includes studies for protection of shipping, investigation of prospective locations for the supply of construction materials, zoning studies, and provisions for payment for the services of consulting engineers.

a. Shipping, including recreational boating is an important activity along the New England coast. Great damage to vessels occurred in the hurricanes of 1938 and 1954. Investigations would be undertaken to determine the feasibility of providing measures to protect this type of property.

b. Conventional types of protective work require large quantities of stone, sand and gravel. Considerable investigation will be required to locate suitable sources of material within economical hauling distance of proposed projects.

c. The possibility of zoning certain portions of the coastal area to prevent future damage will be fully investigated in cooperation with State and local officials.

d. The services of consulting engineers will be needed to assist in the solution of specialized engineering problems and to advise project engineers in the design of projects.

Shore erosion. Past hurricanes have caused extensive erosion to the foreshore above high water line. The erosion has endangered houses, highways, and protective structures. Studies will be made of methods of alleviating the damage. Considerable field work will be accomplished to determine beach profiles, the characteristics of the beaches, and other items. Comparisons will be made of the effects of the 1936 and 1954 hurricanes on problem areas. The entire study will be coordinated with the Beach Erosion Board.