

**Statewide Hazard Risk and Vulnerability Assessment for  
the State of Rhode Island**

**FINAL REPORT**

August 3, 2001

**Prepared for:**

**NOAA Coastal Services Center**

**Charleston, SC**

**Prepared by:**

**Odeh Engineers, Inc.**

**1223 Mineral Spring Avenue**

**North Providence, RI 02904**

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## RI Statewide Hazard Risk and Vulnerability Assessment

### Executive Summary

Statewide planning of natural hazard mitigation requires the ability to quantify and analyze a wide variety of hazards and exposures to develop a mitigation strategy and prioritize mitigation investment.

In this study, an approach was developed to perform statewide and regional vulnerability assessment using publicly available data and simple procedures for risk scoring. The approach was based on the NOAA Coastal Services Center “Community Vulnerability Assessment Technique”, but expanded and modified to be useful in analyzing entire states. The approach comprises three measures of risk:

- Hazard Risk Scores. These scores represent the risk posed by different natural disasters within each geographic region, regardless of population or development.
- Exposure Risk Scores. These scores represent economic, social, environmental, and critical facilities exposure within each geographic region, regardless of hazard level.
- Combined Risk Scores. These scores represent the product of hazard scores and exposure scores for different hazard/exposure combinations, thus illustrating the intersection of hazard risk with exposed populations and property.

The risk scores are designed to be used in databases and maps generated by Geographic Information Systems (GIS) software. Using the GIS maps of the results, state planners can identify key hazard/exposure combinations and visualize pockets of risk within geographic subregions of the state.

In the state of Rhode Island, the following major findings were identified to guide statewide mitigation planning:

- Vulnerability maps allow visualization of major flood, hurricane, snowstorm, and earthquake hazards in different geographic regions of the state.
- Most of the major hazard scores have large areas of impact in relationship to economic, environmental, social, and critical facilities exposures within the state’s small geographic area. This finding suggests that a single disaster could affect much of the state’s exposure simultaneously.
- Given the small size of the state, its diverse population, numerous environmental resources, and strong economic development program, all four major areas of

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exposure (economic, social, environmental, and critical facilities) must be addressed in order to comprehensively mitigate the risk from these natural hazards.

- Vulnerability maps corroborate existing statewide efforts to adopt the IBC2000 building code, which addresses flooding, hurricanes, snowstorms, and earthquakes using hazard maps. For example, the current building code assigns one uniform snow load value to the entire state. This study suggests higher risk in the northern part of the state, as recognized by higher snow loads in the IBC2000 code for these northern regions.
- Maps and graphics should be used as the basis to improve public awareness of key hazards, especially flooding, hurricanes, snowstorms, and earthquakes

Based on these findings, additional study is recommended to simulate disasters and produce more detailed results, such as potential economic losses, loss of life, and environmental impact. For example, simulation of a single hurricane event could further illustrate the exposure of the state's concentrated resources to one large disaster. Such detailed analysis will also serve to validate and enhance the statewide risk assessment methodology for use in other regions and states.

## **RI Statewide Hazard Risk and Vulnerability Assessment**

### **Overview**

#### ***Background***

This project was funded by the National Oceanic and Atmospheric Administration Coastal Services Center (NOAA CSC) in order to build upon prior efforts to develop a community risk and vulnerability assessment model. These prior efforts are published in an interactive CD-ROM prepared by the NOAA CSC entitled “Community Vulnerability Assessment Tool”, NOAA Publication #NOAA/CSC/99044-CD.

The existing Community Vulnerability Assessment Tool was developed for individual communities, such as cities, towns, or counties. The CD-ROM published by NOAA contains an application of this method to New Hanover County, North Carolina, and it has been applied to other communities for use in disaster mitigation planning.

The NOAA CSC, through this study, sought to expand the existing methodology for application on a statewide and regional basis. This expanded geographic study area requires a modified approach, since both the input data and the required results of the study are of a different nature than for an individual community. Furthermore, it is critical that pilot studies be performed to test the practicality and usefulness of the ultimate statewide risk assessment approach.

Thus, the present study incorporates: (1) development of a basic methodology for statewide and regional risk assessment and (2) the application of this approach to the State of Rhode Island, which is currently in the process of updating its State Hazard Mitigation Strategy (409 Plan).

#### ***Purpose/Motivation***

The motivation for performing hazard and vulnerability assessment at a statewide level stems from the need to create focused policies to address the mitigation of natural hazards on a regional basis. The hazard and vulnerability assessment therefore seeks to answer the following key questions:

- What are the hazards that threaten a given region?
- What are the economic, social, environmental, and critical facilities exposure levels to these hazards, and how are they distributed throughout the region?
- How frequently will damaging events occur, how severe and widespread will the impact be?
- What opportunities exist to mitigate the impact of these events to key exposures?

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- How should planning resources and mitigation dollars be allocated among the large number of exposures and hazards to be considered?

While detailed models exist to address individual hazards and exposures, such as earthquake models or hurricane models for economic losses (for example, HAZUS-99, published by the National Institute of Building Sciences and FEMA), no comprehensive quantitative model exists that addresses social, economic, and environmental exposure to multiple disasters within a policymaking framework.

This project aims to provide a generic methodology for evaluating risk levels that is within the capabilities of typical government agencies charged with preparing disaster mitigation plans.

The methodology is tested and applied to two geographic subregions: (1) an individual community, the City of Warwick, RI, and (2) the entire State of Rhode Island.

The benefits of the statewide risk assessment are multifold, including:

- Building awareness of risk and vulnerability
- Mobilizing stakeholders and promote communication
- Prioritizing mitigation investment to areas of most demand
  - Hazards
  - Exposures
  - Regions
- Collecting data to guide community-specific studies

Note that the results of the statewide risk assessment are necessarily limited in application to a regional basis. The intent is to provide risk measures on an aggregate basis, as opposed to risk at individual locations. Aggregate level risk measures can be used to identify and prioritize more localized and detailed risk assessment of critical exposures and hazards.

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### **Scope of Work**

The project comprised the following five tasks:

#### **1. Detailed task plan**

Prepare a detailed task plan for completing Tasks 2,3,4, and 5 for the appropriate project officer at the NOAA Coastal Services Center.

#### **2. Develop framework for a Statewide Hazard Risk and Vulnerability Assessment for the State of Rhode Island.**

Develop the framework for a Statewide Hazard Risk and Vulnerability Assessment for the State of Rhode Island. The assessment should build upon the methodology developed by the Coastal Services Center in the Community Vulnerability Assessment Tool. New Hanover County, North Carolina. NOAA/CSC/99044-CD. CD-ROM. Charleston, SC: NOAA Coastal Services Center, 1999.

#### **3. Develop Pilot Community Risk and Vulnerability Assessment for Warwick, RI.**

The framework for a Statewide Hazard Risk and Vulnerability Assessment for the State of Rhode Island developed in Task 2 should be applied to Warwick, RI.

#### **4. Conduct the Statewide Hazard Risk and Vulnerability Assessment for the State of Rhode Island.**

Apply the methodology developed in Task 2 to the state of Rhode Island. Prepare maps, charts, and tables of results.

#### **5. Demonstration of Results**

Prepare a brief written summary of the work performed and present the results to the appropriate project office at the Coastal Services Center prior to June 30, 2001.