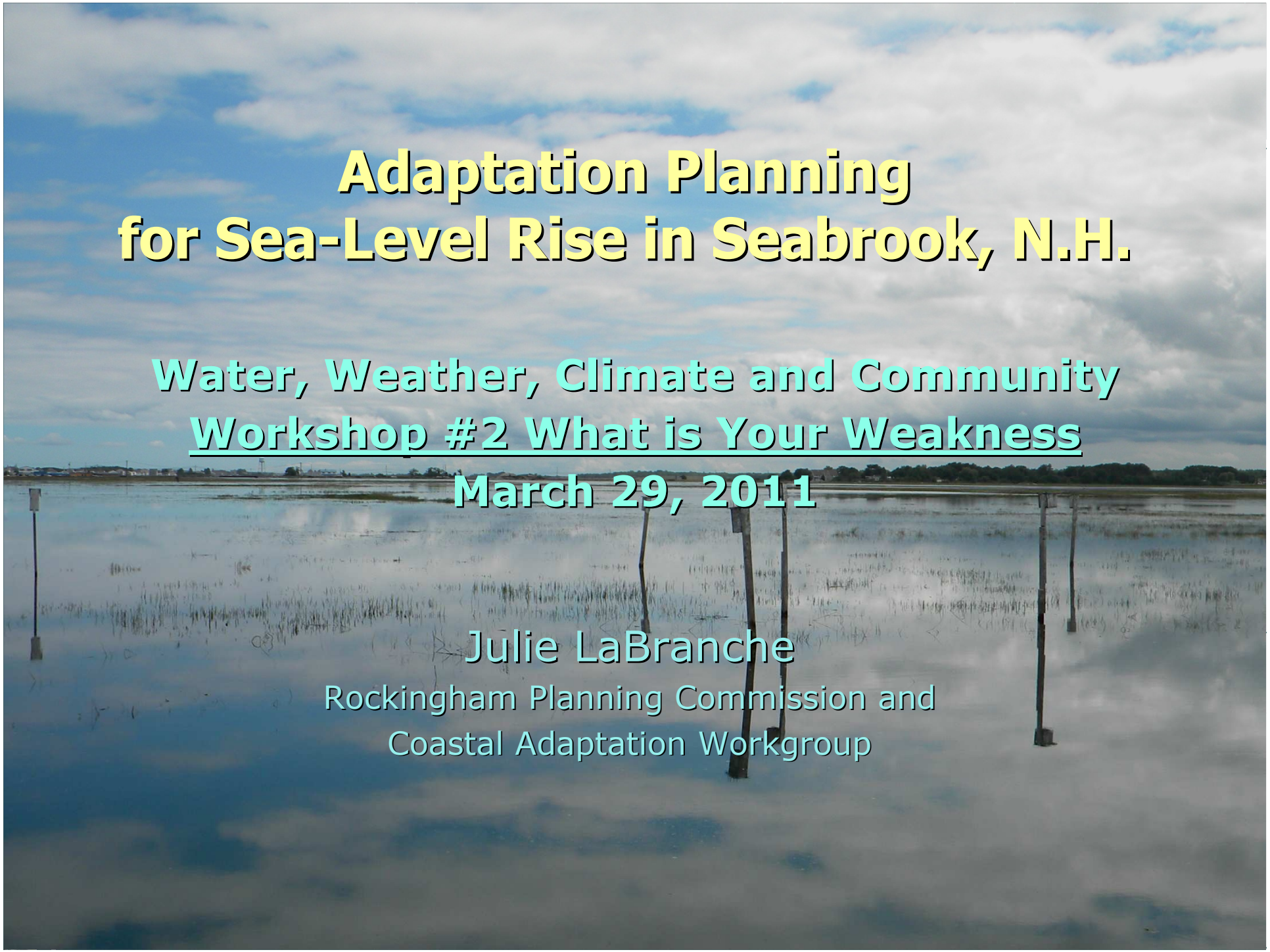


Adaptation Planning for Sea-Level Rise in Seabrook, N.H.

Water, Weather, Climate and Community
Workshop #2 What is Your Weakness
March 29, 2011

Julie LaBranche
Rockingham Planning Commission and
Coastal Adaptation Workgroup

This project was funded by the 2009 NH Coastal Program Technical Planning Assistance Project June 2009

Rockingham Planning Commission

- Theresa Walker, Natural Resources Planning Consultant
- David West, GIS Specialist & Planner
- Dylan Smith, Regional Planner
- Cliff Sinnott, Executive Director

Presentation Outline

1. Project Overview: purpose, scope, origin
2. Sea Level Rise Research and Findings
3. Implications to land use policies
4. Mapping Extended Flood Areas
5. Adaptation Recommendations
6. Steps taken in Seabrook
7. Q & A

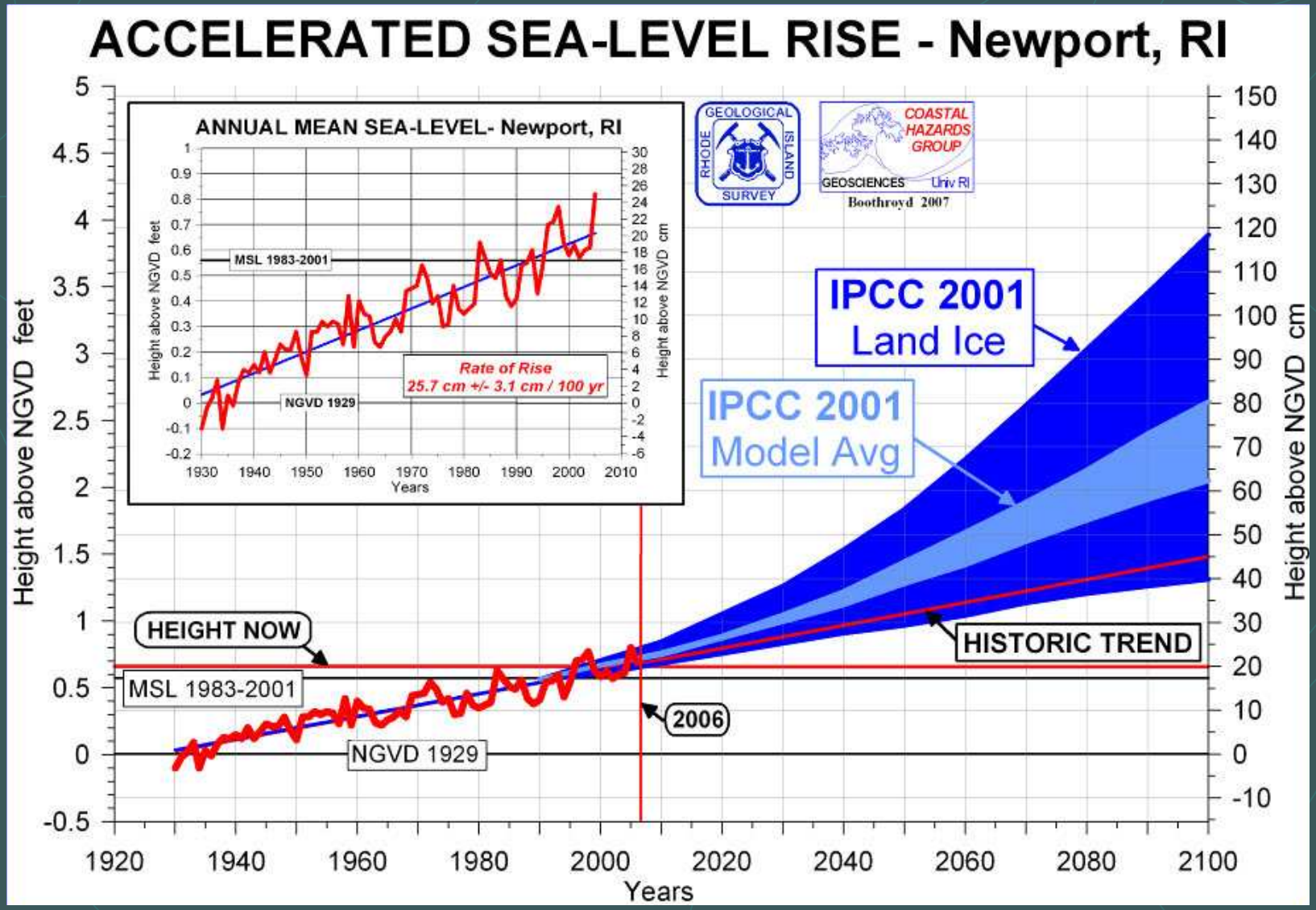
Project Overview

- **Purpose**
  - Identify areas with increased risk for flooding based on projected rise in sea level
  - Identify and recommend "adaptation" strategies and methods to protect areas of increased risk
- **Scope**
  - Research sea level rise scenarios and mapping methods
  - Obtain high resolution elevation data (LIDAR) for mapping & Prepare maps showing extended flood risk area
  - Research and report on regulatory & non-regulatory options to manage risk
  - Prepare draft "Extended Coastal Flood Hazard Overlay District"
  - Summary Report
- **Project Funding:** ($10K) 50% NH Coastal Program (NHDES), 25% Seabrook, 25% RPC & in-kind

Summary of Findings: Sea-Level Rise

- Sea level has risen 400 feet since the last glacial maximum 20,000 years ago, caused by melting of ice sheets
- Land surface in coastal New England is subsiding at a rate of 6 inches/century
- Over the last 100 years, average sea level in New England has risen .56 feet
- The rate of rise appears to be accelerating:
  - 1900 to 2003 = 0.06 inches/year
  - 1961 to 2003 = 0.071 inches/year
  - 1993 to 2003 = 0.12 inches/year.
- The rate of sea level rise is expected to accelerate over the next century with models predicting rises of between 4 inches and several feet by 2100.
- A 2007 IPCC correlates sea level rise with mean surface temperature and projects a rise of 1.6 to 4.6 feet above 1990 levels by 2100.

Sea Level Rise



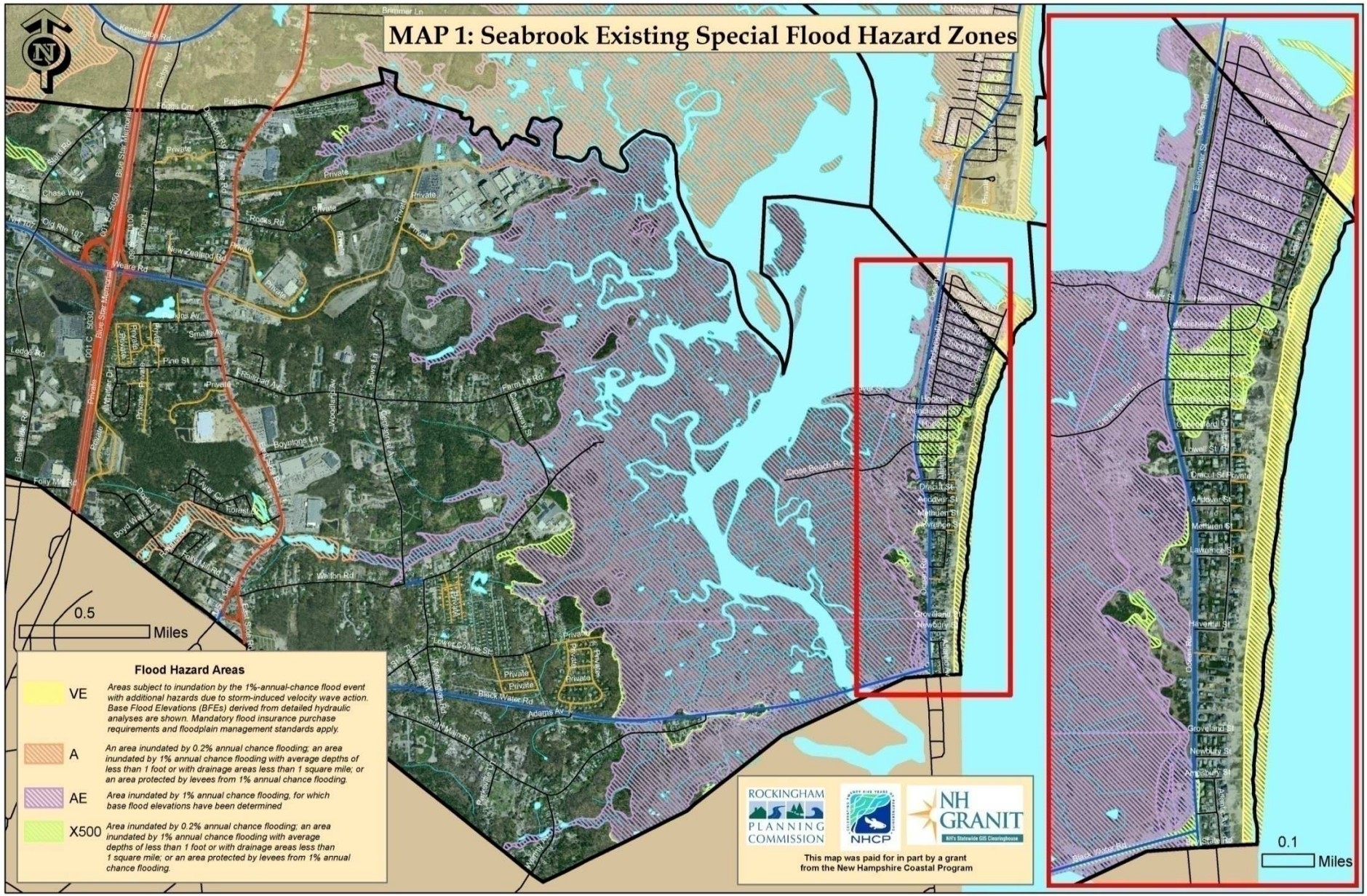
Mapping Extended Risk Areas

- **Sources**
  - FEMA Flood Insurance Rate Maps (DFIRM)
  - NOAA – National Hurricane Center Storm Surge Inundation Map
  - 1998 US Army Corps. LIDAR (+/- 5 Ft. contour) – covering all tidal areas
  - 2007 US Army Corps. LIDAR (+/- 2 ft. contour_ - 2500 ft wide band from beach landward
- **Report maps**
  - 1. Existing Flood Hazard Areas
  - 2. Storm Surge Innundation Areas
  - 3. Extended Coastal Flood Hazard Area
  - 3a. Extended Area – Beach inset

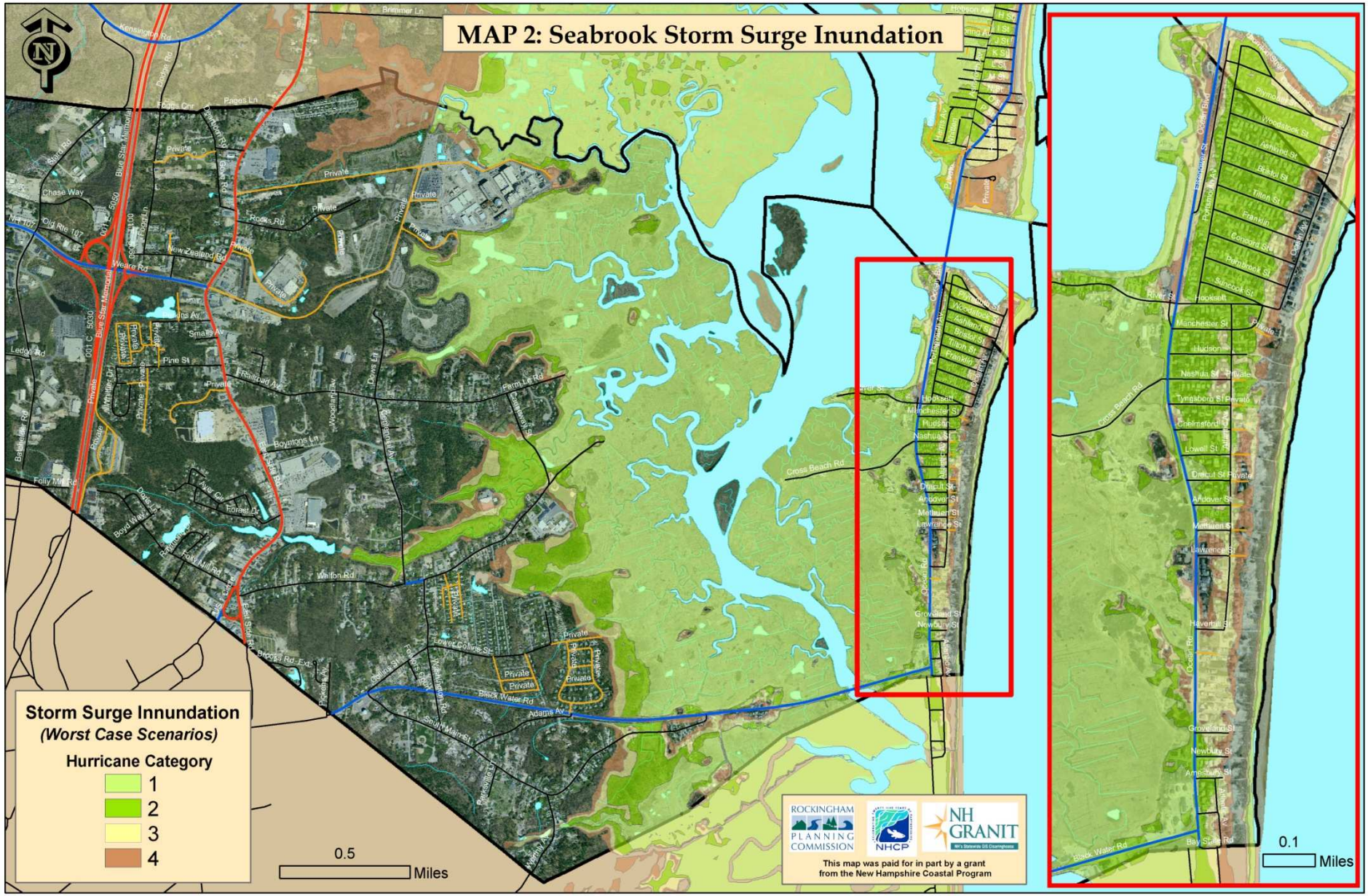
Vertical Tidal Datum – Fort Point, New Castle

Tidal Datums	Elevation in Feet
MHHW (Mean Higher High Water)	9.42
MHW (Mean High Water)	9.00
1998 NOAA NAVD 88	5.02
MSL (Mean Sea Level)	4.72
MTL (Mean Tide Level)	4.69
2007 USACE NGVD 29	4.25
MLW (Mean Low Water)	0.37
MLLW (Mean Lower Low Water)	0.00

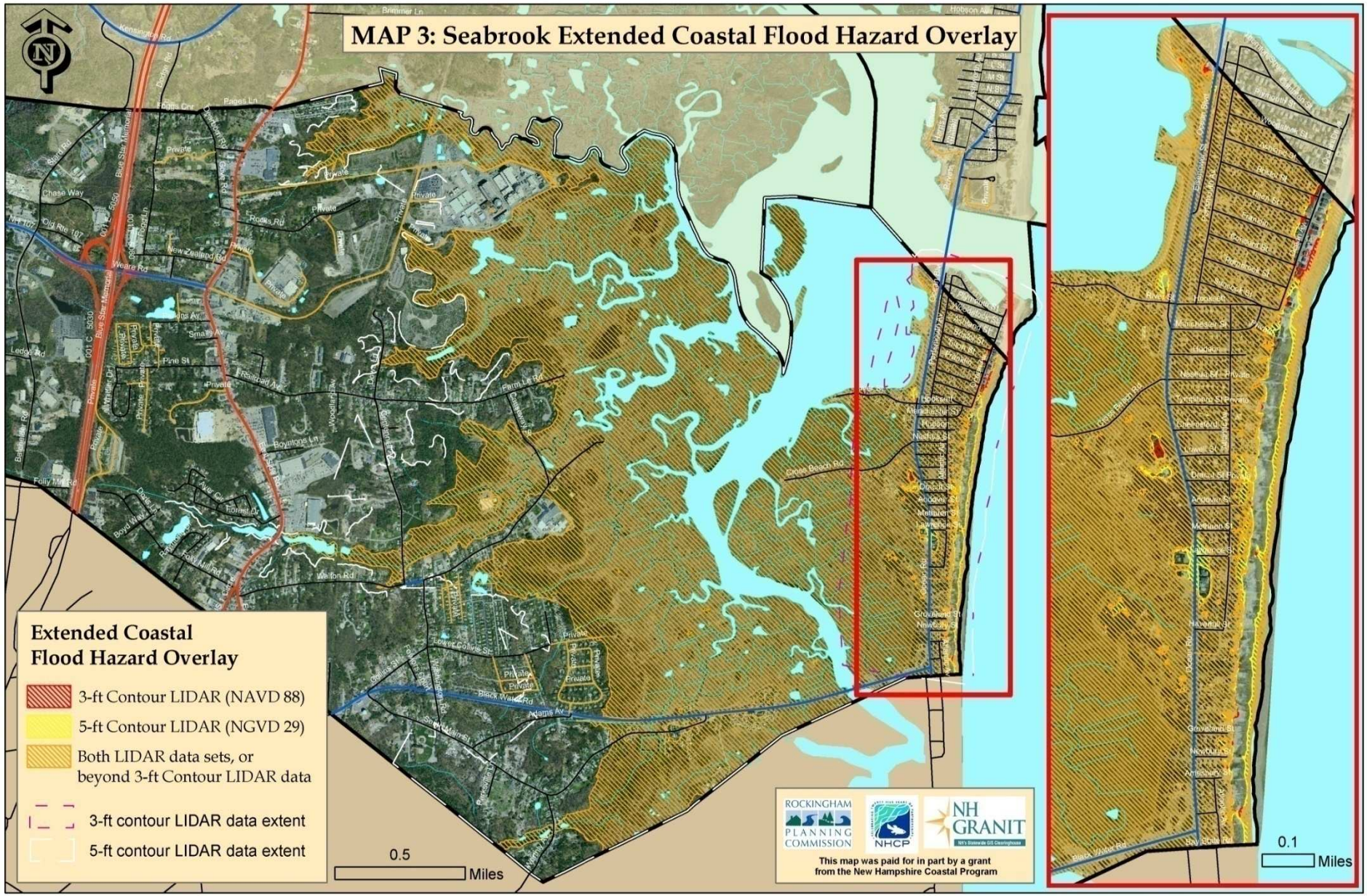
Seabrook Special Flood Hazard Zones –
based on base flood elevation of 9 ft. above mean sea level



Seabrook Storm Surge Inundation



Seabrook Extended Coastal Flood Hazard Overlay:
all land area within 15 ft. of mean sea level



Hazard Area Summary

AREA	ACRES
NOAA Storm Surge Areas	1,835.6
FEMA Special Flood Hazard Zones	2,203.3
Extended Hazard Areas (elev. =/<15 ft)	2,354.7
New Flood Hazard Areas	148.8

Community Impacts

- Sea level rise will displace coastal populations, threaten infrastructure and intensify coastal flooding.
- Higher sea levels will result in salt water intrusion into fresh water aquifers and wells.
- Tidal marshes will be displaced, degraded or destroyed depending on the speed of sea level rise and their ability to migrate inland.
- Low lying areas along New Hampshire's coast will be more susceptible to flooding as storm surges reach further inland.

Land Use Implications

- Through local regulations increase the design flood elevation for buildings and infrastructure in areas identified to be at higher risk of flooding.
- Redesign bridges, culverts and other drainage system components to reflect new hydrologic conditions.
- Protect land abutting tidal marsh to enable the marsh to migrate landward (if feasible).
- Revise Hazard Mitigation and Emergency Operations Planning to anticipate risks associated with the higher risk of flooding

Proposed Building Elevation Standards

(applied to construction within Extended Risk Area)

STRUCTURE TYPE	DESIGN FLOOD ELEVATION	RECONSTRUCTION THRESHOLD
Accessory Structures	10 ft. (9 ft. BFE + 1 ft.)	NA
Single Fam. Residential & Multi-family <5 Units	11 ft. (9 ft. BFE +2ft.)	50%
Multifamily 5+ units	12 ft. (9 ft. BFE + 3ft.)	40%
Commercial & Ind. Development	12 ft. (9 ft.BFE + 3ft.)	40%
Critical Facilities (hospitals, schools, public safety, etc.)	13 ft. (9ft. BFE + 4ft.)	33%
Major Infrastructure** (bridges, roads, utilities, etc)	14 ft. (9ft. BFE+ 5ft.)	25%

** linear infrastructure would be phased


Elevation and siting


Utility Relocation

Model Case Study

- **Rhode Island Coastal Resources Management Council (CRMC), State Coastal Policy, May 2009:**

  Recommends proactive planning and integration of climate change and SLR scenarios to accommodate a 3-5 feet sea level rise by 2100.

  Drafted policies and construction guidelines that recommend a 5 foot freeboard into the design of roads, bridges, wastewater treatment facilities, etc. Policies will be reviewed periodically to address new scientific evidence.

Model Case Study

- **Miami-Dade County, Florida, April, 2008:**

  Climate Change Advisory Task Force

Built Environment Adaptation

Recommends all capital improvement projects be designed for a 3-5 feet sea level rise over 100 years.

Natural Systems Adaptation

Recommends protection and restoration of coastal ecosystems so that communities can be more resilient and be better able to adapt to climate change.

Adaptation Strategies to Address Risk

- Incorporate sea level rise impacts into all land use planning, building regulation, infrastructure and hazard mitigation.
- Utilize a minimum of a 50 year planning horizon and assume a 1.5 feet sea level rise in that period, and at least 3 to 5 feet over 100 years.
- Establish new street grade and building first floor elevation requirements and infrastructure elevations.
- Protect undeveloped uplands abutting salt marsh, referred to as transition zones; limit or prohibit the erection of barriers to salt marsh migration.
- Incorporate sea level rise in current and future capital improvement projects.
- Monitor latest studies and projections and incorporate new information into land use and development policies.

Adaptation steps underway in Seabrook

- Land Protection: Established partnership with PREP, Southeast Land Trust & RPC to identify and preserve transitional lands abutting tidal areas.
- Master Plan: Planning Board may consider incorporating the Adaptation Planning Study and recommendations into the Master Plan update.
- Flood Hazard Overlay Zone: Planning Board may evaluate whether to amend the zoning ordinance to incorporate an extended flood hazard overlay zone.
- Public Infrastructure: School Board evaluating future investments made to "at risk" buildings.
- Hazard Mitigation Planning: Next revision should incorporate address hazards associated with extended flood risk.

Extended Flood Hazard Ordinance

SECTIONS

Preamble/Background

I. Authority & Purpose

II. Definitions

III. Applicability

IV. Development Standards

V. Appeals

VI. Amendments

Supporting Framework

- Preface, Authority & Purpose
  - Flood Plain Regulations: for promoting health safety and the general welfare - 674:16(I)
  - Innovative Land Use Controls- 674:21(I)(j) "environmental characteristics zoning"
- Master Plan Support & Policies
  - Supporting the protection of important resources
  - Support the protection of public safety due to natural hazards
  - Support the protection of public investments and infrastructure from future damage and loss
  - Support hazard mitigation to prevent foreseeable repetitive losses

Approach, Definitions, Applicability

- General Approach
  - Use existing Floodplain regulations (Art. XXII) as underpinning
  - Extend **base flood** and **design flood** elevation standards to account for higher tidal and storm surge related flood levels
  - Apply variable standards depending on uses (RI model)
- Definitions
  - Reference Art. XXII; projected relative sea level rise; others (see report)
- Applicability
  - Overlay district defined as areas at or below 15Ft. MSL
  - Elevation level tied to types of use (i.e. life of structure)
  - Reconstruction/ rehab. applicability triggered to % of value

Proposed Standards

- Design Flood Elevation standards are raised varying amounts depending on structure type
- Underlying structural, flood-proofing and building regulation as in existing Flood Hazard Regulations (Article XXII)
- Elevation Certificate Required (prepared by licensed surveyor or PE)
- Infrastructure construction design reviewed/approved by Town Engineer
- Caveat: Increased standards for linear infrastructure will need to be phased or deferred to encompass logical segments (e.g. roads; sewer lines, water lines, drainage structures)

References:

IPCC. (2007). *Climate Change 2007: The Physical Science Basis, Summary for Policymakers, Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*. Geneva, Switzerland: UNEP.

Rahmstorf, S. (2007). A semi-empirical approach to projecting future sea level rise. *Science*, 311, 1747-1750

Miami-Dade County Climate Change Advisory Task Force, April 2008, http://www.miamidade.gov/derm/library/08-10-04_CCATF_BCC_Package.pdf

Rahmstorf, S. Cazenave, A. Church, J.A., Hansen, J.E., Keeling, R.F., Parker, D.E., & Somerville, R.C.J. (2007). Recent climate change observations compared to projections. *Science*, 316(5828), 709.

Section 145 Climate Change and Sea Level Rise, Rhode Island Coastal Resources Council, Public Working Draft – May 2009.

Northeast Regional Ocean Council's New England Governors' Coast and Ocean Action Plan, 2007, www.community.csc.noaa.gov

www.cmu.edu/steinbrenner/images/docs/Adaptation_Report_October_10_2007.pdf

www.pewclimate.org/docUploads/State-Adapation-Planning-02-11-08_0.pdf

www.ian.umces.edu/pdfs/ian_newsletter_20081002152303.pdf

www.des.nh.gov/organization/divisions/air/tsb/tps/climate/index.htm

http://curs.unc.edu/curs-pdf-downloads/climatechgsymp/Rubinoff.pdf