

Managing Coastal Hazards in a Changing Climate: Available Tools & Techniques

➤ **Wes Shaw | NOAA / Mass CZM**





The background of the slide is a collage of four photographs illustrating coastal erosion. The top-left photo shows a large, dark-colored house on stilts that has been tilted significantly by the erosion of the ground beneath it. The top-right photo shows a similar house on stilts, with a large section of the ground in front of it missing, exposing the foundation. The bottom-left photo shows a house on stilts with waves crashing against its base. The bottom-right photo shows a row of houses on stilts, with the water level appearing high and turbulent. The text "Q: What on earth can we do about it?" is overlaid in large, bold, black letters across the center of the collage.

Q: What on earth can

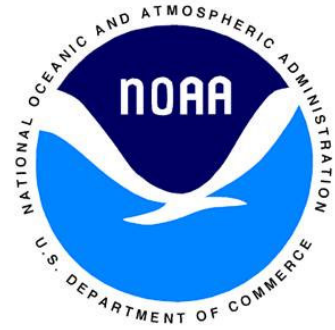
**we do
about it?**

The bad news

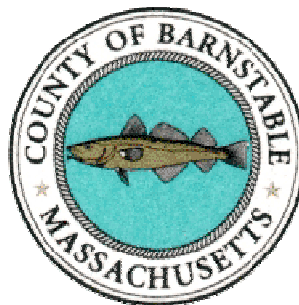


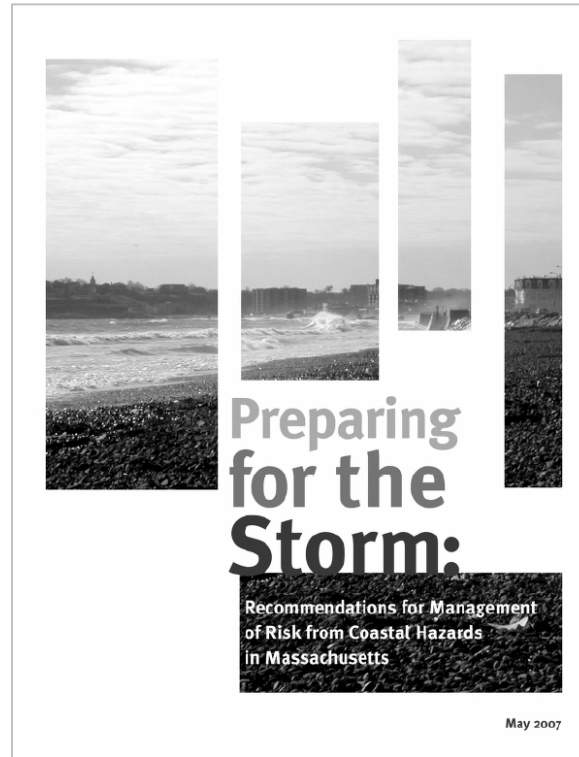


FEMA

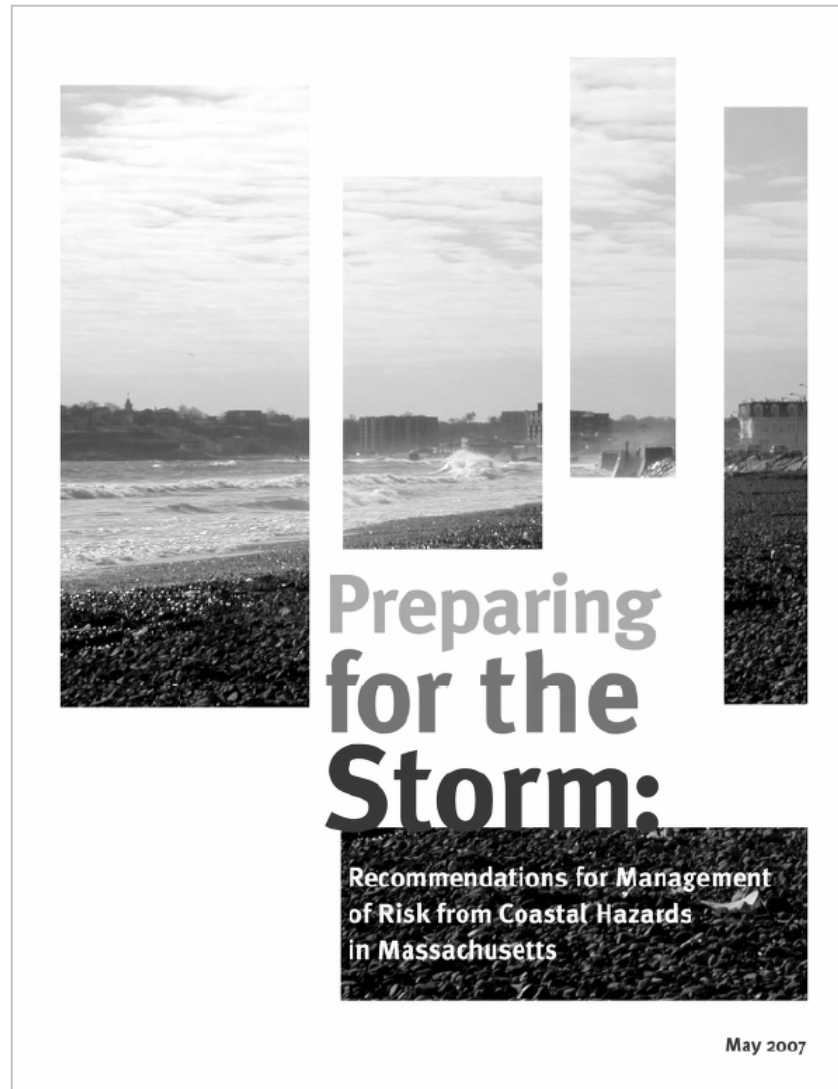


Sea Grant

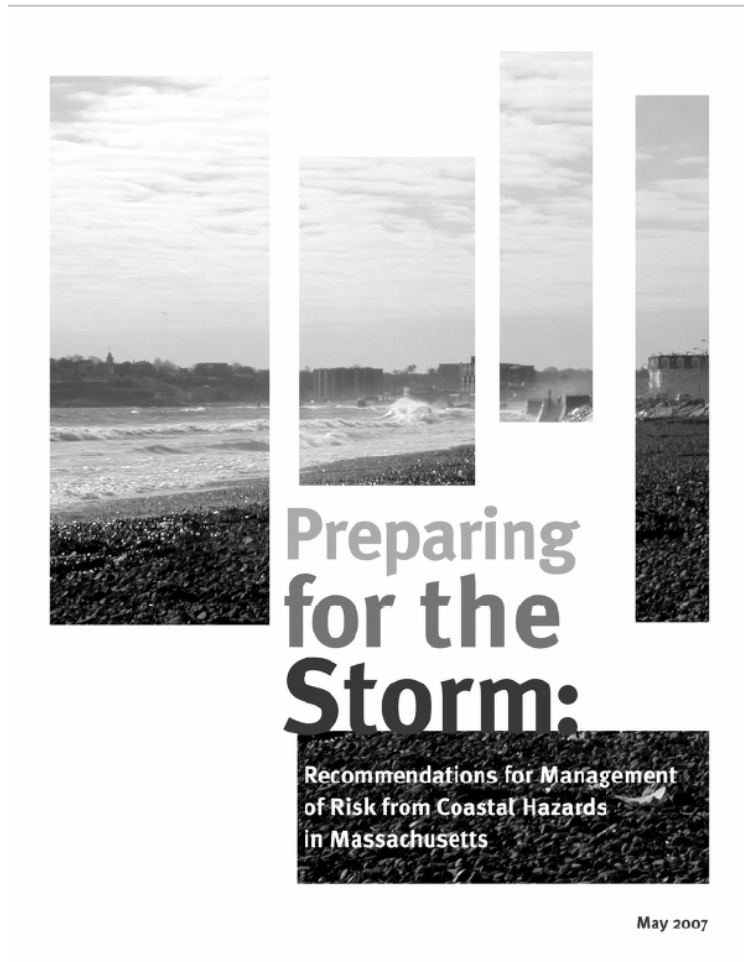




The Coastal Hazards Commission



29 Recommendations



**Recommendation #4:
“Map and model climate
change and sea-level rise
data related to coastal
hazards in
Massachusetts.”**

mass.gov/czm/chc

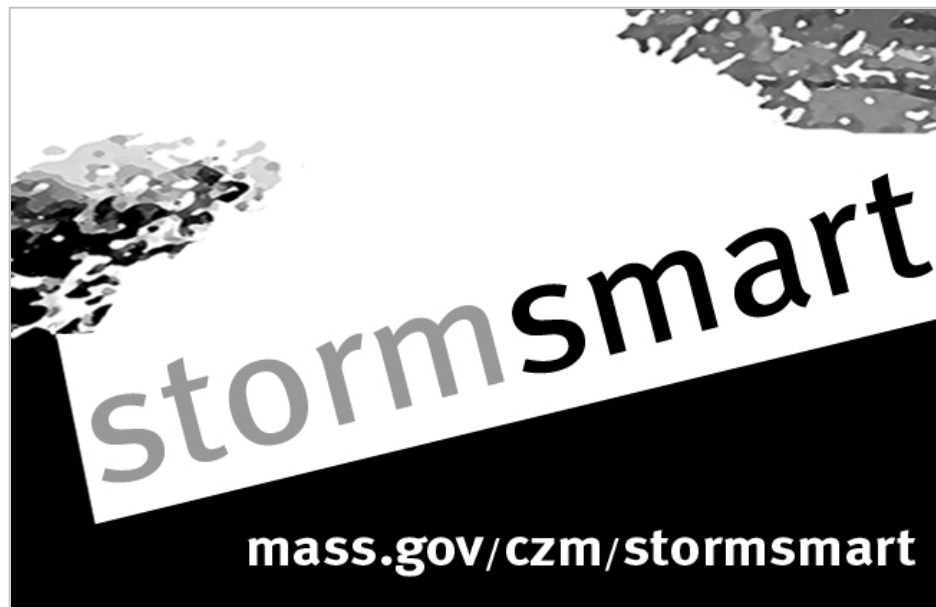


May 2007

Priority Recommendations:

- **Work with FEMA to update FIRMs**
- **Hazard mitigation plans**
- **Regional sand management**
- **Storm-Resilient Communities**

mass.gov/czm/chc



mass.gov/czm/stormsmart

coasts

supporting community
efforts to manage
coastal floodplains

**The way
things are**

**Safe
people &
property**





appetizers

COMIX CHOPPED SALAD
ROMANO / RED PEPPER / RED ONION / DICK PEAS / BROCCOLI / PARMESAN BUNCH DRESSING
ADD PESTO CHICKEN +\$3

CAESAR SALAD
CASERTA CROUTONS / ROMAINE HEARTS / PARMESANO REGGIANO
ADD PESTO CHICKEN +\$3

PISTO MISO
MUSHROOMS / ZUCCHINI CHIPS / CRISP CALAMAR

NATURAL BUFFALO WINGS
VEGETABLE CRUITS / MAYTAG BLUE CHEESE

MUSHROOM AND ROASTED GARLIC DIP
CREAM MUSHROOMS / ROASTED GARLIC / GOAT CHEESE

COMIX CHICKEN SAMPLER
CHICKEN WINGS / CHICKEN TENDERS / CHICKEN CORN MUFFINS

entrees

PAN ROASTED ORGANIC CHICKEN
GARLIC TONIC MASHED POTATOES / FRENCH BEANS / BABY CARROTS

PASTA OF THE DAY
PLEASE ASK YOUR SERVER ABOUT OUR FRESH-HOUSE MADE PASTA

FARMER'S GROVE PLANK STEAK
GARLIC TONIC MASHED POTATOES / GRILLED VEGETABLES

SLOW BAKED ATLANTIC SALMON
ORGANIC WILD MUSHROOMS / POTATO PUREE

EGGPLANT MUSHROOM LASAGNA
RICOTTA CHEESE / FRESH PASTA / SAN MARCINO MARINARA

pizzettas

THREE CHEESE PIZZETA
POMODORO / FONTINA / MOZZARELLA
ADD A TOPPING +\$2 EACH
PEPPERONI / MUSHROOMS / OLIVES / ONIONS
ADD A TOPPING +\$2 EACH
BANG CHICKEN / APPLE WOOD BACON

DELIVERY CHARGE WILL BE ADDED TO ALL ORDERS + TWO FEE AMOUNT PER PERSON IN THE BACKROOM

sandwiches

CRISP CHICKEN BT
TARRAGON CHILI SAUCE / PLUMPED BACON / WAMPLE PEE

CAPRISE PANINI
FRESH MOZZARELLA / BANEL/SAIL / VINE RIPS TOMATOES / PESTO PEE

CHARBROILED ANGUS BURGER
VERMONT CHEESE / APPLE WOOD BACON / COMIX PEE

sides

GARLIC MASHED POTATOES
COMIX PEE
SAUTÉED SPINACH
SAUTÉED HOUSE VEGETABLES
POCCACIA TEXAS TOAST

dinner prix fixe

GLASS OF HOUSE RED OR WHITE WINE

1st COURSE
CAESAR SALAD CASERTA CROUTONS / ROMAINE HEARTS / PARMESANO REGGIANO

2nd COURSE
SLOW BAKED ATLANTIC SALMON ORGANIC WILD MUSHROOMS
OR
PAN ROASTED CHICKEN GARLIC SPINACH / PARMESANO MASHED POTATOES

3rd COURSE
LIMON RICOTTA CHEESECAKE FRESH FRUIT

CUP OF COFFEE OR TEA WITH DESSERT

desserts

LIMON RICOTTA CHEESE CAKE
FRESH FRUIT COMPOTE / RICOTTA CHEESE / COGNAC CRISP

WARM CHOCOLATE CAKE
VANILLA CREAM / CALIFORNIA CHERRY BLOSSOM

CARAMELIZED BANANA CAKE
FRESH FRUIT CRISP / VANILLA CREAM / BANANA PUDDING (GLAZE)

DESSERT OF THE DAY
ASK FOR YOUR SERVER ABOUT OUR DAILY DESSERT SPECIAL

DAIRY CHEESE PLATE
SELECTION OF ARTISANAL CHEESE WITH FRESH FRUIT

SEMI TIRAMISU
RICOTTA CHEESECAKE / FRESH FRUIT / VANILLA CREAM

SELECTION OF LOCALLY MADE GELATO AND SORBET

DELIVERY CHARGE WILL BE ADDED TO ALL ORDERS + TWO FEE AMOUNT PER PERSON IN THE BACKROOM

specialty cocktails

BELLE MARTINI
VINO D'ITALIA / FRESH TOMATOES / BACON / CHAMPAGNE SPARK

RASPBERRY MOUTO
RUBEN AND / FRESH FRUIT / VINO D'ITALIA / CHAMPAGNE SPARK

THE BLACK APPLE MARTINI
VINO D'ITALIA / FRESH FRUIT / VINO D'ITALIA / CHAMPAGNE SPARK

SAPPHIRE LEMONADE
RUBEN AND / FRESH FRUIT / VINO D'ITALIA / CHAMPAGNE SPARK

PLATINUM MARGARITA
VINO D'ITALIA / FRESH FRUIT / VINO D'ITALIA / CHAMPAGNE SPARK

COMIX SORCER
VINO D'ITALIA / FRESH FRUIT / VINO D'ITALIA / CHAMPAGNE SPARK

COMIX BREW
VINO D'ITALIA / FRESH FRUIT / VINO D'ITALIA / CHAMPAGNE SPARK

draught beer

BLUE MOON **SAM ADAMS**
MAGIC HAT #1 **COORS LIGHT**
STELLA ARTOIS

bottled beer

BUDWEISER **BUD LIGHT**
COORONA **AMSTEL**
HEINEKEN **SAKINOFF ICE**
NEW CASTLE **GUINNESS**

non-alcoholic

VOSS WATER 375 ML
VOSS WATER 600 ML
RED BULL 12 OZ CAN
CLAUSTHALER BEER NON-ALCOHOLIC
SOFT DRINKS 14 OZ

by the bottle

AVAILABLE FROM OUR WINE LIST

hot beverages

PREMIUM BLACK COFFEE
SELECTION OF GOURMET TEAS
CAPPICINO
DOUBLE CAPPICINO
ESPRESSO
DOUBLE ESPRESSO

comix after dark

THE HOT KISS GOODNIGHT
VINO D'ITALIA / FRESH FRUIT / VINO D'ITALIA / CHAMPAGNE SPARK
THE CLASSIC IRISH COFFEE
VINO D'ITALIA / FRESH FRUIT / VINO D'ITALIA / CHAMPAGNE SPARK
SWISS COFFEE
VINO D'ITALIA / FRESH FRUIT / VINO D'ITALIA / CHAMPAGNE SPARK

white wine by the glass

SAUVIGNON BLANC WAXDA CHATEAU
PINOT GRIGIO SPINNY ANN VENETO
CHARDONNAY BONEVILLA CHATEAU

rose by the glass

ANJOU ROSE CHATEAU BONEVILLA CHATEAU

red wine by the glass

MERLOT CHATEAU BONEVILLA CHATEAU
CABERNET SAUVIGNON CHATEAU BONEVILLA CHATEAU
PINOT NOIR CHATEAU BONEVILLA CHATEAU
SHIRAZ WAXDA CHATEAU

port by the glass

CASA SANTA SUPREMA 12 OZ GLASS

DELIVERY CHARGE WILL BE ADDED TO ALL ORDERS + TWO FEE AMOUNT PER PERSON IN THE BACKROOM

01. Interpreting FIRMs & FIS reports 02. Limitations of FIRMs & FISs 03. Use shoreline change history in decisions 04. Use sea-level rise data and projections in decisions 05. Consider storm surge in land-use decisions 06. Use Coastal Hazard & Characterization Atlas data 07. Use best available data for coastal hazards 08. Make hazard information available & accessible 09. Share emergency information 10. Create a community master plan 11. Create a multi-hazard mitigation plan 12. Create risk mitigation strategies 13. Create a multi-objective management plan 14. Establish an Area of Critical Environmental Concern 15. Pass strict zoning ordinances and regulations 16. Consider potential future conditions when siting new development 17. Keep public infrastructure outside of hazard-prone areas 18. Incorporate NFIP requirements into local ordinances and regulations 19. Change local regulations to allow more appropriate development 20. Create permanent no-build areas 21. Encourage freeboard 22. Use a cumulative definition of substantial improvement/damage 23. Require foundation/building certification 24. Conduct inspections of lower-area enclosures 25. Use flood and erosion control structures 26. Use non-structural shore protection 27. Use hybrid shore protection 28. Retrofit existing structures 29. Relocate existing structures 30. Acquire existing structures 31. Protect critical access routes 32. Keep roads and utilities out of damage-prone areas 33. Regularly inventory hazard risk to all public property 34. Insure public buildings 35. Improve construction and design of critical facilities 36. Site critical facilities out of harm's way 37. Create a disaster response plan 38. Improve disaster response coordination 39. Create a post-disaster response plan 40. Plan for outside help 41. Assess damage to buildings 42. Raise general hazard awareness 43. Train town officials through FEMA's Emergency Management Institute 44. Train town officials through NOAA's Coastal Services Center 45. Train town officials through the Massachusetts Emergency Management Agency (MEMA) 46. Massachusetts Office of Coastal Zone Management 47. Woods Hole Sea Grant 48. FEMA 49. The Association of State Floodplain Managers 50. Massachusetts Emergency Management Agency (MEMA) 51. Other organizations with outreach & education resources 52. Train town officials through other state agencies

No



**Adverse
Impact**



Good neighbor policy

- **No using land in a way that harms others or other's property**

Legal issues

Communities' legal rights & Communities' legal responsibilities



Nuisance law

Owners may not use their property in ways that will injure their neighbors. . . Thus, even in those cases in which regulation removes all value from the property, the owner will not receive compensation if the regulation prohibits an injurious use.

- **Roger Pilon**, Senior Fellow and Director, Cato Institute



Lingle v. Chevron (2005)



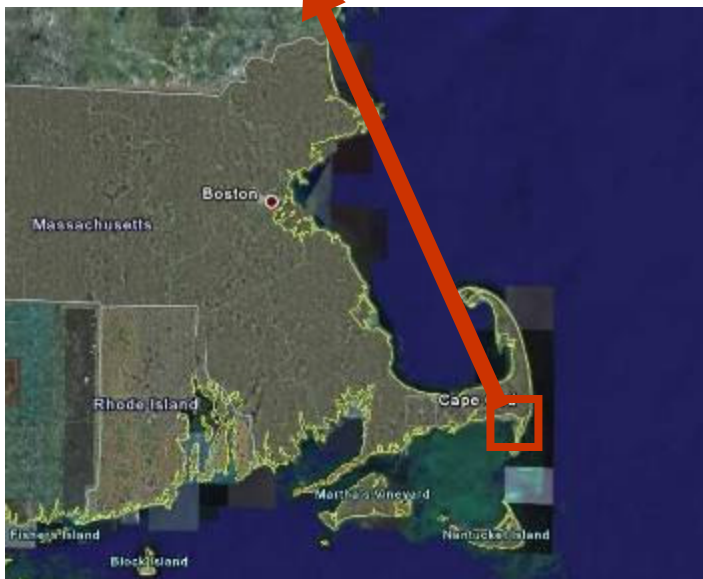
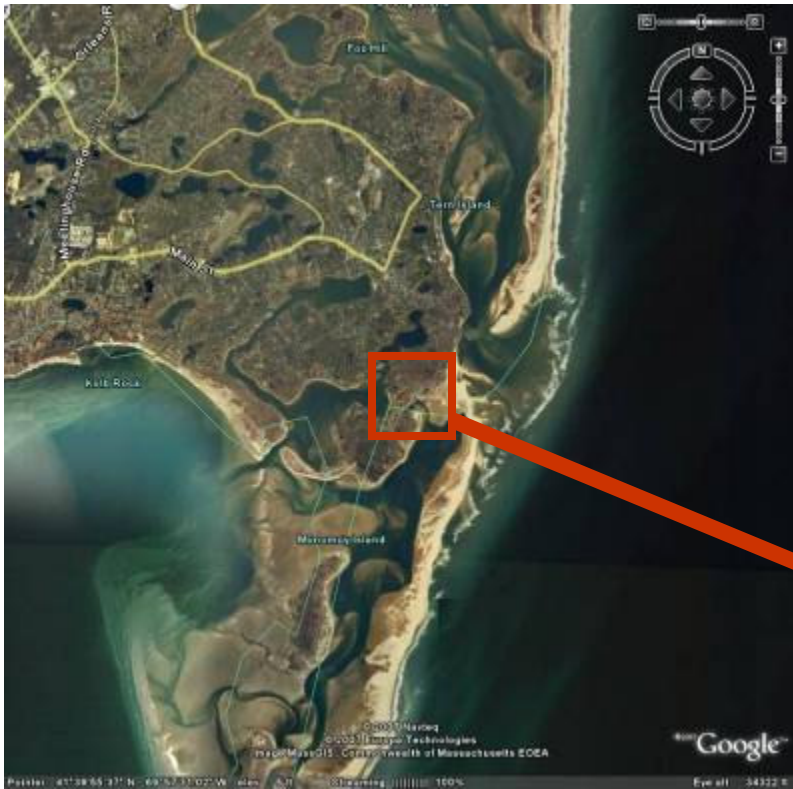
The take-home lesson:

Local governments have the right, and responsibility to manage coastal floodplains.

Communities are over 100 times more likely to be successfully sued for permitting damaging projects than for prohibiting them



Gove vs. Zoning Board of Appeals of the Town of Chatham (July 2005)



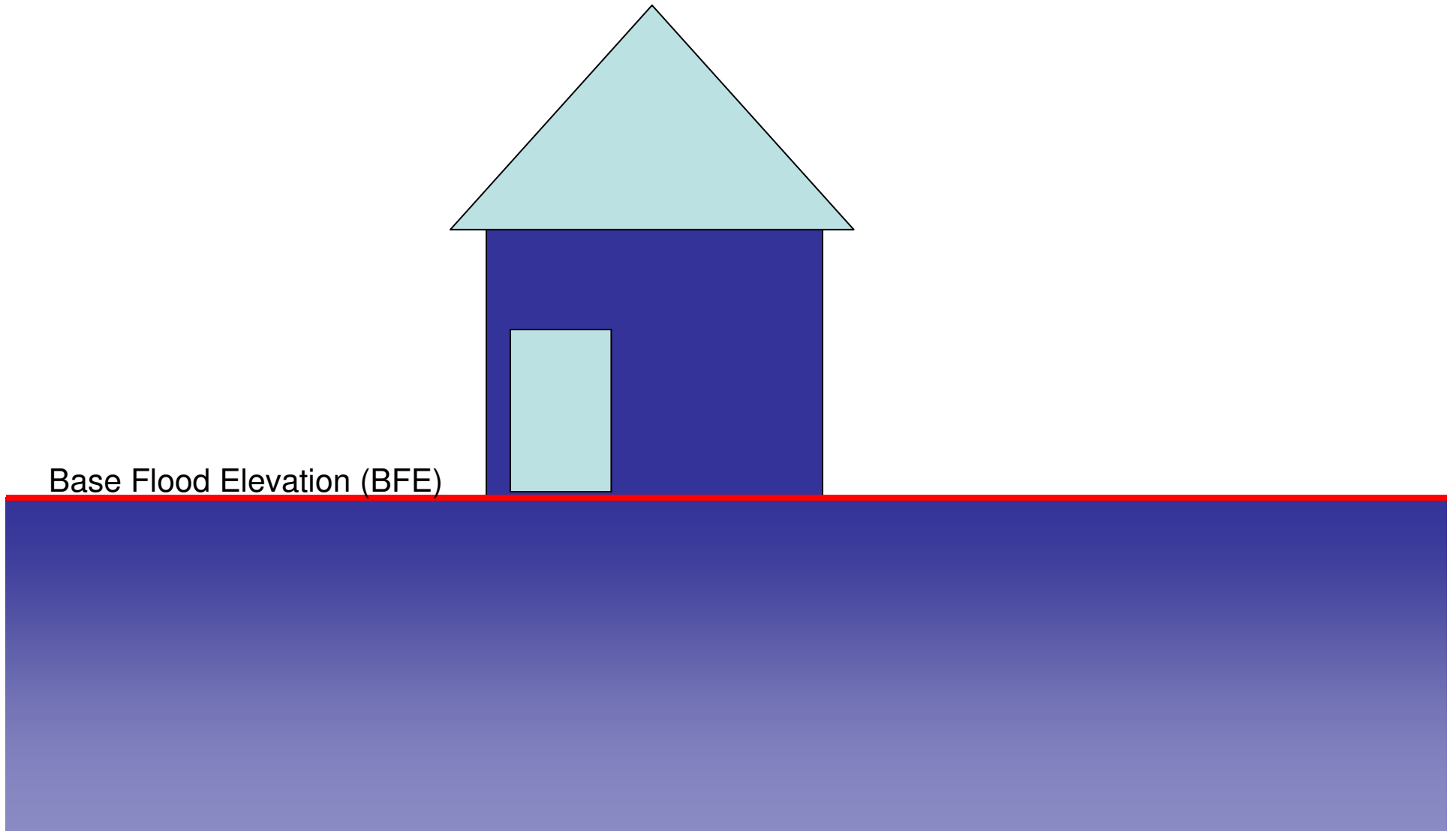
“It is undisputed that [lot 93] falls within a floodplain, and that its potential flooding would adversely affect the surrounding areas if the property were developed with a house. Reasonable government action mitigating such harm . . . typically does not require compensation.”



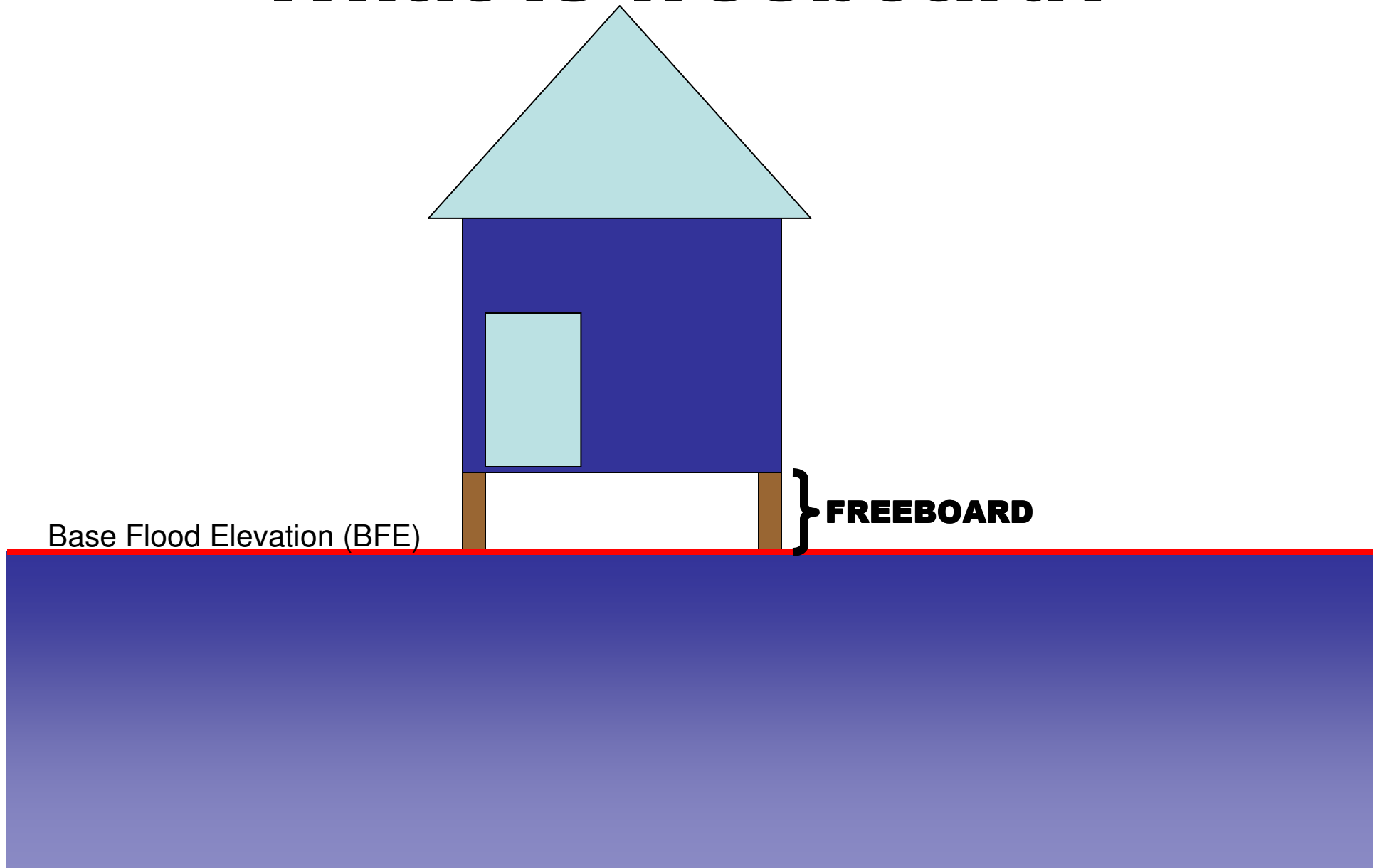
Why Chatham won:

- 1. Bylaw designed to protect people and property**
- 2. Allows for alternative uses**
- 3. Bylaw fair and consistently applied**
- 4. Testimony of risk to emergency workers**
- 5. Town willing to defend itself**

What is freeboard?



What is freeboard?







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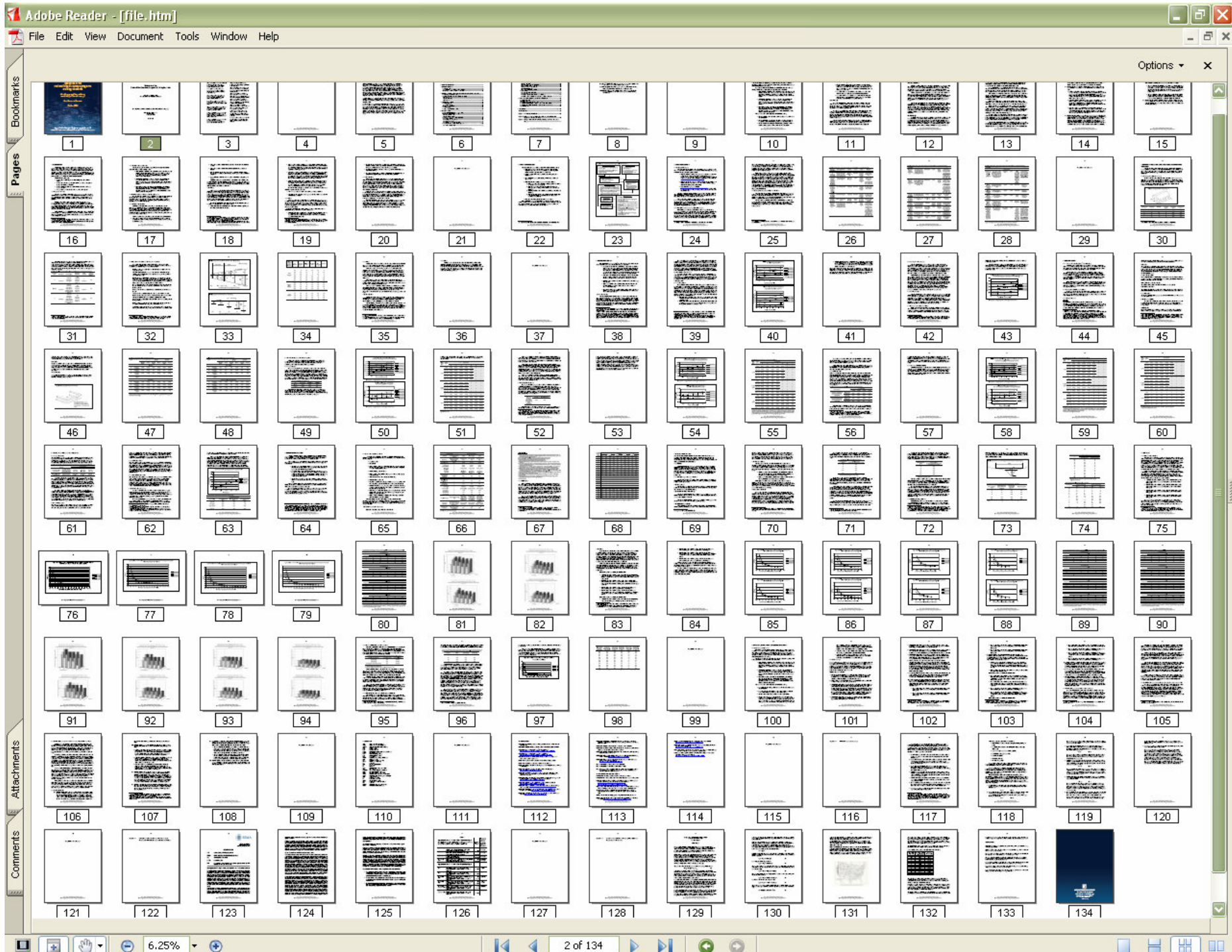
Evaluation of the National Flood Insurance Program's Building Standards

Christopher P. Jones, William L. Coulbourne,
Jamie Marshall, and Spencer M. Rogers, Jr.

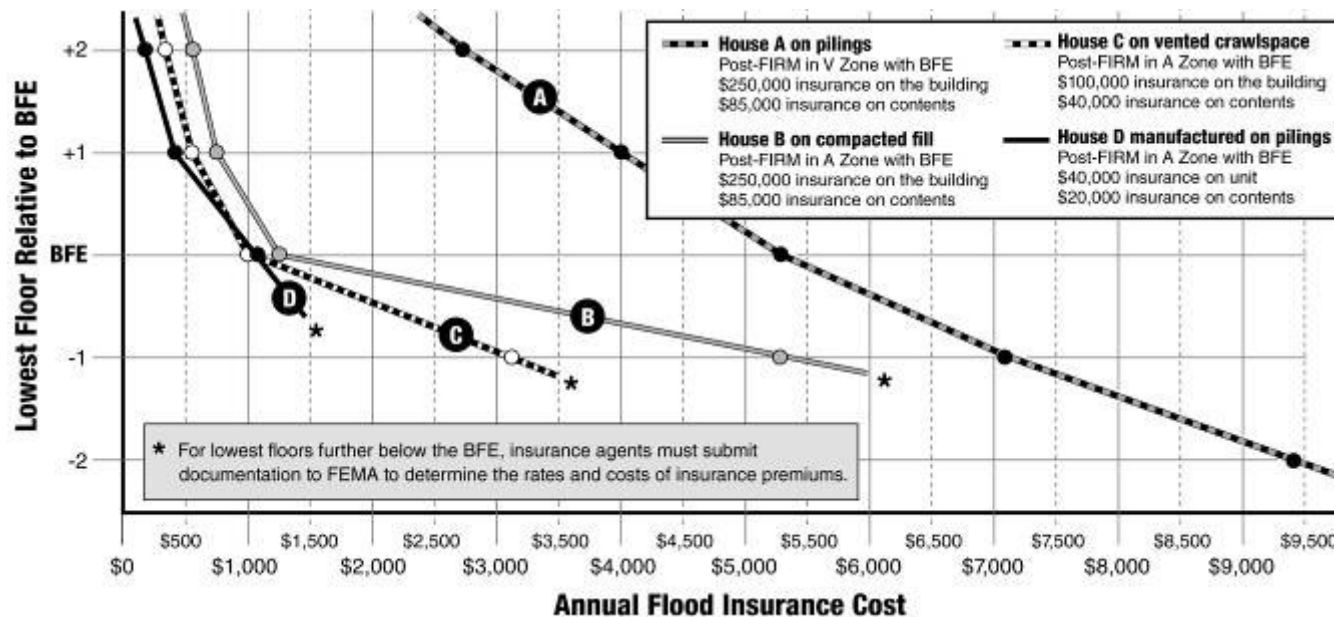
Christopher Jones and Associates

October 2006

Prepared under subcontract to the American Institutes for Research
as part of the 2001–2006 Evaluation of the National Flood Insurance Program



Freeboard benefits

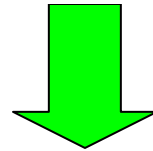
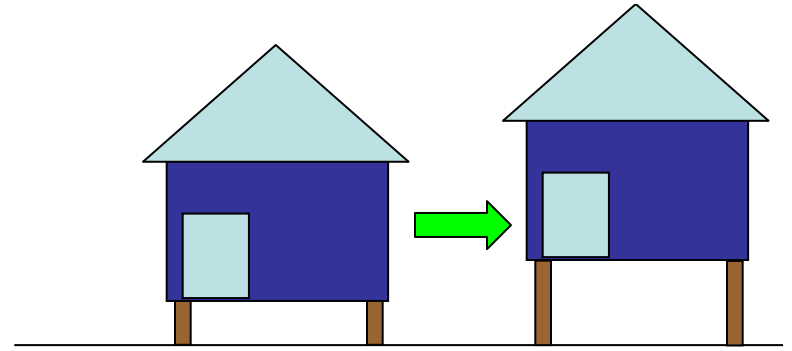


Graph: www.rcquinnconsulting.com

NFIP Premium Comparison:

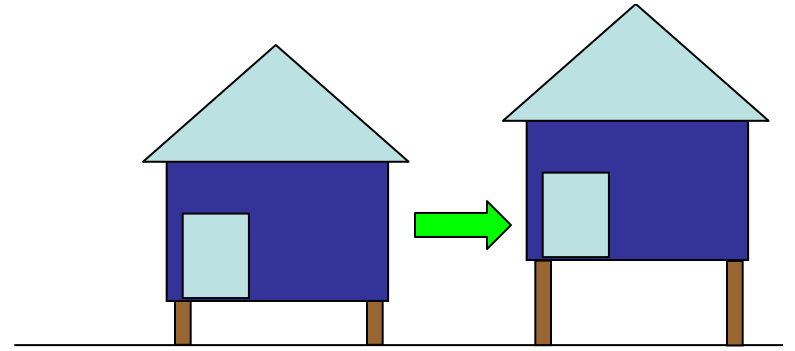
2-story on open foundation

(Coverage: \$200,000 structure, \$80,000 contents, with a \$1,000 deductible)



30 years @ 5% interest: \$133,103.59
@ 10% interest: \$345,240.05





- **Home on piles in V zone**
 - **Adds $\frac{1}{4}$ to $\frac{1}{2}\%$ to construction costs**
 - **6-16 months to recover costs**

Quincy



**2003-2007: ~\$1 million (federal)
& 46 properties**



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Welcome to StormSmart Coasts

StormSmart Coasts is designed to support local efforts to protect people and property in coastal floodplains. Developed for municipal officials, StormSmart Coasts also has useful information for anyone looking to reduce coastal flood damage.

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It also provides background on:

- The [No Adverse Impact](#) approach to land management (a legally-robust way to protect people and property rights developed by the [Association of State Floodplain Managers](#))
- [Legal information](#) on how communities can protect themselves while protecting people and property
- Information on potential [funding](#) sources for floodplain management projects.

This project is in development. Please don't hesitate to [contact us](#) with any questions or ideas.

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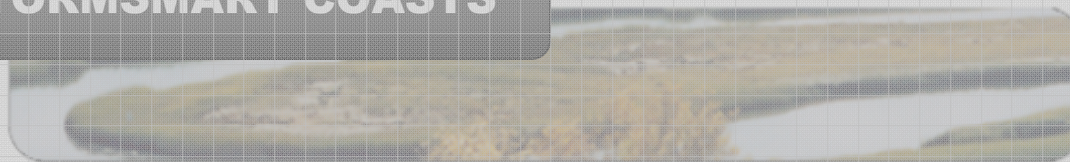
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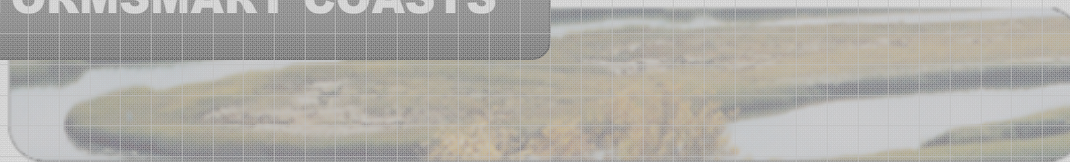
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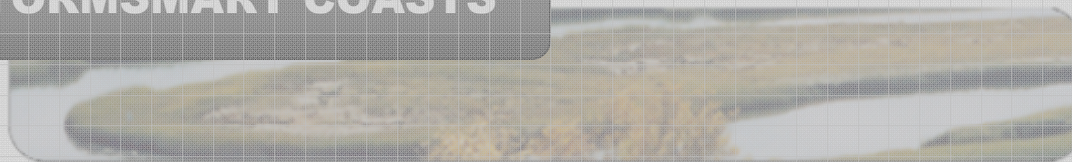
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StormSmart Hazard Identification & Mapping

In an increasing number of communities along the coast of Massachusetts, erosion and flooding impacts are occurring even with relatively minor storms. Knowing what and where these potential coastal hazards are greatly enhances your community's ability to address them. Accurate maps and information are needed to: protect public and private investment, guide development and redevelopment, plan for further economic growth and infrastructure, and protect public trust lands, such as town beaches and parks.

Below is a menu of hazard identification and mapping options. Those likely to lead to a true No Adverse Impact level of protection are designated as NAI.

Using FIRMs & FIS to map and identify hazards

Flood Insurance Rate Maps (FIRMs) and Flood Insurance Study (FIS) reports produced by the Federal Emergency Management Agency (FEMA) are the foundation for most local coastal hazard identification and mapping efforts. The information below helps communities get the most out of FIRMS and FIS reports, while understanding their limitations.

- [Interpreting FIRMs & FIS reports](#)
- [Limitations of FIRMs & FIS](#)

Enhancing FIRMs & FIS

While FIRMS and FIS reports are a great starting place for hazard identification and mapping, incorporating the additional information listed below can greatly increase your community's safety.

- [Existing sources of additional information](#)
- [Developing best available data](#)
- [Using best available data](#)

Sharing hazard information

This information will help you make your hazard identification maps and information available to the people who need them.

- [Making hazard information available & accessible](#)
- [Sharing emergency information](#)

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Interpreting FIRMs and FIS reports

As a part of the National Flood Insurance Program (NFIP), the Federal Emergency Management Agency (FEMA) periodically conducts Flood Insurance Studies (FISs) and uses the results of these studies to produce FIS reports and Flood Insurance Rate Maps (FIRMs). FIRMs show the estimated extent of flooding during a hypothetical "100-year storm" (also called a 1% storm)—a storm that has an estimated 1% chance of being equaled or exceeded during any given year. (Note: a 100-year storm can occur more than once a century.)

Correctly interpreting FIRMs and FIS reports can be complicated. Following are some resources to help.

- The Massachusetts Office of Coastal Zone Management article, [*The Art and Science of Identifying Flood Zones*](#).
- The FEMA introductory fact sheet, [Using a Flood Insurance Rate Map \(FIRM\)](#).
- An animated [FEMA tutorial on FIRMs](#).
- The [FEMA Map Services Center](#) maintains copies of all FIRMs and FIS reports.
- FEMA's [FIRMette tutorial](#) provides instructions for determining the flood designation for an individual parcel by creating a "FIRMette" (a section of a FIRM for a specific address or location).
- The [National Flood Insurance Program](#) website has information on FISs, FIRMs, and other floodplain management issues.
- Contact Richard Zingarelli, Massachusetts NFIP Coordinator at Richard.Zingarelli@state.ma.us or: (617) 626-1407 for more information on these and other NFIP topics.

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Sources for additional hazard information

Following are some sources for additional information on hazard risks your community may face.

Shoreline change history

The Massachusetts Office of Coastal Zone Management's (CZM) Historic Shoreline Change Project provides detailed shoreline change maps and accompanying data tables showing how shorelines have migrated through time.

- The CZM Historic Shoreline Change Project website provides 1:10,000 scale shoreline change maps and accompanying data tables that show the relative positions of historic shorelines, along with information on how to interpret these data.
- For those communities on the South Shore (between Hull and the Cape Cod Canal), more recent data is available in the [South Shore Coastal Hazards Characterization Atlas](#).

Sea-level rise data and projections

While the causes and future rates are still being debated, there is a general scientific consensus that sea levels are rising (for current sea-level rise trends, see the National Oceanographic and Atmospheric Administration's [Sea Levels Online](#)). Consequently, the effects of future, higher, sea levels should be considered when making siting decisions.

Storm surge

Storm surge is water that is pushed toward the shore by winds swirling around a storm. This advancing surge combines with normal tides to create the storm tide, which can increase the effective sea level 25 feet or more. Wind driven waves are added on top of the storm surge, creating tremendous potential for extensive storm damage. For information on your community's storm surge risk, see [Massachusetts storm surge maps](#).

Coastal Hazards Characterization Atlas data

[The South Shore Coastal Hazards Characterization Atlas](#) was developed by the Massachusetts Office of Coastal Zone Management (CZM) to provide communities with information to help review projects that are in areas vulnerable to flooding, erosion, and other coastal hazards. CZM plans to complete atlases for remainder of the Commonwealth's coastal regions when funding is available.

Best available data

In most communities there are areas which flood that are not mapped as flood zones on the community's Flood Insurance Rate Maps (FIRMs). When your community makes decisions about land-use in floodplains, it should do so based on its actual floodplain, which includes the FIRMs' data, relevant parts of the Flood Insurance Study, and your town's experiences. During and immediately after storm events your community can record the true (as opposed to modeled) extent of a storm. This can be done in many ways - if aerial photographs are available, these can be used, as can physically recording the extent of floodwaters (high-water marks) during the peak hours of a storm event or soon after the storm when the evidence is still visible.

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Using best available data

As your community's understanding of its flood and erosion risks improves, so do its chances of successfully addressing them (for how your community can learn more about its hazards, see the [Existing sources of additional information](#) and [Developing best available data](#) pages). Following are of some of the practices listed in this website where your community can put its new information to work. For example, the more detailed information your community has on which areas flood (or erode), the better it can plan for development in its master plan, the more efficiently can prepare for emergencies in its disaster response plan, and the more effectively it can help educate its citizens as to the real risks they face.

Planning

- Create a multi-hazard mitigation plan
- Create a community master plan
- Create risk mitigation strategies
- Create a multi-objective management plan
- Establish an Area of Critical Environmental Concern

Regulations and Development Standards

- Pass strict zoning ordinances and regulations
- Consider potential future conditions when siting new development
- Keep public infrastructure outside of hazard-prone areas
- Create permanent no-build areas

Infrastructure

- Protect critical access routes
- Keep roads and utilities out of damage-prone areas
- Regularly inventory hazard risk to all public property
- Site critical facilities out of harm's way

Emergency Services

- Create a disaster response plan
- Improve disaster response coordination

Education and Outreach

- Raise general hazard awareness

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[Other](#)

Case Studies

[Chatham](#)
[Quincy & Scituate](#)

New!

Site Design Guidance
[Low Impact](#)
[Development in Coastal](#)
[Floodplains](#)

This is only the beginning

- **Project launch: Spring 2008**
 - **Website**
 - **Fact sheets**
 - **Case studies**
 - **Model bylaws/ordinances/regulations**
- **Workshops**
- **Implementation**



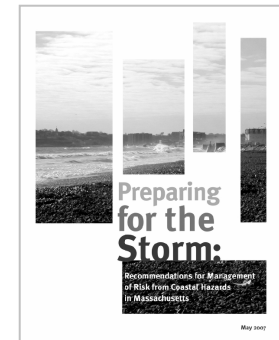
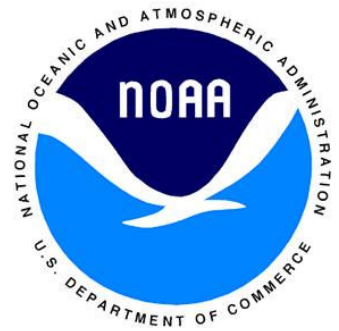
The background of the slide is a collage of four photographs illustrating coastal erosion. The top-left photo shows a large, multi-story house tilted precariously as a significant portion of the ground beneath it has eroded away, with waves crashing at its base. The top-right photo shows a similar house on stilts, with a large, exposed earthen bank in front of it, indicating recent soil loss. The bottom-left photo shows a row of houses on stilts, with a large, dark, eroded area in the foreground. The bottom-right photo shows a row of houses on stilts, with a large, eroded area in the foreground. The text "Q: What on earth can we do about it?" is overlaid in large, bold, black font across the center of the image.

**Q: What on
earth can**

**we do
about it?**



FEMA

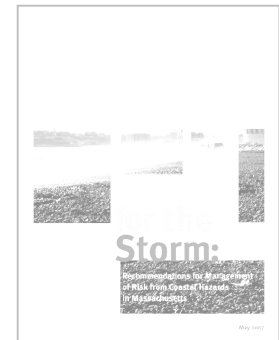
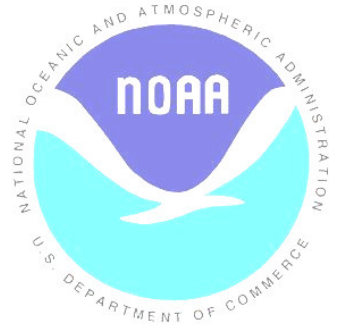


Sea Grant





FEMA



Sea Grant





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mass.gov/czm/stormsmart

