MITIGATING FLOOD DAMAGE IN HISTORIC DOWNTOWNS

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Old City Hall
Augusta

NATIONAL FLOOD INSURANCE PROGRAM

In order for federally backed flood insurance to be sold within a community, the community must adopt a local floodplain management ordinance that meets or exceeds the NFIP minimum floodplain management requirements at 44 CFR 60.3.

Important Concepts:

- All development requires a permit
- 1%-annual-chance-flood (100-Year Flood)
- Standards for improvements to pre-FIRM Structures
- New Construction and Substantial Improvements must meet elevation standards: lowest floor must be elevated to 1' above the base flood elevation

Mapping ~ Insurance ~ Regulations

NATIONAL FLOOD INSURANCE PROGRAM

NFIP Minimum Floodplain Management Requirements for New and Substantially Improved Structures:

- Residential structures must be elevated to 1' above the BFE (riverine & coastal)
- Nonresidential structures must be elevated to 1' above the BFE <u>or</u> dry floodproofed to the BFE (AE, A1-30, A Zones only)
- The flood-carrying capacity of floodways (riverine) must be preserved to ensure that upstream property owners are not subjected to additional flooding and damages
- In coastal high hazard areas, there are additional construction requirements to protect structures from wave impacts, (i.e. free of obstruction below the BFE, locate landward of the reach of mean high tide (unless FD), prohibit alteration of dunes)

Updated Flood Insurance Rate Maps

Confluence of the
Kennebec River and Bond Brook
Augusta

NATIONAL FLOOD INSURANCE PROGRAM

HISTORIC STRUCTURES - EXISTING STRUCTURES (PRE-FIRM)

Johnson Hall Gardiner 1930s

WHAT IS PRE-FIRM?

- Pre-Flood Insurance Rate Map

Constructed prior to 12/31/74 or the date of a community's first FIRM, whichever is later

  - Subsidized rates

- Post-Flood Insurance Rate Map

Constructed after 12/31/74 or the date of a community's first FIRM, whichever is later

  - Actuarially rated

WHAT IS PRE-FIRM?

Google "FEMA Community Status Book"

http://www.fema.gov/national-flood-insurance-program/national-flood-insurance-program-community-status-book

Federal Emergency Management Agency
Community Status Book Report
MAINE
Communities Participating in the National Flood Program

CID	Community Name	County	Init FHBM Identified	Init FIRM Identified	Curr Eff Map Date	Reg-Emer Date	Tribal
230406#	ABBOT, TOWN OF	PISCATAQUIS COUNTY	02/14/75	03/15/78	03/30/93	03/15/78	No
230190#	ACTON, TOWN OF	YORK COUNTY	02/21/75	06/05/85	06/05/85	06/05/85	No
230688#	ADAMSTOWN TO4 R02 WBKP, TOWNSHIP OF	OXFORD COUNTY		07/07/09	(NSFHA)	04/30/84	No
230132#	ADDISON, TOWN OF	WASHINGTON COUNTY	10/18/74	07/16/91	07/16/91	07/16/91	No
230008#	ALBANY, TOWNSHIP OF	OXFORD COUNTY		07/07/09	(NSFHA)	04/30/84	No
230031#	ALBION, TOWN OF	KENNEBEC COUNTY	02/21/75	09/27/85	08/16/11	09/27/85	No
230713	ALDER BROOK T3 R3 NBKP, TOWNSHIP OF	SOMERSET COUNTY			(NSFHA)	04/30/84	No
230652	ALDER STREAM T02 R08 WBKP, TOWNSHIP OF	FRANKLIN COUNTY			(NSFHA)	04/30/84	No

NATIONAL FLOOD INSURANCE PROGRAM

Under the NFIP, "Historic Structure" is defined as:

1) Individually listed in the National Register of Historic Places.

2) Contributing to the historical significance of a registered historic district.

3) Individually listed on a State inventory of historic places in states with approved DOI historic preservation programs.

4) Individually listed on a local inventory of historic places in communities with approved historic preservation programs either by an approved State program or directly by DOI.

NATIONAL FLOOD INSURANCE PROGRAM

The NFIP supports historic preservation in two ways:

Designated historic structures do not have to meet new construction and substantial improvement requirements of the NFIP as long as the building can retain it's historic designation.

A designated historic structure can obtain the benefit of subsidized flood insurance even if it has been substantially improved or substantially damaged.

NATIONAL FLOOD INSURANCE PROGRAM

Under the NFIP, there are 2 provisions that provide regulatory relief for historic structures in floodplains:

1) Definition of "substantial improvement" at 44 CFR 59.1, states: "alteration to an "historic structure" does not constitute a "substantial improvement", provided that the alteration will not preclude the structure's continued designation as an "historic structure".
2) Variance provision at 44 CFR 60.6(a): "Variances may be granted for the repair or rehabilitation of historic structures upon a determination that the proposed repair or rehabilitation will not preclude the structure's continued designation as a historic structure and the variance is the minimum necessary to preserve the historic character and design of the structure."

NATIONAL FLOOD INSURANCE PROGRAM

FPM requirements could apply to "historic structures" if they are located in the Regulatory Floodway:

- Prohibit any encroachment within the floodway unless it has been demonstrated through an engineering analysis that the encroachment will not result in any increase in flood levels within the community during occurrence of the base flood discharge. (44 CFR 60.3(d)(3)
- All structures, including "historic structures" must comply with the regulatory floodway.
- For example, an addition to an "historic structure" in the floodway would be prohibited under the community's floodplain management ordinance if it resulted in any rise in the flood levels.

NATIONAL FLOOD INSURANCE PROGRAM

- New construction in Historic Districts <u>is required to meet the minimum requirements</u> of the NFIP.
- Substantial improvements to a non-contributing building in a Historic District could qualify for relief from NFIP requirements.
  - Property owner could apply for contributing status for the structure "as is" prior to making any improvements.
  - Property owner could undertake the minimum work necessary (less than substantial improvement) to make the building a contributing structure
  - Property owner could obtain preliminary approval that the substantial improvement would qualify the building for contributing status.

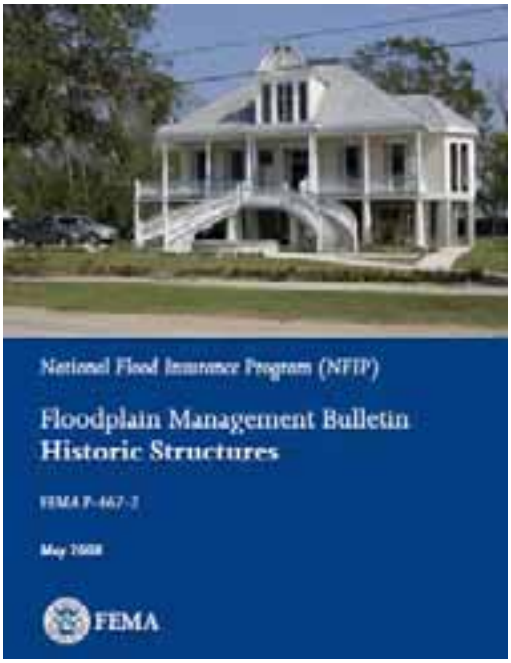
BIGGERT-WATERS FLOOD INSURANCE REFORM ACT 2012 (BW-12)

HOMEOWNERS FLOOD INSURANCE AFFORDABILITY ACT 2014 (HFIAA)

- Subsidy increase and then reversal for many pre-FIRM buildings
- Refunds beginning May 1, 2014
- Other provisions
- Fact sheet
- Emerging guidance on flood insurance reform
  http://www.fema.gov/flood-insurance-reform

NATIONAL FLOOD INSURANCE PROGRAM

Further Guidance
Floodplain Management Bulletin: Historic Structures



FLOODPROOFING HISTORIC BUILDINGS – A CASE STUDY

WATER ST, HALLOWELL, ME - 1936

175 WATER STREET (SLATE'S) HALLOWELL

Photo by Sutherland Conservation & Consulting

BURNED IN 2007 - EXTENSIVE NATURE OF WORK REQUIRED MITIGATION PURSUANT TO THE NFIP (DRY FLOODPROOFING)

Photo by Sutherland Conservation & Consulting

REAR ELEVATION

Photo by Sutherland Conservation & Consulting

NORTH ELEVATION

Photo by Sutherland Conservation & Consulting

FIRE DAMAGE PRIMARILY IN NORTH BAY AND SMOKE DAMAGE THROUGHOUT BUILDING

Photos by Sutherland Conservation & Consulting

The building's floor level was at 27.44', the 100 year floodplain is at 28.5'. NFIP regulation required that the rehabilitation work result in flood-proofing measures to 29.5' – One foot above flood level.

Drawings by Bethanis Associates Architects

NEW METAL FLOOR FRAMING PREPARED FOR WATERPROOFING MATERIAL AND CONCRETE SUBFLOOR

Photos by Sutherland Conservation & Consulting

WATERPROOF MEMBRANE APPLIED TO MASONRY WALLS TO 1' ABOVE THE 100 YEAR FLOOD ELEVATION

Photo by Sutherland Conservation & Consulting

AFTER INSTALLATION OF FINISH FLOORING AND WAINSCOTING

Photos by Sutherland Conservation & Consulting

ADA ACCESS INSTALLED ON NORTH ELEVATION - REQUIRED BY THE MAINE HUMAN RIGHTS ACT

Photos by Sutherland Conservation & Consulting

SOUTH BAY AND CHIMNEY ENTIRELY RECONSTRUCTED USING SALVAGED BRICKS

Photo by Sutherland Conservation & Consulting

THE PROJECT WAS ABLE TO UTILIZE FEDERAL AND STATE HISTORIC REHAB TAX INCENTIVES BECAUSE:

- ✓ It was a "Substantial Rehabilitation";
- ✓ The building was used for income-producing purposes;
- ✓ The property contributes to a National Register listed historic district; and
- ✓ The rehabilitation was done in accordance with the Secretary of the Interior's Standards for Rehabilitation.

Approximately $1.5 million in certified qualified rehabilitation expenses:

20% Federal credit = $300,000
25% State credit = $375,000
Total tax credits $675,000

These credits are often syndicated and sold to a bank or other institution for "up-front" financing of a project. In these scenarios, the property owner currently receives approximately 90 cents per dollar in Federal tax credits, and 78-85 cents per dollar in State tax credits.

New construction and site work related to a historic rehabilitation is not eligible to claim either Federal or State credits

MAINE HISTORIC PRESERVATION TAX INCENTIVES

For more information regarding either the Federal or State rehabilitation tax credits contact:

Mike Johnson
Maine Historic Preservation Commission
207-287-2949
Mike.D.Johnson@maine.gov

Also see our website:
http://www.maine.gov/mhpc/tax_incentives/index.html

449 Main St.
Rockland
Certified 2011

For more information regarding fiscal and tax aspects of the State credit contact:

Richard Truman
Maine Revenue Services
207-624-9547
Richard.E.Truman@maine.gov

Photos by Sutherland Conservation & Consulting

Historic buildings owned by Non-profits and municipalities that are…

- individually listed in the National Register; or
- within National Register listed historic districts; or
- eligible for listing in the National Register;

…may be eligible for grants from a variety of programs to assist in FHIP compliance.

Please contact MHPC for further information.

Thank You!

HAZARD MITIGATION GRANTS

Pre-Disaster Grants

PDM
(PRE-DISASTER MITIGATION)

- Annual (TBA)
- Plan
- NFIP
- BCR* 1:1+
- Plans/Projects
- $3,000,000 cap
- Competitive (Nationally)
- 75/25 match

FMA
(FLOOD MITIGATION ASSIST)

- Annual (TBA)
- Plan
- NFIP
- BCR* at least 1:1
- Plans/Projects
- $100,000 +/-
- Competitive (within state)
- 75/25 (12.5+12.5)

DISASTER OCCURS

- Form 7s estimate damages
- Preliminary Damage Assess (PDA)
- $ threshold met; Gov. request
- Presidential Declaration
- PA (Public Assistance+406 Program)
  - Non-competitive, 75/15/10 matches
- IA (Individual Assistance – rare in ME)
- HMGP grant availability (404 program)

Post-Disaster Grants

HMGP (404)
(HAZARD MITIGATION GRANT PROGRAM)

- Post Disaster Declaration
- Plan
- NFIP
- BCR* at least 1:1
- Projects only
- $ = 15% (of total damages)
- Competitive (within state)
- 75/25 match

All applicants must be part of a FEMA approved Hazard Mitigation Plan and in good standing with the National Flood Insurance Program (NFIP)

All projects must have a "Benefit to Cost Ratio (BCR) of 1:1 or greater.

HAZARD MITIGATION GRANTS

ELIGIBILITY - APPLICANTS MITIGATION	
Eligible Applicants	**Primary Requirements**
Eligible applicants include: • State and Local governments • Indian tribes or other tribal organizations • Certain non-profit organizations (such as public libraries)	To receive grants, all applicants must: 1. **PLAN** - Be participating in a FEMA approved Hazard Mitigation Plan 2. **NFIP** - Be in good standing with the National Flood Insurance Program (NFIP) 3. **COST BENEFICIAL** – Must have project with benefits exceeding costs
Note: Individual homeowners and businesses can not apply directly to the program; however, a community may apply on their behalf.	

ELIGIBILITY - PROJECT MITIGATION	
YES	**NO**
Acquisition of primary residences that have been repetitively damaged by natural hazards (such as flooding) and conversion to open space	**Major** flood control projects such as dams, dikes, floodwalls, groins, jetties, levees, seawalls, waterway channelization, beach re-nourishment
Relocation of primary residences that have been repetitively damaged by natural hazards.	**Maintenance Projects** such as annual ditch cleaning or replacement of old culverts
Elevation of primary residences that have been repetitively damaged by natural hazards.	**Capital Improvement Projects** such as new paving over gravel roads
Public roads/culverts – Upgrades, upsizing and / or stabilization at repetitively flooded areas	**Emergency Repairs** – these are covered under PA and/or 406 if related to the declared storm/county; otherwise, the town's responsibility
Minor structural flood control projects – such as low water crossings on public roads with repetitive flooding, but low traffic count.	**Engineering Designs** that are not integral to a proposed project
Bank Stabilization on public roads to solve repetitive erosion problems	**Studies** – (Engineering, drainage, flood) that are not integral to a proposed project
Storm water management of repetitively flooded public roads / streets	**Mapping** – That is not integral to a proposed project
NEW! **Generators** for critical facilities	**Phased** or partial projects

Why does sea level change?

Global Sea Levels…

Thermal Expansion (the ocean heats up/expands as atmosphere warms)

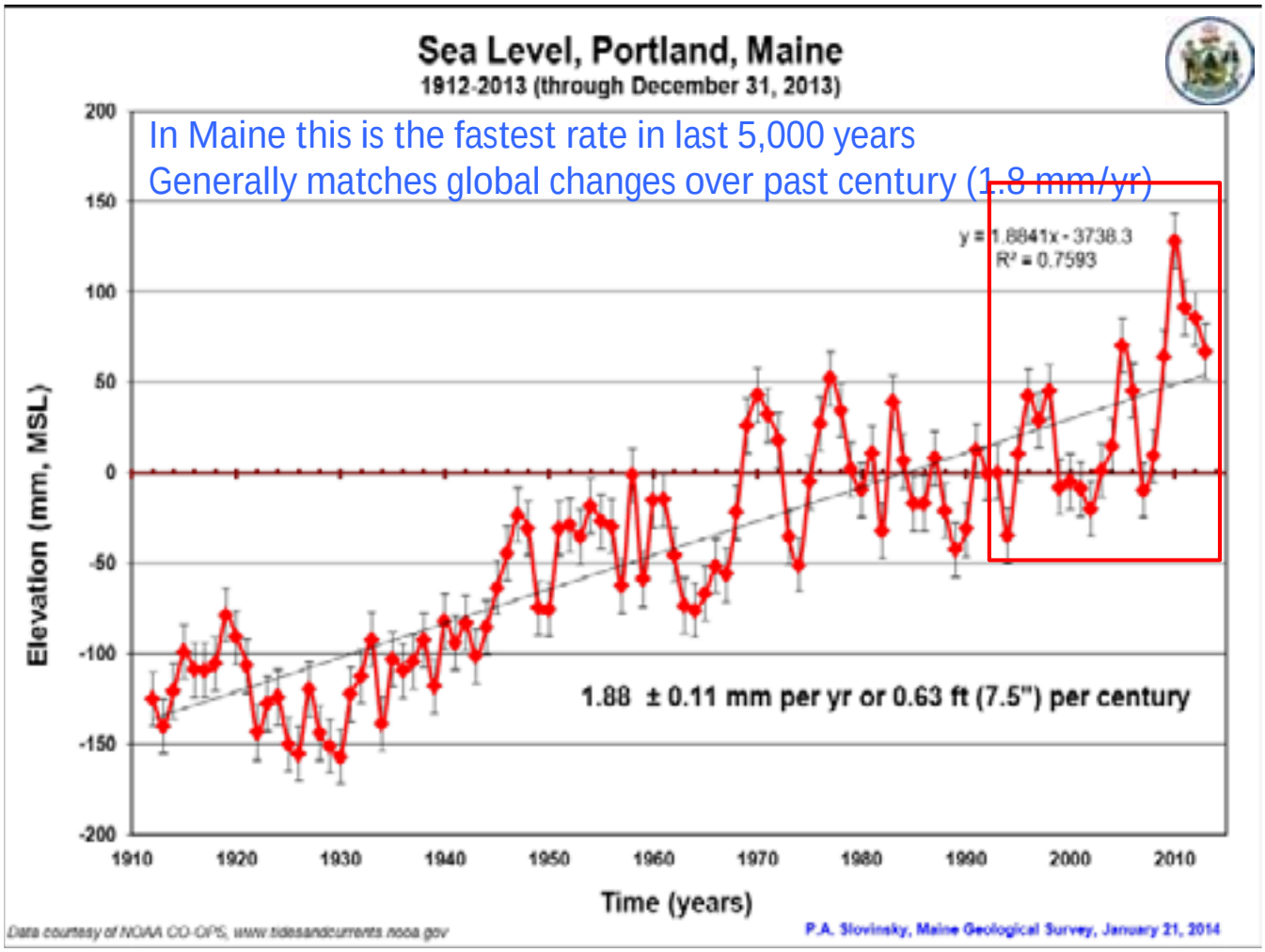
Volumetric Increase (volume increases with water from melting glaciers and land-based ice sheets)

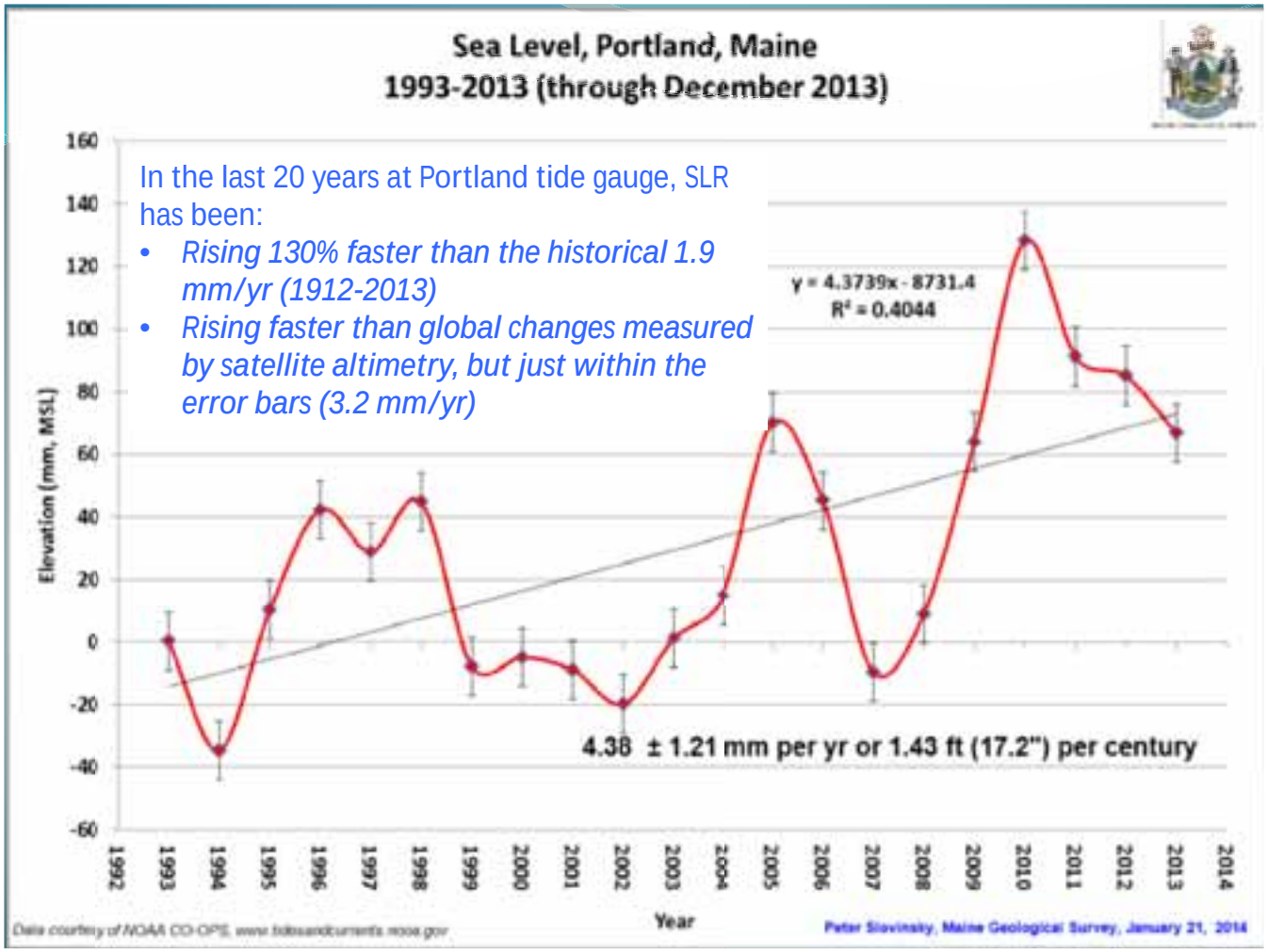
Global climate variation (impacts of ENSO, El Nino/La Niña warming and cooling patterns in the Pacific Ocean)

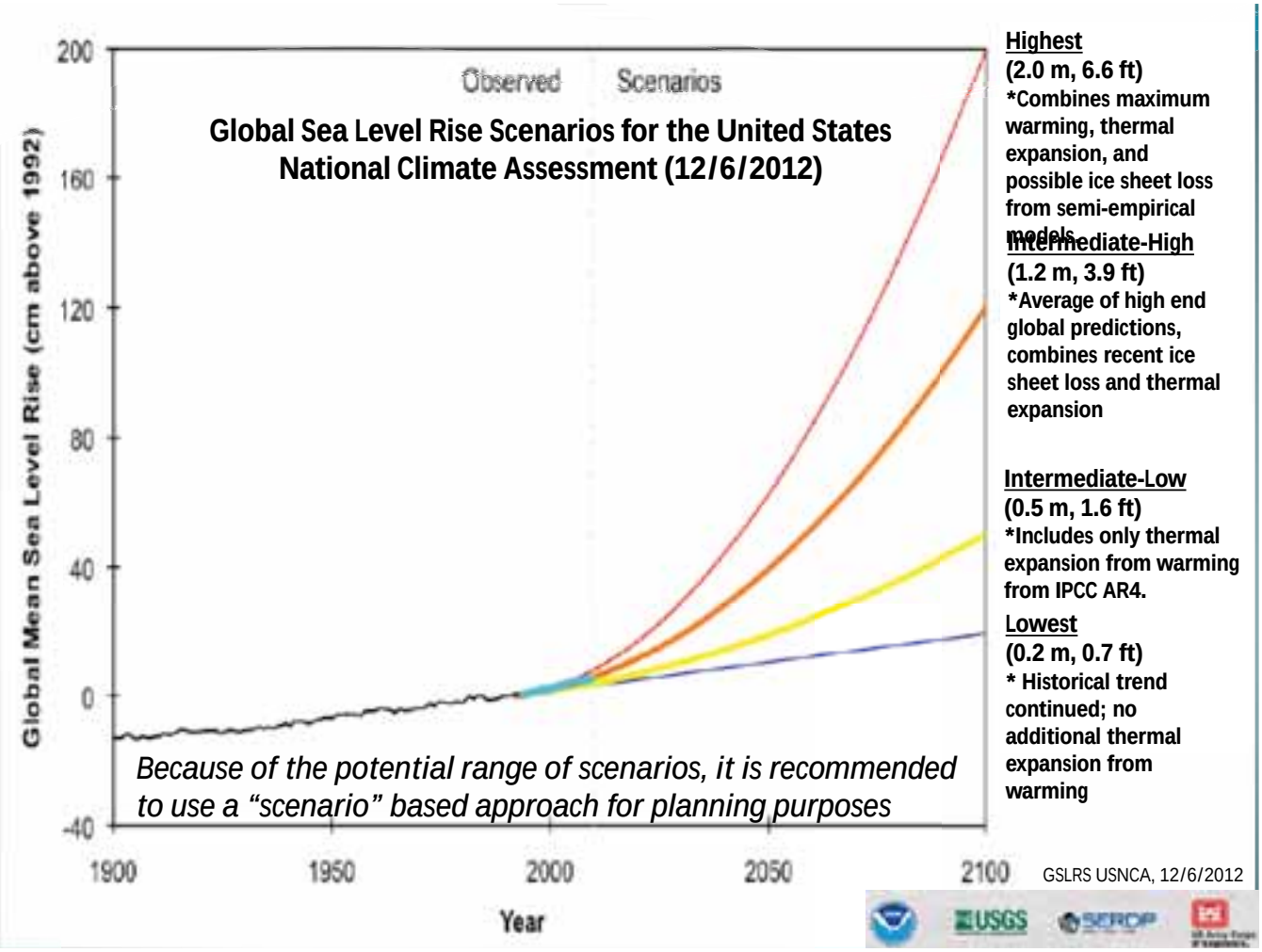
Relative (or "Local") Sea levels…

Isostatic rebound (response of the crust to glaciation) – *this has been a key factor in Maine historically since the last ice age due to glaciation, but not today.*

Subsidence (sinking of the land due to other factors than isostasy)


Sea Level, Portland, Maine
1912-2013 (through December 31, 2013)
In Maine this is the fastest rate in last 5,000 years
Generally matches global changes over past century (1.8 mm/yr)
y = 1.8841x - 3738.3
R² = 0.7593
1.88 ± 0.11 mm per yr or 0.63 ft (7.5") per century
Elevation (mm, MSL)
Time (years)
Data courtesy of NOAA CO-OPS, www.tidesandcurrents.noaa.gov
P.A. Slovinsky, Maine Geological Survey, January 21, 2014

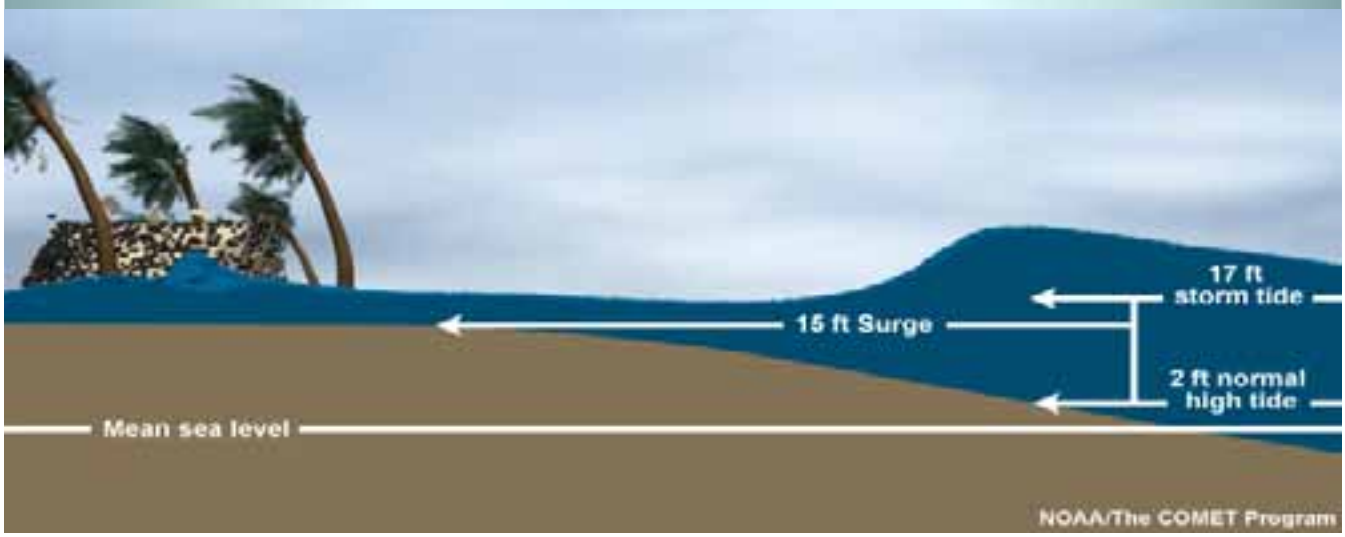

Sea Level, Portland, Maine
1993-2013 (through December 2013)
In the last 20 years at Portland tide gauge, SLR has been:
• Rising 130% faster than the historical 1.9 mm/yr (1912-2013)
• Rising faster than global changes measured by satellite altimetry, but just within the error bars (3.2 mm/yr)
y = 4.3739x - 8731.4
R² = 0.4044
4.38 ± 1.21 mm per yr or 1.43 ft (17.2") per century
Elevation (mm, MSL)
Year
Data courtesy of NOAA CO-OPS, www.tidesandcurrents.noaa.gov
Peter Slovinsky, Maine Geological Survey, January 21, 2014


Observed
Scenarios
Global Sea Level Rise Scenarios for the United States
National Climate Assessment (12/6/2012)
Global Mean Sea Level Rise (cm above 1992)
200
160
120
80
40
0
-40
1900
1950
2000
2050
2100
Year
Because of the potential range of scenarios, it is recommended to use a "scenario" based approach for planning purposes
Highest
(2.0 m, 6.6 ft)
*Combines maximum warming, thermal expansion, and possible ice sheet loss from semi-empirical models
Intermediate-High
(1.2 m, 3.9 ft)
*Average of high end global predictions, combines recent ice sheet loss and thermal expansion
Intermediate-Low
(0.5 m, 1.6 ft)
*Includes only thermal expansion from warming from IPCC AR4.
Lowest
(0.2 m, 0.7 ft)
* Historical trend continued; no additional thermal expansion from warming
GSLRS USNCA, 12/6/2012
USGS
SERDP

DEAD END
What about storm tides and storm surges?

So what is storm surge?

Storm surge is an abnormal rise of water generated by a storm, over and above the predicted astronomical tides. Storm surge should not be confused with ***storm tide, which is defined as the water level rise due to the combination of storm surge and the astronomical tide*** (National Hurricane Center)

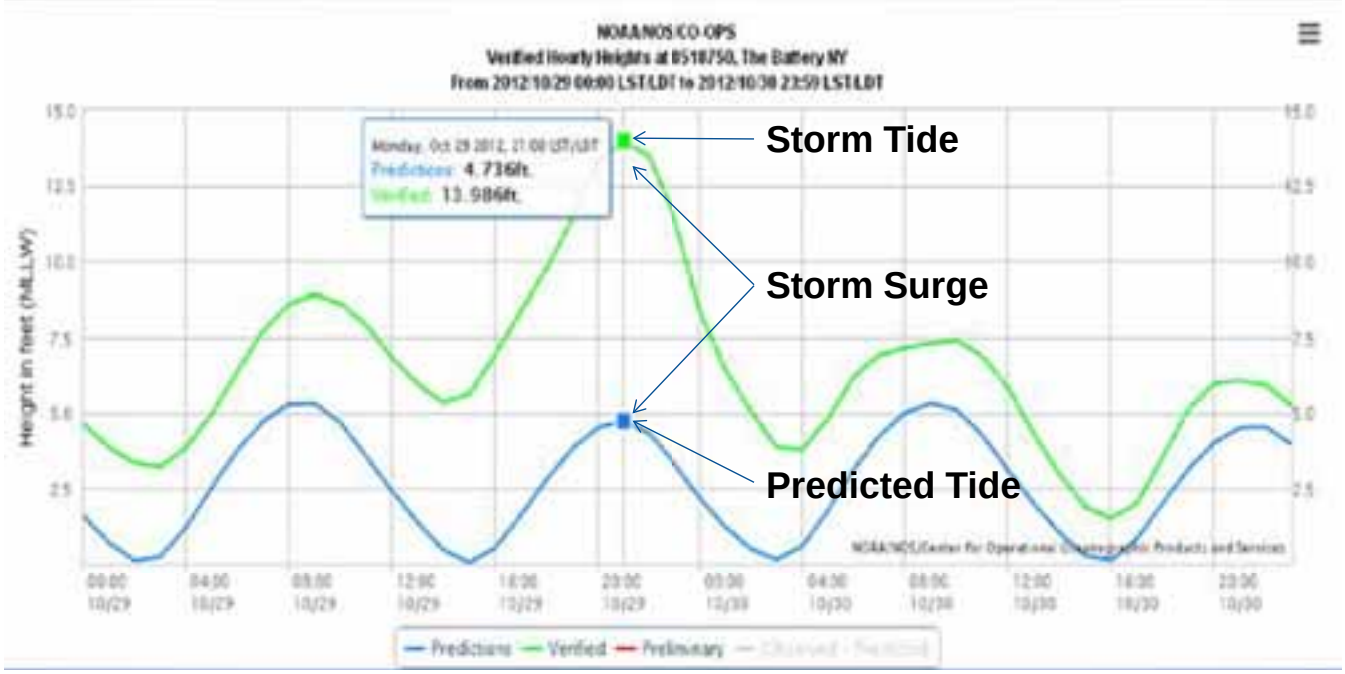


The Battery, NY during Superstorm Sandy

Predicted Tide = 4.74 ft MLLW

Storm Tide = 13.99 ft MLLW

Storm Surge = 9.3 ft



Portland Storm Surges (1912-2012) (at any tide)

Time Interval (years)	Surge Height (feet)
1 (100 %)	1.8
2 (50%)	2.4
5 (20%)	3.3
10 (10 %)	4.0
20 (5%)	4.7
25 (4 %)	4.9
50 (2 %)	5.6
75 (1.3 %)	6.0
100 (1%)	6.3

P.A. Slovinsky, MGS

Because of Maine's tidal variation, it's *the combination of astronomical tide and "storm surge" that are of concern* (NHC calls this overall water level the **"storm tide"**)

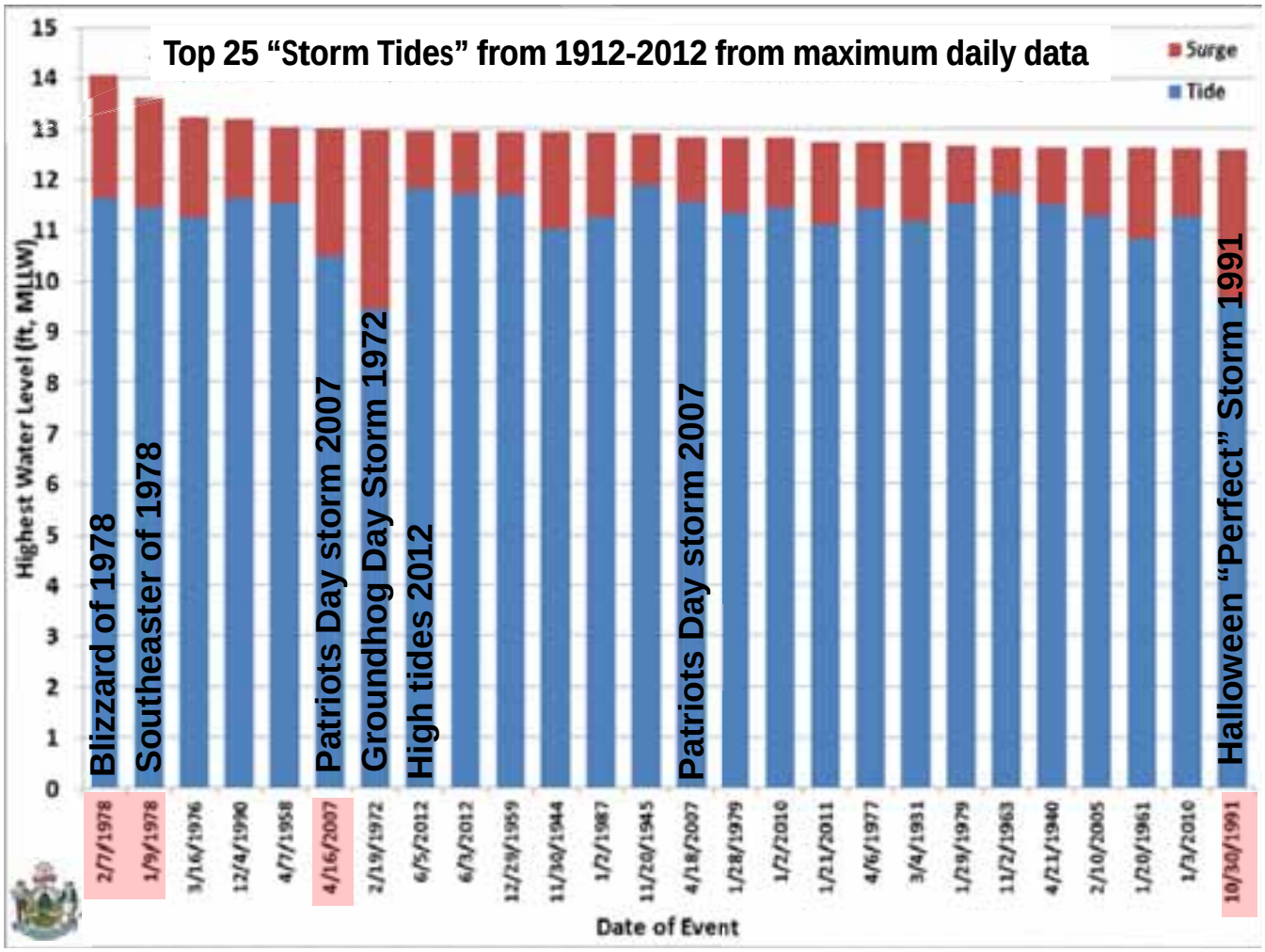
Portland "Storm Tides", 1912-2012

Interval (yrs)	"Storm Tide" Level (ft, MLLW)
1 (100 %)	11.7
5 (20%)	12.6
10 (10 %)	12.9
25 (4 %)	13.4
50 (2 %)	13.7
100 (1 %)	14.1

Portland "Storm Tides", 1912-2012

Interval (yrs)	"Storm Tide" Level (ft, MLLW)
1 (100 %)	11.7
5 (20%)	12.6
10 (10 %)	12.9
25 (4 %)	13.4
50 (2 %)	13.7
100 (1 %)	14.1

1 foot difference!



Sea Level and Storm Surge Summaries

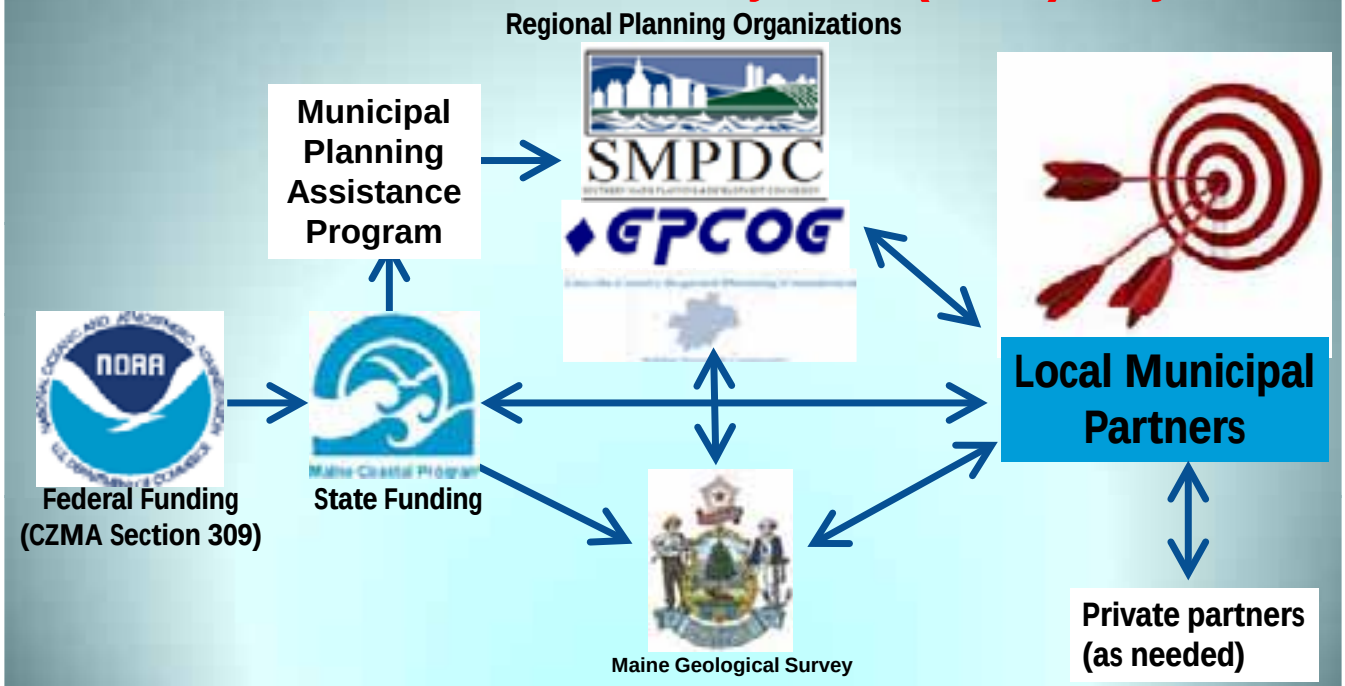
- Latest scientific predictions for SLR: 1 ft 2050, 2-3 ft *but potentially more* by 2100; the **State of Maine has adopted 2 feet as a middle of the road prediction by the year 2100 for areas with regulated Coastal Sand Dunes**.
- There is only about a <u>one foot difference</u> between the "10 year" event and the "100 year" event ; thus, **a one-foot rise in sea level by 2050 would cause the "100 year" event to come about every 10 years because sea level rise significantly lowers the recurrence interval of storms.**
- For vulnerability and adaptation planning, we recommend using a "Scenario Based Approach" using 1 foot, 2 feet, 3.3 feet, and 6 feet on top of the highest annual tide (HAT). **These scenarios also correspond well with evaluating** *potential impacts from storm surges that may coincide with higher tides today.*

Municipal Sea Level Rise Planning in Maine…

Bringing it down to the local level

Proactive Engagement

Coastal Hazard and Resiliency Tools (CHRT) Project



Some Ongoing Adaptation Efforts Transferable to Other Downtown Areas (not just coastal areas!)

- Sea Level Adaptation Working Group (SLAWG)
- Town of Damariscotta
- City of Portland
- Town of York

Saco Bay Sea Level Adaptation Working Group

Local Participation:

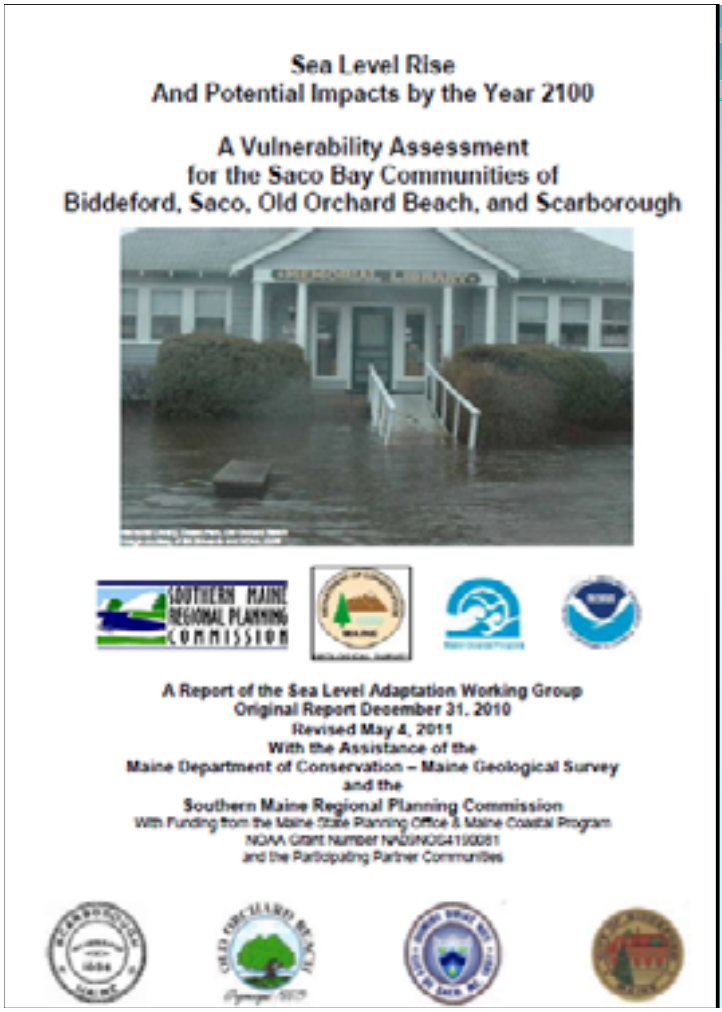
Planning, Science, Technical Support:

SMPDC

Maine Geological Survey

Additional Support Funding:

Maine Coastal Program



Sea Level Rise
And Potential Impacts by the Year 2100

A Vulnerability Assessment
for the Saco Bay Communities of
Biddeford, Saco, Old Orchard Beach, and Scarborough

A Report of the Sea Level Adaptation Working Group
Original Report December 31, 2010
Revised May 4, 2011
With the Assistance of the
Maine Department of Conservation – Maine Geological Survey
and the
Southern Maine Regional Planning Commission
With Funding from the Maine State Planning Office & Maine Coastal Program
NOAA Grant Number NA09NOS4190081
and the Participating Partner Communities

The first effort: SLAWG Assessment

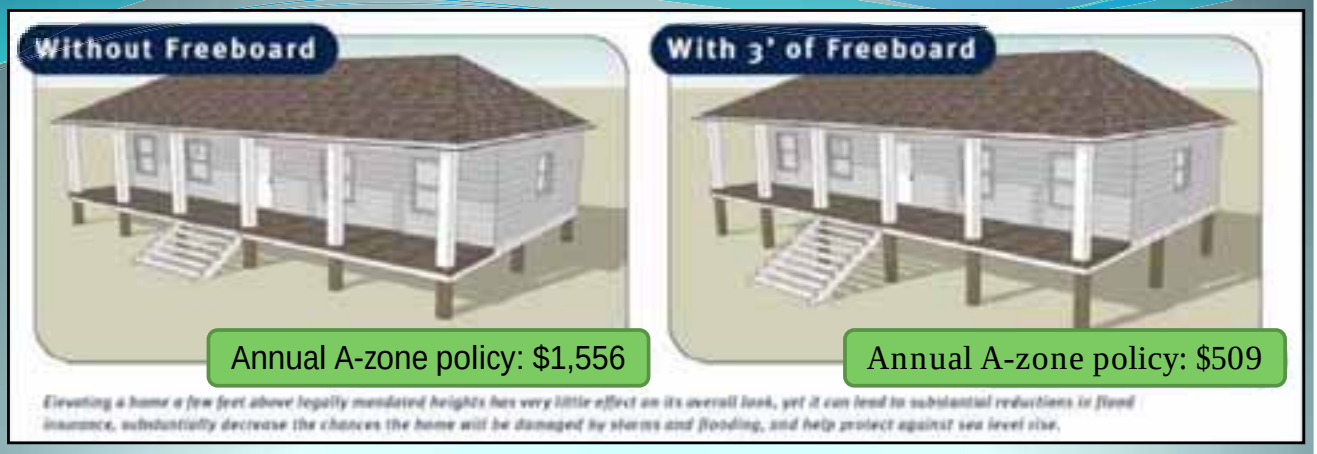
Vulnerability Assessment of the built and natural environments to 2 feet of SLR (agreed upon by the Group) on top of the Highest Annual Tide (HAT) and the historic 1% ("100-year") storm event (February 7, 1978 storm) for each community in Saco Bay.

Identified potentially **vulnerable buildings, transportation infrastructure, and wetland migration areas** and made **recommendations for adaptation.**

Strategy: Incorporating more freeboard into municipal floodplain ordinances to account for SLR or storms

The City of Saco made ordinance changes to increase freeboard to <u>three feet</u> above the 100-year Base Flood Elevation (BFE).

"Low Hanging Fruit" : Flood Insurance Premium Benefits



Scenario	V-zone			A-zone		
	Annual Policy	Savings (%)	30-year savings	Annual Policy	Savings (%)	30-year savings
No Freeboard	$7,747	$0 (0%)	$0	$1,556	$0 (0%)	$0
1 ft freeboard	$5,331	$2,416 (31%)	$72,480	$799	$757 (49%)	$22,710
2 ft freeboard	$3,648	$4,099 (53%)	$122,970	$574	$982(63%)	$29,460
3 ft freeboard	$2,635	$5,112 (66%)	$153,360	$509	$1,047(67%)	$31,410

Based on 2012 rates for a one-floor residential structure, no basement, post-FIRM, $1,000 deductible with $250,000 coverage and $100,000 contents.

Flood policy rating quotes graciously provided to Maine Floodplain Management Program by Chalmers Insurance Group: www.chalmersinsurancegroup.com

Why increase freeboard?

- Is a **simple cost-effective means to protect buildings** from existing ocean storms and surges and accommodate for potential future sea level rise
- Is **only triggered by substantial improvement, new construction, or damage threshold requirements <u>that already exist</u>**
- Will only impact structures that **would need to meet minimum freeboard requirements anyway**
- Will **not substantially increase the costs of elevating a structure** (three feet vs. one foot, 0.25-1.25% of cost!)

Why increase freeboard?

- Will **result in lower Flood Insurance Rate premiums** for property owners
- May result in a **better FEMA Community Rating System (CRS)**, which may further reduce insurance premiums by a certain percentage
- **Conforms with newer FEMA and ASCE guidance** regarding coastal construction in tidal floodplains
- **Sets a model** for other communities to follow

So what are Municipalities doing?

Town of Damariscotta:

- MGS completed **an initial vulnerability assessment** to sea level rise and storm surge as part of the Lincoln County Coastal Hazard Resiliency Tools Project
- Immediately applied for and received Maine Coastal Program Funding for a project to **investigate adaptation strategies** for downtown Damariscotta
- Put together a **project oversight committee** (Town Manager, business owners, environmentalists, regional planner, state geologist)
- Released a **general RFP for engineering services**: *Adaptation Options to Protect Downtown Damariscotta, Maine Against Floods, Storm Surges, and Sea Level Rise*

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LINCOLN COUNTY
REGIONAL PLANNING COMMISSION

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BUSINESS DIRECTORY

UPCOMING DEADLINES

There are no deadlines at this time.

EVENTS

09.19 | August Full Board Meeting
09.18 | September Executive Committee Meeting

CURRENT PROJECTS

Arts & Culture
GIS Subcommittee

Sea Level Rise Scenarios

LINCOLN COUNTY SEA LEVEL RISE

Lincoln County Sea Level Rise - Coastal Hazard Study

Lincoln County Regional Planning Commission
Lincoln County Commission
Maine Geological Survey
Maine Coastal Program

Maine Coastal Program

This presentation was prepared by the LCRPC under award NOAA CZM NA11NOS4190077 and NA11NOS4190188 to the Maine Coastal Program from the National Oceanic and Atmospheric Administration, U.S. Department of Commerce. The statements, findings, conclusions, and recommendations are those of the author(s) and do not necessarily reflect the views of the National Oceanic and Atmospheric Administration or the Department of Commerce.

c.org/damariscotta-sea-level-rise-scenarios

Friends | Getting Started | Suggested Sites | Tech Talk | Web Slice Gallery | [photo] | Khan Academy | Imported From IE | PNMOC WWMAP: N AR

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UPCOMING DEADLINES

09.27 | Boating Infrastructure Grant Program
10.04 | MDOT Small Harbor Improvement Program
10.04 | RFP for LCRPC Brownfield Assessment Grant
11.01 | Maine Coastal Program's Shore and Harbor and Coastal Communities Grants

EVENTS

10.03 | Health Insurance Forums
10.08 | Forum to Focus on Visual Arts in the Community
10.15 | LCRPC October Full Board Meeting

DAMARISCOTTA SEA LEVEL RISE SCENARIOS

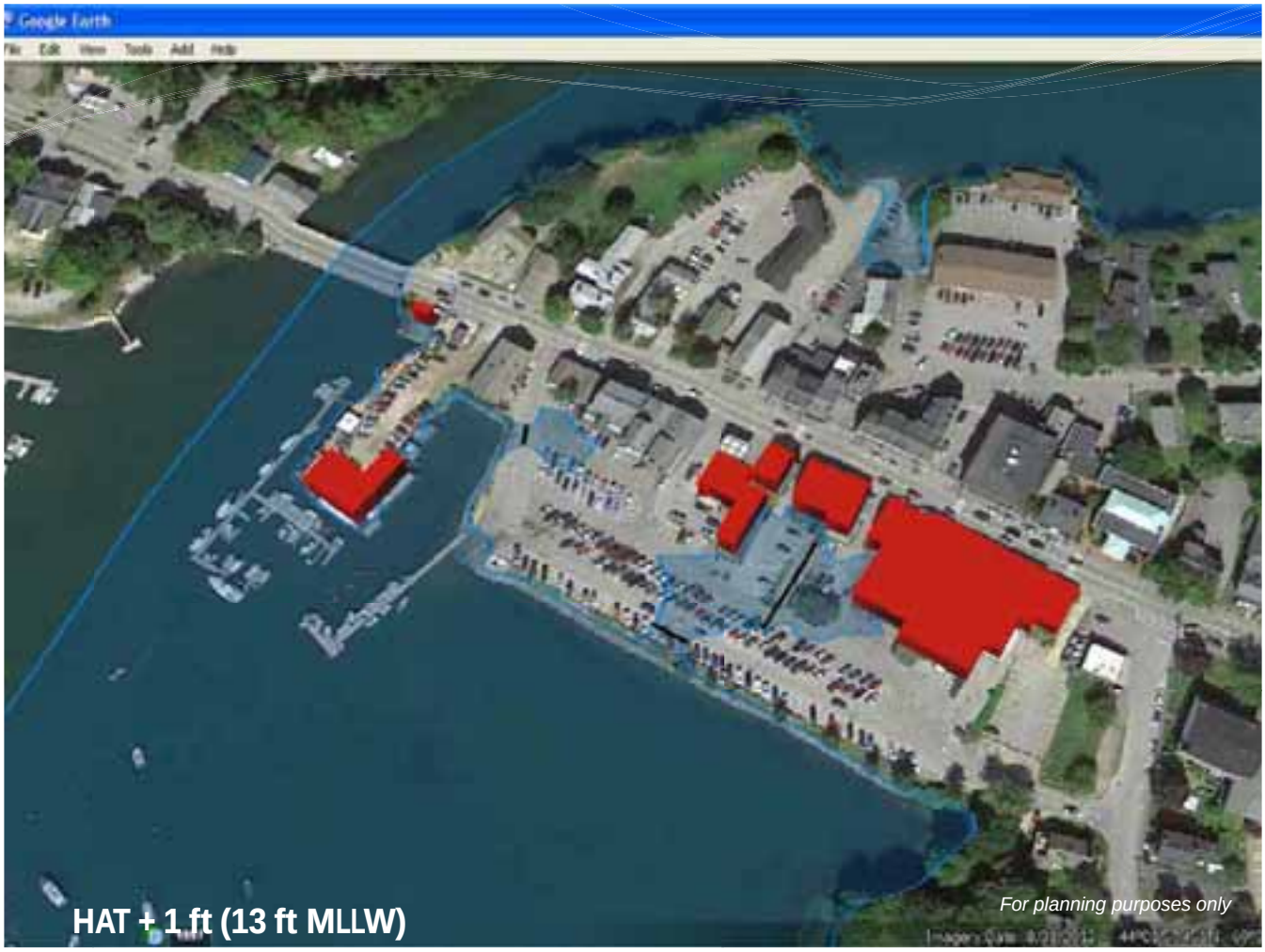
The following scenarios were developed by the Maine Geological Survey in conjunction with the Lincoln County Regional Planning Commission for general planning purposes only. They are based on a "bathtub" simulation model and do not take into account impacts associated with erosion, accretion, or wave action. Though local, regional, and national data indicates that sea level is continuing to rise, scientific authorities cannot predict with certainty the precise increase that will be experienced along Lincoln County's tidal shoreline. Communities are advised to consider the information provided by this project as part of a "scenario-based approach" and create adaption strategies to mitigate impacts on natural systems, public infrastructure and facilities and existing and future development.

Please note the following when viewing the scenarios:

- When a road segment or a rail line is predicted to become inundated it is usually highlighted in black or gray. On occasion the highlighting may be absent so the best indicator of inundation is whether water is shown crossing a road or rail line.

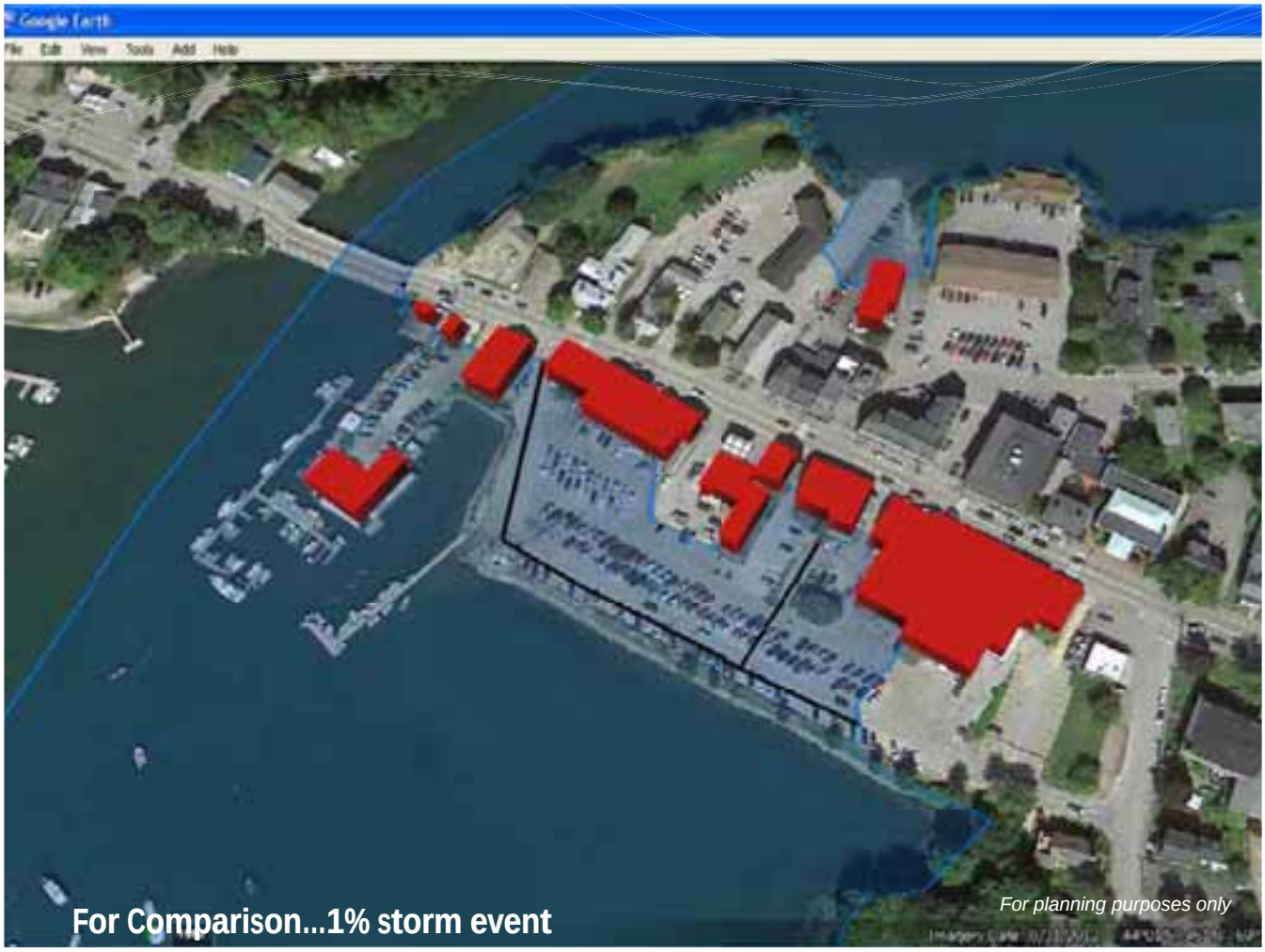
- Buildings are highlighted in red when water is predicted to be present at the building's foundation during a given scenario. The scenarios themselves do not present information on the depth of water, only that some level of water is present at the building's foundation.

HAT (12 ft MLLW)



HAT + 1 ft (13 ft MLLW)

Google Earth
File Edit View Tools Add Help
HAT + 2 ft (14 ft MLLW)
For planning purposes only


Google Earth
File Edit View Tools Add Help
For Comparison...1% storm event
For planning purposes only

Google Earth
HAT + 3.3 ft (15.3 ft MLLW)
For planning purposes only

Google Earth
HAT + 6 ft (18 ft MLLW)
For planning purposes only

So what are Municipalities doing?

City of Portland

- Portland Society of Architects held *Sustainable Portland by 2030: Rising Tides, a Symposium on Sea Level Rise (2011)*
- City **passed a resolve** to study the impacts of sea level rise on the community, *Resolution Supporting the Development of a sea level rise adaptation plan (2011)*
- MGS completed **initial vulnerability assessment** as part of the Coastal Hazard Resiliency Tools Project (2012)
- NEEFC completed initial COAST modeling and a day-long workshop on adaptation for Back Cove area (2012)
- Catalysis Adaptation Partners, LLC completed a **COAST analysis** of **potential economic impact of storm surge and sea level rise for Commercial Street** for 2050, 2075, and 2100 (2013)

Existing and Potential Future Flooding along Commercial St, Portland

Based on Flood Stage

Scenario	Flood Stage Elevation (MLLW)	# times flood stage exceeded	% of Total High Tides	Hours of Inundation (above flood level)
2011 Year	12 ft	11	1.6%	8
+0.3 m (1 ft) SLR	11 ft	98	13.9%	141
+0.6 m (2 ft) SLR	10 ft	281	39.8%	570
+1.0 m (3.3 ft) SLR	8.7 ft	612	86.7%	1759
+1.8 m (5.9) ft SLR	6.1 ft	702	99.4%	3782

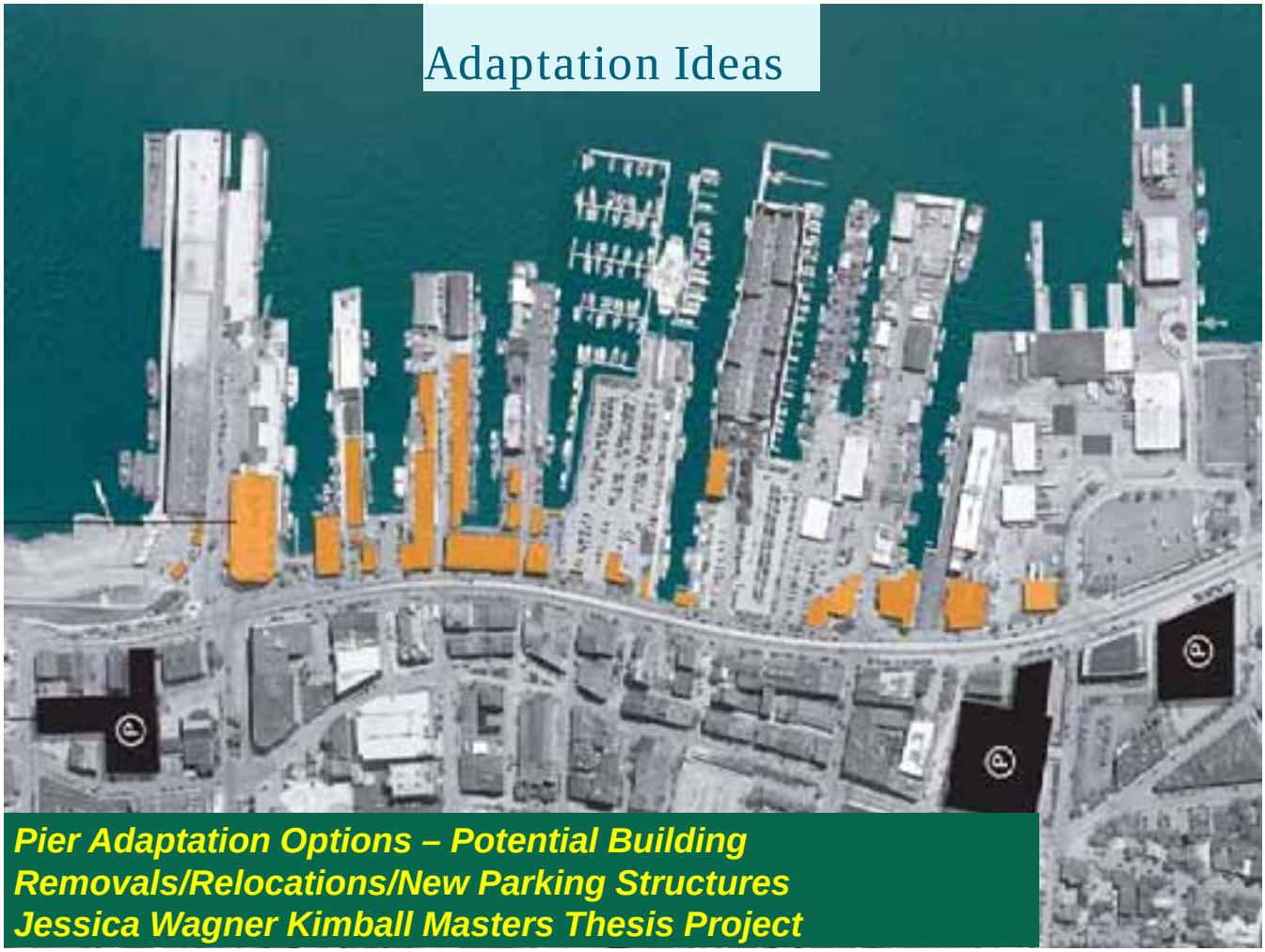
- Flood stage is indicated as 12 feet MLLW (source: NWS)
- Based only on data from 2011
- NOAA CO-OPs Inundation Analysis Tool

Commercial Street East - COAST Model Results, 100 Year Storm in 2050
Total Elevation of Flooding – 11.5 Feet (NAVD 88)

One-Time Storm Damage for This Event:	$16.0 Million
Cumulative Damage Up to This Scenario Year:	$32.9 Million
Value of Buildings on Parcels Lost to Sea Level Rise, by This Scenario Year:	$8.7 Million

Buildings Damaged by Storm Surge from this Event (Height of Bar indicates relative damage amount)
Buildings Permanently Inundated due to Sea Level Rise by this Year, if No Action is Taken

Adaptation Ideas



Pier Adaptation Options – Potential Building Removals/Relocations/New Parking Structures
Jessica Wagner Kimball Masters Thesis Project

So what are Municipalities doing?

Town of York

- MGS and SMRPC (now SMPDC) completed initial outreach to the community on some of the potential impacts of sea level rise in York (2009)
- MGS and SMRPC completed a vulnerability assessment as part of the Coastal Hazard Resiliency Tools Project (2012)
- Town held numerous public hearings on sea level rise and storm surge impacts, including with local decision-makers
- SMRPC and MGS completed a chapter specific to sea level rise for the Town's Comprehensive Plan update that included an inventory, analysis, and recommendations
- **York adopted the Comprehensive Plan Chapter update on sea level rise** by Town vote (November 2013)

This has become a readily transferable model that could be used by any community (and already has…Bowdoinham)

Adaptation to Sea Level Rise Chapter

Comprehensive Plan
Inventory & Analysis

November 5, 2013

Planning Board of York, Maine at time of chapter adoption:
Todd Frederick, Chair
Al Cotton, Vice Chair
Lew Stowe, Secretary
Brud Weger
Peter Smith, Alternate

Questions?

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