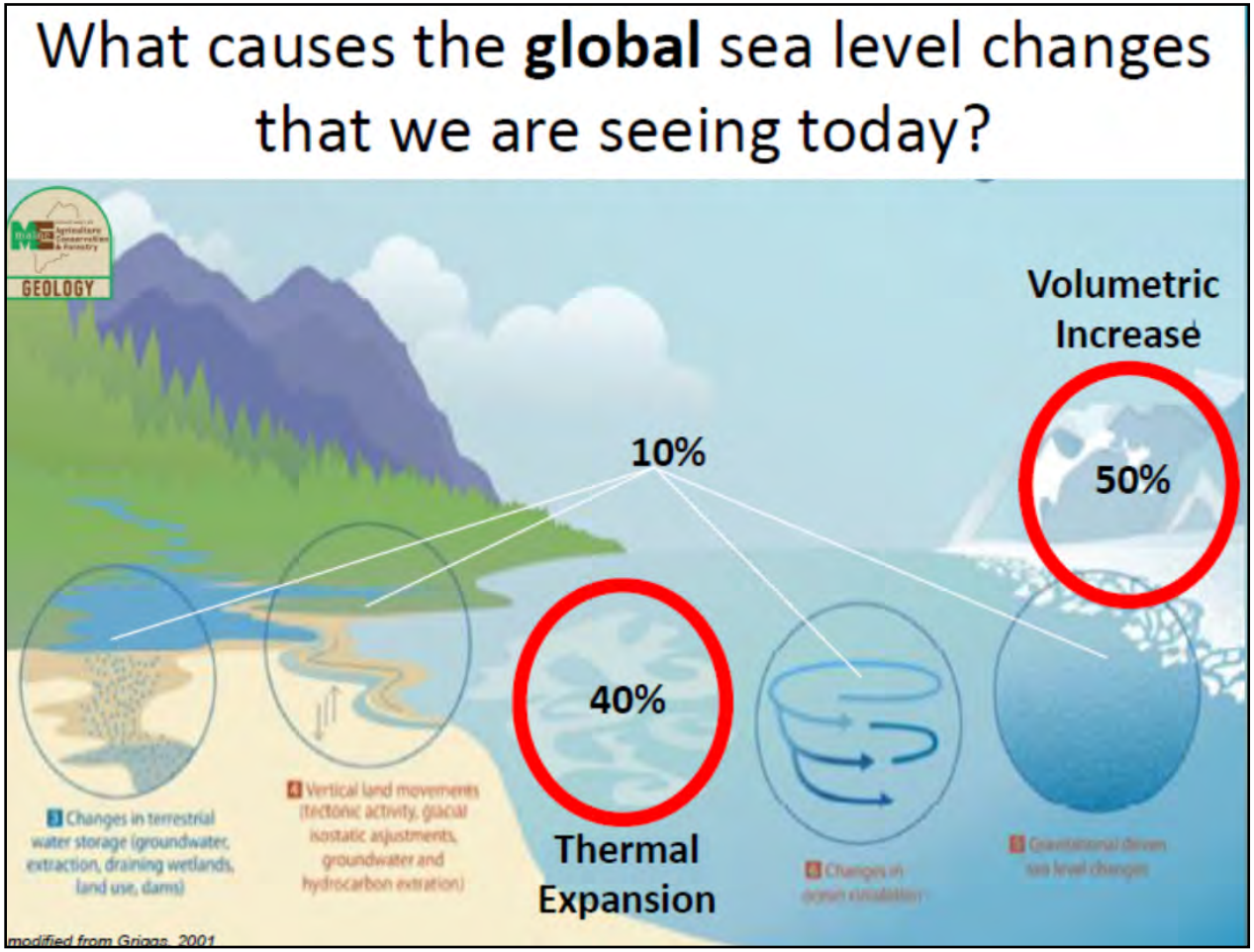
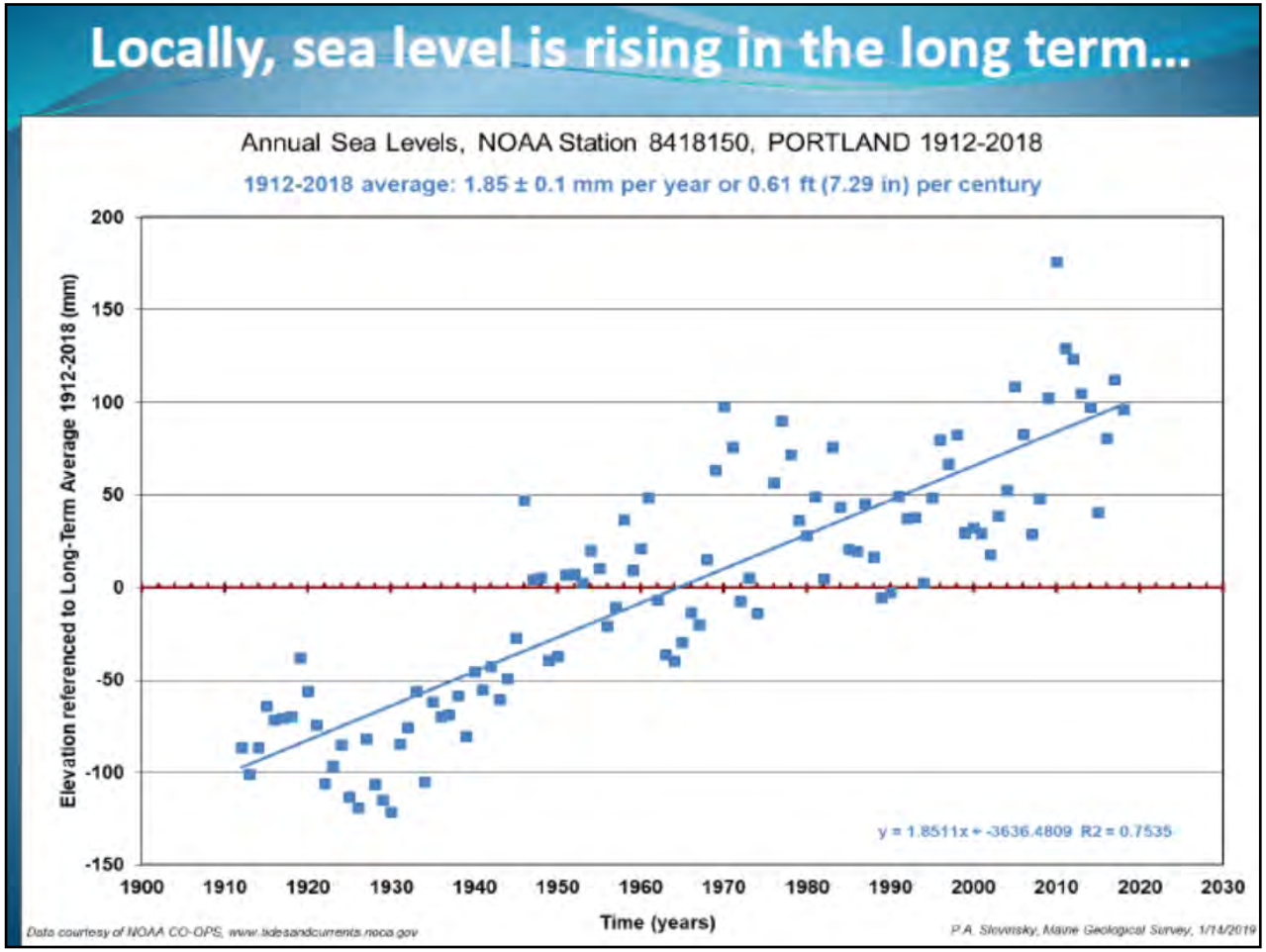
SEA LEVEL RISE: IMPACTS AND PLANNING FOR RESILIENCE IN COASTAL LINCOLN COUNTY

Funding for this presentation was provided to the Lincoln County Regional Planning Commission under award CZM NA18NOS4097419 to the Maine Coastal Program for its FY19 Land Use Technical Assistance contract from the National Oceanic and Atmospheric Administration (NOAA) , U.S. Department of Commerce.



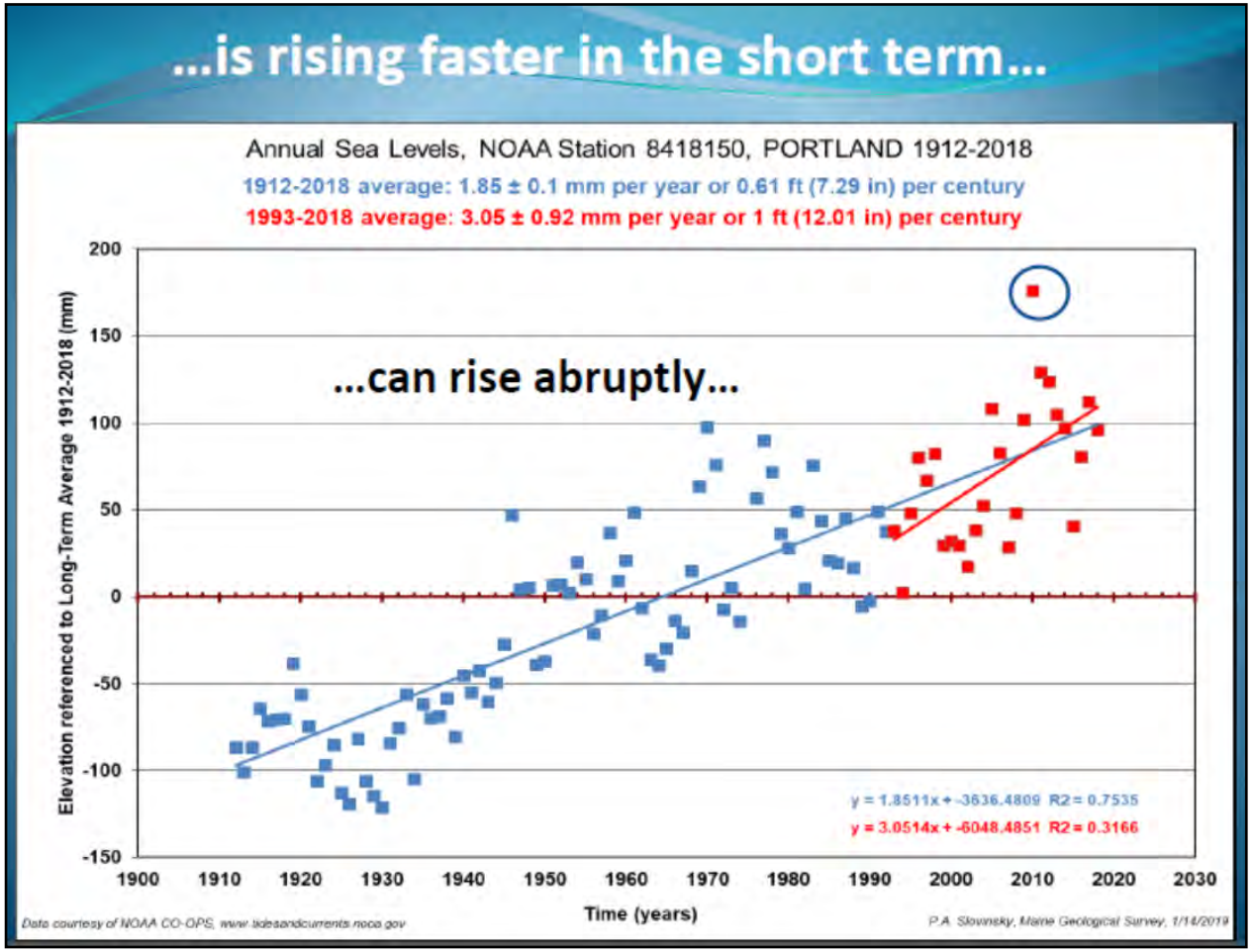
Graphics Courtesy of Peter A. Slovinsky, Marine Geologist, Maine Geological Survey

Locally, sea level is rising in the long term…



maine Department of Agriculture Conservation & Forestry
GEOLOGY

Graphics Courtesy of Peter A. Slovinsky, Marine Geologist, Maine Geological Survey



maine Department of Agriculture Conservation & Forestry
GEOLOGY

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maine Department of Agriculture Conservation & Forestry
GEOLOGY

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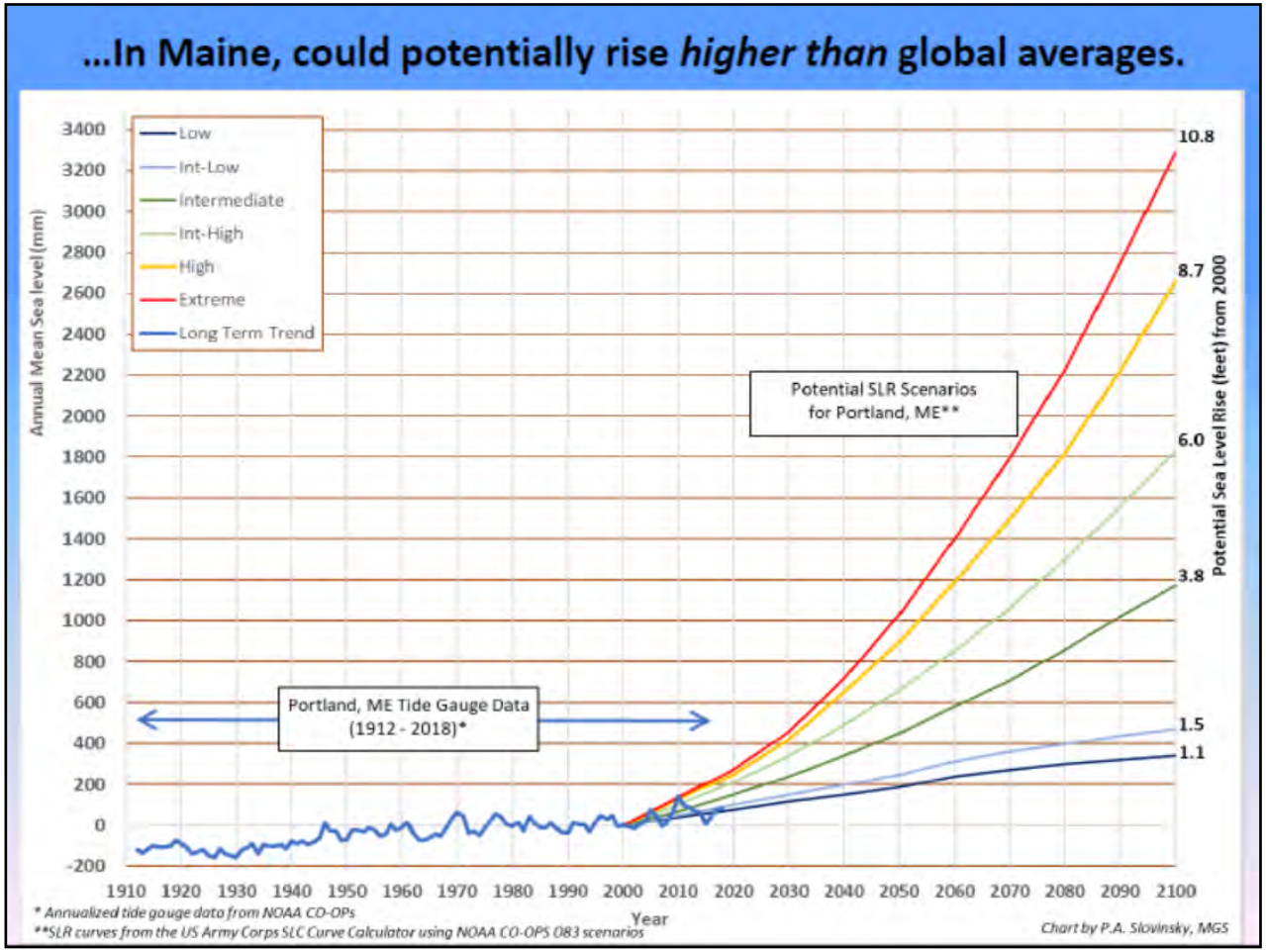
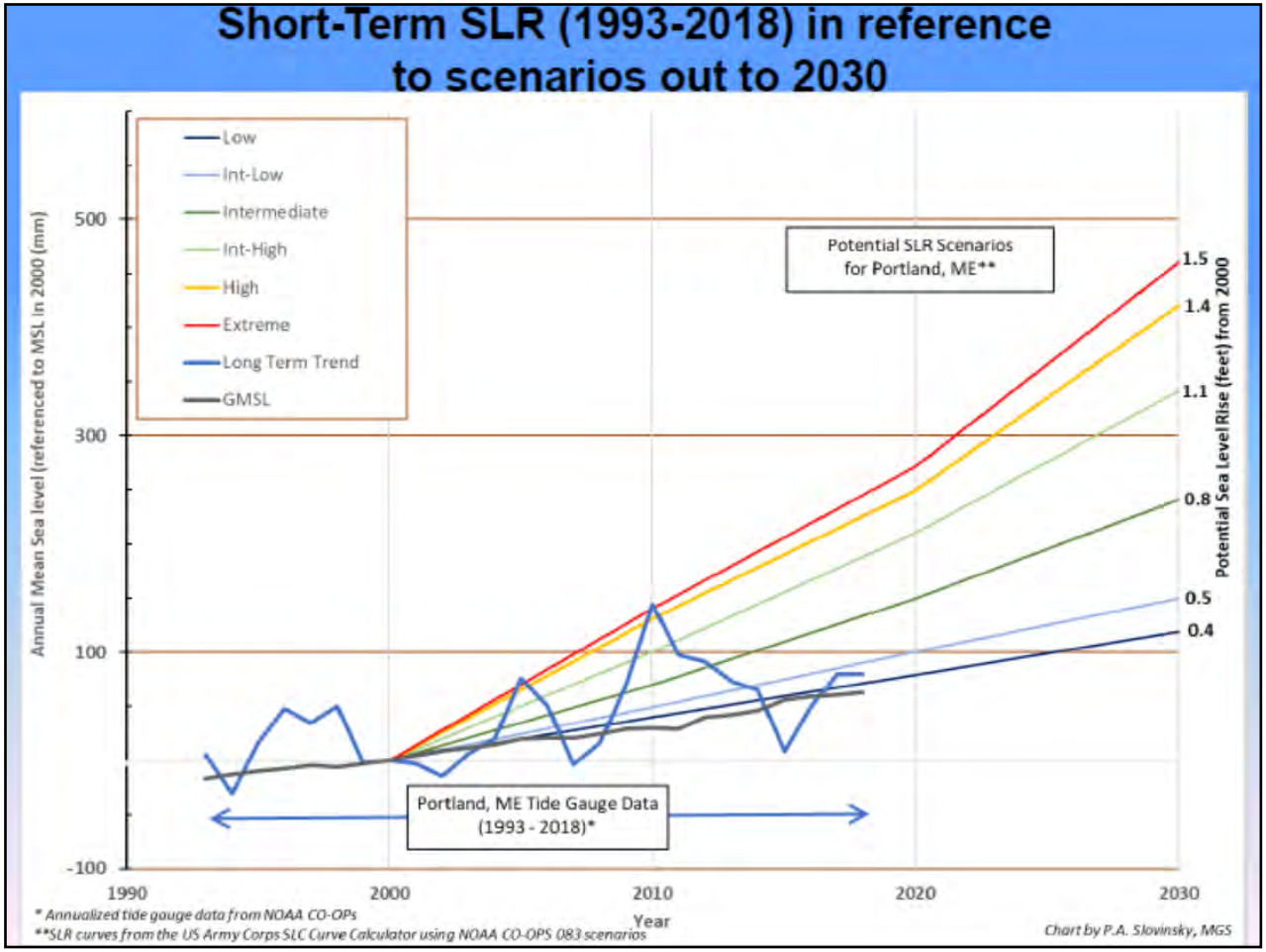


maine Department of Agriculture Conservation & Forestry
GEOLOGY

Graphics Courtesy of Peter A. Slovinsky, Marine Geologist, Maine Geological Survey

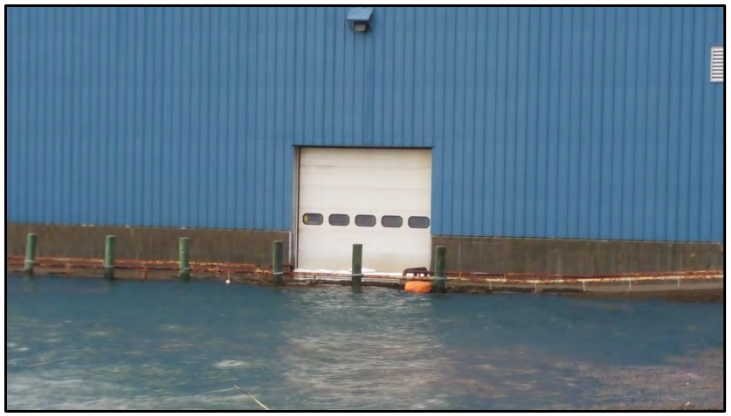


Graphics Courtesy of Peter A. Slovinsky, Marine Geologist, Maine Geological Survey

EXISTING CONDITIONS in LINCOLN COUNTY

WINTER STORM GRAYSON – JANUARY 4, 2018

FEBRUARY 21, 2018 STORM



MARCH 2, 2018 HIGH TIDE - DAMARISCOTTA

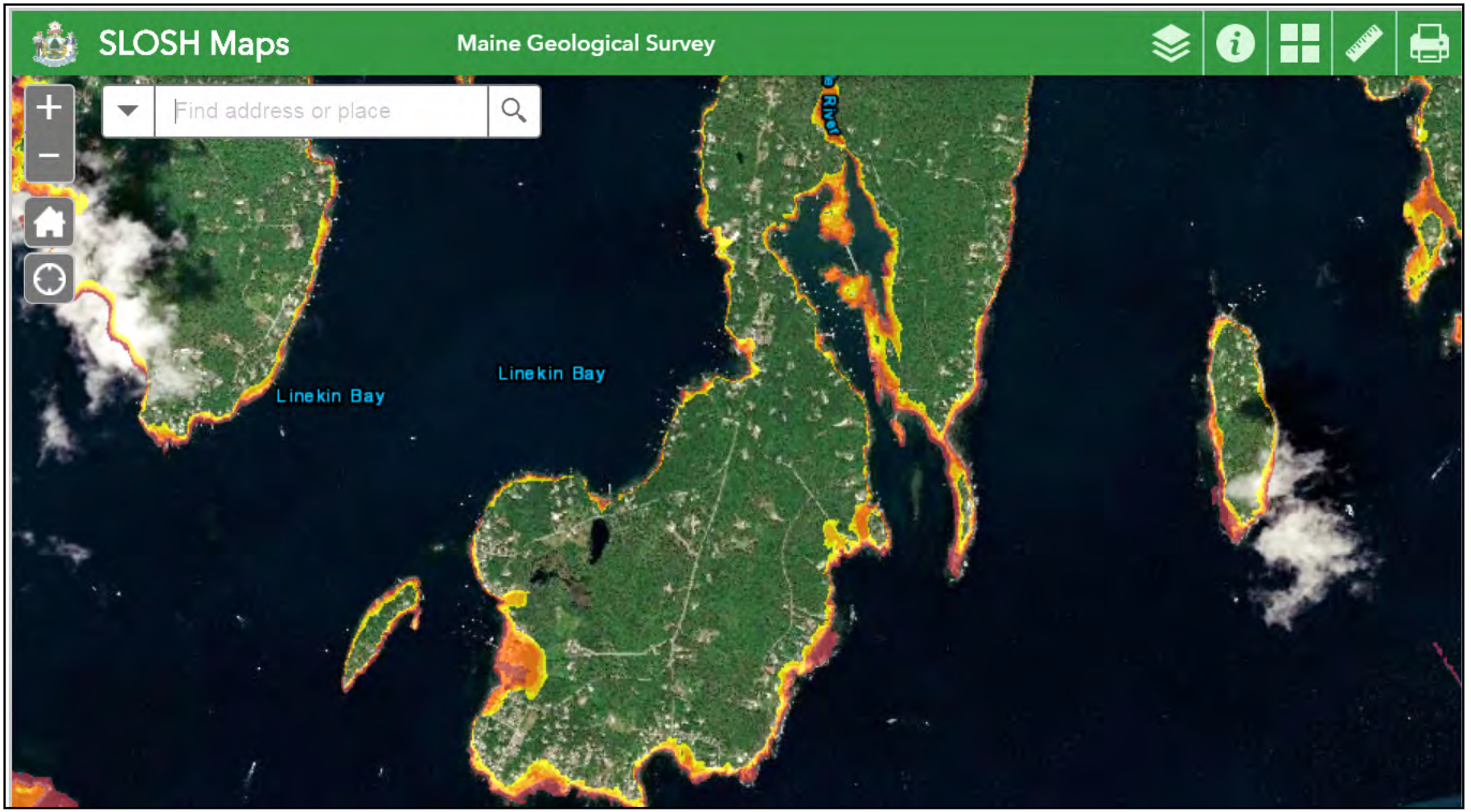
Photos Courtesy Lincoln County News

JANUARY 22, 2019 HIGH TIDE- BOOTHBAY HARBOR

Photos courtesy Stephen Dickson

CAPITOL ISLAND, SOUTHPORT
MARCH 2, 2018 STORM

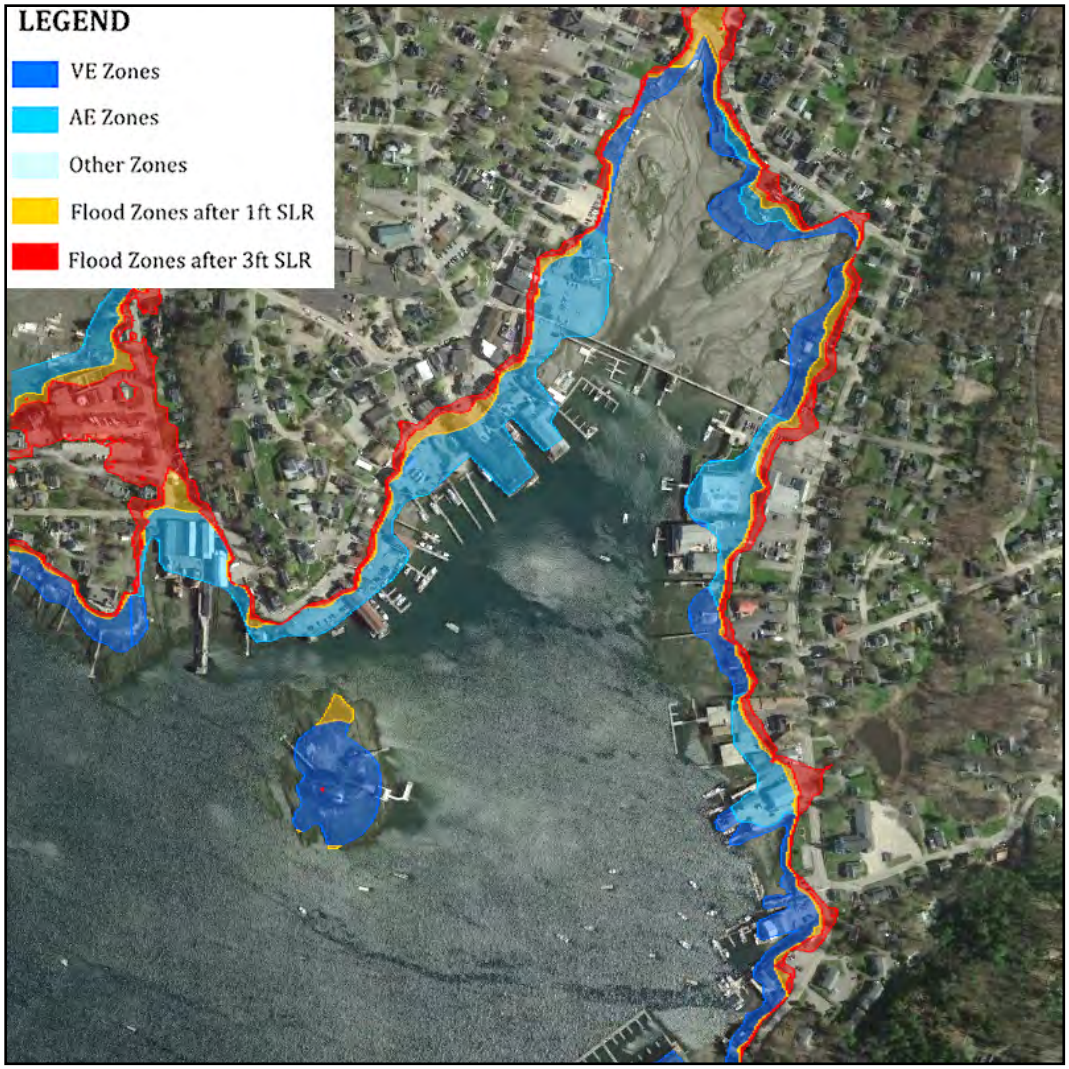
EXISTING CONDITIONS WITH CATEGORY 1 – 4 HURRICANE FLOODING
OCEAN POINT, BOOTHBAY



1% STORM FLOODING AND SEA LEVEL RISE

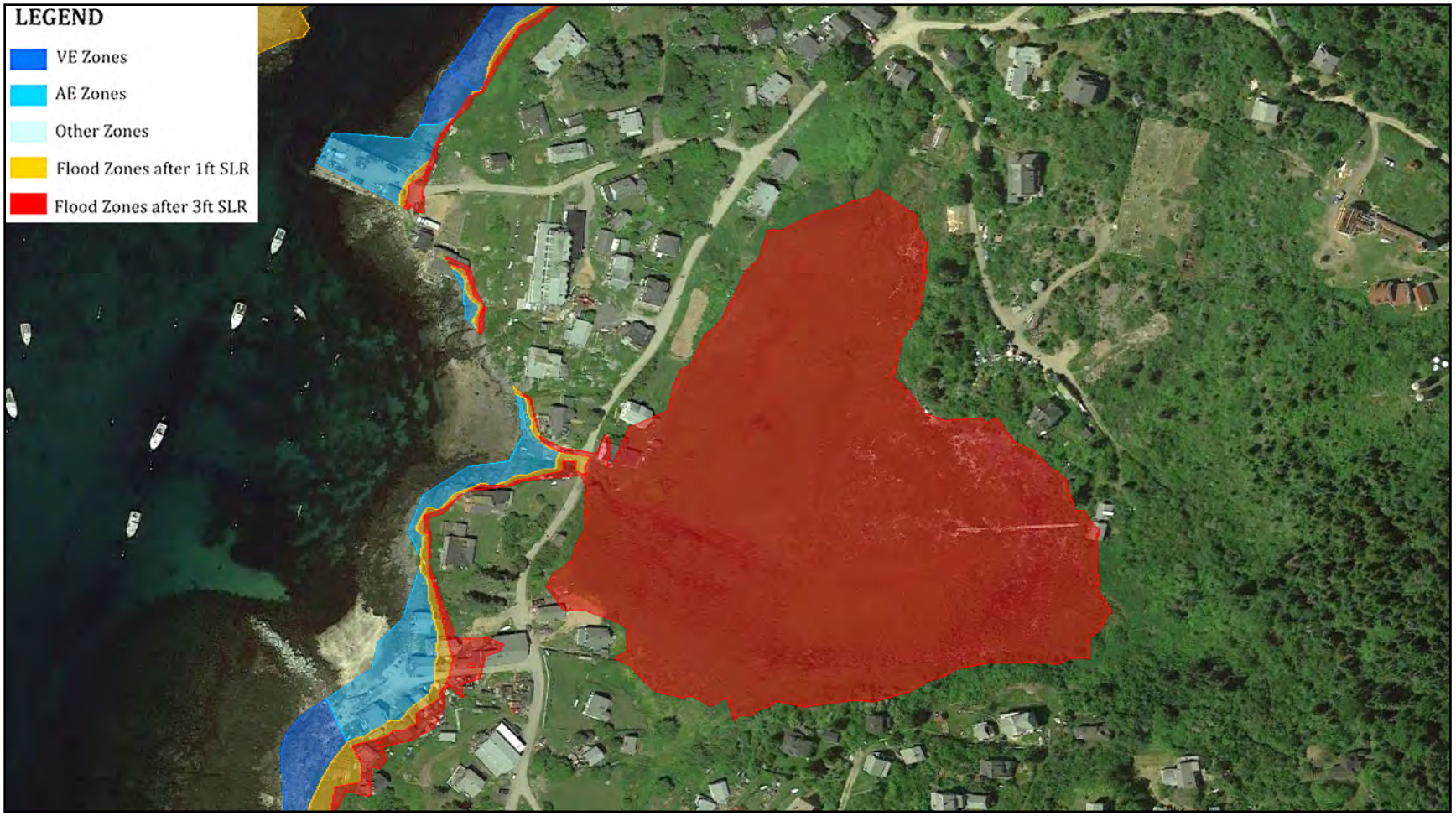
1% STORM FLOODING AND SLR IN DOWNTOWN DAMARISCOTTA

1% STORM FLOODING AND SLR IN DOWNTOWN BOOTHBAY HARBOR

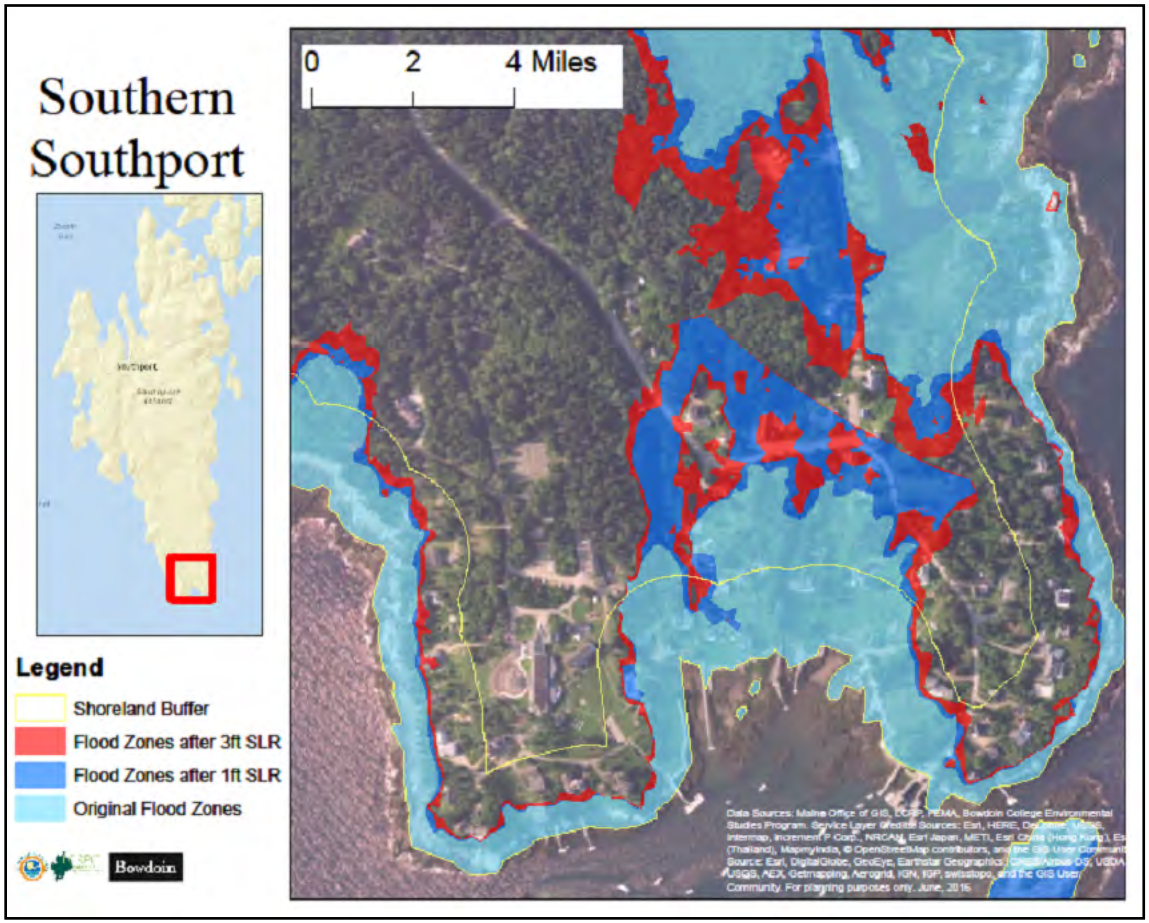


1% STORM FLOODING AND SLR IN WISCASSET

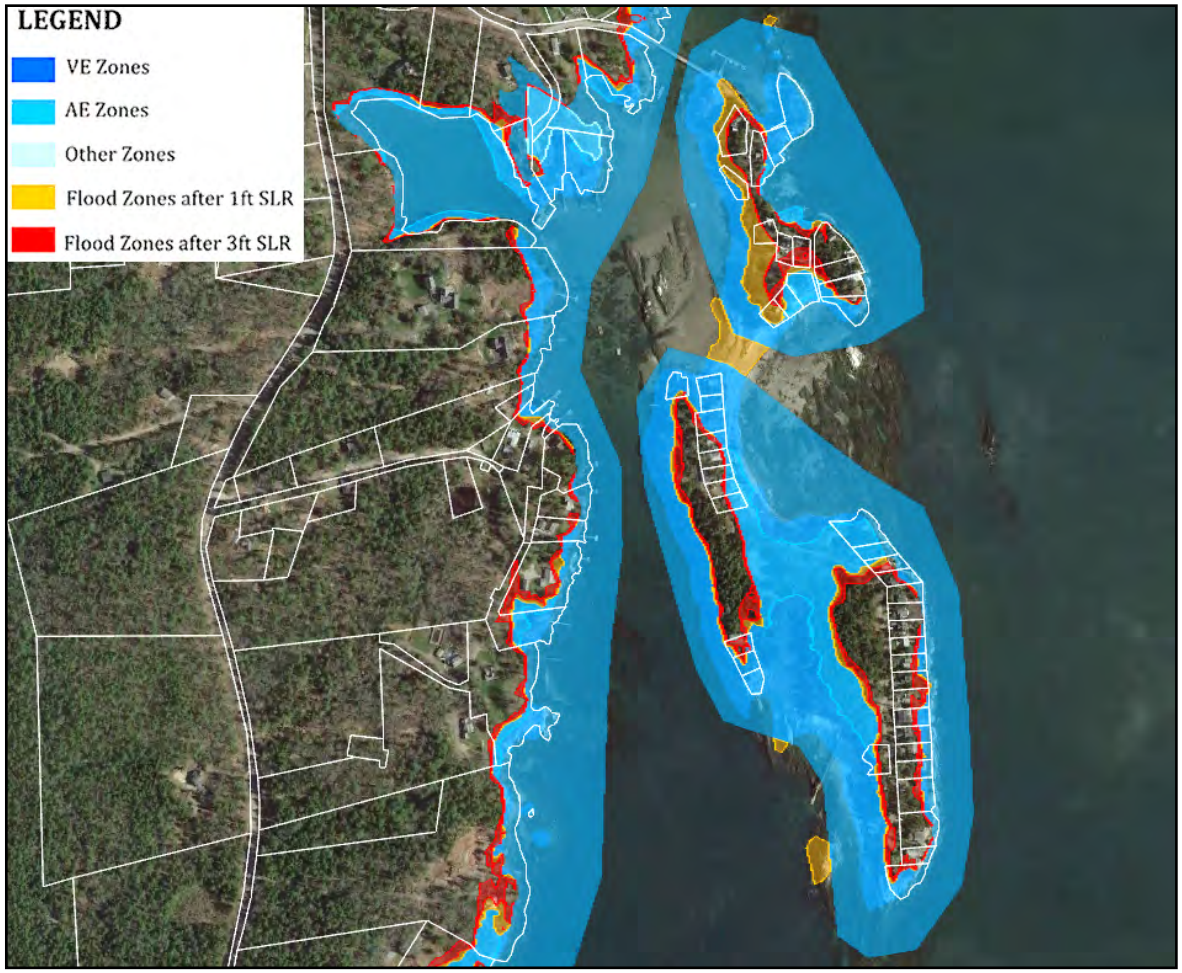
1% STORM FLOODING AND SLR ON MONHEGAN ISLAND



1% STORM FLOODING AND SEA LEVEL RISE IN SOUTHPORT ISLAND



1% STORM FLOODING AND SEA LEVEL RISE
CAPITOL ISLAND, SOUTHPORT



PLANNING FOR RESILIENCE

LINCOLN COUNTY COASTAL PLANNING PROJECTS

http://lcrpc.org/coastal-projects-planning

Areas of Potential Inundation from a Category 1 Hurricane
Lincoln County, Maine

Lincoln County Regional Planning Commission
August 2015

The purpose of this project is to visualize coastal areas in Lincoln County that may potentially be inundated by a Category 1 Hurricane under worst-case conditions of forward speed, trajectory and tide level. This data was developed in order to help support emergency planning and preparedness efforts in Lincoln County.

The project was developed in association with the Maine Geological Survey and designed for use by the Lincoln County Emergency Management Agency and local Emergency Management Staff to assist in disaster preparedness and response. It was funded in part by a grant from the Maine Coastal Program 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.

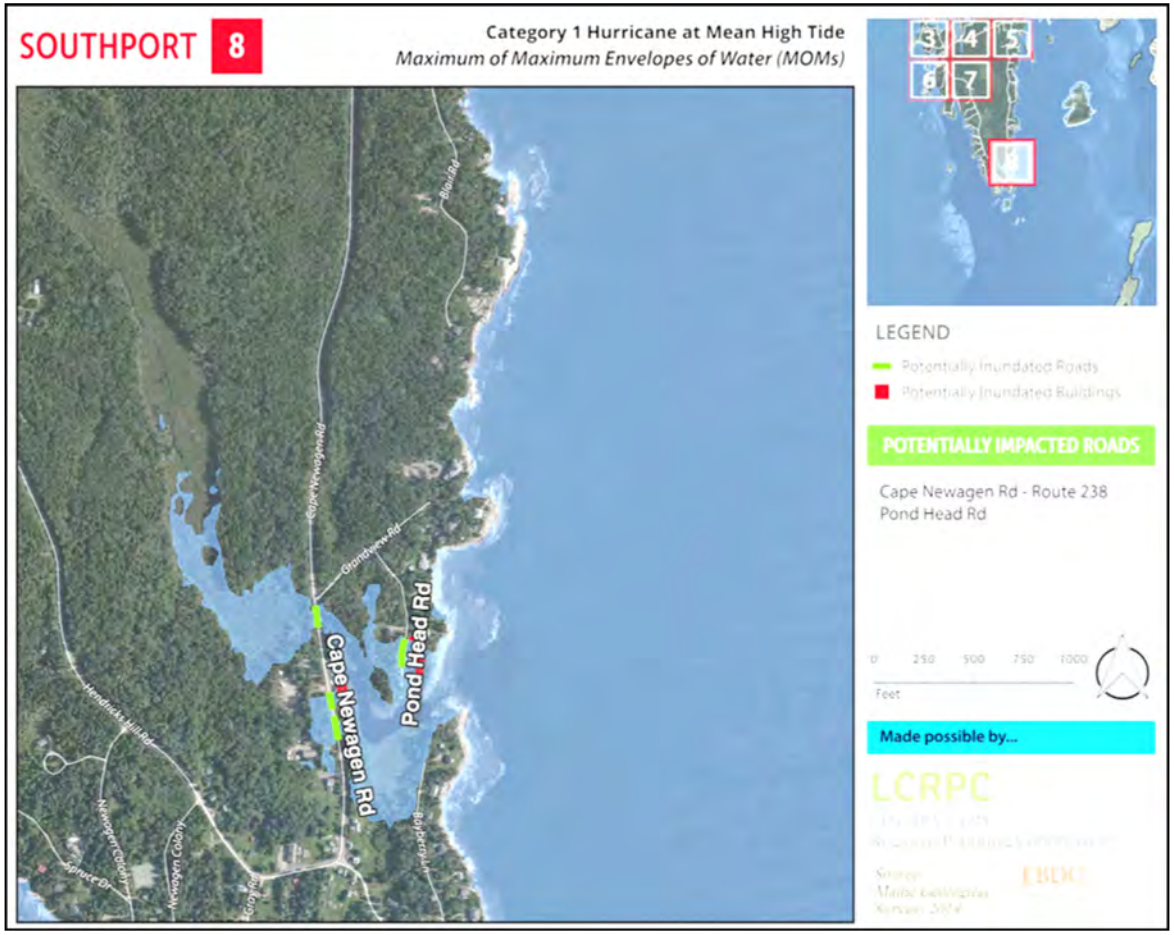
Maine Coastal Program

Maine Department of Agriculture, Conservation and Forestry
Maine Geological Survey

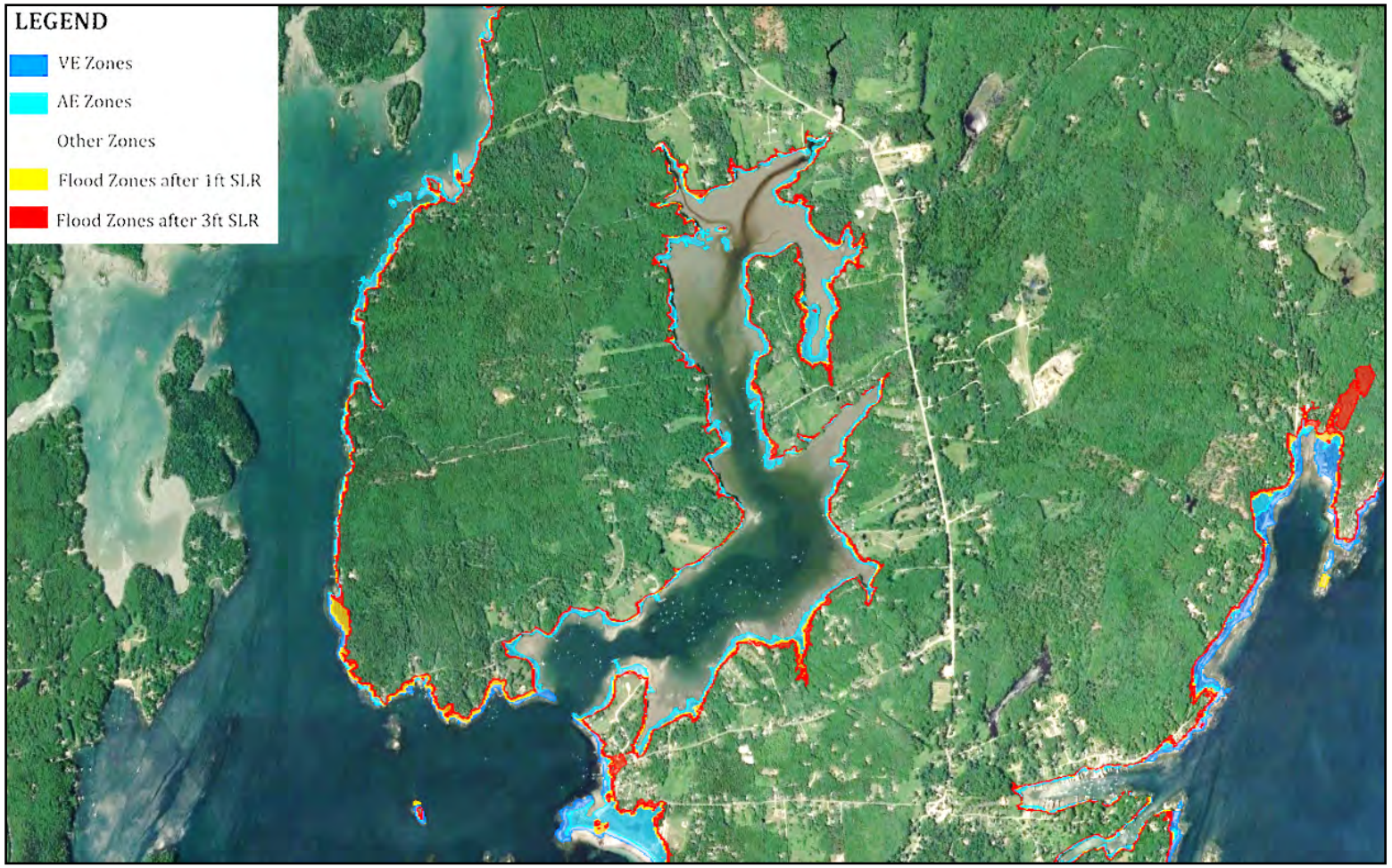
LCRPC
LINCOLN COUNTY
REGIONAL PLANNING COMMISSION

Maine Department of Agriculture, Conservation and Forestry
Municipal Planning Assistance Program

SOUTHPORT POTENTIALLY FLOODED EVACUATION ROUTES DURING CATEGORY 1 HURRICANE



2013 SEA LEVEL RISE – COASTAL HAZARD STUDY (UPDATED 2016 WITH NEW FEMA FLOOD MAPS)



FLOODING AND SLR IN DOWNTOWN DAMARISCOTTA

FLOODING AND SLR IN DOWNTOWN DAMARISCOTTA

ADAPTATION PLANNING STUDY
DOWNTOWN WATERFRONT AREA
DAMARISCOTTA, MAINE

DECEMBER 22, 2014
(REVISED FEBRUARY 2, 2015)

PREPARED FOR:
COASTAL COMMUNITIES GRANT OVERSIGHT COMMITTEE
DAMARISCOTTA, MAINE

PREPARED BY:
MILONE & MACBROOM, INC.
100 COMMERCIAL STREET, SUITE 417
PORTLAND, MAINE 04101

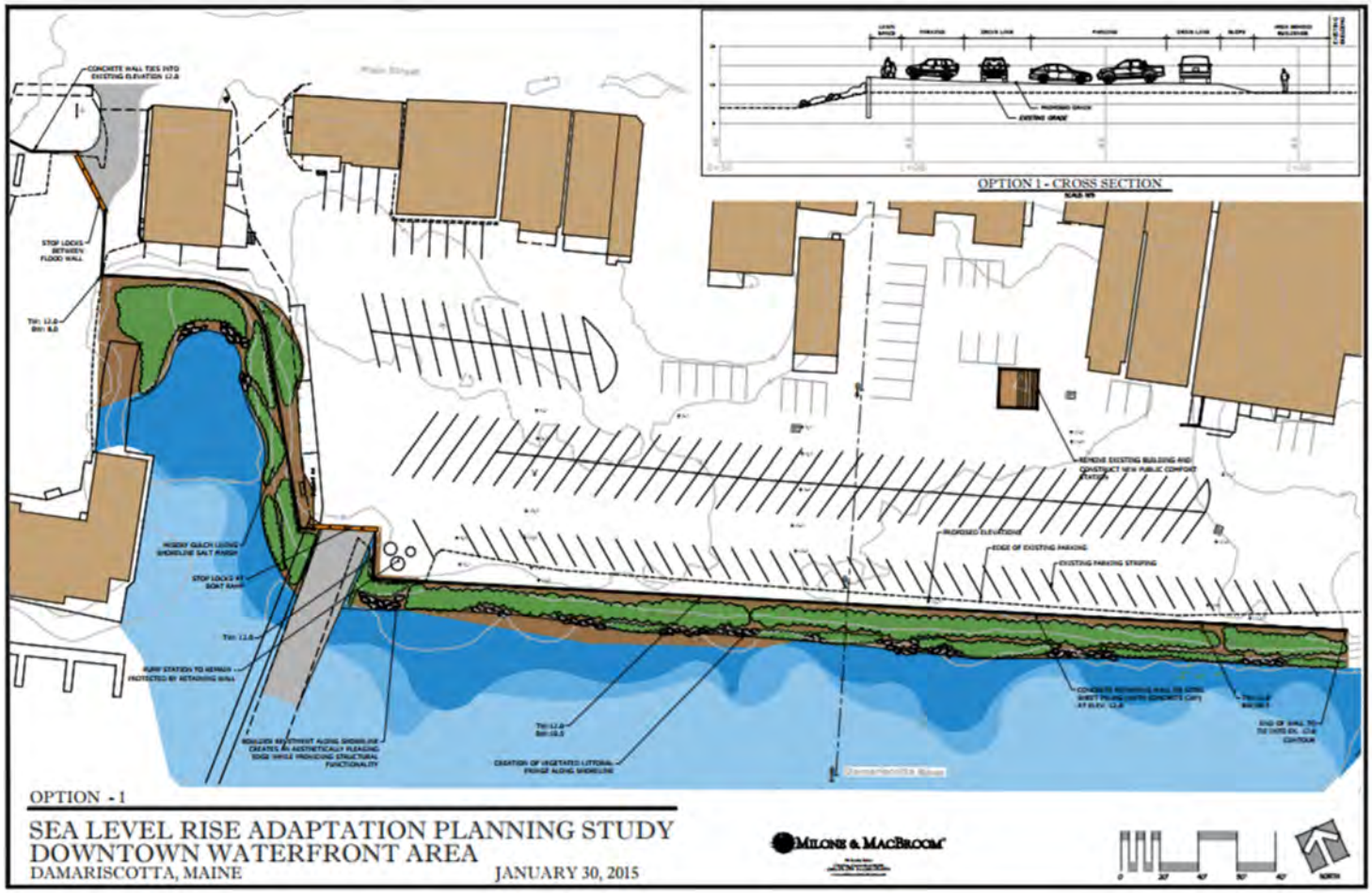
This memorandum was prepared by Milone & MacBroom, Inc., and the Town of Damariscotta under award CZM NA13NOS4190045 to the Maine Coastal Program from the National Oceanic and Atmospheric Administration, U.S. Department of Commerce. The statements, findings, conclusions, and recommendations are those of the author(s) and do not necessarily reflect the views of the National Oceanic and Atmospheric Administration or the Department of Commerce.

FLOODING AND SLR IN DOWNTOWN DAMARISCOTTA
TWO APPROACHES TO FLOOD PROTECTION – INDIVIDUAL BUILDING

TABLE 5
Flood Vulnerabilities and Recommendations

Building Address	Vulnerabilities	Elevation	Recommended Solutions	Cost Range	Average Cost
Ocean Point Furniture - 133 Main St.	East side door	9.01	Install gasketed doors (a)	$1,500-$2,000	$1,750
	Propane on south side		Install quick disconnect fittings and strap down propane tanks (c)	$500/tank	$2,500
	Electric on south side		Elevate utility / install temporary flood barrier (d)	$1,500-$2,000	$1,750
Se Vende Imports	West side windowsill	10.75	Install gasketed doors (a)	$1,500-$2,000	$1,750
	East side door threshold	8.13		$1,500-$2,000	$1,750
Barber Shop	Northeast door threshold	8.29	Install gasketed doors (a)	$1,500-$2,000	$1,750
	Main door threshold	8.54		$1,500-$2,000	$1,750
	West side door threshold	8.56		$1,500-$2,000	$1,750
Artsake/Shapers/Damariscotta River Grill - 151/155 Main St.	Shapers door threshold	7.67	Install gasketed doors (a)	$1,500-$2,000	$1,750
	South side door threshold	7.86		$1,500-$2,000	$1,750
	South side easterly door	7.71		$1,500-$2,000	$1,750
	Propane tanks on south side		Install quick disconnect fittings and strap down propane tanks (c)	$500/tank	$2,000
	Electric/gas on south side		Elevate utility / install temporary flood barrier (d)	$1,500-$2,000	$1,750
	A/C Units on south side			$1,500-$2,000	$1,750
Damariscotta Center - 157 Main St.	South side door threshold	8.23	Install gasketed doors (a)	$1,500-$2,000	$1,750
				$1,500-$2,000	$1,750
Reny's Underground	South side easterly door	9.61	Install gasketed doors (a)	$1,500-$2,000	$1,750
	South side main door	9.28		$1,500-$2,000	$1,750
Seawicks - 112 Main St.	North door threshold	11.81	Install gasketed doors (a)	$1,500-$2,000	$1,750
	A/C & Electric north side		Elevate utility	$1,500-$2,000	$1,750

FLOODING AND SLR IN DOWNTOWN DAMARISCOTTA
TWO APPROACHES TO FLOOD PROTECTION – COMMUNITY
(About $2 million)



1% STORM FLOODING AND SLR IN DOWNTOWN BOOTHBAY HARBOR

FLOODING AND SLR IN DOWNTOWN BOOTHBAY HARBOR

Pictures of all of the waterfront businesses were taken during the February 16, 2016 high tide and were compared to the projected 100-year flood level to demonstrate the potential impact of a major flood event.

February 11, 2016 High Tide Water Level	100-year Storm Water Level
5.4' NAVD88	12' NAVD88

February 11, 2016 High Tide Water Level	100-year Storm Water Level
5.4' NAVD88	11' NAVD88

February 11, 2016 High Tide Water Level	100-year Storm Water Level
5.4' NAVD88	12' NAVD88

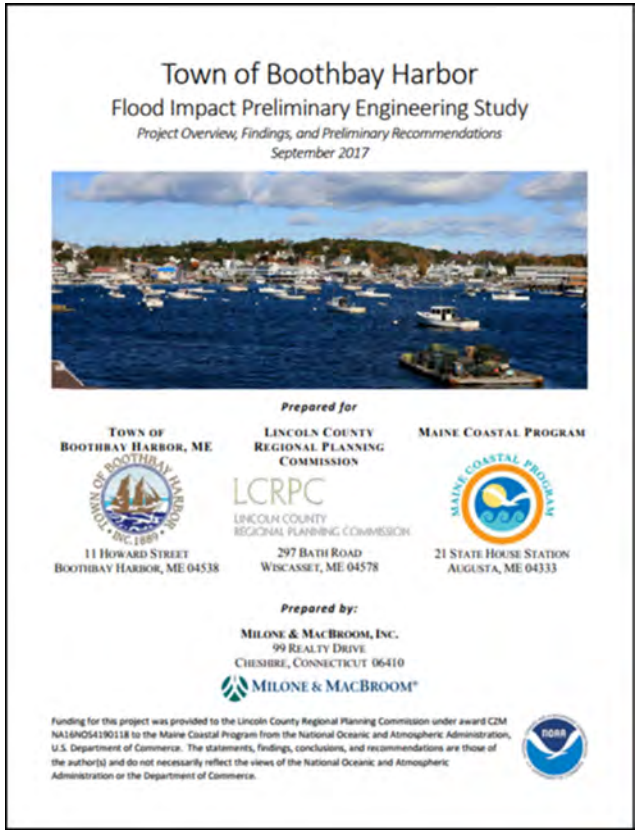
February 11, 2016 High Tide Water Level	100-year Storm Water Level
5.4' NAVD88	10' NAVD88 (building)
	14' NAVD88 (pier)

February 11, 2016 High Tide Water Level	100-year Storm Water Level
5.4' NAVD88	11' NAVD88

February 11, 2016 High Tide Water Level	100-year Storm Water Level
5.4' NAVD88	12' NAVD88

FLOODING AND SLR IN DOWNTOWN BOOTHBAY HARBOR

When this information was presented to the Select Board they expressed concern about the impact of a major flood event, with or without SLR, on jobs and the tax base, and they applied for a Coastal Community Grant to conduct a flooding and SLR impact study.



Town of Boothbay Harbor

Flood Impact Preliminary Engineering Study

Project Overview, Findings, and Preliminary Recommendations

September 2017

Prepared for

TOWN OF BOOTHBAY HARBOR, ME
11 HOWARD STREET
BOOTHBAY HARBOR, ME 04538

LINCOLN COUNTY REGIONAL PLANNING COMMISSION
297 BATH ROAD
WISCASSET, ME 04578

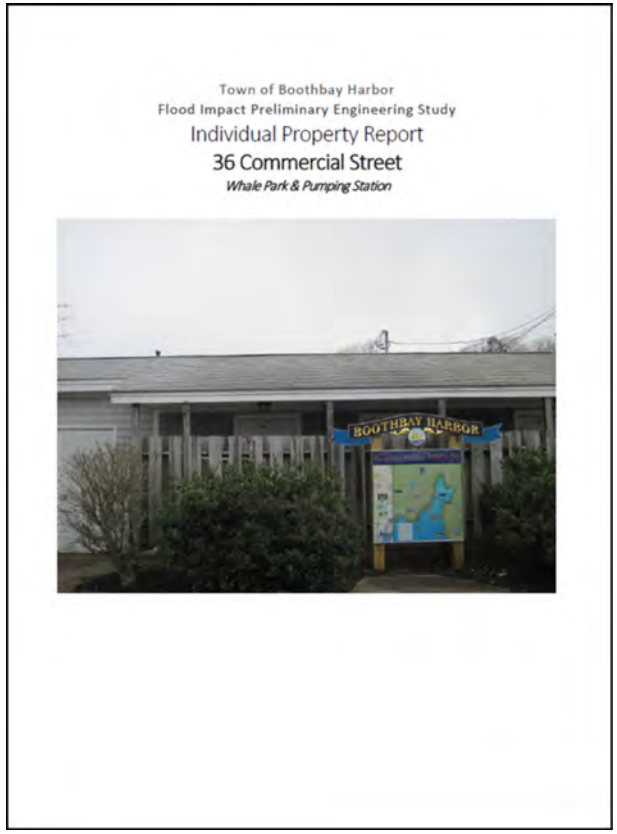
MAINE COASTAL PROGRAM
21 STATE HOUSE STATION
AUGUSTA, ME 04333

Prepared by:

MILONE & MACBROOM, INC.
99 REALTY DRIVE
CHESHIRE, CONNECTICUT 06410

MILONE & MACBROOM®

Funding for this project was provided to the Lincoln County Regional Planning Commission under award CZM NA16NOS4190118 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.



Town of Boothbay Harbor

Flood Impact Preliminary Engineering Study

Individual Property Report

36 Commercial Street

Whale Park & Pumping Station

FLOODING AND SLR IN DOWNTOWN BOOTHBAY HARBOR
INDIVIUDAL PROPERTY REPORTS

Property Overview

36 Commercial Street is a public park with a one-story wood-frame structure built on a slab-on-grade foundation. The structure currently houses a public restroom and a municipal sewer pumping station.

Fuel to power the pumping station is located on the east side of the structure. Pumping station equipment is located on the west side of the structure, as well as underground below the sidewalk to the west of the structure. The restroom is in the center portion of the structure

Table 1: Property Summary

Foundation	Slab
Structure	Wood Frame
Stories	One
Use	Pumping Station / Restroom
Site	Over Land

Risk Framework

Table 2 lists the elevations, determined by the Lincoln County Sea Level Rise - Coastal Hazard Study conducted by the Lincoln County Regional Planning Commission (LCRPC) and Maine Geological Survey (MGS) in 2013. These elevations represent "stillwater" flood elevations from the effective FEMA Flood Insurance Study. Stillwater elevations are the basis for special flood hazard area (SFHA) elevation mapping, and do not include the effects of wave action or local variations. In order to be consistent with the LCRPC study, these elevations are used for the 1% annual chance storm flood planning in this report.

Table 2: LCRPC Sea Level Rise Scenarios

Scenario:	Highest Astronomical Tide	1% Annual Chance Storm
Current/Historical	6.5 feet NAVD88	9.5 feet NAVD88
+ 0.3 meter	7.5 feet NAVD88	10.5 feet NAVD88
+ 0.6 meter	8.5 feet NAVD88	11.5 feet NAVD88
+ 1.0 meter	9.8 feet NAVD88	12.8 feet NAVD88
+ 1.8 meter	12.5 feet NAVD88	15.5 feet NAVD88

This property is located completely within a FEMA AE Special Flood Hazard Area (SFHA) with a base flood (1% annual chance storm) elevation (BFE) of 11 feet NAVD88.

Please note that the FEMA BFE addresses local variations and includes the effects of waves, wave setup, and wave runup; therefore this figure may be different than the "Current/Historical" scenario 1% chance storm elevation in Table 2, which is a stillwater elevation only. The FEMA BFE is derived from the 2015 Flood Insurance Rate Map update and is the regulatory elevation for purposes of new construction and flood insurance.

Table 4: Risk Summary

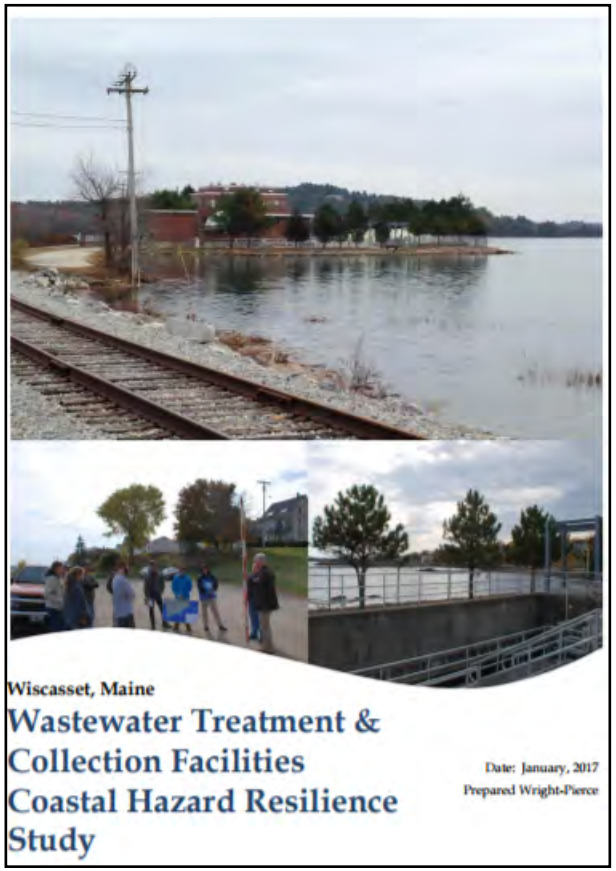
Risk	Vulnerability	Scenario of Concern		Notes
		HAT	*1% Storm*	
Foundation Degradation	Minimal	None	None	None
Structural Damage	Minimal	None	+ 1.8 m	None
Erosion	Minimal	None	None	None
Hydrostatic Forcing	Minimal	None	+ 1.8 m	None
Interior Inundation	Moderate	+1.8 m	+ 0.3 m	Vulnerable municipal utility
Utility Damage	Moderate	+1.8 m	+ 0.3 m	Vulnerable municipal utility
Business Operation	Moderate	+1.8 m	+ 0.3 m	Vulnerable municipal utility

Table 6: Cost Estimate for Recommended Alternatives

Alternative	Details	Cost		Frequency
Monitor Sea Level Rise	Professional survey every 5 years		$1000	Every Five Years
Dry Floodproof	~ 100 feet of wall pumping station & utilities	$10 per foot of wall Total	$10,000	Once
Elevate Interior Floor Or Dry Floodproof	~400 square feet restroom area	$10 per ft^2 $5,000 for facility realignment Total	$9,000	Once
	Total Cost		$25,000	Over 30 years

WISCASSET WWTP

WISCASSET WWTP VULNERABILITY ASSESSMENT



(Left to Right) Headworks Bldg, Blower Bldg, Shed, Sludge Storage, Control Bldg – BFE +3

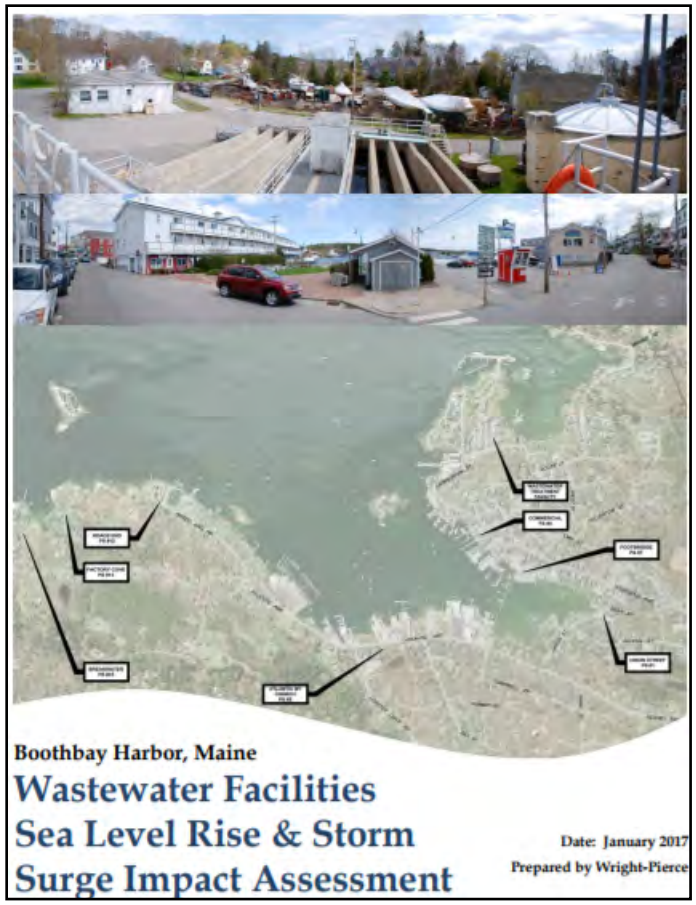
Clarifiers Looking East – BFE +3

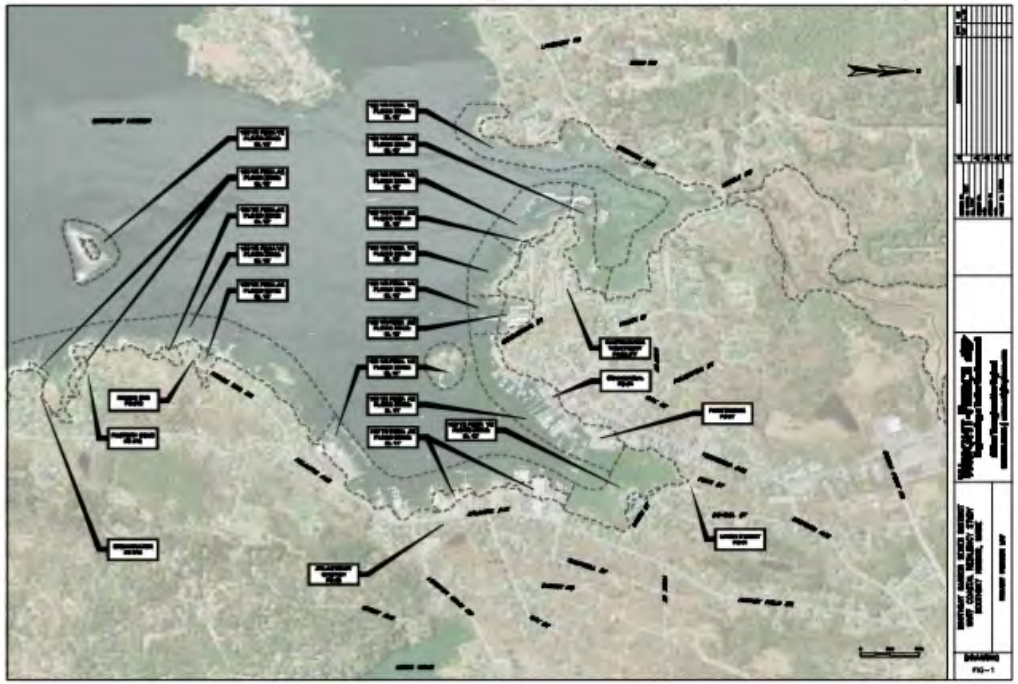
PS #6 Looking North – BFE +3

WISCASSET WWTP VULNERABILITY ASSESSMENT
(Cost about $1 million)

BOOTHBAY HARBOR WASTEWATER TREATMENT PLANT

BOOTHBAY HARBOR WWTP VULNERABILITY ASSESSMENT





BOOTHBAY HARBOR WWTP VULNERABILITY ASSESSMENT
(Pump Stations Protection and Flood Wall about $2.5 million)

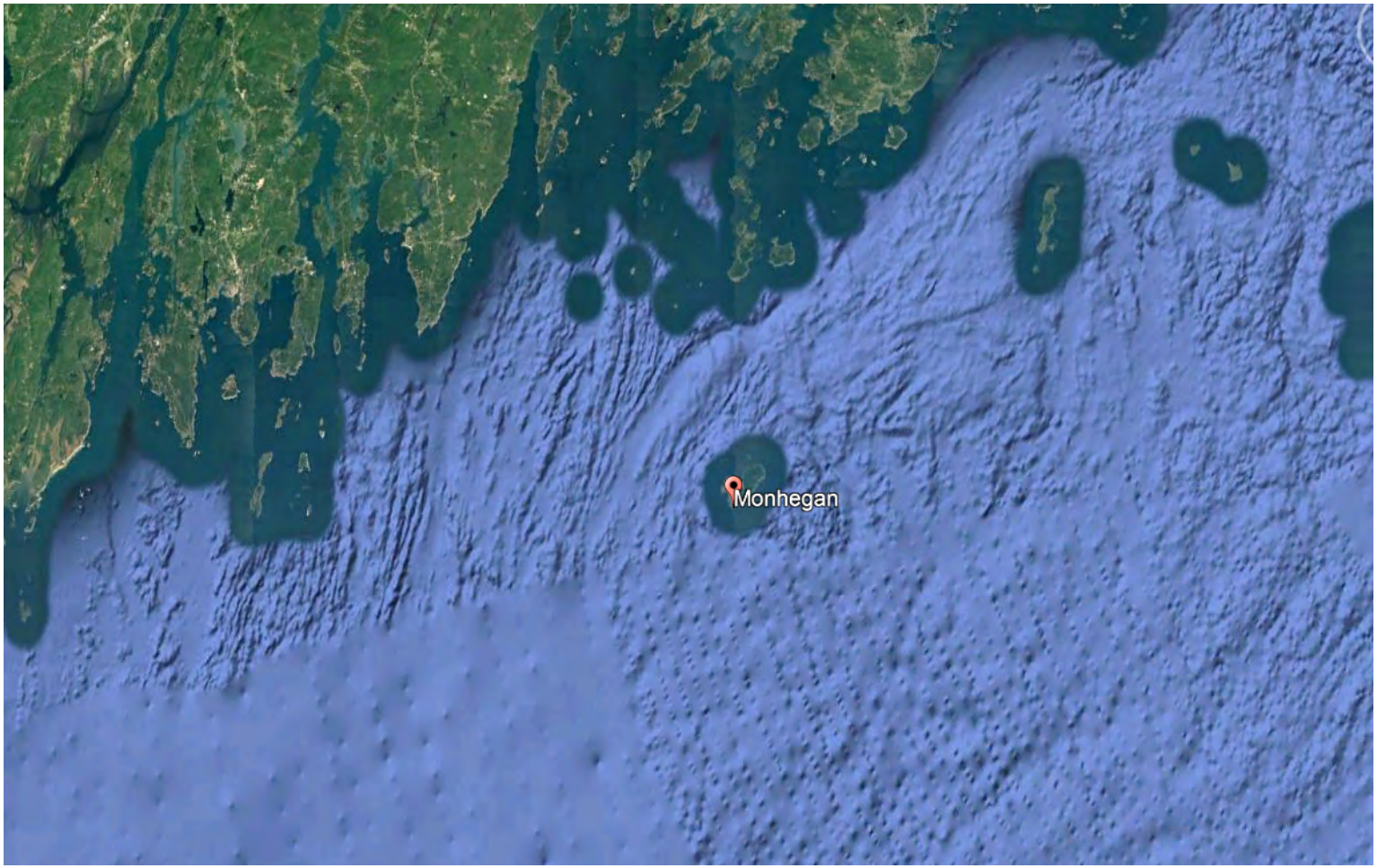
WWTP Looking North Between the Process Building and SBRs – BFE –4

PS #12 Wetwell Looking North - BFE –4

WWTP Looking West Past the Process Building - BFE –4

PS #12 Electrical / Controls Panel Looking South - BFE –4

FLOODING AND SLR ON MONHEGAN ISLAND



FLOODING AND SLR ON MONHEGAN ISLAND

FLOODING AND SLR ON MONHEGAN ISLAND

FY 2019 Shore and Harbor Planning Grant Program
Maine Coastal Program Maine Department of Marine Resources

Project Title:	Monhegan Island Harbor and Water Supply Protection Project
Region Covered:	Monhegan Island
Grant Category:	Category 2. Planning and Design Projects for Harbor Improvements
Grant Request Amount:	$30,000
Match Proposed and Source:	$10,000 cash from the Town of Monhegan Island $ 6,000 from the Island Institute (anticipated)
Project Manager:	Andrew Dalrymple
Project Partners:	Town of Monhegan Island Lincoln County Regional Planning Commission Island Institute

SOUTHPORT AMENDMENTS TO ORDINANCES TO INCREASE MINIMUM FREEBOARD ABOVE BASE FLOOD FROM 1' TO 3'

Southport

Floodplain Management Ordinance

F. **Residential** - New construction or substantial improvement of any residential structure located within:

1. Zone AE shall have the lowest floor (including basement) elevated to at least three feet ~~one foot~~ above the base flood elevation.

3. Zone AO shall have the lowest floor (including basement) elevated above the highest adjacent grade:

   a. at least three feet ~~one foot~~ higher than the depth specified in feet on the community's Flood Insurance Rate Map; or,

   b. at least three feet if no depth number is specified.

4. Zone A shall have the lowest floor (including basement) elevated to at least three feet ~~one foot~~ above the base flood elevation utilizing information obtained pursuant to Article III.H.1.b.(1); Article V.B.; or Article IX.D.

G. **Non Residential** - New construction or substantial improvement of any non-residential structure located within:

1. Zones AE and AH shall have the lowest floor (including basement) elevated to at least three feet ~~one foot~~ above the base flood elevation, or together with attendant utility and sanitary facilities shall:

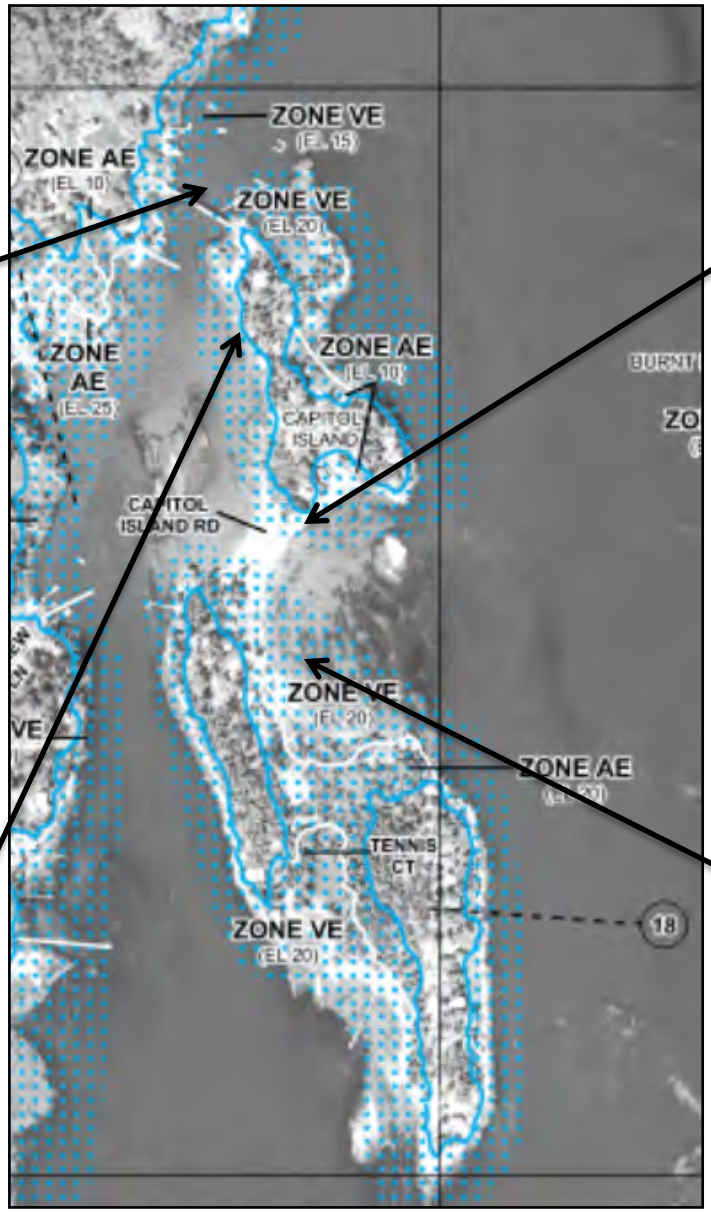
   a. be floodproofed to at least three feet ~~one foot~~ t above the base flood elevation so that below that elevation the structure is watertight with walls substantially impermeable to the passage of water;

3. Zone AO shall have the lowest floor (including basement) elevated above the highest adjacent grade:

CAPITOL ISLAND, SOUTHPORT - NOVEMBER 15, 2016 KING TIDE

WATER ELEVATION IN EACH LOCATION – 6.5’ NAVD88

PREDICTED 1% STORM WATER ELEVATION WITH NO SLR - 20’ NAVD88



Work highlighted in this presentation was completed by the Lincoln County Regional Planning Commission and funded through Coastal Community Grants awarded and administered by the Municipal Planning Assistance Program at the Department of Agriculture, Conservation and Finance.

The Coastal Community Grant Program is funded by NOAA awards to the Maine Coastal Program. For more information on the Coastal Community Grant Program:

https://www.maine.gov/dacf/municipalplanning/casestudies/ccg-case-studies.shtml

Contact: Ruta Dzenis AICP, Municipal Planning Assistance Program ruta.dzenis@maine.gov

For more information on Lincoln County Regional Planning Commission's coastal projects:

http://lcrpc.org/coastal-projects-planning

Contact: Bob Faunce rfaunce@lcrpc.org
Megan McLaughlin mmclaughlin@lcrpc.org