

## Adapting to Sea Level Rise in South Portland



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**Prepared by  
The Greater Portland Council of Governments in cooperation with  
the Maine Geological Survey**

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## **Climate Change, Coastal Flooding, and Sea Level Rise**

Sea level rise is associated with increased storm activity and intensity and leads to increased beach erosion, wetland habitat conversion or loss, and intrusion of salt water into freshwater habitats. The potential impacts of increased sea levels may have far-reaching consequences on our national, regional and local economies. Locally, data collected at the City of Portland tide gauge documents an actual 0.63 ft. rise in sea level between 1912 and 2011. Most scientific projections expect historic rates to persist, at a minimum, and likely accelerate. In response, Maine adopted a “middle of the road” prediction (Maine DEP, 2006) of an expected 2 foot rise in sea level by the year 2100; this prediction was based on work conducted by the Intergovernmental Panel on Climate Change (IPCC, 2001), which provided a mean value of approximately 1.6 ft. of sea level rise by the year 2100.

In order to prepare for potential consequences from sea level rise, coordination among federal, state, regional and local government entities is essential. However, implementing strategies to adapt to our changing coastline and reduce the potential damage to the environment and local economies will require targeted outreach, education, and partnership development. Policy makers and the public must recognize the economic and environmental challenges associated with the effects of sea level rise, and that most of these effects will be felt at the local level and therefore can be addressed most efficiently at that level. Making informed decisions now about construction, maintenance, and location of development and infrastructure could result in significant long-term financial savings for many coastal communities.

### **Casco Bay Coastal Hazard Resiliency Pilot Project: South Portland**

In 2010, the Maine Coastal Program (MCP) partnered with Maine Geological Survey (MGS) and the Greater Portland Council of Governments (GPCOG) to establish a sea level rise pilot project for the Cumberland County community of South Portland. The project is modeled after a very successful Coastal Hazard Resiliency Tools project developed initially by MCP, the Southern Maine Regional Planning Commission (SMRPC), and MGS for the communities surrounding Saco Bay. For the Casco Bay Project, MGS created a vulnerability assessment for South Portland depicting scenarios for 0.6 m (2 ft.), 1.0 m (3.28 ft), 1.8 m (5.95 ft) of sea level rise on top of both the Highest Annual Tide (HAT), and the 1% (“100 year”) storm stillwater elevation (February 7, 1978) using a GIS tool for flood inundation mapping. The tool visually depicts how increases in sea level rise might affect vulnerable wetland and marsh areas, residential and commercial zones, and infrastructure such as roads, bridges, sewer, drainage facilities, and various public utilities. It utilizes 2006 LiDAR (Light Detection and Ranging) data (Sanborn, 2006) to create the baseline “bare earth” topography of the areas assessed. LiDAR is a series of light pulses collected from planes that produce a rapid collection of points (more than 70,000 per second) over a large geographic area. These points are used to measure elevations or distances on land and result in a more refined geography.

MGS, with assistance from GPCOG, presented this data to the South Portland City Council at a workshop on October 12, 2011. At the request of the City of Portland, MGS conducted a similar vulnerability analysis and presentation to the Portland City Council’s Transportation, Sustainability, and Energy Subcommittee in February 2012.

## Maine's Coastal Policies and Regulations

Maine has regulated its coastal areas for decades and is considered more progressive than most coastal states in this regard. The first documented reference to sea level rise in Maine was in the **Maine Coastal Policies Act** (*Title 38 M.R.S.A sec. 1801* passed in 1985). These policies require the state to regulate coastal resources and implement planning and development policies that are consistent with these guidelines.

The **Natural Resources Protection Act (NRPA)** was adopted in 1988 to protect natural resources such as coastal sand dune systems, coastal wetlands, wildlife habitat, fragile mountain areas, freshwater wetlands, great ponds and rivers, and streams or brooks. The Act establishes a permit system for all activities in any protected natural resource, and any activity adjacent to a water resource if the activity would result in runoff to that area. Chapter 355 of the NRPA, known as the Sand Dunes Act, is particularly significant to coastal issues because it defines Coastal Sand Dunes and regulates activity in the Sand Dunes. The Act states a project may not be permitted if, within 100 years, the property is expected to erode as a result of changes in the shoreline such that the project is likely to be severely damaged after allowing for two-feet of sea level rise over 100 years (beach nourishment and dune restoration projects are excluded from this requirement). Additionally, a building greater than 35 feet in height or covering a ground area greater than 2,500 square feet may not be constructed in a coastal sand dune system unless the applicant demonstrates convincing evidence that the site will remain stable (reliance on a seawall is not sufficient evidence) after allowing for two-feet of sea level rise over 100 years.

***“Anticipatory Planning for Sea Level Rise along the Coast of Maine”*** is a report created by the State Planning Office and the United States Environmental Protection Agency in 1995. The report is still available on the U.S. Environmental Protection Agency website today and is considered to be one of the most comprehensive reports examining the issue of sea level rise in Maine. Unfortunately, because most of its recommendations were never implemented on the local level, it is often cited as an example of the disconnect between state policy and local implementation.

Other notable studies and regulatory policies include ***“Protecting Maine Beaches for the Future”*** completed in 2006 which was the result of a two-year stakeholder process. As a result of this report, Maine adopted 2 feet of sea level rise over the next 100 years, which was considered a “middle-of-the road” prediction for global sea level rise, into its Natural Resources Protection Act (NRPA) Coastal Sand Dune Rules (Chapter 355).

In 2010, the Maine Department of Environmental Protection released ***“People and Nature Adapting to a Changing Climate: Charting Maine’s Course”***, a collaboration of 100 stakeholders throughout the state from diverse interests. The report was commissioned by the Joint Standing Committee on Natural Resources of the 124th Maine Legislature, and provided an extensive list of recommendations regarding preparing Maine for the potential impacts of climate change. Some of the most applicable recommendations for the current work focused specifically on developing sea level rise vulnerability data, and bringing it to the local level for development of local adaptation strategies.

### ***Maine’s Current Shoreland and Floodplain Regulations***

At the local level in Maine, most land uses within 250 feet of rivers, wetlands, lakes, the ocean, and within 75 feet of certain streams are under the jurisdiction of **Maine's Mandatory Shoreland Zoning Act**. The Act, adopted by the state legislature in 1971, requires municipalities to draft and adopt a Shoreland Zoning Ordinance that incorporates certain minimum requirements mandated by the state. According to the legislation, a local ordinance is required to be either as restrictive as or more restrictive than the state’s model

ordinance. Nationally, Maine's Shoreland Zoning Act is considered to be more progressive than regulation in most states.

As part of the Shoreland Zoning Act, Maine defines "coastal wetlands" as all tidal and subtidal lands, including all areas below any identifiable debris line left by tidal action; all areas with vegetation present that is tolerant of salt water and occurs primarily in a salt water or estuarine habitat; and any swamp, marsh, bog, beach, flat or other contiguous lowland which is subject to tidal action during the maximum spring tide level as identified in tide tables published by the National Ocean Service. Coastal wetlands may include portions of coastal sand dunes. [38 MRSA 480-B (2)]. Therefore, areas within 250 feet of the upper edge of coastal wetlands, defined by the highest annual tide (HAT), are considered to be within the Shoreland Zone and therefore under the jurisdiction of the Shoreland Zoning Ordinance.

The National Flood Insurance Act of 1968 established the National Flood Insurance Program. This program made flood insurance available to any city or town that agreed to adopt an ordinance regulating development in flood-prone areas. Maine's Floodplain Regulations are managed by the State Planning Office and are based on data provided by the Federal Emergency Management Agency (FEMA) and presented in effective Flood Insurance Rate Maps (FIRMs). FIRMs designate Maine's coastal floodplains typically as "V" flood zones (V refers to velocity due to dynamic storm surge and waves over 3 feet), "AO" flood zones (dynamic zones with waves less than 3 feet), and "A" flood zones (stillwater flood zones). Although a community may decide to make its floodplain ordinance more stringent, the law requires it must at least meet the requirements of the state and federal floodplain laws; this currently is to elevate structures within flood zones a minimum of 1 foot above the effective Base Flood Elevation (BFE) associated with the special hazard flood zones (V, AO, or A).

Floodplain ordinances regulate new construction or renovation of an existing structure if it's considered a "substantial improvement" of that structure. Substantial improvement is defined as any repair to a structure that exceeds 50% of its market value. In many cases, floodplain regulations require a structure in a special flood hazard zone (A, AO, or V) to be elevated above the predicted flood elevations. This is called freeboard. Most Floodplain Ordinances in coastal communities meet minimum floodplain guidelines; that is, requiring structures to include one foot of freeboard above the effective 100-year FEMA Base Flood Elevation (BFE). In addition to flood proofing a structure, increasing its freeboard (generally to 3 feet above National Flood the effective Base Flood Elevation) will result in a reduction in flood insurance costs. Many communities in York County are currently considering this strategy.

## **Adaptation Strategies for Sea-Level Rise**

Often the geography, politics, or economic priorities of a community will dictate the extent to which it explores adaptation strategies in response to sea level rise. In terms of the built environment, adaptation strategies fall into three general categories (or a mixture of these categories): engineering barriers, accommodating inundation, or retreat.<sup>1</sup> Specific long-term adaptation strategies can also take the form of regulatory and policy changes, capital planning projects, land acquisition, and expansion and protection of existing open space and recreation areas.

The sea level vulnerability assessment created for South Portland identifies several areas where infrastructure may be at risk under different scenarios of sea level rise on top of the current HAT, and the historic 100-year storm stillwater flood elevation. Areas identified as vulnerable to a future 100-year storm event after different SLR scenarios included: 1) the oil storage tanks located adjacent to the Veterans Bridge and Route 1,

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<sup>1</sup> Mann and Kump, *Dire Predictions: Understanding Global Warming* (DK, 2008)

the wastewater treatment plant adjacent to the Casco Bay Bridge, and the Hannaford site at Mill Cove Creek (see Photo 1); 2) residential and transportation infrastructure in the vicinity of the Ferry Village residential neighborhood located between the Coast Guard Station and Bug Light Park, in addition to other oil storage tanks in this area (see Photo 2); and 3) residential infrastructure and a sewer pump station in the vicinity of Willard Beach (see Photo 3). The photos below identify the areas studied. Each area is very different in character, with different vulnerabilities. It may be necessary to employ unique adaptation strategies to cope with their respective challenges. For example the neighborhood of Ferry Village faces the challenge of adapting an historic residential neighborhood and aging infrastructure, while the wastewater treatment plant must cope with community safety and maintenance risks.

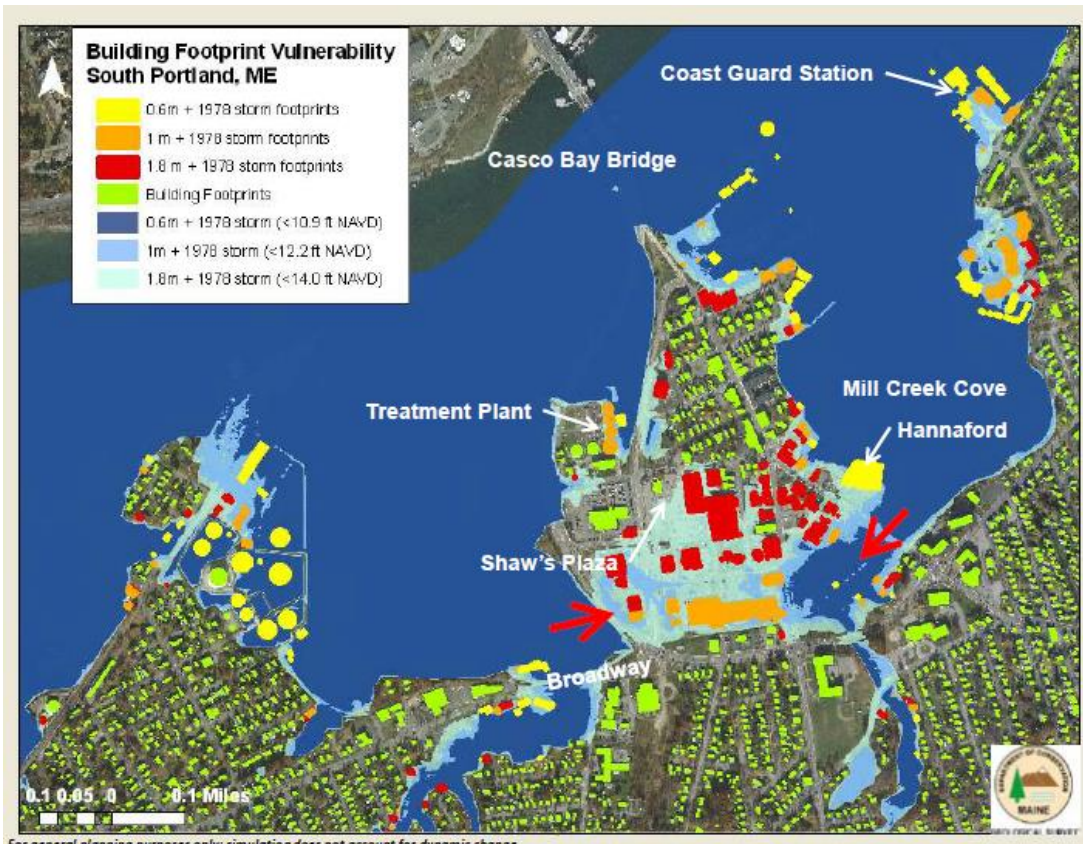
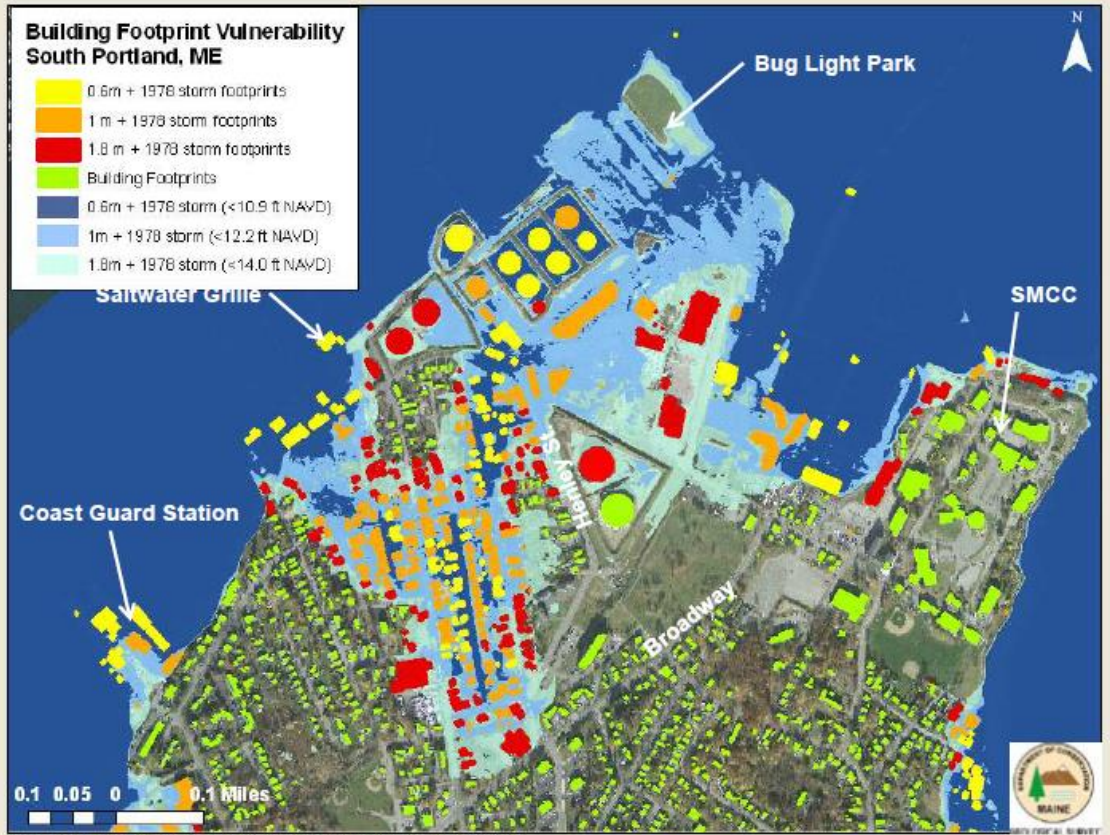
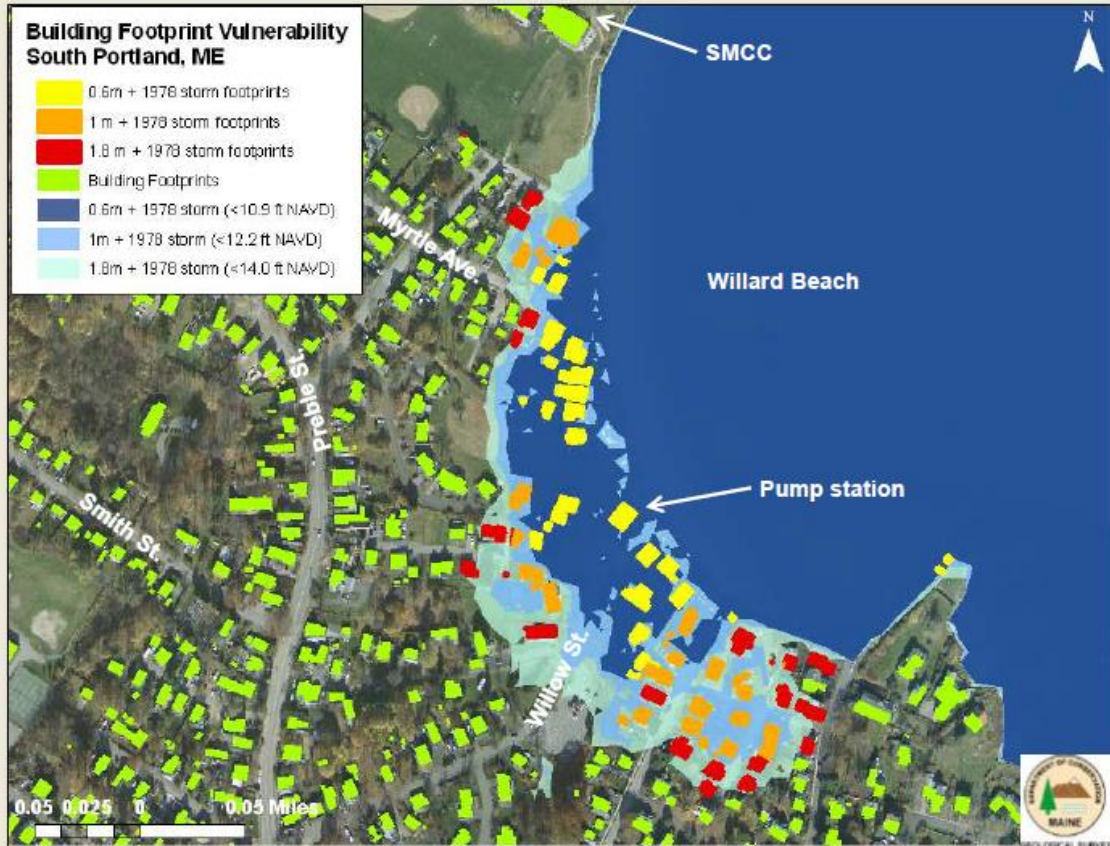


Photo 1. Area East of Coast Guard Station. Maine Geological Survey, Department of Conservation, Inundation Scenario Presentation 2011.



For general planning purposes only; simulation does not account for dynamic change.  
 Photo 2. Area West of Coast Guard Station. Maine Geological Survey, Department of Conservation, Inundation Scenario Presentation 2011.



For general planning purposes only; simulation does not account for dynamic change.  
 Photo 3. Area South of Coast Guard Station. Maine Geological Survey, Department of Conservation, S. Port. Presentation 2011.

## General Recommendations

### **Infrastructure**

Much of South Portland's coastline is developed. In 2006, the report titled, "Protecting Maine's Beaches for the Future (A Report of the Stakeholder's Group to the Joint Standing Committee on Natural Resources 122<sup>nd</sup> Maine Legislature 2<sup>nd</sup> Regular Session)," recommended that any analysis of proposed projects or infrastructure should consider a minimum of two feet of sea level rise over a 100-year window. Consistent with this recommendation, South Portland may wish to review its development review process to consider the effects of different scenarios of sea level rise on top of high tides and future 1% storm events. Construction and upgrades to roads and bridges should be done to a higher than minimum existing standard in regularly flooded areas. Drainage infrastructure (see photo below) should be located outside vulnerable areas, (or at a minimum adequately constructed to accommodate for future sea levels and increased storm events).



Photo 4. This photo depicts Mill Creek Bridge, and South Portland Wastewater Treatment Facility.

T. Haeuser, City of South Portland

### **Retreat**

Although retreat is generally considered the least invasive strategy because it allows ecosystems to naturally migrate inland, it is not always practical--especially in urbanized areas. In the report "Anticipatory Planning for Sea Level Rise Along the Coast of Maine" prepared by the Marine Law Institute of the University of Maine School of Law, the Maine Geological Survey, and the Maine State Planning Office, the merits of a retreat strategy are further discussed in Chapter 5, *Responsiveness of Existing State and Federal Laws to Sea Level Rise*, Page 2):

"Only in very limited circumstances (e.g., the commercial port area of the Portland/South Portland harbor) might it make economic sense to deviate from this policy; in limited areas the already disturbed character of the shoreline and the nature and intensity of the threatened development might justify protective engineered solutions, such as seawalls, to keep the shoreline from migrating."

Although the report specifically cites South Portland as an area where the abundance of hardscape along the coast makes the retreat strategy more challenging, it is clear from the vulnerability analysis that some wetland areas do exist, although it appears they may not have sufficient open space for migration. Additionally, this statement does not consider the possibility of accommodating some wetland migration if a site is redeveloped.

## Regional Approach

Issues such as sea level rise do not abide by municipal or political boundaries. Although home rule tradition in Maine has challenged the concept of regional planning on many levels, there are many advantages to approaching coastal issues from a regional perspective. If there is sufficient commitment and “buy in” from local municipalities, communities can combine resources, and coordinate responses. With both South Portland and Portland examining the long-term effects associated with sea level rise, an opportunity exists to coordinate resources between these two communities. Other states such as Massachusetts, Florida, and California have all adopted regional measures to address the effect of sea level rise.<sup>2</sup>

The Sea Level Adaptation Working Group (SLAWG) is a group of communities in the Saco Bay area that have combined efforts to further investigate and develop regional strategies for adapting to sea level rise. SLAWG is an effort led by Peter Slovinsky (MGS) and J. T. Lockman (SMRPC) and its members include Scarborough, Biddeford, Saco, and Old Orchard Beach. The group has recently recommended that all of the cities and towns in Saco Bay adopt three feet of freeboard for properties located within effectively mapped (by the community’s effective Flood Insurance Rate Map, or FIRM) tidally influenced floodplains. This will create extra space under newly elevated buildings to accommodate the rising of mean sea level by the year 2100, and will help the community to adapt to the increasing frequency and severity of coastal flooding caused by ocean storms. This proposed change would only affect new construction, or buildings that sustain more than 50% damage. Ultimately, this policy change could substantially lower the cost of flood insurance for these buildings.

### Example of Savings on NFIP Premiums\* with Freeboard

	V Zone <sup>1</sup>		A Zone <sup>2</sup>	
	Annual savings	30-year savings	Annual savings	30-year savings
1' freeboard	\$1,360 (25%)	\$40,800	\$502 (41%)	\$15,060
2' freeboard	\$2,730 (50%)	\$81,900	\$678 (55%)	\$20,340
3' freeboard	\$3,415 (62%)	\$102,450	\$743 (60%)	\$22,290

*\*Chart taken from Massachusetts Office of Coastal Zone Management. (<http://www.mass.gov/czm/stormsmart/regulations/freeboard.htm>)  
NFIP premiums based on May 2007 rates for a one-floor residential structure with no basement built after a FIRM was issued for the community (post-FIRM rates differ from pre-FIRM rates). \$500 deductible/ \$250,000 coverage for the building/\$100,000 for contents.*

## Local Land Use Regulations

South Portland is currently updating its comprehensive plan. This update is an opportunity to identify the issue of sea level rise and acknowledge the need to develop specific adaptation strategies for the community. The community may also wish to identify frequently flooded areas and suggest possible regulatory responses for future development and infrastructure maintenance or upgrades.

In addition to its comprehensive plan, South Portland should incorporate sea level rise adaptation techniques into all relevant ordinances such as zoning, shoreland and floodplain ordinances. Amendments should address existing regulations such as setbacks, density limits, first floor elevation requirements, and require appropriate and adequate infrastructure improvements for coastal or transition zones. Evaluation of future development proposals should also incorporate a minimum of two-feet of sea level rise over the next century at a minimum. As much as possible, the City should consider mandating the location of future development, infrastructure and essential facilities outside coastal or flood hazard prone areas.

<sup>2</sup> Local Land Use Response to Sea Level Rise, Land Use Law Center, Pace University School of Law (May 2010).



Floodplain and shoreland zoning boundaries should be evaluated and updated with LIDAR data and the boundaries should be measured by the contour of the “highest annual tide” rather than “normal high water.” This type of adaptation is considered by many to be “low-hanging fruit.”

## **Next Steps**

The Greater Portland Council of Governments will continue its work with the City of South Portland through another grant from the Maine Coastal Program. As part of this effort, GPCOG will examine ways to amend the City’s floodplain and shoreland zoning to better accommodate sea level rise.

As a follow up to the work in Southern Maine, the MCP and MGS are currently working with the Lincoln County Regional Planning Commission to develop a similar vulnerability assessment for sea level rise. Currently the Lincoln County Regional Planning Commission is conducting outreach and education efforts in the community. To support this effort, MGS is developing scenarios based on the highest annual tide (HAT) and 100-year storm elevation plus 0.6 m, 1m, and 1.8 m of sea-level rise. They are focusing on the effect of sea level rise on critical regional infrastructure including roads, wastewater treatment facilities, police/rescue/fire stations, and schools.

## **Websites:**

Greater Portland Council of Governments:

<http://www.gpcog.org>

Maine Geological Survey:

<http://www.maine.gov/doc/nrimc/mgs/mgs.htm>

Maine Department of Environmental Protection:

<http://www.maine.gov/dep/>

## **Reference Material/Studies:**

Anticipatory Planning for Sea-level Rise along the Coast of Maine:

<http://www.epa.gov/climatechange/effects/coastal/SLRAnticipatory.html>

Maine DEP, 2006, Chapter 355: Coastal Sand Dune Rules

<http://www.maine.gov/sos/cec/rules/06/096/096c355.doc>

Protecting Maine Beaches for the Future:

[http://www.seagrant.umaine.edu/files/chg/report06\\_protect-1.pdf](http://www.seagrant.umaine.edu/files/chg/report06_protect-1.pdf)

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