

Sea Level Rise Adaptation in the Public Sector: Challenges, Solutions, and Opportunities

As climate change progresses, the relentless march of sea level rise (SLR) presents an array of challenges and opportunities to coastal cities and towns in the United States and worldwide. Along the northeast coast of the U.S. in particular, sea level is projected to rise at rates three to four times faster than the global average due to local variations in ocean circulation, salinity, and temperature.ⁱ If the U.S. continues with business as usual, between \$238-507 billion worth of existing coastal property nationwide is likely to be below sea level by 2100.ⁱⁱ This figure does not include flooding of roads and other critical infrastructure or related costs to the millions of people who will be displaced or impacted. Continued information sharing and collaborative efforts among American cities is vital in the effort to safely and efficiently navigate the challenge and capitalize on the opportunities presented by SLR.

Some cities and public entities in the U.S. have begun serious work on coastal adaptation planning, and are ahead of the curve in terms of preparing for the impacts of SLR on infrastructure and property. Adaptation planning in municipalities is important for protecting property and public health as well as the businesses that sustain community economies. A recent report from CDP found that actions by city governments to address climate impacts such as SLR also serve to make businesses more resilient to climate risk.ⁱⁱⁱ Municipalities that direct attention to adaptation planning are better able to sustain existing economic drivers and may also attract business from other areas that do not strive to become more resilient.

In this paper we will examine key challenges, solutions and opportunities encountered by practitioners working on the leading edge of SLR adaptation efforts. While this collection is not meant to be comprehensive, ACCO hopes that sharing lessons learned from “early adaptors” will help those who are beginning their own adaptation planning efforts to avoid common pitfalls and better safeguard their communities, economies, and natural assets against the impacts of rising seas.

This white paper has been compiled with input from Pinar Balci (Director, Bureau of Environmental Planning and Analysis - New York City Department of Environmental Protection), Susanne Torriente (Assistant City Manager - City of Fort Lauderdale), Cody Hooven (Senior Environmental Specialist - Port of San Diego), Olga Dominguez (Retired, Assistant Administrator, Office of Strategic Infrastructure - NASA), and Adam Whelchel (Director of Science - The Nature Conservancy).

ⁱ <http://www.nature.com/nclimate/journal/v2/n12/full/nclimate1597.html>

ⁱⁱ <http://riskybusiness.org/report/overview/executive-summary>

ⁱⁱⁱ <https://www.cdp.net/CDPResults/CDP-global-cities-report-2014.pdf>

Challenges

Work on SLR in the public sector presents many challenges. Below we outline some of the more critical challenges confronting practitioners in this field.

Funding Mechanisms

Resiliency and hazard mitigation funding is most often reactive – it typically only becomes available after disasters. There are few or no mechanisms for providing funding before a storm hits. Further, climate change transcends geographic boundaries and there is often insufficient funding available from any one source, so funding needs to come from multiple sources. Many state, federal, and local laws and guidelines make combining funding in this way difficult. State and federal governments also cannot easily pool funding across state lines or even across departments and agencies. Furthermore, traditional hazard funding often only allows for replacement of the exact same infrastructure in the same location versus modifying design and/or placement to accommodate future hazards such as SLR.

Multiple Socio-economic and Environmental Goals

A cost/benefit analysis between various environmental and socio-economic goals is difficult to agree on. It is challenging to think of systems holistically, taking into account timescale, energy, waste, air and water quality, and socioeconomic and neighborhood impacts, as well as consider how to set goals and measure improvements. Comprehensive approaches across sectors and planning areas are required at the municipal scale for longer-term and permanent impacts from SLR.

Tidal and Stormwater Flooding

During seasonal extreme high tides and storms, many coastal areas have experienced road, railway, airport, and wastewater treatment facility flooding caused by an excess of sea- or stormwater runoff over land and through storm drains. Even areas further inland are experiencing an increasing frequency and severity of flooding during both normal and extreme storm events. Changes in sea level and weather patterns mean that more infrastructure is at greater risk than ever before.

Beach Impacts

Erosion and wave impacts associated with SLR – including storm surge – present costly challenges, especially in areas where tourism is vital to the local economy. Direct and indirect impacts of climate change and SLR are likely to damage infrastructure and natural and cultural attractions critical to the tourism sector in many coastal communities.^{iv}

Community Engagement and Education

Even though there is irrefutable evidence for SLR, there is still significant reluctance in many communities to accept scientific facts and take action. This challenge becomes even more difficult given many scientists' poor communication abilities, a caustic political atmosphere, and the general lack of incorporation of climate education in schools.

^{iv} <http://www.cisl.cam.ac.uk/Resources/Climate-and-Energy/Climate-Change-Implications-for-Tourism.aspx>

Organizational Buy-In

Sea level rise is an issue with impacts across the public sector. As such it requires a coordinated approach to integrate efforts across departments and siloes within organizational structures. Even with champions in place who support SLR adaptation work, creating the cultural shift required throughout agencies to implement meaningful organization-wide change can be very difficult. Lack of action in the public sector can also hinder private sector investment and momentum to address immediate and longer-term challenges of SLR.

Standards

Standards for building, permitting, design, and construction are often antiquated and based on historical records rather than up-to-date projections. These standards must be updated in order to mitigate the significant risk posed by SLR, increased storm surge and flooding induced by extreme precipitation events.

Solution Sets

Here we provide examples of key solutions and effective policies from practitioners on the front lines of SLR adaptation.

Funding Mechanisms

Incorporating resiliency criteria into the weighting scheme for annual State Revolving Funds is one way to promote funding for SLR resiliency measures. This should be done in advance of extreme weather events, rather than in response. A growing number of States are requiring the incorporation of SLR planning in redevelopment or new development of critical infrastructure (i.e., wastewater treatment plants) in order to be eligible for federal/state funding. At the Federal level, the Federal Emergency Management Agency (FEMA) should expand its programming to provide municipalities with a “cookbook” of specific resiliency measures and put in place more mechanisms to provide funding before a storm hits in order to decrease response time and reduce overall impacts.

In some cases geography and flood level projections may make cost-effective adaptation impossible, and redevelopment away from zones most vulnerable to SLR and flooding may be necessary. Redevelopment projects can be supported through mechanisms like Tax Incremental Financing (TIF), which can help fund a project through bonds for portion of the new tax revenue to be created.^v This mechanism has been used to finance infrastructure and redevelopment projects in Connecticut.

Multiple Environmental Goals

New York City’s green infrastructure program takes stress off of the combined sewer system by absorbing more stormwater runoff. This approach offsets some of the need to build new gray infrastructure in response to increasingly frequent combined sewer overflow events and local flooding. A 2012 consent order between NYC DEP and the New York State Department of Environmental

^v <http://www.ctinnovations.com/irb-program/129/salestaxtif>

Conservation (NYS DEC) identifies an appropriate balance between green- and gray infrastructure for Combined Sewer Overflow (CSO) controls. New York City's green infrastructure program has set a goal to capture the first inch of runoff from 10 percent of impervious surfaces citywide in areas within the combined sewer system by 2010, which will also help to increase the city's resiliency to SLR. Similar actions are being significantly advanced in the City of Philadelphia including stormwater trenches and planters, pervious pavement, green roofing projects, cisterns and rain gardens.^{vi}

Community Engagement and Education

The City of Fort Lauderdale has utilized a network of formal and informal relationships to reach out to the community on the issue of SLR. The city has conducted two city-wide Neighbor Surveys to better understand public attitudes on climate change and flooding, uses Advisory Boards to gain feedback, and leverages community expertise to address emerging or lingering issues. Fort Lauderdale's 2035 Vision document, created with input from the community, resulted in a five-year strategic plan that supports priority setting for capital and annual budgets.^{vii} Fort Lauderdale also employs multiple engagement tools, and continues to test new outlets such as social media and interactive websites to gather feedback from the community.

In the State of Connecticut the Nature Conservancy has conducted Hazards and Community Resilience Workshops with over 21 coastal and inland municipalities as part of the Coastal Resilience Program.^{viii} These workshops provide a facilitated forum for the communities to comprehensively identify vulnerabilities and strengths, ownership and responsibilities, and identify and prioritize actions to reduce risk and improve resiliency across all hazards (i.e., heat, wind, ice/snow, SLR, inland flooding). The Nature Conservancy and National Oceanic and Atmospheric Administration (NOAA)'s Coastal Service Center^{ix} are converting this workshop approach into a national model for all communities to use across the United States.

Tidal Flooding

The City of Fort Lauderdale entered into an agreement with a homeowner's association to test one-way valves to reduce flooding. When the technology proved successful, Fort Lauderdale expanded its installation of tidal valves to other areas similarly impacted, and has plans to install additional valves to improve resilience against future flooding.

Stormwater Management

The Fort Lauderdale Public Works Department has developed a Comprehensive Stormwater Master Plan.^x Using initial funding from Fort Lauderdale's Stormwater Utility, over the next five years projects will be implemented using a variety of traditional and innovative methods to address coastal flooding, including bioswales, stormwater reserves, and permeable pavement. Fort Lauderdale is also using

^{vi} http://phillywatersheds.org/what_were_doing/green_infrastructure/tools

^{vii} <http://www.fortlauderdale.gov/vision>

^{viii} <http://www.coastalresilience.org>

^{ix} <http://www.csc.noaa.gov/>

^x <http://www.broward.org/NaturalResources/AboutUs/Documents/wabpres05152014ftlaudstormwater.pdf>

planning tools to set policy to help identify and prioritize areas in need of infrastructure improvements to increase climate resilience. Fort Lauderdale is collaborating with other departments to pilot implementation of the Adaptation Action Areas (AAA). Coastal communities experiencing coastal flooding tied to SLR can designate AAAs as a way to recognize impacts and prioritize funding. Fort Lauderdale has developed AAA policies, solicited and received public comments, gained Commission approval, and submitted the proposed policies for review by the state.

NYC DEP has adopted a new Resilient Design Standard – a key recommendation from the NYC’s Climate Risk Assessment and Adaptation Study^{xi} – that ensures cost-effective resiliency measures are considered in the design of vulnerable wastewater infrastructure. This design standard applies to critical infrastructure like stormwater pumping stations (NYC has one of the largest storm and wastewater treatment systems in the world) and ensures that equipment for these systems is elevated and flood-proofed to account for FEMA 100-year flood levels plus 30 inches of SLR.^{xii}

Beach Impacts

In November 2012, 2000 feet of coastal Highway A1A collapsed into the Atlantic Ocean when the combined effects of Hurricane Isaac, Superstorm Sandy, an extreme high tide, and easterly winds eroded the supporting beach and undermined the road. In partnership with the Florida Department of Transportation and Broward County, the beach was restored and the road stabilized. Following meetings with residents and Fort Lauderdale staff, design for permanent repair includes a number of features that improve the road’s resilience to storms, such as sheet piling to prevent undermining, altered stormwater flows, and the incorporation of dunes to enhance shoreline protection.

Organizational Buy-In

Pulling together all relevant stakeholder groups, including planners and officials as well as engineers, operations personnel, and others implementing measures on the ground is key to success. Furthermore, the influence of a visionary leader at the commissioner level can be critical to propagating a climate-ready mindset throughout the culture of an organization.

Opportunities

Work on SLR can also create opportunities for practitioners in the public sector. Some of the most important opportunities are summarized below.

Collaboration

Sea level rise represents an opportunity to work collaboratively with other municipalities, County governments, businesses and NGOs to better understand climate and SLR vulnerabilities, pilot new technology and policy approaches, and share best practices from around the country. Organizations

^{xi} http://www.nyc.gov/html/dep/pdf/climate/climate_complete.pdf

^{xii} <http://www.nyc.gov/html/dep/pdf/climate/climate-executive-summary.pdf>

that work with their neighbors on these issues stand to improve local support for their adaptation efforts.

Communication

Climate practitioners can present evidence to the leaders of their organizations to show why they should support and allocate funding to mitigate climate risk through SLR adaptation. Scientists have an opportunity to explain their climate results in a way that is more easily understood by the American public, as well as explain uncertainty without leading to inaction. Better communication by leaders and scientists can help create momentum around SLR adaptation issues. Also, tools such as the Neighbor's Survey provide communities with an opportunity to stimulate conversation about SLR as well as track changes in public perception.

Education

Modifying curricula to include climate change education can help to transform the next generation of students into proactive climate change leaders. Curricula should incorporate information on climate change and SLR adaptation responses, including the valuable role that natural infrastructure can play in reducing risk for communities (i.e., wave attenuation, flood storage, etc.).

Standards and Policy Modification

New standards for construction, design, permitting, roadways, utilities, urban and suburban areas, policies, and guidelines can be created and put in place. To mitigate climate change, these standards must consider the latest projections for SLR and flooding impacts to communities. Public sector work on SLR can lead to identification of innovative solutions through pilot projects at the local level. Successful technologies could be expanded through additional investments and replicated in other locations. The impacts of major storm events can also encourage communities to integrate green/gray infrastructure and proactive, long-term resiliency.

Maintaining Flexibility

Agencies can work together before storms/disasters/SLR to develop integrated approaches and negotiate the best solutions on a case-by-case basis. Dialogue between utilities and federal regulators should be centrally monitored to ensure that all parties are held to consistent standards, with the flexibility to develop plans that acknowledge changing circumstances as well as the nuances of each locale.

About ACCO

The Association of Climate Change Officers is a 501(c)(3) non-profit membership organization for executives and officials worldwide in industry, government, academia and the non-profit community. ACCO's mission is to define, develop and support the functions, resources and communities necessary for effective organizational leadership in addressing climate-related risks and opportunities. For more information about ACCO, please visit www.ACCOonline.org.

1900 K Street NW • Washington, DC 20006 • 202-496-7390 • www.ACCOonline.org

Copyright © 2014 Association of Climate Change Officers. All rights reserved.