

Sea level rise: Regulatory responses in San Francisco Bay and across the globe

By Zane Gresham and Miles Imwalle

The National Oceanic and Atmospheric Administration has concluded that during the 20th century, sea levels rose some 5–9 inches throughout the world. On an annual basis, each increment was small; the cumulative effect was considerable. Recent research estimates that 10 percent of the world's population lives in low lying areas potentially vulnerable to sea level rise impacts, a number that is expected to balloon as coastal areas are expected to see considerable population growth. It goes without saying that sea level rise has the potential to be utterly devastating. Regulatory agencies are starting to take note, and action.

The American agency furthest along in this effort is the San Francisco Bay Conservation and Development Commission (BCDC). BCDC is a regional planning and regulatory agency that includes representatives of the California State Senate and Assembly, various municipalities and counties, as well as representatives of the federal Environmental Protection Agency and the Army Corps of Engineers, the State Lands Commission and State Water Resources Control Board. On October 6, 2011, BCDC amended its “San Francisco Bay Plan” to address projected sea level rise. The process took two and a half years, dozens of public hearings, and extensive negotiations among BCDC staff, local governments, environmental organizations, business, and labor. The resulting Bay Plan amendment (Amendment) requires shoreline projects to anticipate and plan for sea level rise. While BCDC may have been one of the first agencies to adopt policies responding to sea level rise, coastal regions throughout the country—and globe—are starting to take regulatory action.

A challenging problem

The sea level in the San Francisco Bay is expected to rise 16 inches by mid-century and 55 inches by the century's end. Without action to protect shoreline areas, BCDC concluded that sea level rise could leave 180,000 acres of bay shoreline vulnerable to flooding by mid-century. By 2100, sea level rise could threaten 270,000 residents and an estimated \$62 billion in shoreline development. Sea level rise also has ecological impacts as habitat is modified and wetlands move inland, or are prevented from doing so.

While BCDC declared that it is imperative to plan for the impacts of sea level rise, how to do so presents enormously complex policy and economic issues both for existing communities and new development. There are several strategies for responding sea level rise, ranging from protection (raising or building levees), to building “resilient” structures, to precluding new development in flood-prone areas, to abandoning existing built-up areas and retreating from the rising waters. The favored approach depends not only on the specific circumstances, but also on one's point of view regarding which values to protect.

The BCDC debate on the Amendment exemplifies these difficulties. Environmental organizations urged BCDC to focus on habitat protection and a retreat from the bay, while

local government, business, and labor groups argued for protecting existing communities, promoting “smart growth,” and preserving a vitally important economic region.

The Bay Plan Amendment

The key portion of the BSDC Amendment is a new “Climate Change” section in the Bay Plan which includes the following concepts:

Flood risk assessment. When conducting shoreline planning or designing larger shoreline projects, the Amendment calls for preparing a risk assessment based on the estimated 100-year flood elevation. The assessment should identify potential flooding, degrees of uncertainty, the consequences if flood protection devices fail, and the risk to existing habitat from proposed flood protection devices.

Resilient design. Projects determined to be vulnerable to future shoreline flooding should be designed to be “resilient” to a mid-century sea level rise projection. Projects that are intended to remain in place longer than mid-century should prepare an “adaptive management plan” to manage long-term sea level rise impacts.

Habitat protection in undeveloped areas. Undeveloped shoreline areas that also sustain significant habitat should be considered for preservation and habitat enhancement.

Interim case-by-case assessment. Until a regional sea level rise adaptation strategy is developed, BCDC will assess projects on a case-by-case basis to determine the public benefits, resilience to flooding, and capacity to adapt to climate change. The Amendment generally considers the following types of projects to meet this test: remediation of contamination, transportation facilities and public utilities that serve planned or existing development, certain types of infill projects, and natural resource restoration or enhancement. Other types of projects are encouraged if they do not negatively affect the bay or increase risks to public safety, including repairs of existing facilities, small projects, interim projects that can be easily removed or relocated, and public parks.

Rising bay, new Amendment...now what?

BCDC's action has gained widespread attention, but most notable is what remains to be done. The Amendment did not address questions such as which developed areas deserve protection (and which do not), how to protect such areas, how to fund new infrastructure, or how these difficult decisions would be made and by whom.

BCDC recognized these difficult questions, but it also respected the limits of its jurisdiction. Accordingly, the Amendment calls for regional planning bodies, in collaboration with federal, state, and local governments, to create a comprehensive regional sea level rise adaptation strategy. The Amendment envisions that this regional strategy will tackle the hard choices of identifying existing communities to be protected, new development to be allowed and, to the contrary, where existing structures should be removed.

Such a policy framework is essential, but hardly sufficient. Responding to sea level rise is enormously expensive—the shoreline within the bay is roughly the same length as the entire coast of California—and fraught with complexity. Government in the Bay Area is fragmented among nine counties, dozens of municipalities, various regional agencies, and a plethora of special districts. Confronting sea level rise will require all these agencies to take a coordinated, regional approach.

Nationwide and international responses to sea level rise

East Coast and Gulf Coast states have been responding to problems related to erosion, flooding, and storm surges for years, but are now beginning to pursue long-term solutions. Most past responses have taken the form of mitigating contemporary impacts. Those impacts are substantial on the East Coast and the Gulf Coast and are exacerbated by the large number of structures within 500 feet of the shoreline in those areas. The average shoreline along the East Coast is eroding at a rate of between two and three feet per year, while along the Gulf Coast average shoreline erosion exceeds four feet per year.

Regulatory responses have been varied. Many states have developed rules for oceanfront developments that prohibit construction of structures within a certain distance from the shoreline. North Carolina, for instance, requires new buildings of less than 5,000 square feet to be constructed at a distance from the shore of thirty times the annual erosion rate (with a minimum setback of 60 feet). Larger buildings must be set back at a distance of at least sixty times the annual erosion rate.

In contrast, Texas courts recognize public beaches as rolling easements that migrate inland with the shore. *Feinman v. State*, 717 S.W.2d 106 (Tex. App. 1986). As such, Texas has prevented people from repairing their storm-damaged houses because their houses were seaward of the shore vegetation line. *Arrington v. Mattox*, 767 S.W.2d 957 (Tex. App. 1989). The South Carolina legislature has since adopted the rolling easement approach as well.

Especially after Hurricane Irene, New York City presents one of the most startling examples regarding the dangers of sea level rise. Projected sea level rise around Long Island is between two and five inches within the next twenty years. Given the huge population and development of New York City in close proximity to the shore, the risks to this area are enormous. New York began to address these risks on December 31, 2010, when New York's Sea Level Rise Task Force (Task Force) delivered its final report to the state legislature. Significantly, the report notes that structural protection measures such as seawalls and beach nourishment—the most common measures nationwide—are likely more expensive and less effective considering long-term sea level rise than non-structural measures such as planned relocation away from shorelines. Internal disagreements within the Task Force prevented complete adoption of some of the more aggressive recommendations, such as requiring some state agencies to factor projected impacts of sea level rise into all relevant aspects of decision making. The New York legislature has yet to act on the Task Force's recommendations.

Although some states' attention to sea level rise may be lagging behind the Bay Area, some foreign countries are far out ahead. In the Netherlands, where half the country is at or below sea level, locally elected groups have managed flooding since the thirteenth century. These groups, called *waterschappen*, still exist today as independent government organizations and play an integral part in managing the country's substantial sea level rise risks. Twenty-five *waterschappen* build, operate, and manage structural defenses such as dunes and dykes, maintain safe water levels and surface water quality, issue permits for sewage discharge and treatment, and collect their own taxes to fund their operations. The local *waterschappen* are given significant control over their particular areas, but are supervised by provincial governments.

The United Kingdom has responded to similar risks from the North Sea. The Thames Barrier near London, completed in 1984, was designed with sea level rise in mind, to protect London from flooding and storm surges for at least another fifty years. The government's Environmental Agency, in association with local authorities, is developing revised Shoreline Management Plans incorporating up-to-date sea level rise projections. These plans seek to move away from structural protection measures toward long-term, adaptive approaches such as realigning natural shoreline features to better protect coastal communities.

Sadly, although the threat of sea level rise is most immediate in low-lying developing countries, such as Bangladesh and the Maldives, the lack of funding and of alternative interior space leaves the most vulnerable most at risk. Even in this country, the impact of rising sea levels has devastated at least one native Alaskan village. *See Native Village of Kivalina v. ExxonMobil Corp.*, No. 09-17490 (9th Cir.).

Although most climate change related regulatory action has focused on reducing greenhouse gas emissions, responding to perhaps the most immediate climate change threat—sea level rise—is proving to be an equally daunting challenge. The decisions required are difficult—particularly whether a community should “retreat”—the solutions complex and enormously expensive, while the actual impact is likely to be years beyond the career life of most elected officials. Despite these challenges, agencies in the Bay Area and around the world are starting to confront the problem.

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