

# Executive Summary

***Climate change is happening. Past greenhouse gas emissions have committed us to decades of rising temperatures and seas.*** Recent studies, factoring in ice-sheet melt, estimate that we may experience an average of up to 6 feet of sea-level rise across the globe over the next century. The potential physical and fiscal impacts of sea-level rise (SLR) are stark. We are already seeing increasing erosion of our beaches and the inundation of low-lying wetlands. Physically, SLR will intensify impacts from storm surge, flooding, and erosion. Fiscally, governments will need to spend large amounts of money on emergency response and to rebuild flooded infrastructure. Valuable government tax base and significant private investment will literally fall into the sea. And, if governments fail to plan for these impacts, legal fallout is a certainty.

Governments have powerful reasons to begin planning and adapting now. Emergent ad-hoc responses to climate impacts will put people, property, and scarce financial resources at risk. However, governments need not invent entirely new methods to address these impacts. State and local governments have an assortment of tools that they have used to address other land-use problems (such as flooding and sprawl) that they could refashion and use to adapt. This Tool Kit describes 18 different land-use tools that can be used to preemptively respond to the threats posed by SLR (see Table 1 on the next page). This Tool Kit focuses on land-use tools that could be used to adapt to impacts to the built environment (public and private coastal development and infrastructure).

In order to devise a comprehensive strategy, governments will need to determine which tools to employ given their unique socio-economic and political contexts. To this end, we also provide policymakers with a framework for decision making. We analyze each tool by (1) the type of power exercised to implement it (planning, regulatory, spending, or tax and market-based tools); (2) the policy objective that it facilitates (protection, accommodation, planned retreat, or preservation); and (3) the type of existing or potential land uses that the tool can be used to adapt (critical infrastructure, existing development, developable lands, and undevelopable lands). Finally, we provide a top-level analysis of the trade-offs between tools—the economic, environmental, and social costs and benefits, and the legal and administrative feasibility of implementing each tool.

**TABLE 1: Synopsis of SLR Adaptive Tools**

Tool Number	Adaptation Measure	Description	Implementation to Address SLR
<b>PLANNING TOOLS</b>			
1	<b>Comprehensive Plans</b>	Provide the long-range planning tool used to guide future development in a community.	Considering SLR in comprehensive plans is the first step by which local governments can begin to incorporate adaptive strategies into their communities' land-use decision-making framework. Studies and evidence used to amend comprehensive plans can serve as the evidentiary support needed to amend zoning ordinances.
<b>REGULATORY TOOLS</b>			
2	<b>Zoning and Overlay Zones</b>	Provide the legal framework that governs the use and development of land in a community. Zoning maps divide the community into different districts based upon the types of uses that are permitted (e.g., residential, commercial, or industrial). Then, within each zone the ordinance specifies the design requirements that govern development (e.g., setbacks, building heights, building densities). Overlay zones superimpose additional regulations on an existing zone based upon special characteristics of that zone (e.g., floodplains and historic districts).	As a necessary predicate to implementing most land-use tools, local governments will need to amend their zoning ordinances to designate areas that are vulnerable to impacts and to impose special regulations on those areas. Special regulations could prohibit or limit expansion or major renovation to existing structures and rebuilding of damaged structures. Governments could create zones based upon their adaptation goals (protection, accommodation, retreat, or preservation).
3	<b>Floodplain Regulations</b>	As a requirement to participate in the National Flood Insurance Program (NFIP), local governments must impose minimum regulation on development in floodplains (generally delineated as the 100-year floodplain). Typically structures in these areas must be constructed to minimize flood damage (e.g., elevated).	Governments could impose additional restrictions on development in floodplains above NFIP minimum standards. Governments could impose use restrictions in the 100-year floodplain (e.g., limit permitted uses to low-density, large-lot residential, agricultural, or recreational uses). Governments could also begin to impose design requirements in the 500-year floodplain (e.g., requirements that structures be elevated).
4	<b>Building Codes and Resilient Design</b>	Establish requirements for building construction to maximize protection from flooding (e.g., elevation and construction techniques and materials).	Governments can extend building code regulations to properties in the 500-year floodplain and require that new structures be designed to be more resilient to flood impacts. Governments can require that structures in the 100-year coastal floodplain be further elevated or strengthened to account for increased coastal flooding from SLR over the life of the structure.

**TABLE 1: Synopsis of SLR Adaptive Tools [continued]**

Tool Number	Adaptation Measure	Description	Implementation to Address SLR
5	<b>Setbacks/Buffers</b>	Require that development be set back a distance from a baseline, typically a shoreline feature (e.g., high water mark, bluff crest, or vegetative line). Require landowners to leave, in their natural state, portions of property that support natural and beneficial functions (such as wetlands that prevent runoff and flooding).	Governments could establish or increase mandatory setbacks from the coast, establish setbacks based upon projected shoreline position using calculations of increased flood and/or erosion rates, or create a tiered setback system permitting smaller structures with less of a setback and requiring greater setbacks for larger development. Governments could require that development adjacent to the shore leave buffers to provide natural protection to development while allowing for upland migration of beaches and wetlands.
6	<b>Conditional Development and Exactions</b>	Impose special conditions as a condition of a development permit. Conditions can be designed to mitigate the impacts of development, and can take the form of impact fees, land-use restrictions, and dedications of lands for public purposes.	Governments can use conditions to restrict landowners' rights to build hard coastal protection, require removal of structures that come to be inundated as the shoreline recedes, require dedication of coastal buffers, require impact fees to pay for emergency response costs or to mitigate impacts from coastal armoring, or require that structures have greater levels of flood protection.
7	<b>Rebuilding Restrictions</b>	Limit a property owner's ability to rebuild structures destroyed by natural hazards, such as flooding.	Governments can limit when and how structures are rebuilt by prohibiting reconstruction, requiring that structures be rebuilt using resilient design techniques, or conditioning redevelopment on a landowner's agreement not to armor in the future.
8	<b>Subdivision and Cluster Development</b>	Require the concentration of development in desirable areas using subdivision ordinances. These programs allow developers to increase densities in specified areas in exchange for the developer's agreement to designate open space.	Governments could encourage concentration of development in upland areas and require dedication of vulnerable areas as open-space and flood buffers.
9	<b>Hard-Armoring Permits</b>	Use permitting processes to regulate the construction of hard-engineered structures that provide flood and erosion control.	It may be necessary to harden the coast where there is considerable existing development or critical infrastructure. However, governments can limit hard armoring along vulnerable coastlines with sensitive ecosystems, require that the armoring be constructed to protect against storm surge combined with increased sea levels, and require mitigation where armoring is permitted.
10	<b>Soft-Armoring Permits</b>	Facilitate "soft" coastal protection projects that replenish or mimic natural buffers, such as beach nourishment, living shorelines, or wetlands restoration.	Governments could create permitting programs to require the use of soft-armoring techniques where feasible in order to lessen environmental impacts of shoreline armoring.
11	<b>Rolling Coastal Management/ Rolling Easement Statutes</b>	Combine different land-use regulations that serve to ensure that coastal development does not impede the natural inland migration of coastal resources.	Rolling coastal management statutes can limit new development in at-risk coastal areas, limit or prohibit the construction of hard-coastal armoring, require removal of structures that come to encroach on public lands due to erosion, and require real estate disclosures.

**TABLE 1: Synopsis of SLR Adaptive Tools [continued]**

Tool Number	Adaptation Measure	Description	Implementation to Address SLR
<b>SPENDING TOOLS</b>			
12	<b>Capital Improvement Programs (CIPs)</b>	Guide future investments in public infrastructure based upon projections of the community's growth.	Governments can use CIPs to site new infrastructure out of harm's way, discontinue maintenance and repair of infrastructure that is repetitively damaged, or relocate or retrofit existing infrastructure to be more resilient to SLR.
13	<b>Acquisitions and Buyout Programs</b>	Acquire property at risk from flooding or other hazards. Structures are typically demolished and the property is restored. Undeveloped lands are conserved as open space, public parks, or for natural resources.	Governments could extend floodplain buyout programs to properties threatened from SLR and could prioritize for acquisition vulnerable properties with high natural resource value. Governments could prioritize for acquisition lands with potential to serve as flood buffers for existing development and potential to serve as corridors for migrating beaches and wetlands.
14	<b>Conservation Easements</b>	Provide a flexible mechanism by which public entities can preserve land in its natural state while allowing land to remain in private ownership. Landowners grant an easement agreeing to restrict development of the land often for compensation or tax benefits.	Governments could prioritize acquisition of easements on properties vulnerable to SLR and acquire conservation easements to ensure preservation of lands that could serve as flood buffers, habitat, or migration corridors.
15	<b>Rolling Conservation Easements</b>	Adapt conservation easements to provide a rolling boundary that is designed to preserve the ability of the shoreline to migrate inland.	Rolling easements could be used to purchase any rights that landowner may have to construct coastal armoring and to require owners to remove structures that become threatened by rising seas and erosion while allowing for some upland development of the property.
<b>TAX AND MARKET-BASED TOOLS</b>			
16	<b>Tax incentives</b>	Encourage preferred development patterns and can take the form of preferential assessment programs, tax abatements, and tax credits.	Governments can encourage conservation of vulnerable properties by taxing properties at a lower rate based upon its restricted "use value;" encourage relocation or retrofit of flood-prone properties by providing a one-time tax credit; or encourage upland infill development by providing tax credits or streamlined permitting.
17	<b>Transfer Development Rights</b>	Restrict development in one area ("sending area") and allow for the transfer of development rights to another area more appropriate for intense use ("receiving area").	Governments could restrict development in vulnerable areas and allow for transfer of development rights to upland parcels where development will be out of harm's way.
18	<b>Real Estate Disclosures</b>	Require sellers of real estate to disclose certain property defects to prospective buyers prior to close.	Governments can compile and disseminate information about a property's vulnerability to SLR, or require sellers to disclose if a property is located in an area vulnerable to SLR.