



Tackling Sea-Level Rise

BEST PRACTICES IN THE SAN FRANCISCO BAY AREA



Urban Land Institute **San Francisco**
Serving the Greater Bay Area

Tackling Sea-Level Rise

BEST PRACTICES IN THE SAN FRANCISCO BAY AREA

About the Urban Land Institute

The mission of the Urban Land Institute (ULI) is to provide leadership in the responsible use of land and in creating and sustaining thriving communities worldwide. ULI is committed to:

- Bringing together leaders from across the fields of real estate and land use policy to exchange best practices and serve community needs;
- Fostering collaboration within and beyond ULI's membership through mentoring, dialogue, and problem solving;
- Exploring issues of urbanization, conservation, regeneration, land use, capital formation, and sustainable development;
- Advancing land use policies and design practices that respect the uniqueness of both built and natural environments;
- Sharing knowledge through education, applied research, publishing, and electronic media; and
- Sustaining a diverse global network of local practice and advisory efforts that address current and future challenges.

Established in 1936, the Institute today has more than 34,000 members worldwide representing the entire spectrum of the land use and development disciplines. ULI relies heavily on the experience of its members. It is through member involvement and information resources that ULI has been able to set standards of excellence in development practice. The Institute has long been recognized as one of the world's most respected and widely quoted sources of objective information on urban planning, growth, and development.

Cover photo: Morning stillness on San Francisco Bay. (Flickr/David Yu)

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About ULI San Francisco's Resiliency Best Practices Grant

This project, an initiative of ULI San Francisco, consisted of two forums highlighting lessons learned and best practices that could contribute to greater resilience for the community and new development. One forum highlighted three jurisdictional planning efforts; the second highlighted entitlement processing and conditions of approval for new development. Each forum involved a panel whose role was to identify lessons learned and best practices while representing diverse perspectives. Subsequently, summary reports of these panels were shared more broadly with a panel of experts at ULI's Building the Resilient City conference on September 4, 2014. This report incorporates the perspectives of both the forums and conference panelists.

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Acknowledgments

ULI San Francisco would like to thank the individuals and organizations that contributed to the two forums and conference session that formed the basis of this report.

FORUM 1

July 15, 2014

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Lindy Lowe, Senior Planner, Bay Conservation and Development Commission

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Ezra Rapport, Executive Director, Association of Bay Area Governments

FORUM 2

July 30, 2014

Presenters

Jon Knorpp, Managing Director of Development Services, San Francisco Giants

Joe LaClair, Chief Planning Officer, Bay Conservation and Development Commission

Moderator

Gabriel Metcalf, Executive Director, SPUR

Panelists

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Daniel Ngoroi, Coastal Mapping Engineer, Woolpert

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BEST PRACTICES IN RESILIENCE PLANNING FROM ACROSS THE SAN FRANCISCO BAY AREA

(ULI Building the Resilient City conference session)

September 4, 2014

Moderators

Gabriel Metcalf, Executive Director, SPUR

Charles A. Long, Charles A. Long Properties

Panelists

Ezra Rapport, Executive Director, Association of Bay Area Governments

Bruce Riordan, Consultant, Bay Area Joint Policy Committee

Will Travis, Consultant, Former Executive Director, Bay Conservation and Development Commission

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Contents

- 6 EXECUTIVE SUMMARY
- 8 INTRODUCTION
- 13 KEY FINDINGS
- 29 CONCLUSION



**Low tide on tidal mudflats in
San Pablo Bay in Sonoma County.**
(Flickr/Lisa Ouellete)

Executive Summary

FUNDED BY A RESILIENCY GRANT made possible by the Kresge Foundation, ULI San Francisco embarked on a project in 2014 to examine current subregional resilience planning initiatives and resilience-related development entitlement conditions in the Bay Area. The project had the following goals:

- Identify best practices and lessons learned in defining and enabling resilient economic, public health, and environmental systems, both in terms of response to episodic events and planning for long-term change.
- Identify barriers and constraints preventing resilience, including regulatory, funding, and jurisdictional impediments that prevent effective response to the resilience challenges.
- Break down silos separating multiple functional areas of resilience planning.
- Build relationships among professionals from the different disciplines of resilience planning.

A steering committee composed of ULI members and actors in resilience activities in the Bay Area defined the issues for discussion. Two forums were held, one focused on sub-regional planning and the other on entitlement. Each began with presentations by project managers to a panel of experts in a variety of disciplines, including economists, developers, engineers, public finance and insurance specialists, and staff from local and state government. The forums concluded with a discussion of the best practices presented.

The results of the forums were the focus of a panel discussion at the ULI Building the Resilient City conference in San Francisco in September 2014. This report summarizes the forum findings and conclusions.

The Resiliency Best Practices project offers five key findings for consideration by communities and the private sector as they engage in efforts to increase the resilience of communities and private development.

Highest tide of the year at Marina Green in San Francisco.
(Flickr/Matt Richardson)



1

RETHINK APPROACHES TO GOVERNANCE AND SCALE

Resilience planning requires interjurisdictional collaboration at the subregional level and funding and leadership at the regional level. Integrating resilience planning with existing governance structures or approaches is challenging because its scale and scope are often beyond the geographic boundaries of established jurisdictions. Modified or entirely new approaches with the appropriate geographic scope and jurisdictional collaboration are vital to success.

2

INTEGRATE RESILIENCE INTO EXISTING PLANNING AND FUNDING SYSTEMS

Planning for resilience needs to be embedded in existing planning and capital planning tools, such as general plans, capital planning cycles, zoning codes, building codes, local coastal programs, hazard-mitigation planning, and sustainable community strategies, so that resilience planning becomes routine. This constitutes an ongoing, evolving challenge requiring continued effort.

3

DEVELOP AND IMPLEMENT INNOVATIVE FINANCING

Financing solutions for long-term shoreline resilience are in their infancy and need to consider proposals that address multiple issues: areawide infrastructure, amortization of costs, a regional funding base, and measures that pay for future rehabilitation or removal of development that sea-level rise may jeopardize.

4

ENGAGE THE PRIVATE SECTOR

The public and private sectors need to work together because neither can tackle the impacts of sea-level rise alone. This is not just a governmental problem: business involvement in community resilience planning is essential for the creation of innovative solutions. On the other hand, resilience is not just a business practice independent of community connections to services and access; it requires both sectors to work collaboratively.

5

ESTABLISH CERTAINTY IN STANDARDS AND FLEXIBILITY IN RESPONSE

Entitlement agencies should address uncertainty concerning the impacts of sea-level rise by agreeing on a standard initial increase in sea level that should be considered by developers of new projects. However, the agencies should be flexible in approving responses to that standard, allowing developers and local governments to implement innovative, site-specific resilience measures and encouraging solutions that both adapt to future resilience stressors through adaptive project design and address the resilience of adjacent developed areas.

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This report is organized into three main sections: Introduction; Key Findings, with explanations of those findings; and Conclusion.

Introduction

THE BAY AREA IS NO STRANGER TO NATURAL DISASTERS. In 1989, the Loma Prieta earthquake caused 57 deaths and over \$6 billion in damage. In 1991, the Oakland Hills firestorm caused 25 deaths and destroyed 4,000 homes. Resilience planning in the Bay Area should address multiple threats, including drought, flooding, inundation (permanent flooding), and earthquake. Many of these threats, such as sea-level rise and seismic activity, create hazards, the cumulative impact of which can be liquefaction of low-lying land.

Relatively recently, sea-level rise has been added to the list of resilience challenges, largely as a result of the leadership of the Bay Conservation and Development Commission (BCDC), a state agency created by the California legislature in 1965 with the charge of minimizing future unnecessary filling of San Francisco Bay. Urban development patterns in the Bay Area make the challenge of rising sea levels particularly critical: over 280 square miles of low-lying land is vulnerable to being inundated by 2050. In addition, the Bay Area, including the Sacramento–San Joaquin River Delta region, accounts for almost half the total coastal shoreline of California.

Responding to these challenges is complex because more than 110 cities and counties and many other entities need to collaborate in order to mitigate the problem. To address this fragmented authority, the Bay Area has become something of a laboratory for resilience planning, with almost 30 subregional consortiums devising bottom-up solutions to multiple resilience challenges through collaborative initiatives.

These separate initiatives have evolved somewhat independently, generating their own ideas and practices. This has produced a dynamic and innovative regional atmosphere, but it also creates the opportunity and need for the cities and counties implementing these independent initiatives to increase their efficiency and effectiveness by learning from each other. Through its Resiliency Best Practices grant, ULI San Francisco (ULIsf) hopes to enhance communication across the multiple subregional resilience planning efforts and to foster interdisciplinary and interjurisdictional collaboration and regional consistency.

To accomplish this goal, ULIsf designed and conducted two forums highlighting different aspects of planning, focusing on multijurisdictional, integrated initiatives and comparing several development projects, the conditions of their approval, and their entitlement process. Through these two forums, ULIsf hoped to identify best practices and lessons learned in terms of:

- response to episodic events;
- planning for long-term change; and
- identifying barriers that hamper resilience efforts, including regulatory, legal, funding, and jurisdictional impediments.

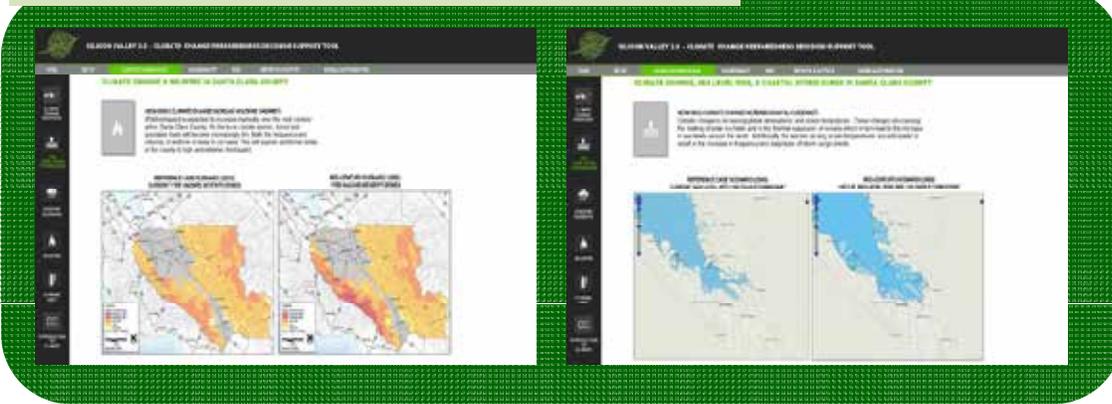


SILICON VALLEY 2.0 CLIMATE CHANGE PREPAREDNESS DECISION SUPPORT TOOL

PURPOSE:

- **PROVIDE CITIES IN SANTA CLARA COUNTY WITH AN ON-LINE TOOL THAT FACILITATES UNDERSTANDING OF HOW CLIMATE CHANGE COULD THREATEN THEIR COMMUNITIES**
- **IDENTIFY THE VULNERABILITY OF INFRASTRUCTURE AND OTHER COMMUNITY ASSETS TO CLIMATE CHANGE:**
 - SEA LEVEL RISE
 - RIVERINE FLOODING
 - EXTREME HEAT
 - STORM SURGE
 - WILDFIRE
- **DESCRIBE THE POTENTIAL ECONOMIC CONSEQUENCES OF CLIMATE CHANGE VULNERABILITY**
- **PROVIDES INFORMATION THAT CITIES AND THE REGION CAN USE TO DEVELOP CLIMATE PREPAREDNESS STRATEGIES**

TOOL MODULE 1: SUMMARY OF CLIMATE CHANGE IN SANTA CLARA COUNTY



SUBREGIONAL PLANNING

The first ULI's Resiliency Best Practices panel, held July 15, included detailed presentations on three subregional planning initiatives, focusing on their efforts to increase the resilience of their subregions. The three initiatives were Silicon Valley 2.0 in Santa Clara County; BCDC's Adapting to Rising Tides pilot project in Alameda County; and the Regional Climate Protection Authority's Climate Action 2020 in Sonoma County.

Silicon Valley 2.0

The Silicon Valley 2.0 project—managed by the Santa Clara County Office of Sustainability and funded by the Strategic Growth Council¹—is a subregional effort to minimize the anticipated impacts of climate change. The project will have two main outputs—a regional climate adaptation guidance document, and a vulnerability and risk assessment tool for use by jurisdictions and agencies in the county.

Context for the project was provided by a detailed gap analysis to understand the current state of climate preparedness of assets in the county. The web-based vulnerability and risk assessment tool allowed users to select climate stressors, scenarios, sectors, and geographies to evaluate the exposure of community assets (i.e., infrastructure, residents, and landscapes) to likely climate impacts, and to examine the potential consequences to the economy, society, and environment of this exposure. The results of the vulnerability assessment informed the development of adaptation strategies appropriate for regional implementation.

Silicon Valley 2.0 Climate Change Preparedness Decision Support Tool.
(Santa Clara County/AECOM)



Black-necked stilt foraging at Hayward Regional Shoreline.
(Flickr/Ken-ichi Ueda)

Hayward Regional Shoreline with views of San Francisco across the bay.
(Flickr/Ingrid Taylor)

Biking along the levees at Hayward Regional Shoreline.
(Flickr/el_finco)



BCDC’s Adapting to Rising Tides Pilot Project

Alameda County’s Adapting to Rising Tides—the ART Project—is a collaborative planning effort to help San Francisco Bay Area communities adapt to sea-level rise and storm-related flooding. Led by the San Francisco BCDC and the National Oceanic and Atmospheric Administration Coastal Services Center, the ART Project has engaged local, regional, state, and federal agencies and organizations, as well as nonprofit and private associations.

Together, the ART Project team and its partners are working toward the goal of increasing the Bay Area’s preparedness and resilience to sea-level rise and storm events while protecting critical ecosystems and community services.



Regional Climate Protection Authority’s Climate Action 2020

The Regional Climate Protection Authority (RCPA), California’s only legally constituted local climate authority, was created through state legislation in 2009 to improve cross-agency coordination and collaboration in Sonoma County on climate change issues. The RCPA staff is leading the development of the new Climate Action 2020 initiative and is engaged in

a variety of efforts aimed at reducing greenhouse gas (GHG) emissions, including energy efficiency, building retrofits, and alternative transportation programs. Integrating climate change into every aspect of local government, Climate Action 2020 is a collaborative effort among all nine cities in Sonoma County and the county government to take further action in reducing GHG emissions community-wide, assessing vulnerable assets, and preparing climate adaptation strategies.



These three initiatives were selected from the numerous climate adaptation planning efforts in the Bay Area because they represent multiple-objective, innovative approaches to resilience planning in three different regions of the Bay Area. The panel's role in this forum was to identify from among each of these initiatives the best practices and lessons learned that could be applicable generally to enhancing subregional resilience.

PRIVATE SECTOR RESILIENCE

The second ULISf Resiliency Best Practices panel, held July 30, was centered on private sector engagement in resilience planning and specifically focused on entitling development projects to incorporate resilience. The panel heard two detailed presentations—on the San Francisco Giants' Mission Rock project in San Francisco County, and BCDC's sea-level rise guidance and planning efforts.

Mission Rock Project

Over the past four years, the San Francisco Giants have worked with the Port of San Francisco, neighbors, and the larger community to develop a design strategy for Seawall Lot 337 and Pier 48, located just south of AT&T Park, that will convert the 24-acre surface



Mission Creek flowing under Interstate 280 toward the San Francisco Giants ballpark.

(Flickr/Steve Boland)



The Port of San Francisco as seen from Pier 14.
(Flickr/David Yu)

parking lot into a commercial and retail center with a neighborhood park, collectively known as Mission Rock.

As Giants officials worked with the San Francisco Planning Department in designing the Mission Rock project, they collaboratively created an innovative set of development standards for designing a resilient shoreline. These standards include a sea-level-rise topographic strategy to create a variety of zones, from the highest—designed to be above 100-year floods, including king tides (the highest tides of the year) in 2100—to the lowest, designed to accommodate flooding, as well as incorporate stormwater management techniques and a resilient planting palette.

The Mission Rock development program is designed to be flexible enough to respond to future market conditions—an approach intended to achieve the shared goal of preserving flexibility for individual development sites and creating a land use framework within which the program will evolve.

BCDC’s Sea-Level Rise Efforts

BCDC’s Planning Unit is responsible for conducting major planning studies, specialized research, and policy development, as well as developing amendments to the San Francisco Bay Plan. BCDC’s Climate Change Program promotes research to improve the commission’s collective understanding of climate change impacts, mitigation, and adaptation; develops and implements climate change adaptation policies in coordination with regional partners and stakeholders; and builds the region’s institutional capacity to effectively adapt to climate change in a coordinated and collaborative way.



Several other development projects were invited to participate in this forum, but hesitated over concerns regarding the contentious nature of waterfront development in San Francisco. This to some extent thwarted the goal of ULIs’s Resiliency Best Practices grant to increase collaboration among development project managers throughout the region. Nevertheless, the panel for this forum discussed what regulatory agencies and developers of new projects should consider in order to achieve regional resilience goals that apply not just to new development, but also to existing development.

Key Findings

RESILIENCE WILL ONLY COME through effectively addressing governance, finance, and design challenges. Each of these areas requires public and private stakeholders to think through some dilemmas, such as local versus regional responsibility, public funding versus private funding, and perimeter protection versus elevation of developments—or even deciding whether new development should be allowed in areas thought vulnerable to sea-level rise.

The Resiliency Best Practices project identified five key areas for improving the effectiveness of resilience efforts.

1

RETHINK APPROACHES TO GOVERNANCE AND SCALE

2

INTEGRATE RESILIENCE INTO EXISTING PLANNING AND FUNDING SYSTEMS

3

DEVELOP AND IMPLEMENT INNOVATIVE FINANCING

4

ENGAGE THE PRIVATE SECTOR

5

ESTABLISH CERTAINTY IN STANDARDS AND FLEXIBILITY IN RESPONSE

The Vista del Mar staircase in Pacifica during the highest tide of the year.

(Flickr/Cassidy Teufel)



1

RETHINK APPROACHES TO GOVERNANCE AND SCALE

Resilience planning requires interjurisdictional collaboration at the subregional level and funding and leadership at the regional level. Integrating resilience planning with existing governance structures or approaches is challenging because its scale and scope are often beyond the geographic boundaries of established jurisdictions. Modified or entirely new approaches with the appropriate geographic scope and jurisdictional collaboration are vital to success.

There is only so much any one jurisdiction can do to plan for and implement improvements that effectively address the challenges of climate change, sea-level rise, and other extreme climate events and natural disasters. No jurisdiction acting alone can be effective, yet hundreds of public agencies have authority over portions of the San Francisco Bay shoreline. Fragmented authority and inherent jurisdictional competition represent threats to successful climate adaptation planning. Resilient shorelines need collaboration, not fragmentation and competition.

The Role of Government Agencies

Defining the roles of the local, regional, state, and federal governments in partnership will be essential. In the case of the San Francisco Bay Area, *regional* is usually defined as the nine counties surrounding the bay.

Case Study: Mapping Damage from Superstorm Sandy across Jurisdictions

When it hit the United States as a post-tropical cyclone, Hurricane Sandy had a diameter of 1,100 miles, making it the largest Atlantic hurricane on record. In the wake of the devastation wreaked by the storm, dozens of federal, state, and local agencies as well as private companies took part in the response.

These stakeholders contracted with pilots to collect LIDAR (light detection and ranging) data from many of the affected areas, with the main purpose of quickly and collaboratively obtaining accurate elevation information covering a large area spanning multiple jurisdictions. What resulted was more than 250 miles of coastal data spanning New York, Virginia, and Maryland.

This information was used by the U.S. Army Corps of Engineers to visually evaluate, denote, and quantify hurricane damage areas, assess changes, and set priorities for recovery efforts. In addition, information was made available to emergency responders, relief and reconstruction workers,

the public, government agencies, and private companies for use in restoration and planning.

By rethinking their approach to governance and scale, collaborating stakeholders, both public and private, were able to rapidly assess damage, establish response priorities, and better plan for the future.



Damaged homes along the New Jersey shore after Hurricane Sandy.
(Flickr/Greg Thompson, USFWS)

Source: Woolpert.

A regional mechanism or mechanisms may be needed to bridge the gaps between local land use authority and the scope of interrelated problems baywide. The state is likely to continue to provide technical leadership and demonstration funding, but is unlikely to provide comprehensive authority to any one state agency. Federal agencies may eventually provide structured relief, but have not yet gone beyond technical assistance. The very high cost of enhancing a region's ability to withstand the impacts of rising sea levels makes a compelling argument for the federal government playing a major role as well. In many cases, tighter coordination with private long-term equity investment and hazard insurance entities will also be needed.

The Bay Area Joint Policy Committee (JPC), which coordinates the planning efforts of BCDC, the Association of Bay Area Governments (ABAG), the Bay Area Air Quality Management District (BAAQMD), and the Metropolitan Transportation Commission (MTC), serves as a forum for initiating problem solving at the subregional level involving multiple jurisdictions and provides a platform through which people working on projects in different counties can communicate. Subregional collaboration will also require informed political leadership that understands the interjurisdictional dynamic involving policy makers, professional staff, and the public.

Through coordination with the JPC, all three initiatives explored in the first forum—the ART Project, Silicon Valley 2.0, and RCPA—hope to scale up and assist other climate adaptation programs throughout the Bay Area so they do not have to “reinvent the wheel.” Future projects can benefit from lessons learned to increase the efficiency of their analysis and, ideally, hasten appropriate implementation. Lack of data and the need for better data collection, for example, have already been recognized as key issues.

The Role of Utilities

The scope of the resilience challenge involves multiple jurisdictions, land areas, and the systems that connect them through geography and community. A single jurisdiction, such as a city, rarely has the scope of services or scope of area to effectively address broad resilience challenges. Utility and transportation providers and their systems must be included in resilience efforts because their systems are vital to the communities within any one planning area.

Among utility service providers, water and sewer agencies already act as drivers of smart growth and as the financiers of resilient infrastructure investments. Public utilities also have the ability to incur revenue-bond debt to generate capital improvement funds secured by user rates without voter approval. Such capital improvements can be used to address problems at a wide geographic or systemwide scale. Regional transportation investments by the MTC represent another way to finance resilience improvements.

However, it is important to note that analysis confined to a single sector, such as water supply or roads, can prevent a more holistic understanding

The California Aqueduct carrying water southward.
(Flickr/David Levinson)



of the bigger picture. Effective implementation of resilience measures will require alignment of jurisdictional service providers, initial capital and ongoing funding, and identification of entities (like the JPC) to broker solutions to problems involving multiple jurisdictions, including scheduling and allocation of funds.

Use of Natural Systems to Determine Boundaries and Scale

The natural processes on the shoreline may also help determine the scale and boundaries for sea-level-rise planning projects. For example, it would be ineffective to build a shoreline defense structure that stopped in the middle of a marsh.

Some planning efforts are occurring at the subregional scale, such as the South Bay Salt Pond Restoration Project, the largest tidal wetland restoration project on the West Coast, and the Strategy to Advance Flood protection, Ecosystems, and Recreation along the Bay (SAFER Bay), a project of the San Francisquito Creek Joint Powers Authority to integrate wetlands restoration on the shoreline to enhance protection. When complete, the South Bay project will convert over 15,000 acres of industrial salt ponds to a rich mosaic of tidal wetlands and other habitats. Both of these projects are addressing the ecological and flood-risk management implications of sea-level rise at a geographic scale appropriate to the natural systems.

The scale of planning modeled by the three initiatives explored in ULI's first Resiliency Best Practices forum illustrated this issue of subregional collaboration around geographically connected systems: Silicon Valley 2.0 and Sonoma County RCPA are dealing with systems on a countywide basis, while the ART Project is focused on a stretch of shoreline within one county that is large enough that interconnected systems and adaptation responses will be addressed.

The South Bay Salt Ponds Restoration Project.

(Flickr/Doc Searls)



The San Francisquito Creek Flood Protection Project.

(Flickr/Christina B. Castro)



2

INTEGRATE RESILIENCE INTO EXISTING PLANNING AND FUNDING SYSTEMS

Planning for resilience needs to be embedded in existing planning and capital planning tools, such as general plans, capital planning cycles, zoning codes, building codes, local coastal programs, hazard-mitigation planning, and sustainable community strategies, so that resilience planning becomes routine. This constitutes an ongoing, evolving challenge requiring continued effort.

As described in the first key finding, though many organizations have undertaken resilience projects in the Bay Area, planning for resilience must move beyond individual projects to involve ongoing programs. Just as Sonoma County has embraced climate change planning, all counties and agencies in the Bay Area should mainstream climate adaptation, injecting it into capital improvement programs wherever possible and pairing projects offering immediate benefits with long-term strategies for improving resilience. Though framing the issue in terms of the need to adapt to climate change makes it seem like something to be addressed in the distant future, in fact, many challenges involve problems that require immediate solutions.

Case Study: BCDC's Adapting to Rising Tides Project in Alameda County

The Bay Conservation and Development Commission (BCDC) Adapting to Rising Tides (ART) assessment not only provided information necessary for developing sub-regional adaptation responses, but also helped answer a number of key process questions. Among these are: How does the project's scope, including the number of assets or the geographic scale, affect the assessment and planning outcomes? What types of analysis can be completed at these different scales? How can issues that cut across different types of assets, sectors, or scales be clearly summarized and communicated?

The ART Project was able to investigate these questions because the project scope cut across multiple asset categories and sectors, and because vulnerability and risk were assessed at different geographic scales and levels of specificity within asset categories.

At the scale of the project area or subregion that included most of one county's shoreline, each of 12 asset categories was evaluated as a whole. In some cases these more fine-grained assessments looked at unique sites within the subregion (e.g., a shoreline park, a wastewater treatment plant, or the Port of Oakland seaport). Where it was impossible to consider all assets in a category, vul-



BCDC's Adapting to Rising Tides Project planning process.
(BCDC)

nerability of representative assets and asset components was described.

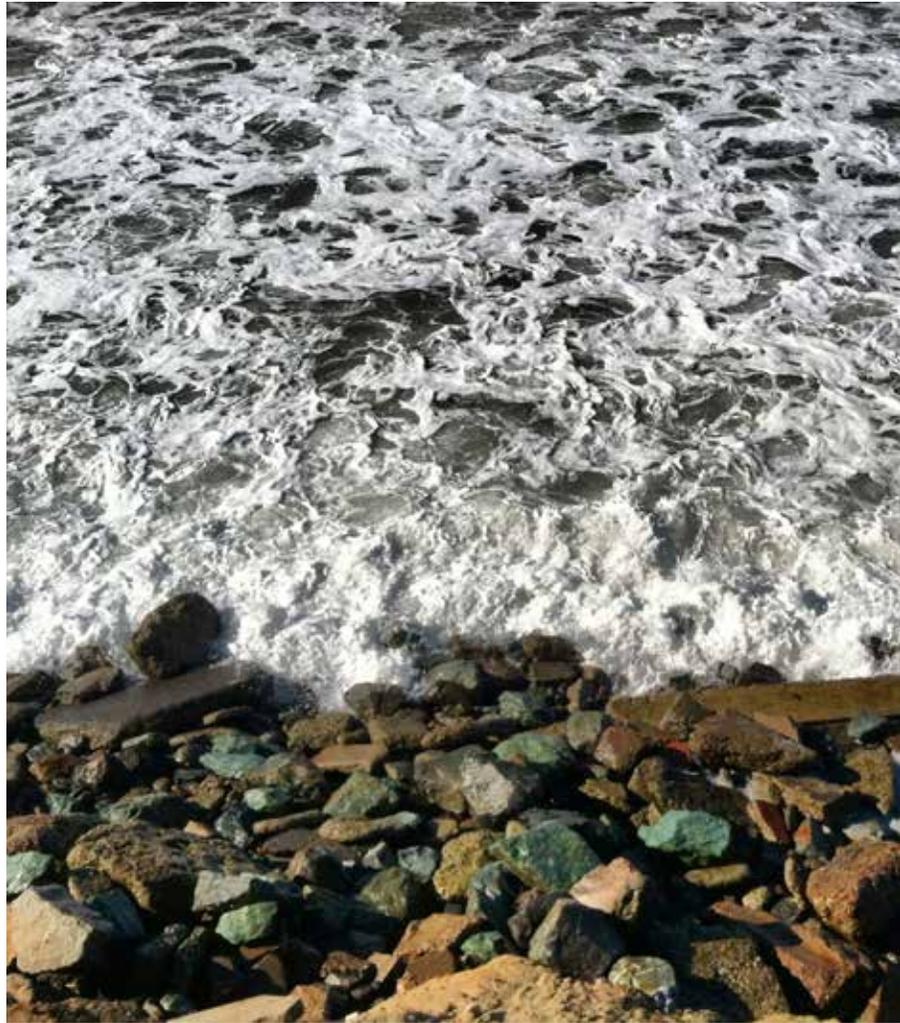
This broad-scope, multi-scale approach shed light on the benefits and constraints that project scope and different scales of analysis play in adaptation processes and outcomes.

Source: Bay Conservation and Development Commission.

the state's 18 metropolitan planning organizations, or designated transportation funding agencies for federal and state funds, is required to develop a sustainable communities strategy to accommodate future population growth and reduce greenhouse gas emissions from cars and light trucks. Plan Bay Area is integrated with the 2040 Regional Transportation Plan and represents the next iteration of a planning process that has been evolving for decades.

Used in coordination with cities and counties, the plan advances initiatives to expand housing and transportation choices, create healthier communities, and build a stronger regional economy. Plan Bay Area will be implemented through the designation of priority development areas and allocation of One Bay Area grants to subsidize development in municipalities that comply with plan suggestions.

Although Plan Bay Area included review of the impacts of 24 inches of sea-level rise on the households and employees in the priority development areas and priority transit projects and suggested how to mitigate those impacts, the plan as approved in 2013 did not fully account for sea-level rise². The next iteration of Plan Bay Area, anticipated in 2017, will take sea-level rise into greater consideration when directing housing and transportation investments and will present a critical opportunity to elevate the Bay Area's disparate resilience projects to program-level thinking.



Funding for Data-Driven Collaborations

Data gaps were identified as one the biggest vulnerabilities in the effort to incorporate resilience planning into subregional planning efforts. This is in part due to a deficit of systems set up to collect and track data that would help in understanding vulnerability and in developing effective adaptation strategies. This problem is also linked to a general lack of funding at the agencies to do this type of collection, even if the appropriate systems were in place. The region needs to address this issue.

Going forward, the region needs to establish an ongoing process and funding mechanism that requires jurisdictions to engage with one another and produce resilience strategies. Such an accountability mandate may require state legislation providing the authority for monitoring at the regional level. This call for accountability must be flexible enough to foster creative solutions using performance benchmarks to measure success. The planning process should incorporate an adaptive management cycle—assessing, planning, implementing, monitoring, and reassessing—in order to address the accelerating trend of climate change and the uncertainty in projections.

Ocean Beach in San Francisco during the highest tide of the year.

(Shannon Fiala)

3

DEVELOP AND IMPLEMENT INNOVATIVE FINANCING

Financing solutions for long-term shoreline resilience are in their infancy and need to consider proposals that address multiple issues: areawide infrastructure, amortization of costs, a regional funding base, and measures that pay for future rehabilitation or removal of development that sea-level rise may jeopardize.

Resilience planning will evolve to be mainstreamed into daily activities requiring ongoing—not just one-off—funding. For example, two of the planning initiatives featured during ULI's first Resiliency Best Practices forum—the ART Project and Silicon Valley 2.0—occurred solely on the basis of a one-time grant.

In the public domain, capital financing authority for developing resilience improvements is shared by cities, counties, special districts, and schools. Generally, but not exclusively, resilience planning for key infrastructure is led by water and sewer utilities and regional transit agencies. Regional coordination can be catalyzed among these entities. ABAG, MTC, and the Bay Restoration Authority each have a role to play in identifying, researching, and

Coastal erosion exposes construction fill under the Great Highway at San Francisco's Ocean Beach.

(Shannon Fiala)





Olentangy River flowing through downtown Columbus, Ohio.
(Flickr/Ron Reiring)

communicating policy issues. In addition, regional efforts can benefit from state involvement from groups such as BCDC and the Coastal Conservancy.

Enterprise Revenue Bond Financing

Financing for capital improvements to enhance the resilience of water and sewer systems can be secured by a pledge of enterprise net revenues to pay off the bonds. Water and sewer enterprises have the unique authority to enter into long-term debt without voter approval. Such enterprises also have rate-setting authority with an established public protocol for rate changes.

Capital markets will make financing available at relatively reasonable rates to sound projects secured by a pledge of net revenue and a rate covenant of the enterprise. While the consequences of capital improvement financing may be higher user charges, the benefits of long-term financing include a tax-exempt cost and amortization over the expected useful life of the capital improvement.

Sales-Tax Financing

Transit and transportation resilience improvements generally may be financed regionally using a sales tax override approved by voters. As a dedicated tax in California, a levy for transit and transportation resilience requires a two-thirds majority vote. Proceeds of the sales tax levy can be pledged to pay off long-term financing of resilience improvements. Similar to an enterprise revenue bond, a sales tax revenue bond will benefit from tax exemption and an amortization term matched to the useful life of the capital improvement.

Transit agencies proposing sound projects with voter approval generally are well received by capital markets, though the capital markets will expect a margin of safety in the form of

Case Study: Regulatory Stormwater Fee Assessments in Ohio

To address the U.S. Environmental Protection Agency's National Pollutant Discharge Elimination System (NPDES) mandate, Columbus, Ohio, launched a pilot project in 2008 to assess the accuracy of stormwater fees by combining remote sensing data with aerial photography and geospatial software to map paved surfaces.

When the project revealed inaccuracies in historical data that had generated imprecise stormwater billings, Columbus was able to use the assessments innovatively to fund compliance with the NPDES requirements. The new method of mapping-based billing allocation yielded improved results and convinced officials to update data for the entire Columbus stormwater service area.

Through this innovative financing mechanism, the city was able to recover more than \$1.5 million during a three-year period to fund compliance projects to meet NPDES requirements.

Source: Woolpert.

debt service coverage from sales tax revenues. This coverage will constrain the bonding capacity of the sales tax, but may provide an ongoing revenue source for pay-as-you-go capital improvements, maintenance, or both.

General Obligation Funding

Local governments in California can secure local public capital improvements through a voter-approved pledge of a property tax override. Referred to as a general obligation of the local government, this form of finance generally has the lowest cost because of the super-majority (two-thirds) voter approval required and the unlimited property tax created to secure the debt. Such general obligation debt may be used to finance local resilience public infrastructure improvements, but the high voter-approval threshold and the cost of holding an election can and often will frustrate local implementation.

Special Taxes/Parcel Taxes

Similarly, California special taxes can be used for resilience improvements for more specifically designed improvements. A property-secured special tax can be imposed through a two-thirds majority vote. This type of finance has more typically been used in development areas where there are few, if any, registered voters. (Under California special tax law, a property-secured special tax can be imposed by property owners so long as there are fewer than 12 registered voters in the proposed special tax district.) Property owners may vote on the basis of land ownership to impose a property tax-secured special tax for the purpose of financing public improvements.

Bonding capacity in this instance is generally limited by either or both the property value and the tax rate that is created. Capital market underwriting criteria such as the debt burden relative to property value may constrain this source of capital finance. Likewise, property developers are sensitive to burdening new owners with special taxes and may limit the use of this type of debt to keep the overall property tax burden low.

Local or regional entities may also consider a parcel tax in place of a special tax, but a similar logic applies to parcel taxes, which require a two-thirds majority vote to implement.

Financing Leases

A California city or county may choose to lease long-lived resilience improvements in a long-term financing lease. In such cases, the leases are secured by the local government's promise to budget and appropriate funds annually so long as the leased improvements are available to the local government.

While this financing technique may be structurally possible and fiscally sound depending on the facts and circumstances of each project, no new revenues are created by this financing method. Annual lease payments are budgeted and appropriated from available general fund resources.

The financing challenges for resilience are numerous. However, regional water and sewer authorities as well as transit agencies have financing tools at their disposal that may be applied in the near term. Any serious effort to address the long-range issues will require a policy commitment to lowering the voter thresholds for imposing taxes or fees for necessary public infrastructure improvements.

Case Study: The Novartis Multiagency Flood Protection Agreement

Located in the lower reaches of the Belmont Creek watershed in San Carlos, California, the Novartis Pharmaceutical Corporation's research and production facility has experienced frequent flooding. In 2010 and 2011, floods cost the global health care company almost \$1 million in repairs and disrupted research and production. Worst of all, there was little the company could do to address the problem except pull up stakes and move.

But Novartis wanted to stay, so it obtained permits to dredge the creek channel near the office to increase flood capacity. However, the facility is in the lower, flatter reaches of the creek, and sediment filled in the dredged area within a year.

Instead of relocating, Novartis looked upstream to better understand the problem and the solutions that might be available. In late 2013, Novartis hired WRECO, a Bay Area engineering firm with expertise in stream and coastal engineering, to prepare a detailed watershed study of Belmont Creek, which forms a watershed spanning three cities—Belmont, San Carlos, and Redwood City. No one city is responsible for managing the water-

shed; instead responsibility rests with each city for its segment of the creek.

WRECO determined that the highest-ranking strategies—in terms of balancing flood protection, environmental impacts, and cost—should be applied upstream in Belmont, with significant benefits accruing in the downstream cities. At an interagency meeting convened by the U.S. Army Corps of Engineers and the Regional Water Quality Control Board, WRECO and Novartis representatives presented their results, and a collaboration was born and continues among the three cities through which Belmont Creek flows.

This outcome is the result of an initiative undertaken by a health care company that shared its flooding problem with local government agencies and became interested in exploring a multi-agency partnership to protect homes, jobs, and shopping areas from flooding in a manner that respects the environment.

Source: Joe LaClair, Bay Conservation and Development Commission.



**Redwood Shores downstream of
Novartis in Belmont.**
(Flickr/Karri Linnoinen)

4

ENGAGE THE PRIVATE SECTOR

The public and private sectors need to work together because neither can tackle the impacts of sea-level rise alone. This is not just a governmental problem: business involvement in community resilience planning is essential for the creation of innovative solutions. On the other hand, resilience is not just a business practice independent of community connections to services and access; it requires both sectors to work collaboratively.

Neither government nor private enterprise separately can provide a clear solution to addressing the problems anticipated from climate change. Although the private sector has been engaged in addressing climate change and resilience challenges, this engagement in general has focused solely on buildings and sites, not on the broader issue of the viability of the surrounding community. Businesses have at their disposal a vast number of tools for fiscal risk management that can and should be used for community resilience planning.

For example, sea-level rise is already being considered in new developments around the Bay Area because investors acknowledge the risks posed by climate change. This focus needs to be broadened to include developer support for and involvement in community resilience efforts because if a private development survives a natural disaster but the surrounding community and its infrastructure are decimated, the individual development will be stranded and also rendered unusable.

Key participants in this ongoing process are utility and transportation providers whose systems interconnect and on which the functionality of entire regions depends. These utility and transportation providers also bring resources to the table in terms of fee-based revenue systems and engineering expertise.

Resilience for the private sector plays out not just in terms of risk management, but also in value maintenance. Local governments should specifically request that members of the private sector collaborate, for example, to establish a design standard for considering sea level rise in new development.

5

ESTABLISH CERTAINTY IN STANDARDS AND FLEXIBILITY IN RESPONSE

Entitlement agencies should address uncertainty concerning the impacts of sea-level rise by agreeing on a standard initial increase in sea level that should be considered by developers of new projects. However, the agencies should be flexible in approving responses to that standard, allowing developers and local governments to implement innovative, site-specific resilience measures and encouraging solutions that both adapt to future resilience stressors through adaptive project design and address the resilience of adjacent developed areas.

Uncertainty is inherent in resilience planning, but uncertainty does not excuse doing nothing; nor does it excuse an absence of standards. A range of projections exists for how high the seas will rise and how quickly. The challenge is how to establish uniform development standards across jurisdictions in the context of this uncertainty. Effective response requires using uniform sea-level-rise hazard levels and uniform approaches for evaluating the vulnerability to those levels. Such uniformity will prevent variability among neighboring jurisdictions with similar circumstances.

King tide along the Embarcadero in San Francisco.
(Flickr/Sergio Ruiz)



However, uniform standards need to evolve over time as the science progresses. They also need to recognize the design lifetime for a project and its protection. The standard will change as the science changes—and, for that matter, in response to the reality of higher sea levels. And recognizing that the standards are being set in an environment of uncertainty, they should be tailored to specific projects depending on expected lifespan, function, capacity of the owner or manager to adapt, and consequences for the environment, economy, and public health.

Flexible Design

With sea levels expected to rise for centuries, the location of the shoreline will tend to move inland and upland. In this continuum of ever-rising sea levels and a moving shoreline, any uniform standards selected must be seen as interim in nature.

A new approach to coastal planning and community development is needed to deal with this new reality. Rather than build permanent structures along an impermanent shoreline, temporary structures may be more appropriate. Like world's fair exhibition buildings that look permanent but are designed and built to be temporary, future coastal communities may need to be treated as temporary cities.

In these communities, new types of architectural forms that can adapt to sea-level rise are needed. In some places, floating structures may be appropriate. In other places, buildings designed to last only a short time may work. Structures that can be disassembled, moved, and reassembled elsewhere are also worthy of consideration. However, current laws and regulations make it difficult to approve these types of structures.

Uniform Standard

Under the current governance structure, one regionwide standard will be difficult to establish because no single agency has jurisdiction over areas subject to sea-level rise. While BCDC has jurisdiction over a portion of likely inundation areas, its authority to establish inundation standards is limited. Cooperation among the primary entitlement authorities—namely, cities and counties—will be required. Agreement on one standard throughout the Bay Area would provide clarity and considerably improve the time-consuming and confusing process of entitling a project, which is created by considerable variation in standards among different jurisdictions (although variations in the rise expected around the bay should be taken into account).

In addition, for longer-term investments, a three- or four-foot standard for sea-level rise may not be high enough. People need to learn to think in three different time frames. In the short run, most buildings and infrastructure should be designed to accommodate three or four feet of sea-level rise. In the longer run, a much higher rise needs to be prepared for. Finally, with sea levels expected to continue rising for centuries, it must be accepted that whatever higher water level is anticipated, the sea level considered eventually will be overtopped. This will present tremendous challenges for designers, regulators, and financiers.

The call for uniform standards, of course, raises the question of where the legal authority to set such standards should be placed. California's McAtteer-Petris Act, which created BCDC, was enacted to manage the shrinking of the bay. The bay is now growing, and BCDC does not have the statutory authority to address this challenge, nor does any other jurisdiction acting alone.



Flooding has always been regarded as an issue to be addressed by local government, but resilience planning requires that the region create mechanisms to manage the changing shoreline holistically using the authority of multiple jurisdictions responding to uniform standards. The challenges faced by the Bay Area now in dealing with an expanding versus shrinking bay illuminate the fundamental need to update laws created before climate change was recognized or understood.

The sun sets over San Francisco's Sunset neighborhood.
(John Brian Kirby)

Collaborations between the Public and Private Sector

The Giants' Mission Rock project demonstrates a best practice of taking regulatory requirements for public access and turning them into amenities. Other projects could meet regulations while also protecting their sites by using public-access areas for flood control. This could be achieved in a phased approach leaving space on the site that could be modified later for future sea-level-rise protections.

In other words, projects should focus more on taking "multiple bites at the apple" over time rather than getting it right from the start at the entitlement stage. Projects that design for future flexibility in retooling could become more valuable over time; projects that commit to a single purpose or route could eventually become liabilities or maladaptive. A progressive or phased response to higher sea levels could become a useful tool.

This best practice highlights that within the context of a uniform standard, flexibility in project design should be encouraged and also should accommodate some uncertainty. For example, should developers design projects to be protected from inundation, or to allow ground floors to accommodate temporary flooding without significant damage? Mission Rock, for example, will be designed to integrate topographic zones that can accommodate flooding, with progressive grades used as public space as the sea level rises.

New waterfront or coastal developments should be designed in collaboration with the entitlement agency to specifically detail a sea-level-rise strategy for each project site. The building code already requires an evaluation of how essential facilities will perform after disasters such as earthquakes. Similarly, the code should require performance standards for addressing sea-level rise, ensuring that projects have the ability to perform and react.

Neighborhood-Scale Planning

The issue of flexibility in design standards must also take into account the ongoing tension between measures that protect the portion of the shoreline belonging to a new development project and other portions occupied by existing development.

Under San Francisco's current approach, each new project will invest millions of dollars to build a perimeter and raise the height of its building sites, which could effectively create a series of islands along the waterfront. The long-term resilience of such a strategy is not certain and, in fact, may increase the hazard to adjacent existing development. At a minimum, it will make access across existing developed areas to the newly developed area problematic. The city will need to address how development areas, such as Mission Bay and the Giants ballpark, can create affordable, adaptable interventions to deal with sea-level rise.

Building on BCDC's pioneering work, consideration should also be given at the land use level—for instance, that residential neighborhoods are much more difficult to move or convert to other uses than are commercial or industrial areas.

Designers should consider the amount of damage or disruption that would occur if assets were exposed to high tides that caused permanent inundation or to temporary but potentially damaging flooding. In approving a project, regulators should consider consequences to the environment, economy, and public health and safety—a complex task, but one that could be carried out considerably more effectively if projects have the flexibility to meet a uniform standard through a variety of means.

Conclusion

THE BAY AREA HAS MADE GREAT STRIDES through recent regional collaborations, such as the Joint Policy Committee's Bay Area Climate and Energy Resilience Project report. The Bay Area is an ideal model to observe because it has a history of natural disasters and has benefitted from the leadership of BCDC in addressing the issue of rising sea levels.

This report has presented suggestions for improving community resilience planning and setting conditions of approval for new development based on observations of pioneering efforts in the San Francisco Bay Area. The suggestions call for rethinking governance, integrating resilience planning into the other planning activities of jurisdictions, implementing innovative funding, putting in place collaboration between the public and private sectors, and establishing uniform standards.

King tide along the Embarcadero in San Francisco.
(Flickr/Sergio Ruiz)



Through conferences, such as Building the Resilient City, organizations like ULI can and should continue to build relationships between the public and private sector.

Climate adaptation and resilience planning are gaining national momentum through initiatives such as President Obama's Climate Action Plan and the U.S. Department of Housing and Urban Development's flood resilience design competitions. ULISf hopes the best practices and lessons learned in this report will be employed as governments, businesses, and organizations across city, county, and state boundaries collaborate and share information, and that they may provide some leadership in the responsible use of waterfronts and in creating and sustaining thriving communities worldwide as they face the challenges presented by sea-level rise and global climate change.

NOTES

1 California's Strategic Growth Council (SGC) brings together state agencies and departments—including Business, Consumer Services and Housing, Transportation, Natural Resources, Health and Human Services, Food and Agriculture, and Environmental Protection—with the Governor's Office of Planning and Research to coordinate activities that support sustainable communities, emphasizing strong economies, social equity, and environmental stewardship.

2 For more information on the sea-level rise analysis, see *Plan Bay Area 2040 Draft Environmental Impact Report*, Part Two: Settings, Impacts, and Mitigation Measures, Section 2.5: Climate Change and Greenhouse Gases, http://planbayarea.org/pdf/Draft_EIR_Chapters/2.5_Climate_Change.pdf.

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