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Testimony Before the
Milton Marks Commission on California State Government Organization and Economy
(Little Hoover Commission)

Public Hearing on California Climate Change Adaptation Strategies
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State Capitol, Room 437

The San Francisco Bay Conservation and Development Commission (BCDC or the Commission) appreciates the opportunity to present information to the Milton Marks Commission on California State Government Organization and Economy (LHC) on the subject of climate change adaptation strategies. Your hearing could not be more timely.

Rising sea level (RSL) is a fact. According to the Nation's oldest continually operating self-recording tidal observation station, located near the Golden Gate Bridge in San Francisco Bay, the Bay has risen by over seven inches during the past century. BCDC Commissioners never have questioned the need to plan for a rising Bay.

It may seem a puzzle, then, that BCDC was created almost fifty years ago as the State's response to development pressures that threated to shrink the Bay into merely a nice-sized river. After years of protecting the Bay against almost unbridled growth, BCDC began to analyze climate change and RSL in relation to the Bay during the 1980s and published "*Sea Level Rise: Predictions and Implications for San Francisco Bay"* in December 1987. Two decades later, BCDC released a set of "inundation maps" prepared by BCDC staff based on United States Geological Survey (USGS) data that caused local, national, and international excitement, interest, and consternation. They showed, quite dramatically, the results of projected RSL both within BCDC's jurisdiction

and inland. BCDC recognized then, as now, that planning for climate change and RSL is critical to the long-term safety, wellbeing, and vitality of the Bay Area's communities, natural resources, and economy. Therefore, BCDC is developing and implementing a multi-dimensional program to address RSL and its affects in the San Francisco Bay Area that is based upon community participation, local government capacity building, voluntary cooperation, and the Commission's regulatory responsibilities. Sustained Institutional support for programs that rely upon community participation and voluntary cooperation can only strengthen the Bay Area's ultimate resiliency in the face of climate change.

THE CONTEXT

The Bay's shoreline is approximately half the length of the California coastline. The Bay is approximately 550 square miles, which is larger than all but nine cities in the United States. It is almost 20% larger than the City of Los Angeles and is larger than the combined dimensions of San Diego and San Jose. Nine counties and over 40 cities touch Bay waters.

The San Francisco Bay is the largest estuary on the west coast. It is biologically diverse, and it includes unparalleled marshes and mudflats along the shoreline that provide food and shelter to fish and wildlife and account for 77% of California's remaining perennial estuarine wetlands. It is home to over 1,000 species of animals, including endemic, threatened, and endangered species. It is a critical stopover on the Pacific Flyway and hosts more wintering shorebirds than any other estuary on the west coast outside of Alaska. Its diversity of key habitats and production of environmental benefits such as flood protection, water quality maintenance, nutrient filtration and cycling, and carbon sequestration compelled the international community to designate San Francisco Bay in late 2012 as a "Wetland of International Importance."

The Bay also helps provide a high quality of life for residents. It supports the world's 19th largest economy. The Bay shoreline hosts two major international airports and 40% of California's petroleum refinery capacity. The Oakland seaport is the Nation's fifth largest and moves a startlingly large portion of California's crops to market. Considerable commerce takes place on the water and in the shoreline band on a daily basis. The diversity of watercraft that appears on the Bay at any one time rivals that of any port.

With unparalleled recreational opportunities and beautiful scenery, San Francisco Bay is one of the world's greatest tourist destinations. Its beauty and its contributions to such a high quality of life help make the Bay Area one of the country's most desirable places in which to live. The Bay is inextricably woven into each resident's sense of place, culture, and community. The Bay is a dynamic and interconnected system whose value is crucial to the region's environmental, economic, and social prosperity. BCDC's mission is "to protect and enhance San Francisco Bay and to encourage the Bay's responsible and productive use for this and future generations."

BCDC MISSION AND ACCOMPLISHMENTS

BCDC has two ongoing primary functions: to maximize feasible public access to the Bay consistent with authorized projects; and, to minimize Bay fill. The Commission recognizes that the most important word in Bay Conservation and Development Commission is "and." BCDC does not, and cannot, unilaterally oppose development – indeed, BCDC has approved billions of dollars of capital investment in its jurisdiction. Bay fill has required mitigation, however, and the Bay is larger today than it was fifty years ago due to BCDC's efforts and those of other agencies and stakeholders. Mitigation has included removing fill in other Bay locations, breaching levees, and

creating and restoring wetlands. BCDC also has required public access on over 100 miles of the Bay shoreline and is an active partner of the Bay Trail project. BCDC's role is to ensure that appropriate development can take place that respects the need to conserve the Bay's natural resources, and to do so without superseding the role of local governments.

BCDC HISTORY, JURISDICTION, AND AUTHORITY

In 1965, California enacted the McAteer-Petris Act, which designated the San Francisco Bay as a State-protected resource and established BCDC. Twenty-seven members sit on the Commission. They represent a wide variety of public, private, and nonprofit sector interests. The Act is the key legal provision in California state law to prevent indiscriminate Bay fill. Concurrently, BCDC has permitting responsibility to ensure that appropriate and environmentally sound development provides public benefits and economic development for the entire region. BCDC was not created to obviate or supersede the authority of cities, counties, and special districts that are located along the Bay and its shoreline. Instead, its role is to view the Bay as an entire system, which is impossible for more narrowly focused governmental bodies. BCDC was the State's first regional coastal management agency. Throughout its history, BCDC has learned that its most notable successes are produced by coordinating, collaborating, and/or partnering with governments at all levels and with a wide variety of other stakeholders. This cooperation is vital given that BCDC's jurisdiction extends 100 feet into the Bay shoreline from mean high tide for purposes of public access – now and into the future.

BCDC's initial San Francisco Bay Plan was approved in 1968 and BCDC was made permanent one year later. The Bay Plan is updated regularly to ensure the responsible use of the Bay and its shoreline and address new issues as the Bay Area changes. The

Plan includes policies on issues critical to the Bay, ranging from port activities and public access to urban development and transportation. The Bay Plan maps the entire Bay and designates areas for water-related purposes such as ports, industry, public recreation, airports, and wildlife refuges.

In 1977, California expanded the Commission's authority to provide special protection for the Suisun Marsh. The Marsh is the "mixing zone" that connects the Bay with the Delta. It is the largest contiguous brackish marsh on the west coast of North America; more than 10% of California's remaining wetlands and more than 300 species, including 80% of the State's commercial salmon fishery, are found in the marsh. Therefore, BCDC has a great incentive to work closely with the organizations and interests that are associated with the current Bay Delta Conservation Plan. The environmental, economic, and social connections between and among the Bay, the Suisun Marsh, and the Delta should be understood as assets to all residents of the greater Bay Area and California, and they are all subject to climate change.

BCDC is the federally designated state coastal management agency for the San Francisco Bay segment of the California coastal zone. In this role, BCDC ensures that federal projects and activities are consistent with the State statutes and regulations. BCDC is the Nation's oldest coastal zone management agency. ***(A summary description of BCDC can be found in Appendix 1.)***

BAY PRODUCTIVITY

San Francisco Bay's marshes and associated transitional areas provide invaluable habitat, recreational, and aesthetic values. In addition, they can play a critical role in protecting the shoreline from a rising Bay. The first attack of rising water will occur during storms and extreme wave events when the added water elevation from RSL will

provide more power and thrust to waves pounding the shoreline. Wetlands and associated mudflats attenuate the power of incoming waves and protect the areas behind them. Therefore, less shoreline protection will be required for areas where wetlands are present, at least in the near and medium-term. (BCDC's Corte Madera Shoreline study with USGS and other researchers addresses this benefit and is discussed on page 27.)

The San Francisco Bay is where the tidal salt waters of the Pacific Ocean mix with the fresh water from the Sierra Nevada that flows through the Sacramento and San Joaquin Rivers to form the San Francisco Bay Delta estuary. Historically, the Sierra watershed and local Bay watersheds have provided sediment to form and sustain tidal marshes. The ability of wetlands to create this "sponge" affect will be reduced by rising Bay levels, both through potential drowning and through erosion caused by increasing wave energy. Therefore, the Bay's wetlands need a constant replenishment of watershed sediments that can feed marshes and help them to adapt to rising waters. Unfortunately, sediment concentration in Bay waters has decreased over the past decades, for many reasons. How can this issue be addressed?

Regional Sediment Management (RSM): Regular dredging to maintain channels and berthing areas is crucial for maritime commerce and recreational boating in the Bay. Without it, major ports (including the Port of Oakland) would become silted in and unusable. This would end the Bay's status as a major Pacific Rim port, recreational boating would founder, and the region's economy would suffer. Fortunately, most of the sediments dredged from Bay channels can be used to help restore and maintain Bay wetlands (known as "beneficial reuse"). Examples of this "win-win" are the Sonoma Baylands near the mouth of the Petaluma River in Sonoma County, the Montezuma Wetlands along the Carquinez Strait, the Suisun Marsh in Solano County, Bair Island in Redwood City, and the Hamilton Wetlands on the former Hamilton Army Airfield in

Novato, Marin County. These projects have beneficially reused millions of cubic yards of material dredged from Bay navigational projects to create over a thousand acres of wetlands.

This beneficial reuse of dredged materials supports the productivity of wetlands in the face of rising waters and protects the productivity of shoreline areas behind them, as well as the productivity of the ports and harbors from which the material is dredged. Expansion of this benefit must be a major component of the Bay Area's climate change strategy. That is why BCDC is a founding member of the Long Term Management Strategy (LTMS) for dredging and disposal in the Bay region, along with the U.S. Environmental Protection Agency, the U.S. Army Corps of Engineers, the San Francisco Bay Regional Water Quality Control Board and the San Francisco Estuary Partnership. LTMS is charged with maintaining Bay channels in an economically and environmentally sound manner, and maximizing the beneficial use of Bay sediments. LTMS will be a key player to further regional sediment management and help the region and its wetlands adapt to a rising Bay.

In addition to reusing dredged material, understanding and managing more globally the flux of sediments into, within and through the Bay should be a key part of regional adaption. For example, flood control projects have a major impact on the movement of sediments from Bay tributaries. BCDC is working with a myriad agencies to better assess how to maximize the benefits of dredging, flood control, and other activities affecting sediment flows, and contribute to adaptation to RSL.

RSM Advocacy: BCDC has initiated an advocacy strategy development plan aimed at increasing federal funding for beneficial reuse and other Bay-centered environmental and economic strategies. Along with the State Coastal Conservancy, Save the Bay, the Bay Planning Coalition, and the Bay Institute – with help from the

USACE, SFEP, and the USEPA – BCDC plans to increase national recognition that the Bay is a resource no less valuable than the Chesapeake Bay or the Great Lakes and merits similar funding and program attention. Creating a Bay-wide advocacy group that includes regulators, funders, environmentalists, private sector interests, and the scientific community is a start.

CHALLENGES AND OPPORTUNITIES

How can the State and its governmental subdivisions create a public consensus around where a new public shoreline will grow and exist and what public benefits it will spawn or eliminate? What templates are available for local, subregional, regional, and State agencies to prepare their stakeholders for the major changes that will alter how California will look and work during the next 25, 50, or 100 years? How can the public become engaged in this discussion? For example, despite a quarter-century of warnings, less than half of Bay Area residents are prepared for a major earthquake and it required 24 years for the Bay Area and the State to decide whether to build a new eastern span of the Bay Bridge, design it, and then build it. The magnitude of this slow post-Loma Prieta response does not inspire confidence that governments alone can prepare the public to make and/or accept decisions about how to adapt to this "slow moving emergency" of rising sea level. So, all levels of government must be smarter, more aggressive, and more creative in meeting this challenge.

How can governments build and maintain planning and implementation capacity on the community, local, subregional, and regional levels? Capacity building requires sustained funding, greater levels of expertise, the willingness to prioritize projects, and recognizing that local planning processes must become part and parcel of larger planning efforts. The number and diversity of public agencies involved in such planning is astounding. Many in local government view regional agencies as necessary evils to

ward off; larger and more inclusive planning efforts may be viewed by some as an attempt to dilute local *de facto* and *de jure* authority. How can those feelings be transformed into more positive responses? Building local capacity takes money, time, effort, and recognition that the world – and California – is changing in uncertain ways. Part of BCDC's challenge is to enlist local governments in seeing capacity building as an opportunity and not simply a burden.

Given such uncertainty, what governance structures and policies can embody new types of cost/benefit analyses that reflect the uncertainties surrounding RSL and future climate change and reflect the values and benefits inherent in natural resources? Absent structures and clear guidance, local governments will have a convenient excuse for not planning well, or to want to address these issues, if at all. As LHC's academic panel discussed in August, government's basic cost/benefit analysis techniques do not work well in this scenario. Typically, they encourage one-size-fits-all solutions – the exact opposite of what is required in local, subregional, and regional adaptation planning. Developing new structures and policies to address these regional issues requires difficult, iterative discussions between representatives of the State, regional entities, and local governments.

What is the best time to implement change? While much of the State's economy may be at risk due to climate change, time gives us options. In other words, the State does not have to fix everything now, or by 2017. Instead, conducting the kind of difficult and productive discussions noted above during the next few years might actually preserve valuable policy options, especially because it is likely to take at least five years to develop a region wide strategy, even with increased funding for planning throughout the Bay Area.

BCDC Rising Sea Level Working Group: Under the direction of BCDC Chair Wasserman, a group of eight Commissioners is regularly and informally engaging with regional stakeholders to gather information about their efforts to confront RSL. In July, the Working Group met with representatives from Chevron, Union Pacific, Kaiser, Pacific Gas and Electric Company, and San Francisco International Airport to learn how they are planning to deal with a rising Bay. In August, the Working Group met with representatives from BART, the Capitol Corridor Rail Service, Caltrans, East Bay MUD, and the Port of Oakland. In October, the group met with representatives of the Bay Area Council, the Bay Planning Coalition, the Silicon Valley Leadership Group, the East Bay Economic Development Alliance, and the San Francisco Chamber of Commerce to discuss their stakeholders' preparations for a rising Bay. Next month, the Working Group is scheduled to meet with representatives of the insurance industry. The group is a key outreach mechanism for the Commission in its effort to develop the Resilient Shorelines regional strategy and its other climate program elements.

CONCLUSIONS AND RECOMMENDATIONS

1. *Land use decisions should continue to be made on the local level and fit into a Bay Area-wide response strategy. Concurrently, the State should create a more sustainable and robust integrated statewide process that provides incentives to local and regional governments to plan for RSL both as individual government entities and as members of subregional and regional collaboratives (and avoid mandating that they do so).* Decisions to develop new infrastructure or alter existing infrastructure to respond to RSL must result from processes that include meaningful participation by representatives of the communities affected. The vast differences within and among the extensive coastal and Bay shorelines throughout California should temper any inclination to adopt a comprehensive statewide plan to account for every inch of possible shoreline protection or

development. In addition, the Bay Area public – and likely the public throughout the State – is unaware of what changes to current governmental structures and authorities may need to occur for local, subregional, and regional planning to account for RSL. While BCDC's work with a wide variety of governmental, nonprofit, and private sector collaborators in the Bay Area is bringing us closer to understanding what those changes could be, at best it is premature to alter the current land use policymaking landscape.

2. *Such an integrated statewide process must include clear and consistent guidance to local and regional governments regarding a wide variety of issues, including data that informs and supports local decision-making processes.* These include: how to best use forecasts and work within the framework of uncertainty; the need for vulnerability analyses; the permission to plan for and finance both strategic development and strategic retreat; and, a variety of other technical requirements to understand how the landscape will change during the next century. Special care should be taken to ensure that communities are precluded from putting one another at risk. Any statewide "adaptation" strategy should look outward from Sacramento and reflect the groundbreaking policy and planning work occurring in coastal and shoreline communities. It must reflect thoughtful local, subregional, and regional input from the public, private, and nonprofit sectors throughout the State.

3. *The State should support a wide variety of on-the-ground community-based resilience programs that exemplify best practices, provide necessary and useful policy information for a region's SB 375 sustainability program, and measure and monitor results.* The results of these programs should inform the State's adaptation strategy. Special attention should be paid to inventorying best practices and providing incentives to local, subregional, and regional

governments to adopt them. Competitions and other efforts to promote innovative solutions to policy, design, and engineering challenges should be encouraged.

4. *Frameworks for regional collaboration, such as that authorized in the current SB 792 (DeSaulnier), should be rewarded.* The Bay Area's Joint Policy Committee (JPC) consists of the Association of Bay Area Governments (ABAG), the Metropolitan Transportation Commission (MTC), the Bay Area Air Quality Management Board (BAAQMD), and BCDC. Executive Directors and staff, the JPC's leadership team, and the complete body (with five representatives from each agency) meet regularly together and separately. The JPC is charged to ensure cohesive and collaborative relationships, promote policy alignment among the agencies, coordinate the development of a regional economic development strategy, and respond to challenges emanating from climate change and RSL. (Unfortunately, BCDC has not been able to convince the Administration that the Commission should co-locate with its three agency partners in the new JPC Headquarters building so that the four agencies' planners, regulatory, and enforcement personnel work together even more cooperatively than they do now.) The State also should provide incentives for statewide collaboratives, e.g., the Alliance of Regional Collaboratives for Climate Adaptation (ARCCCA), whose purpose are to share best practices and inform policymaking throughout various regions. In addition, the State should encourage creative policymaking collaborative processes among all levels of government that reflect state, local, and regional needs and values.

5. *That statewide integrated process should spur a constructive policy discussion among all levels of government regarding jurisdictional issues.* Questions to be answered include: what is the future of "the public trust" given RSL; should BCDC

and other entities continue to use the definition of "mean high tide" to define jurisdiction in 35-50 years; and, should different governments decide what science is "best" for their communities? The State should initiate multi-level discussions about how both environmental protection and economic growth can occur in spite of, or due to, RSL. Finally, the state must ensure that communities that do not touch the Bay but whose residents are inextricably linked to its commerce and environmental benefits are part of this discussion; their ways of life are at risk, as well, from climate-related challenges such as changing temperatures, increased wildfires, and flooding.

6. *The State should undertake an active advocacy role in Washington, D.C. on behalf of local, regional, and statewide projects that demonstrably improve shoreline and coastal resilience, including LTMS dredging projects.* The State should inventory and prioritize legislative and regulatory vehicles, propose a wide range of monetary and nonmonetary assistance, and use the weight of the California House and Senate delegations to assist local RSL and climate change adaptation efforts.

7. *The State, in conjunction with regional agencies and collaboratives, should undertake an extensive public education campaign about the probable effects of climate change.* It should offer residents non-threatening information about what might occur, how different levels of government are planning for its ramifications, and how communities can discuss policy options. BCDC has not sought an expansion of its authority or jurisdiction because neither the Commission's stakeholders nor the Commission are ready to propose or accept such a change. Like BCDC, the State should not propose to expand the authority of its agencies at this point because such an expansion likely would preclude a thoughtful discussion of options.

CURRENT BCDC CLIMATE CHANGE ACTIVITIES

The Commission's climate change activities include three different types of programs. Each is based on the policy assumption that adaptation planning and shoreline resilience is best planned on the local level with assistance from subregional, regional, and/or state and federal entities.

1. Adopted Policies, Case Studies, and Adaptation Projects

2011 Bay Plan Amendments: In 1989, the Commission amended the findings and policies in the Bay Plan to address RSL when making permit decisions and to provide policy advice to local governments. Twenty years later, BCDC staff prepared a vulnerability assessment, "*Living With A Rising Bay: Vulnerability And Adaptation In San Francisco Bay And On the Shoreline*," that evaluated:

1. Key Bay systems, both in the natural and the built environment, the stressors they faced, and potential impacts due to RSL and coastal flooding;
2. The sensitivity of those systems to those impacts; and,
3. Those systems' adaptability.

The USGS research on RSL in the Bay Area was integral to this assessment. So was an analysis of the socioeconomic impacts of that potential inundation by the Pacific Institute. The results showed that approximately 180,000 acres of shoreline are vulnerable to flooding following a 16-inch rise in sea level, and more than 213,000 acres following a 55-inch rise in sea level. This potentially affects over 250,000 Bay Area residents. The replacement value of the resources at risk is about $62 billion. The area vulnerable to inundation with a 16-inch RSL roughly corresponds to today's 100-year floodplain. Simply put, myriad Bay Area communities will be under water unless BCDC

and our stakeholders can plan and implement effective adaptation strategies. The maps of this analysis were released in April 2009. ***("Living With a Rising Bay" and the associated maps can be found in Appendix 2.)***

From April 2009 through October 6, 2011, when BCDC voted on the Bay Plan Amendments that resulted from this analysis, the Commission held almost forty public hearings, workshops, and meetings centered on its analysis and suggested regulatory language to protect the Bay and Bay Area communities. The staff's proposed amendments generated considerable controversy; representatives of the business community and many local governments were concerned that the Commission proposed to expand its jurisdiction into low lying areas beyond 100 feet above mean high tide. After a series of difficult and complex negotiations regarding BCDC's regulatory authority, the Commission voted 24-0 to amend the *San Francisco Bay Plan* to require permittees to address climate change in their development plans. The revisions to the Bay Plan create a climate change policy section that:

1. Incorporates science-based RSL projection ranges for use in the permitting process;
2. Calls for developing a long-term regional strategy to address RSL, storm activity, and other Bay-related impacts of climate change in a way that protects the shoreline and the Bay, and allows for appropriate, well-planned development that responds to the impacts of climate change and future RSL;
3. Calls for collaboration with the JPC and other agencies to integrate regional mitigation and adaptation strategies and adaptation responses of multiple government agencies, to analyze and support equity issues, and to support research that provides useful climate change information and tools;
4. Provides recommendations and requirements to guide planning and permitting of development in areas vulnerable to RSL; and

5. Includes policies that promote wetland protection, creation, enhancement, and migration.

The amendments also modified the Bay Plan by amending:

1. The findings and policies on tidal marshes and tidal flats to ensure that buffer zones are incorporated into restoration projects where feasible and sediment issues related to sustaining tidal marshes are addressed;
2. The policies on shoreline protection to address protection from future flooding; and,
3. Public access policies so that such access is sited, designed, and managed to avoid significant adverse impacts from RSL and ensure long-term maintenance of public access areas through site-specific adaptive management strategies.

(The entire text of the Bay Plan Amendments can be found in Appendix 3.)

Implementation of Bay Plan Amendments: BCDC's Climate Policy Implementation project, which commences in October 2013 with funding from the National Oceanographic and Atmospheric Administration (NOAA), will enable BCDC permit applicants, BCDC staff, Commissioners, and the public to better understand and comply with BCDC's new climate policies as embodied in the Bay Plan Amendments. BCDC will develop guidance around the following elements of the policies:

1. Risk assessments – whether one is required and how to address flood risks;
2. Fill designed to prevent flooding – how fill can be placed in ways so that it does not violate other BCDC policies;
3. Designing shoreline protection – how to design projects such as levees and seawalls to withstand projected RSL and be integrated with adjacent protection;
4. Preserving public access – how to design and maintain such access to avoid flood damage or provide equivalent access;

5. Ecosystem protection and restoration – to be resilient and provide space for marsh migration as sea level rises; and,
6. Preserving undeveloped areas --- to encourage conservation and habitat enhancement in areas vulnerable to future flooding.

BCDC will conduct a public outreach effort, establish a stakeholder advisory panel, host public workshops, and post material on BCDC's website (including summary translations in non-English languages) to garner as much useful information as possible prior to the publication of the guidance and vet draft language. In addition, this project will leverage several tools that have been developed recently by NOAA and PRBO Conservation Science to assist with projecting shoreline change. This project also will leverage BCDC's groundbreaking "Adapting to Rising Tides" (ART) Pilot Project, the Innovative Wetlands Adaptation Strategies Study, the Head of Tide Study, and the Regional Sediment Management Study.

Project Review: BCDC has reviewed proposed projects in the Bay and along the shoreline in light of the Bay Plan Amendments since Fall 2011. Two permitted projects demonstrate, in part, how BCDC is implementing the policies:

Port of Redwood City: The Port's application to replace several of its wharves and associated backland in San Mateo County in Spring 2012 was the first permit BCDC reviewed using its newly adopted climate change regulations. The Port's facility receives bulk cement, sand, and gravel aggregate. The area upland of the wharves contains related infrastructure and is protected from flooding by a berm and unengineered fill.

BCDC's climate change policies require that new major projects in the Bay be resilient to mid-century (or for the life of the project, if less). Each must have a feasible plan to be resilient to the end of century, as well. The Port's project's lifespan is approximately 60 years, and the Port's vulnerability assessment (using California Ocean Protection Council data) concluded that sea level might rise an additional 1.53 feet by 2060. Under that scenario, the project would be resilient to the rising Bay for the life of the project. In addition, BCDC's policies also require that "[a]dequate measures should be provided to prevent damage from sea level rise and storm activity that may occur on fill or near the shoreline over the expected life of a project…. New projects on fill or near the shoreline should…be built so the bottom floor level of structures will be above a 100-year flood elevation *that takes future sea level rise into account* for the expected life of the project." Therefore, the Port combined its RSL estimate with a 100-year flood level of +11.2 feet MLLW and designed the project to withstand water levels of up to +12.7 feet MLLW by 2060. BCDC held a public hearing on the project, found that the project was consistent with the Bay Plan policies, and approved it in May 2012. ***(A project summary and staff recommendation can be found in Appendix 4.)***

Phoenix Commons (Oakland): In September 2013, BCDC approved a major permit application for a senior co-housing project along the Alameda shoreline called "Phoenix Commons." The project is a four-story, 41-unit facility with a private patio adjacent to a 27- to 32-foot-wide public shoreline promenade, a 2,522-square-foot pier largely over the Bay that will provide an additional public access area, and a 650 square-foot floating dock for private use by the facility's residents.

While the Redwood City Port project is a maritime use and Phoenix Commons is a residential use, another major difference between the two projects is that the only portion of the Phoenix Commons project in the Bay is a pile-supported deck over the Alameda estuary. To comply with the BCDC climate change policies, the Applicant

provided RSL projections that showed the impact of a rising Bay over time on the public promenade. The applicant's analysis concluded that the public promenade's elevation would remain above flood elevations given a projected 16-inch sea level rise at mid-century. Using an end-of-century projection of 55-inches, however, the public promenade will be inundated by approximately one foot of Bay water during high tide flood events. Although the pier will be inundated by end of century, its useful life is expected to be much shorter than 87 years. Most important, the senior housing facility is at a similar elevation as the pier and will be vulnerable to flooding due to end-of-century RSL (its useful life likely will last far beyond the pier's). However, when a proposed project is located in the shoreline band (as opposed to in or over Bay tidal waters), BCDC can deny an application only if it does not provide maximum feasible public access consistent with the project or is inconsistent with a Bay Plan priority land use designation. This project is not within such a designation. Further, BCDC has no authority or policies regarding RSL outside of its jurisdiction. BCDC concluded that it is infeasible for the Applicant to modify the pier to withstand projected RSL because it will be connected to adjacent public access. Also, BCDC and the Applicant recognized that this infill project and its neighbors ultimately would have to be protected by a comprehensive and integrated RSL strategy rather than by actions of each property owner constructing protection independently in an uncoordinated manner. Further, BCDC has no jurisdiction or policies regarding RSL outside its jurisdiction. Therefore, the Phoenix Commons project is consistent with the new climate change policies, and BCDC approved the project in September 2013. ***(A project summary and staff recommendation can be found in Appendix 5.)***

BCDC's climate change policies are not intended to be comprehensive or to be a substitute for regional governance and adaptation strategies. Instead, they are intended to ensure that major new projects will address such vulnerabilities while the region is preparing and implementing a comprehensive approach to this challenge.

ART (Adapting to Rising Tides) Pilot Project: BCDC, in partnership with NOAA and with assistance from ICLEI Local Governments for Sustainability, MTC, and the California Department of Transportation (Caltrans), is working with Bay Area communities in a groundbreaking way to increase their preparedness and resilience to RSL and storm events while protecting critical ecosystem and community services.

ART is a community-based collaborative planning effort that addresses two questions:

1. *How will climate change impacts of RSL and storm events affect the future of Bay Area communities, infrastructure, ecosystems and economy; and,*
2. *What strategies can BCDC and its stakeholders pursue, both locally and regionally, to reduce and manage these risks?*

ART is being conducted in a portion of the Alameda County shoreline, from Emeryville to Union City. This subregion was selected based on local community and stakeholder interest and capacity, its diverse shoreline features, and the presence of regionally significant transportation infrastructure. Phase 1 of ART included forming ART's Subregional Working Group, comprised of representatives from staff at local, county, regional, state and federal agencies that work in the subregion, and some private interests with investments in the study area. The ART Working Group is composed of local government staff, park, flood and water district staff, airport, utility, and other regional agency staffs, and federal partners. The Project Management Team defined project goals and objectives, developed communications strategies, identified important assets along the shoreline, and selected climate scenarios and impacts associated with RSL and storm events. ART's second phase assessed the subregion's vulnerability and its risks, beginning with characterizing the existing conditions of assets in twelve categories. This analysis set the stage for a comprehensive evaluation of the

vulnerability of the assets in the subregion, including transportation, community land use, parks and recreation, contaminated lands, structural and non-structural shorelines, the Port of Oakland, Oakland International Airport, stormwater/wastewater, hazardous waste sites and pipelines.

The ART project team also considered the capacity of existing institutions to carry out adaptation efforts. Climate change presents serious challenges for the municipalities, agencies, community organizations, business interests, and many other institutions that will play a part in planning for resilience. However, the Bay Area's vulnerability may be greatly reduced if robust and thoughtful adaptation strategies are put to work. Such an effort will require coordination, cooperation, and partnership across different sectors and jurisdictional lines, and among a variety of organizations. In some instances, new programs, policies, and institutional arrangements also will be required.

ART's "Adapting Governance" white paper examines the factors that may help or hinder Bay Area institutions as they work to foster resilience to climate change. Current institutional arrangements, decision-making processes, and laws and regulations need to be reviewed in light of the challenges presented by RSL and storm events. The paper identifies three overarching governance challenges: uncertainty; complexity; and, resource constraints. With those challenges in mind and using ART's vulnerability and risk assessment as a foundation, ART developed a portfolio of possible adaptation responses to address the subregion's vulnerabilities. These are starting points for further adaption planning that will need to occur at multiple scales in the region. Indeed, the next steps of ART involve working with partners throughout the Bay Area to utilize the tools, resources, and lessons learned from the ART pilot project to assist resilience planning efforts that address specific sectors, neighborhoods and assets, as well as the broader resilience planning that is underway in the region. BCDC's

Commission meeting on October 17, 2013 was an actual ART workshop at which BCDC Commissioners, Alternates, and various other governmental, nonprofit, and private sector staff worked with ART Working Group members and members of the public on resilience issues. The ART project is evolving into the ART program of local assistance to apply the methods developed and lessons learned from the ART project throughout the region. ***(More information on the ART Project can be found in a separate binder titled Appendix 6.)***

2. Formal and Informal Policy Collaborations

Joint Policy Committee: Pursuant to AB 2094 (2008), BCDC is a full member of the JPC, which has two climate change goals – reducing regional greenhouse gas emissions and encouraging climate change adaptation. In May 2011, the JPC adopted a strategic work program to further Bay Area economic development and climate/energy resilience. In part, the program will inform the region of potential climate change impacts and provide guidance on adaptation measures to increase the region's resilience. ***(A copy of that work plan can be found in Appendix 7.)***

BCDC's Bay Plan Amendments recommend that BCDC collaborate with the JPC and other agencies and interested parties to prepare a regional strategy to adapt to a rising Bay. After almost a year of careful consideration, the JPC agreed to take a lead role in preparing a regional strategy for adaptation to climate change.

Sustainable Communities Strategy: Under SB 792 (pending, by Senator DeSaulnier), the four JPC member agencies would be responsible for the development of the second and third sustainable communities strategies required by SB 375. Although MTC and ABAG took the lead in formulating the first SCS, BCDC staff served on the *ad hoc* Committee, participated in its development, and ensured that agency

partners integrated adaptation considerations into the SCS, particularly for infill development areas that may be vulnerable to future RSL. BCDC staff played a lead role in crafting the vulnerability assessment and conceptual adaptation strategies in the Plan Bay Area EIR. ***(A copy of the amended SB 792 can be found in Appendix 8.)***

Local Government Adaptation Assistance Program: BCDC has taken the lead in developing an adaptation assistance program (AAP) to provide information and resources to local and regional governments, thus assisting them in planning for and adapting to the impacts of a changing climate. The AAP builds capacity within local governments to assess climate change issues and to plan for and implement adaptation strategies. BCDC's outreach efforts focus on addressing the needs of land use planning, public works departments, park and open space districts, flood control districts, and wastewater authorities, as well as resource-based managers. The AAP is supported by the JPC through its Regional Agency Climate Protection Program. The long-term goal of the AAP is to help communities adopt coordinated plans to make their communities more resilient to climate change impacts.

BCDC has identified five broad program components to accomplish these AAP objectives:

(1) Build partnerships that cut across jurisdictional boundaries;
(2) Perform public outreach to build community and institutional support for adaptation planning;
(3) Educate planners and managers about adaptation planning;
(4) Create a "one-stop shop" website and information clearinghouse; and,
(5) Develop and disseminate strategies to improve the region's resilience and adaptive capacity.

During the past five years, AAP efforts have focused on the first three components successfully. BCDC, with ABAG, the San Francisco Bay National Estuarine Research Reserve (SF Bay NERR), BAAQMD, NOAA, Office of National Marine Sanctuaries, ICLEI, and the Center for Ocean Solution at Stanford University, have held five workshops and a weeklong training for local governments that focused on adaptation. ***(A copy of case studies can be found in Appendix 9.)***

Bay Area Ecosystem Climate Change Consortium (BAECCC): BAECCC (pronounced "bake") is sponsored by the Coastal Conservancy and funded by the Gordon and Betty Moore Foundation. Its purpose is to advance the use and acceptance of nature-based solutions to climate change and RSL. BCDC staff serves on the steering committee. BAECCC is leading the Baylands Ecosystem Habitat Goals Update, which is producing a set of far-reaching management recommendations to restore and maintain these nature-based approaches to a rising Bay. Simply put, healthy ecosystems make the region more resilient to climate change and restoring ecosystems is a cost-effective strategy to make the Bay Area more resilient to the impacts of climate change. Natural ecosystem processes to sequester carbon, reduce flood impacts, and moderate climate extremes must be part of any far-reaching approach to making the Bay Area more resilient to climate change.

BCDC/State Coastal Conservancy/ABAG Partnership: The State Coastal Conservancy, ABAG, and BCDC are formally exploring ways to better coordinate, collaborate and partner on their various climate change related projects and programs. In part, this effort is focused on advancing the regional Resilient Shorelines initiative, called for in the recent Bay Plan Amendments, which ABAG and BCDC lead as part of the JPC. Current and future BCDC/ABAG/Conservancy collaborative projects include:

1. Integrating ABAG's regional Earthquake and Hazards Program into the ART Pilot Project work in Alameda and Marin Counties;

2. Developing with MTC, BART, and Caltrans adaptation strategies extending the ART project into key locations in Alameda County, including the Bay Bridge Toll Plaza, the Coliseum area, the Highway 92 Corridor and Toll Plaza, and/or other priority sites;
3. Conducting a region-wide assessment of the affects of a rising Bay on Priority Development Areas; and,
4. Integrating ABAG's housing vulnerability and infrastructure interdependency projects with the Resilient Shorelines initiative; and,

Regional Sediment Management: Bay sediment dynamics relentlessly affect the locations of tidal flats and marshes, habitat variability, and the productivity of Bay waters. Understanding sediment dynamics can help to more accurately forecast the impact of RSL and climate change. Sediments can feed tidal flats and wetlands to maintain their elevation in the tidal frame while minimizing erosion and inundation. Decreases in local or regional sediment supply can exacerbate erosion and inundation. BCDC and its partners, including the San Francisco Bay Regional Water Quality Control Board, the U. S. Environmental Protection Agency (USEPA), the U.S. Army Corps of Engineers, State Coastal Conservancy, San Francisco Estuary Institute, USGS, and local flood control agencies, are practicing regional sediment management to manage sediments within the context of the entire Bay system, including sediment sources, movement and sinks within the system, and sediment exchange with the ocean. ***(A staff report and presentation describing regional sediment management can be found in Appendix 10.)***

Dutch Partnership: BCDC has taken advantage of the Netherlands' experience in protecting low-lying areas from flooding. BCDC and Dutch staff compared and contrasted the two geographies, conducted technical research, and modeled the impact of RSL on the Bay. The analysis showed that tidal elevations due to a rising Bay largely

will be linear across the Bay and tidal velocities and wave heights within the Bay likely will increase. The team analyzed a range of shoreline typologies for adaptation purposes, identified potential adaptation measures, developed a decision-making matrix for their use, and identified differences in governance with respect to adaptation between the Netherlands and the Bay Area.

The partnership's final report, "*San Francisco Bay: Preparing for the Next Level*," was well received at a symposium on September 21, 2009. BCDC's partnership with the Dutch is continuing through its participation in the Delta Alliance, an international organization whose mission is to improve the resilience of four of the world's largest deltas in Indonesia, Vietnam, the Netherlands, and California. BCDC is leading the partnership in the Bay Area with the Port of San Francisco, other City Departments, and private property owners. The project will focus on the Mission Creek Area of San Francisco starting in Fall 2013. The project will include a high level vulnerability assessment and develop a suite of adaptation strategies.

3. Research and Innovation

Rising Tides Competition: Grappling with the realities of a rising Bay will require planners to approve a new suite of shoreline design concepts. BCDC's "Rising Tides" competition sought architectural and engineering responses to various design challenges, including; how do we build in an area that is dry now, but that may be wet in the future?; how do we retrofit existing shoreline infrastructure such as shipping ports, highways, airports, power plants and wastewater treatment plants?; can we imagine a different shoreline configuration or settlement pattern that allows temporary inundation from extreme storm events?; and, how can we provide flood protection inland of marshes without drowning the wetland when the water rises? In partnership

with the American Institute of Architects (San Francisco Chapter) and NOAA, BCDC sought a wide variety of submissions to address issues in estuarine environments.

Design proposals ranged from practical and pragmatic to aggressively imaginative and speculative. The best ideas could be transferred to other estuaries and expanded on traditional design solutions, such as seawalls and levees, or offered entirely new perspectives. Ideas addressed RSL for particular shoreline elements or structures, and larger issues related to a site, a neighborhood, commercial districts, public infrastructure, transportation systems or an entire watershed. Many integrated "green building" principles with resilient designs.

BCDC received more than 130 entries from around the world. An independent judging panel chose the six winning entries. Thousands of people viewed them at San Francisco's Ferry Building and the Commission curated the posters as a traveling exhibit in various public spaces to raise awareness about RSL and the need to adapt.

Innovative Wetland Adaptation Strategies: The "*Innovative Wetland Adaptation Techniques in Lower Corte Madera Creek Watershed"* project is one of the first analyses to examine how to reduce the vulnerability of tidal wetlands to a rising Bay. BCDC and USEPA undertook the study to better understand the flood control and wave attenuation benefits of tidal wetlands, the vulnerability of tidal wetlands to RSL, and potential strategies to improve the resiliency of tidal wetlands. The research team of BCDC, USEPA, USGS, the University of San Francisco, the Marin County Flood Control District, and private consultants has collected and analyzed data to evaluate the current flood and wave attenuation benefits of the tidal marsh system and to evaluate the sensitivity of the system to rising sea level. Staff will develop a conceptual adaptation

strategy for nature-based resiliency based on the data collection and the modeling results. ***(A non-scientific discussion of the project and its possible benefits can be found in Appendix 11.)***

Head of Tide: Head of Tide is the space of high ecological importance where freshwater flowing down tributaries to the Bay meets tidal currents flooding upstream from the Bay. Many Bay cities were located originally where freshwater met navigable Bay waters. RSL will shift head of tide upstream, which will increase flood risks. However, Head of Tide for Bay tributaries is not mapped and the flooding risks have not been evaluated. BCDC's Head of Tide study will establish a protocol to determine the location of the zone within which Head of Tide is located and will develop a protocol to evaluate changes due to RSL.

Climate Ready Estuary Pilot*:** The USEPA and BCDC conducted a pilot project to assess key vulnerabilities of the San Francisco estuary system to climate change. The assessment took advantage of significant work underway in the region, particularly on RSL, to support analysis of climate drivers and ecosystem effects. The project identified known stressors and potential climate change impacts on the Bay, and then synthesized experts' opinions to address uncertainties due to insufficient technical information. USEPA staff has prepared a report that describes the results of the analysis and the utility of the process to studying climate change impacts, which will be released after internal USEPA review. ***(A copy of the Executive Summary of the Final Report can be found in Appendix 12.)