SAN FRANCISCO BUSINESS TIMES
ADVERTISING SUPPLEMENT
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San Francisco Bay Conservation and Development Commission

RISING TO THE CHALLENGE

In the coming years, the San Francisco Bay Area will see significant sea level rise. BCDC is helping communities prepare while preserving the quality of the Bay.

bcdc @50

The San Francisco Bay Conservation and Development Commission is working with Bay Area communities to plan for sea level rise.

From left: Anne Halsted (Vice Chair), Zack Wasserman (Chair) and Larry Goldzband (Executive Director).

OUR BAY ON THE BRINK

THE HIDDEN THREAT TO OUR ECONOMY

The Bay is the heart of our region, economy, and our way of life. But outdated infrastructure and neglected bay wetlands leave Bay Area communities and businesses vulnerable to rising sea levels and extreme weather. Experts warn that if we don't act now, the Bay could be subject to at least **$10 billion dollars in widespread economic damage** from a flood event.

There are simple, low-cost solutions that scientists and engineers confirm will protect our economy from catastrophe.

We can:

> Upgrade outdated infrastructure, like levees.

> Restore wetlands, which serve as natural flood protection.

That's why businesses and environmentalists have come together to form Our Bay on the Brink, a new public information project.

BAYAREA COUNCIL Leading in a connected world

Santa Clara Valley Water District

SAVE THE BAY

SILICON VALLEY LEADERSHIP GROUP

We all agree: if we want our children and grandchildren to inherit a thriving Bay Area, we must act now to protect it.

LEARN MORE: OurBayontheBrink.org @SFBayontheBrink

PHOTO COURTESY OF PORT OF OAKLAND

Oakland's Middle Harbor exemplifies innovative engineering that can lead to new policies.

SAN FRANCISCO BAY CONSERVATION AND DEVELOPMENT COMMISSION

Five decades of balancing preservation and growth

BCDC celebrates successes while rising to new challenges

Since 1965, the San Francisco Bay Conservation and Development Commission (BCDC) has been remarkably successful in its mission to protect and enhance San Francisco Bay and to encourage the Bay's responsible and productive use for this and future generations.

The Bay is now larger than it was when BCDC was established. Before 1965, an average of 2,300 acres were being filled each year. Now only a few acres are filled annually – all for critical water-oriented needs. In addition, opening previously diked areas has increased the size of the Bay.

More than 200 miles of Bay shoreline are now open to the public. When BCDC was established, only four miles of the Bay shoreline were open to public access. Today, the Bay and its shoreline are recognized as a national recreational treasure. Residents and visitors have ample opportunities to enjoy the Bay and its environs, including the Golden Gate National Recreational Area and numerous parks, beaches and the prize-winning Bay Trail. An array of restaurants, shops and residences grace the Bay shoreline, taking full advantage of their scenic locations.

The Bay Area economy has experienced unprecedented growth. BCDC has contributed to this growth by approving billions of dollars of construction and creating special area plans to encourage appropriate new development around the Bay.

San Francisco Bay continues to be a global shipping center. BCDC has provided strong support for maritime development while guiding regional port expansion and minimizing or avoiding impacts to the Bay's natural resources.

Bay wetlands have been protected and restored. Healthy wetlands are critically important "sponges" that provide habitat and a natural buffer against storms and sea level rise along the Bay shoreline. BCDC has prevented the filling of wetlands and mudflats, encouraged restoration of degraded marshes, supported the continued and productive use of salt ponds and helped to preserve the 85,000-acre Suisun Marsh. BCDC was also instrumental in establishing the San Francisco Bay and San Pablo Bay National Wildlife Refuges.

Bay Area jurisdictions are collaborating to address Bay issues. Local governments acting alone cannot fully address regional issues such as the challenges posed by rising seas. BCDC is raising awareness and building consensus among the many public agencies that touch the Bay and working to focus state and federal laws and policies on this regional resource of national significance.

The Bay Area has come together to Adapt to Rising Tides (ART). BCDC is leading a collaborative planning effort to help San Francisco Bay Area communities prepare for sea level rise and storm events while protecting critical ecosystems and community services.

"San Francisco Bay is a national treasure because of the stewardship of BCDC for the last 50 years."

San Francisco Mayor Ed Lee

"BCDC brings together local, regional, state, federal, nonprofit and private organizations... We need cooperation and foresight like this across California to adapt to the new normal of climate change."

California Natural Resources Secretary John Laird

Commitment to legacy of a healthy Bay

BY JOE BODOVITZ
BCDC's first Executive Director, 1965-1973

BCDC's success owes much to strong public support, but also to seven remarkable people – three women and four men.

When Kay Kerr, Sylvia McLaughlin and Esther Gulick, all with strong ties to U.C. Berkeley, learned that the City of Berkeley planned to fill the Bay out to the end of the Berkeley pier, they wondered how many other cities were planning to do the same. What would the Bay be like if they succeeded?

The women did not just wonder. They organized. They formed the Save San Francisco Bay Association and asked their Assemblyman, Nick Petris, to sponsor fill-control legislation in Sacramento. But the initial efforts didn't succeed.

Next they turned to Senator Eugene McAteer of San Francisco. McAteer's legislative skills and tenacity, helped by Petris, led to passage of the McAteer-Petris Act in 1965, which created BCDC – if only temporarily.

Mel Scott, a researcher at U.C. Berkeley (who coined the name Bay Conservation and Development Commission), wrote the first analysis of Bay issues. He explained how easy the Bay is to fill because it is so shallow in many places and riddled with complex and divided ownership of underwater property.

The temporary commission might well have floundered but for its chairman, Melvin B. Lane. Lane, whose family published *Sunset* magazine and a series of books about California's great natural settings, was both a businessman and an environmentalist. His quiet leadership was exactly right for the job.

The Commission completed its work on time and, in 1969, the legislature voted to make BCDC permanent. Imagine what the Bay might look like today had BCDC not been here to minimize fill and maximize feasible public access!

Citizen action has brought public benefits

BY MIKE WILMAR
BCDC Executive Director, 1979-1983

Viewed from the perspective of 50 years, BCDC's achievements are truly remarkable. Created in 1965 to respond to the haphazard, uncontrolled filling of San Francisco Bay, and with only a four-year life span, BCDC had what seemed to be the insurmountable task of creating a plan for San Francisco Bay. The legislature gave BCDC the permit power to override local government Bay fill decisions in the meantime, a truly revolutionary step.

But the San Francisco Bay Plan was completed on time. The planning process was hailed as a model of citizen involvement. And in 1969, after an epic battle that pitted an energized citizenry against entrenched special interests, the legislature made BCDC permanent and gave it the power to carry out the Bay Plan through the issuance of permits. BCDC's permit jurisdiction was also expanded to the shoreline, where every project would now have to provide maximum feasible public access.

The results speak for themselves. Since 1970, as a result of mitigation and public access conditions in BCDC permits, the Bay has increased in size by almost 29 square miles. The amount of new shoreline public access is equally impressive: almost 200 linear miles. Along the way, BCDC has authorized projects with a total project cost of almost $20 billion.

Even these achievements fail to fully capture BCDC's larger legacy. BCDC has played a pivotal role in shoreline planning and habitat protection. BCDC's success led directly to the California Coastal Commission, the Tahoe Regional Planning Agency and the federal Coastal Zone Management Act of 1972. The expansion of federal and state jurisdiction over navigable waters and wetlands in California and elsewhere is also traceable to the BCDC effort. Similarly, the state's heightened scrutiny over the last 50 years of the use and protection of California's tidelands stems directly from BCDC's early focus on the public interest in these areas.

In keeping with its pioneering spirit, BCDC has now turned its attention to a challenge wholly unforeseen 50 years ago: an expanding Bay as the result of climate change and rising sea levels.

BCDC rises to meet new challenges

BY WILL TRAVIS
BCDC Executive Director, 1995-2012

It might seem unrealistic to expect BCDC, which was created to address uncontrolled Bay filling in the past, to successfully grapple with rising sea level in the future. But BCDC possesses an unusual legal authority that will help it meet this challenge.

BCDC evaluates permit applications to determine whether proposed projects will be consistent with both the general provisions of state law and the more specific policies of the San Francisco Bay Plan. The Commission is legally authorized to amend the Bay Plan to reflect new information and conditions. Thus, BCDC can amend its regulatory standards to allow development that will be resilient to rising sea level, as well as protect the natural resources of San Francisco Bay.

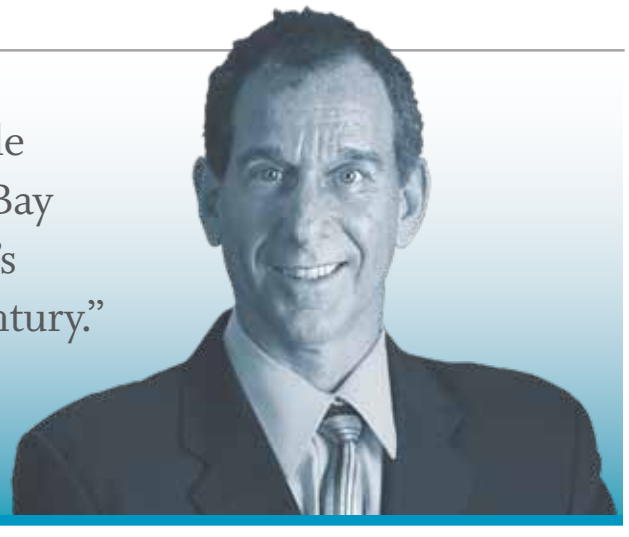
Using this authority and flexibility wisely presents a formidable challenge. Virtually all government coastal laws treat the location of the shoreline as a fixed location, but as the sea level rises upward, the shoreline will move inland — or at least it will unless shoreline barriers are built ever higher.

To deal with this challenge, society will have to find new ways to make productive use of shoreline areas in a manner that will accommodate and adapt to the fact that the shoreline wants to forever migrate inland. BCDC and other agencies can then reverse engineer their policies to make it possible to permit the resilient structures.

To advance this process, BCDC should encourage ideas for innovative adaptation by recognizing that failure is an inherent part of the process of innovation. BCDC should be willing to authorize innovative projects even though they may not work. BCDC can learn from these failures and move on to then craft thoughtful long-term policies that accommodate resilient shoreline development.

"Only a coordinated, comprehensive approach will enable us to meet the challenges posed by rising San Francisco Bay waters. BCDC's leadership role is crucial to the Bay Area's environment, economy and infrastructure in the 21st century."

State Senator Bob Wieckowski
Chair, California Senate Environmental Committee



Projected inundation of a portion of the South Bay in the year 2100, using mid-range estimates.

How will we adapt?

Sea level rise is a given; how we plan for it will mean the difference between disaster and resilience

San Francisco Bay is rising and it's time to prepare for how we're going to adapt.

The fact is, rising sea level, from as little as six inches in 2030 to 36 inches in 2100, and possibly much higher, are going to affect everyone in the Bay Area, whether they live next to the Bay, do business there or commute just about anywhere in the region. Records from the Bay's tidal gauge show that it has risen about eight inches since 1900.

And the challenges posed by rising sea level will be compounded by tides and storms.

"Anyone who wants to get to SFO or the Oakland airport or ship goods through the Port of Oakland or who rides BART or Muni will be affected," says Zack Wasserman, BCDC's chair.

"Those who travel on highways or depend on East Bay MUD for wastewater treatment or the Delta for clean drinking water are going to feel the effects, as are Silicon Valley companies like Google and Facebook that abut the Bay."

While Bay Area governments and the state have long been working to reduce greenhouse gas emissions, mitigation alone will not be adequate to address impending sea level rise and other climate change impacts.

In 2010, BCDC partnered with the National Oceanic and Atmospheric Administration (NOAA) to work with Bay Area communities to plan for sea level rise.

"For years, those concerned with global warming and climate change focused on mitigation – lowering emissions of greenhouse gasses," says Larry Goldzband, BCDC's executive director.

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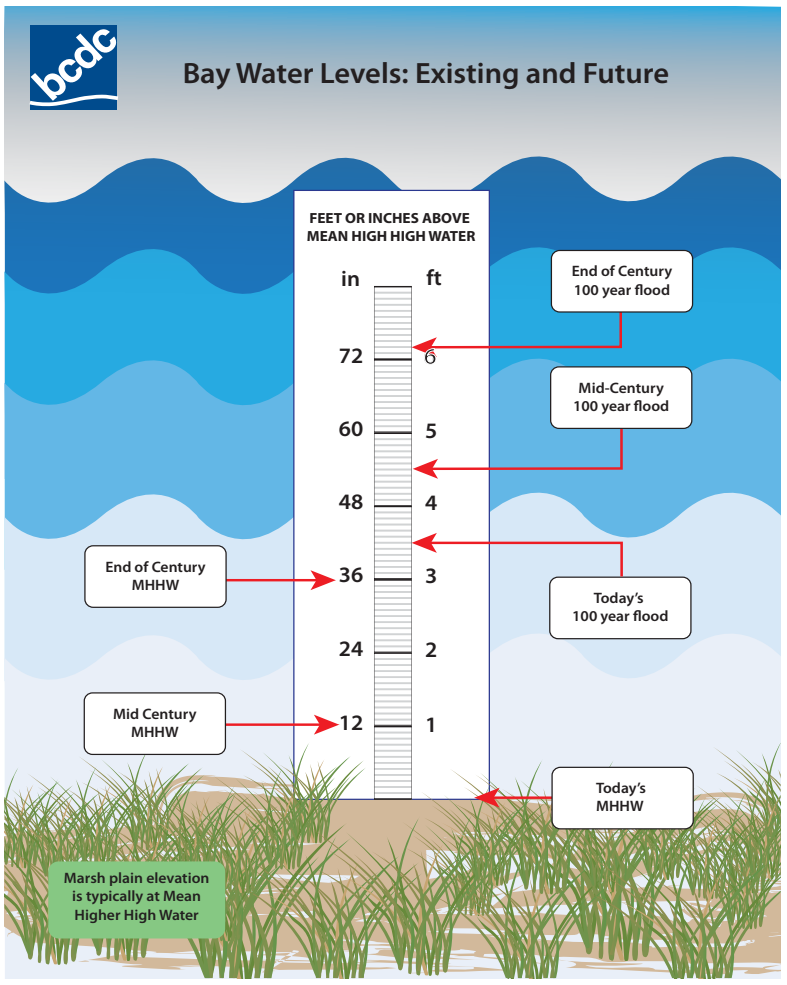

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"While these measures are critically important, we also need to be prepared to adapt to the effects of climate change, including a significant increase in sea level."

The pioneering Adapting to Rising Tides (ART) program is studying local vulnerabilities in depth, creating adaptation strategies to build resilience and modeling a planning process that can be replicated throughout the Bay Area – all with the active participation of local residents, non-governmental organizations and other government affiliates.

Motivating positive action

"One of the reasons ART is successful is the way we're working collaboratively with local jurisdictions, community activists, nonprofits and other agencies so that everyone can understand their neighborhood's vulnerabilities, as well as the region's, and what they can do to plan for them," says Goldzband.

"We're not about scaring people into paralysis, but in educating and motivating them to take action."

No time to waste

There's no time to waste. Experts agree that today's flood is the future's high tide. Areas that currently flood every 10 to 20 years during extreme weather and high tides will begin to flood regularly.

In addition, flooding will be more frequent and longer-lasting. There's a danger of toxins being released from contaminated areas or industrial sites and sea levels undermining seismic stability due to liquefaction.

The Bay Area is the fifth-largest metropolitan area in the country, surrounding the nation's most urbanized estuary. At risk are thousands of homes, critical infrastructure, Silicon Valley, Mission Bay, diverse habitats and valuable community resources.

"We need to instill a sense of urgency in identifying and advancing groundbreaking solutions," says Wasserman. "Planning now for the next 20-50 years is essential."

In San Jose, that planning includes "a focus on 'not making the problem worse,'" says Mayor Sam Liccardo. "The most important action cities can take today is saying 'no' to development in low-lying areas that's surely to be imperiled as we see rising sea levels."

San Jose is also investing in supporting and replacing levees around sensitive assets and is engaged in regional conversations around large investments needed to protect critical assets, like airports and highways, as well as the homes and businesses that could be impacted by inundation.

One of the significant benefits of BCDC's ART program, says Daniel Hamilton, sustainability program manager in the City of Oakland, is the way it has influenced city planning.

"As a result, we're developing new regulations for how we deal with private lands, public lands and critical infrastructure," says Hamilton.

ALAMEDA COUNTY ADAPTING TO RISING TIDES PROJECT

Project Scope

The first project undertaken by the Adapting to Rising Tides (ART) program was working with communities to assess the vulnerability to sea level rise and storm surges in a 66 square mile area of Alameda County and to develop strategies that could reduce and manage the risks they face.

The project area stretches from Emeryville to Union City and includes six cities, one unincorporated community and numerous special districts. The study area includes shoreline residential communities, the Oakland International Airport, energy infrastructure and pipelines, the Port of Oakland, wastewater treatment plants and parks, protected habitats and recreation areas.

Possible Adaptation strategies

ART developed a number of possible adaptation responses that can be applied at multiple scales: from an individual asset to an entire project area. Any adaptation option needs to address a wide variety of information and governance challenges, physical conditions and, above all, fit well into the place that adopts those particular strategies.

Enjoying a morning stroll along the Bay Trail.

For example, the connection to the Bay Bridge toll plaza from I-80/Powell St. is highly susceptible to flooding. Possible solutions could include improving the drainage system, raising the roadway or constructing a causeway over low-lying areas, building a berm or floodwall along the perimeter of the freeway and retrofitting the toll plaza to elevate wiring and electrical elements.

"Each possible solution comes with its own set of challenges but none is insurmountable," says Goldzband.

Planning process

Rising water has no respect for jurisdictional boundaries; the flow will follow the path of least resistance. One of the most valuable outcomes of the ART planning process has been fostering collaboration among public agencies, nonprofits, private interests and community activists to increase the Bay Area's preparedness and resilience to sea level rise and storm events while protecting critical ecosystem and community services.

BCDC and its partners are moving forward with resilience planning efforts that address specific sectors, neighborhood assets and supportable broader resilience planning that is underway in the region.

OAKLAND/ALAMEDA SHORELINE RESILIENCE PLANNING

Project scope

The Oakland/Alameda shoreline has significant infrastructure and community assets that are at risk due to its location, low-lying topography, underlying Bay fill and other loose soils that are susceptible to liquefaction. Many of the assets in the focus area have regional significance. Consider, for example, the disruption to the regional and state economies if flooding cut off access to Oakland International Airport.

Planning process

BCDC and the Association of Bay Area Governments (ABAG) are working with stakeholders to plan for multiple hazards in a holistic way – earthquakes, sea level rise and flooding.

By looking at an array of vulnerabilities and opportunities for solutions, project managers hope to streamline the planning process for all of the many jurisdictions and property owners involved.

Priority areas for adaptation strategies include those where flooding is most likely:

- Access on and off Alameda's Bay Farm Island and to and from the Oakland airport.
- Housing and community facilities in low-lying areas.
- The Oakland Coliseum neighborhood, facilities, and transportation assets.
- Shoreline habitat, much of which is not predicted to persist given sea level rise, sediment projections and surrounding land uses.

Just as important, the project is examining how assets within the focus area are related to each other and how they relate to those outside the focus area.

"We're changing our systems and decision-making criteria for everything from planning to how we prioritize capital investments."

Earlier this year, San Francisco Mayor Ed Lee convened an interagency Sea Level Rise Coordinating Committee to coordinate city efforts to deal with and plan for the potential impacts of higher waters.

"The realities of climate change and sea level rise threaten not just the beauty of our fragile coastline but the future of our neighborhoods, public infrastructure and way of life," says John Rahaim, San Francisco's planning director. "I look forward to working together with BCDC toward developing innovative solutions so that San Francisco will not just survive, but flourish in the face of these challenges."

"The Adapting to Rising Tides program is an inspiration to those of us in county government for how to think about and plan for the impact of rising seas in our communities… BCDC is leading the way."

Supervisor Kathrin Sears,
Marin County District 3

Not just a shoreline problem

San Francisco Bay is a dynamic tidal estuary connected to the Pacific Ocean through the Golden Gate. As sea levels rise so will the Bay, which will affect everybody, whether you live next to the Bay, in Cupertino or in Livermore.

"All of us rely on infrastructure that is next to the Bay that will be affected by rising sea level, including highways 101 and 880, BART and CalTrain, SFO and Oakland airports, our seaports, wastewater treatment plants and major business headquarters, just to name a few – so we all need to work together to figure out how to become resilient regionally and plan for the future," says Goldzband.

CONTRA COSTA COUNTY ADAPTING TO RISING TIDES PROJECT

Project scope

The Contra Costa ART project includes west and central Contra Costa County, from Richmond to Bay Point. The project encompasses a broad expanse of areas that are vulnerable to rising Bay water, including the Richmond Parkway, residential neighborhoods in the cities of Richmond and San Pablo, the enormous West County landfill, and the Chevron and Tesoro refineries.

Planning process

Using the ART approach, stakeholders are working together to investigate how flooding may impact transportation and utility networks, industrial facilities and employment sites, residential neighborhoods, community facilities and shoreline park and recreation facilities.

Some areas along the shoreline or streets or rivers already experience temporary flooding during Pacific storms when high tides coincide with high winds or when significant rain causes creeks and rivers to overflow their banks. While some assets and areas can function after the water recedes, others may suffer irreparable damage.

"The problems are complicated by the fact that the region's urbanized areas are served by an infrastructure network that depends on gravity to drain," says Wendy Goodfriend, senior planner, BCDC. As Bay waters rise, the ability of these systems to move water effectively and efficiently away from residential and commercial areas will be significantly impaired.

Prolonged inundation can release pollutants from contaminated landfills and toxic materials from storage tanks, pipelines or industrial sites and increased sedimentation in tidal creeks. Shoreline erosion can damage roads, bridges and footings, levees, embankments and foundations.

Flooding can also result in disruptions of power, water and water treatment, and access to goods, services and jobs, and impair disaster and recovery response. Power outages can damage underground electrical and mechanical equipment and homes that rely on electric pumps.

With the loss of communications services and utilities, the movement of goods and commuter services, job sites, government services and businesses will be disrupted – and the losses to the economy will be significant.

Adaptation strategies

ART is helping conduct a high-level assessment for the entire project area. Adaptation responses – from further information gathering and infrastructure changes to resource management and policy solutions – will be developed to address the highest-priority needs.

HAYWARD SHORELINE RESILIENCE STUDY

Project scope

The Hayward Regional Shoreline covers 817 acres between Hwy. 92 and San Lorenzo Creek. It is a good example of how planners need to take multiple uses and multiple constituents into account when figuring out adaptation strategies.

The project is taking a close look at two miles of shoreline that includes sloughs, marshes, mud flats, a rocky shoreline and former landfills; major wastewater infrastructure; a large power plant; and the western approach to the Hayward-San Mateo Bridge. The Bay Trail runs along the top of dirt levees built in 1854.

From the Hayward Shoreline Interpretive Center, visitors can see how the marshes are transformed into mudflats at low tide, bustling with sea birds probing in the mud for food. At high tide, the marshes are flooded and the birds take to floating on the lapping waves, wading the shallows or diving for a meal.

"The Hayward shoreline is a great place for seeing how the tides affect the Bay and inland marshes and also threaten bayshore development," says Lindy Lowe, senior planner, BCDC.

Possible adaptation strategies

Options being discussed by the community include:

- Addressing the impact of extreme tidal flooding on marshes and managed ponds and improving bayfront levees.
- Replacing or substantially upgrading the joint wastewater outfall pipeline, which serves some 900,000 residents.
- Improving the resiliency of the approach to the Hayward-San Mateo bridge, from installing new drainage systems to eliminating or relocating the toll plaza, building levees or seawalls, or constructing an elevated causeway.
- Retrofitting and possibly relocating the Hayward Shoreline Interpretive Center.
- Constructing a horizontal levee near the shoreline through the oxidation ponds to protect commercial/industrial land and maintain utilities in their current location. The Bay Trail could be sited on top of the levee.
- Adopting new decision-making frameworks to plan, permit and fund new adaptation projects.

Next steps

The study is a significant step for adaptation along the Hayward shoreline. Now it's up to working group members and local asset managers to carry the information forward in their own agencies to better prepare for temporary flooding and permanent inundation.

Port of Oakland preparing for sea level change

The Port of Oakland is a world-class international cargo transportation and distribution hub. Oakland was among the first ports globally to specialize in the intermodal container operations that have revolutionized international trade.

The Port of Oakland loads and discharges more than 99 percent of the containerized goods moving through Northern California, the nation's fifth largest metropolitan area. Oakland's cargo volume makes it the fifth busiest container port in the United States.

Of California's three major container ports – Oakland, Long Beach and Los Angeles – Oakland is almost 300 nautical miles closer to Asia, a major trading partner of the U.S. This means reduced transit times, lower fuel and vessel costs and faster turnaround for ocean carriers.

PHOTO COURTESY OF PORT OF OAKLAND

The Port of Oakland is taking a proactive approach to adapting to sea level change.

PORT OF OAKLAND BY THE NUMBERS

73,000
Jobs in the Bay Area

50%
Of the nation's total cargo volume

2
Major railroads serve the port

300 miles
Closer to Asia than Long Beach or Los Angeles

The Port of Oakland supports more than 73,000 jobs in the region and is connected to nearly 827,000 jobs across the nation.

The Port of Oakland also owns and operates the 2,500-acre Oakland International Airport. Both the seaport and airport are low-lying and vulnerable to the impacts of sea level rise.

"Different parts of the Bay are vulnerable in different ways," says Richard Sinkoff, the Port's director of environmental programs and planning. "Working with BCDC, we're beginning to understand that we don't need to buttress the entire Bay to protect the built environment. If we address the most vulnerable points along the shoreline, we can potentially have a greater beneficial effect on upland areas."

The Port is taking a three-pronged approach to adapting to sea level rise: planning, policy development and engineering design.

"BCDC has been successful in implementing policies to prevent the filling of the Bay," says Sinkoff. "With projected sea level rise, certain areas may actually benefit from creating living shorelines that can temper the effects of storm surge and rising sea level."

The Port, other agencies, jurisdictions and the private sector can be a source of innovative engineering solutions to adapting to sea level rise, says Sinkoff.

He cites the Port's creation of a 180-acre shallow water tidal habitat at the foot of Seventh Street is an example of how prototypical projects can guide new policies to temper the effects of sea level rise and storm surges.

The Middle Harbor habitat was built using clean material from harbor deepening projects and now provides both a rich ecological area for birds and fisheries and natural shoreline protection.

"The potential is enormous for what BCDC is doing to influence our future planning for low-lying areas," says Sinkoff. "As a region, we're looking at private land use, public land use, infrastructure, development regulations and how we prioritize capital investment."

Stronger Housing, Safer Communities

Most Bay Area homes are not built to withstand any amount of flooding. Historic and current construction materials, siting and design standards do not address potential exposure to either water or salt. As sea level rises, housing of all types within flood hazard areas will be at greater risk of flooding, and neighborhoods close to the bayshore – from low-lying neighborhoods around the Oakland Coliseum and in West Oakland to Marina Bay in Richmond, East Palo Alto, Redwood Shores and Corte Madera – will be at even greater risk.

A quarter of the land in East Palo Alto is within the current 100-year flood plain.

The Association of Bay Area Governments (ABAG) and BCDC partnered to identify what makes Bay Area housing and communities more vulnerable to earthquakes and flooding related to sea level rise and to develop strategies that reduce these vulnerabilities.

"As communities gain experience with assessing vulnerability to sea level rise and flooding and begin putting recommendations into action, they'll further modify the recommendations or develop additional adaptation strategies of their own," says BCDC's Lindy Lowe.

BUILDING RECOMMENDATIONS

Adopting safe, smart growth strategies

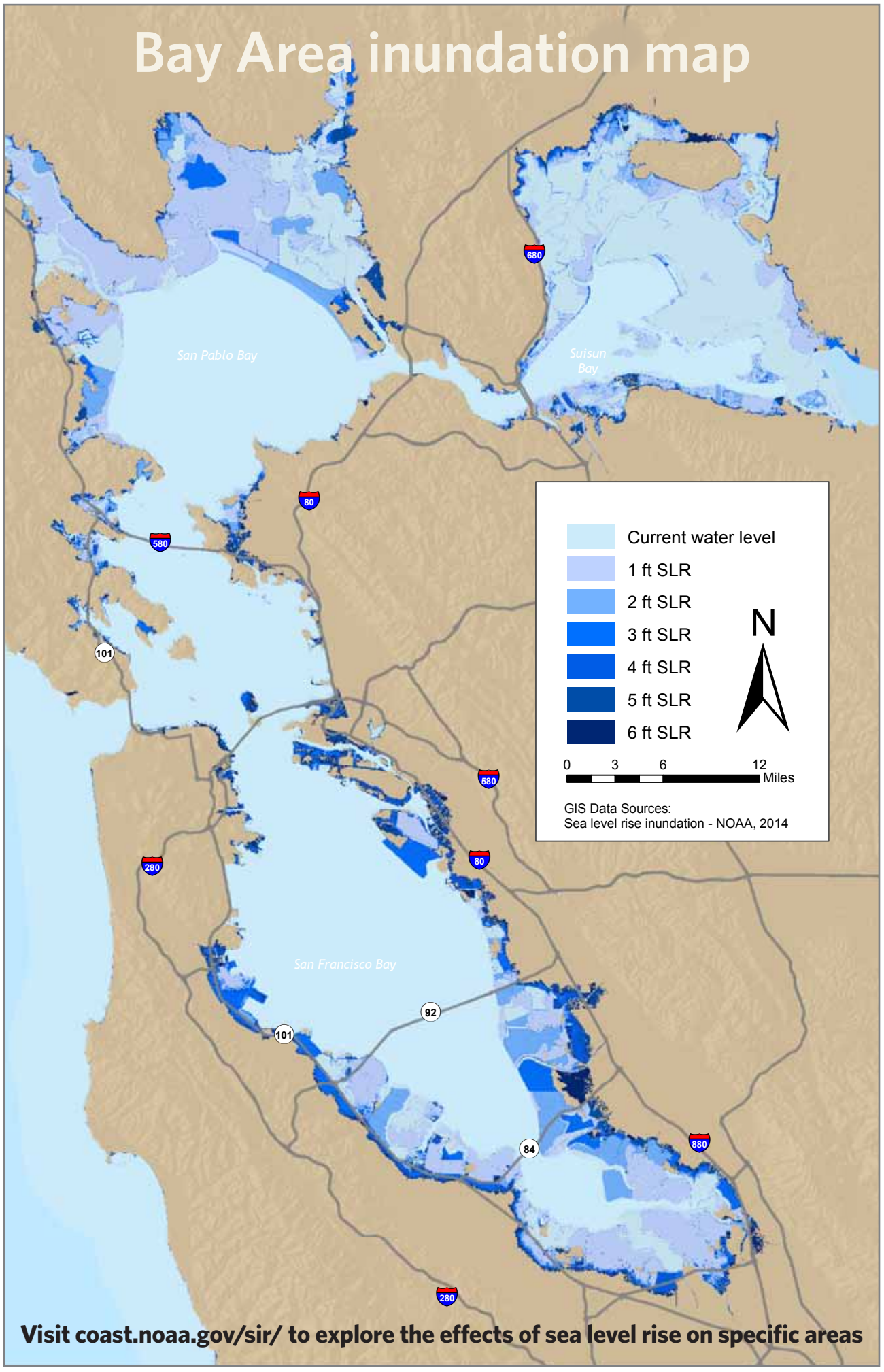
- Establishing a cooperative, coordinated shoreline management program to facilitate shared decision-making and funding to reduce risks.
- Developing guidelines for transit-oriented development to reduce flood risks.
- Encouraging innovative insurance solutions, including the expansion of mandated catastrophe insurance programs.
- Advocating improvements in multi-family rebuilding efforts.
- Decreasing reliance on grid-supplied power.
- Promoting innovative resilient design solutions.

Protecting critical facilities in high hazard areas

- Prohibiting development of critical infrastructure and public service facilities in the most hazardous areas, and offering incentives for relocation.
- Redirecting development to low hazard areas.
- Placing permanent conservation or hazard mitigation easements on properties in high-hazard areas.

Addressing flooding hazards

- Encouraging local governments to implement floodplain management activities through integrated watershed management, improved runoff storage, green infrastructure and floodplain restoration.
- Requiring flood-proof construction within or near flood hazard zones.



"BCDC provides the technical knowledge and expertise we cannot replicate at the local level."

Supervisor Dave Pine,
San Mateo County, District 1

SEA LEVEL RISE BY THE NUMBERS

8 inches
Sea level rise since 1900

6 inches
Sea level rise by 2030

36 inches
Sea level rise by 2100

355,000
Residents in Bay Area's 100-year floodplain*

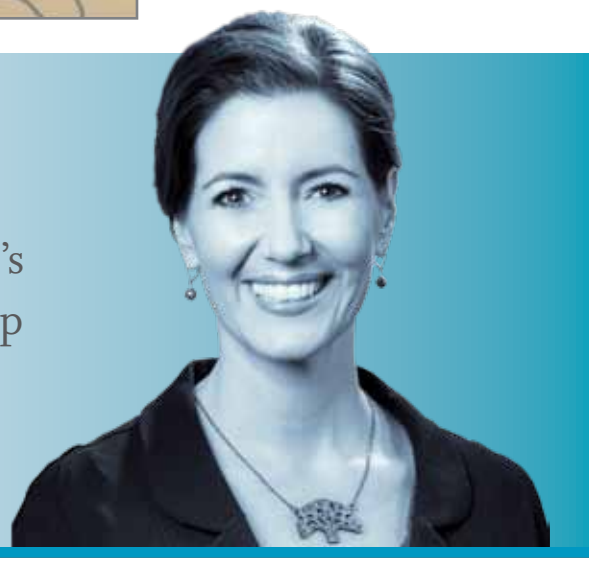
$46.2 billion
Value of structures & contents in Bay Area's 100-year floodplain*

$10.4 billion
Potential economic loss from superstorm & associated floods*

★ FROM BAY AREA ECONOMIC INSTITUTE'S SURVIVING THE STORM STUDY

"We are fortunate to live in one of the most beautiful and geographically rich and diverse parts of the country, but with that diversity comes risk and responsibility… BCDC's work illustrates the power and effectiveness of partnership in the face of big challenges."

Oakland Mayor Libby Schaaf



Business is taking up the challenge

A recent Bay Area Council Economic Institute study found a superstorm and associated flooding could have a $10.4 billion impact on the Bay Area economy

COURTESY OF SF GIANTS

Waterfront Development: The Giants' proposed Mission Rock development (top) and the Treasure Island plan. Both have incorporated innovative engineering stragies to create resilient shorelines.

While a coordinated public sector response is necessary to tackle the impacts of sea level rise, the best practices are going to come from a collaboration of the public and private sectors.

"There's growing awareness within the business community about the economic and environmental imperative for protecting the Bay," says Jim Wunderman, president and CEO of the Bay Area Council.

"We see it manifested in numerous projects along the waterfront. There's more work that needs to be done, particularly in figuring out how we will finance both ecological enhancements and man-made structures. This will require close collaboration among agencies like BCDC and groups like ours that represent many of the region's largest employers."

Resilient shoreline at Mission Rock

The San Francisco Giants propose building 1,500 rental units, a new Anchor Brewery and space for local retailers on a windswept 24-acre parking lot just south of AT&T Park. The project goes before voters this coming November.

Project managers have incorporated innovative engineering strategies to create a newly resilient shoreline at the site, with interior grades for buildings set above the 100-year flood levels and low-lying areas preserved and expanded as wetlands to accommodate flooding at the perimeters.

"The Giants have enjoyed a long partnership with the Port, BCDC and the State Lands Commission," says Larry Baer, Giants' president & CEO. "We've worked together for years to improve and maintain the waterfront around AT&T Park."

"BCDC has partnered with the Dutch government, the Port and other key public agencies on important studies for Mission Creek and the Mission Bay area."

Baer points out that more than eight acres of parks at Mission Rock will reconnect people to the waterfront, which will help to "encourage future generations to continue environmental stewardship of this incredible regional resource."

Adapting Google's campus

Google is making adapting to sea level rise an integral component of its proposed redesign of its Mountain View Campus. Plans include both ecological restoration and transferring development from lower lying areas along Stevens Creek to higher elevation areas near Hwy. 101 – an important regional precedent for adaptation to accelerated sea level rise.

Google's proposal offers a significant opportunity to address large-scale restoration of core habitats, specifically Permanente Creek and Charleston Retention Basin.

Protecting PG&E's customers

As a provider of energy to nearly 16 million Californians, "PG&E has extensive plans in place to help us face the challenges of a changing climate," says Pat Hogan, vice president of the utility's electric operations.

"We're focused on building a more modern, flexible and resilient system to ensure the delivery of safe, reliable, affordable and clean energy."

In addition to its own internal risk assessment process, PG&E is engaged with cities and counties throughout the region to learn more about the impacts of climate change, such as sea level rise and extreme storms.

A recent Bay Area Council Economic Institute study that found a superstorm and associated flooding could have a $10.4 billion impact on the Bay Area economy. PG&E estimates that disruption to its substations could result in losses to customers of up to $125 million.

The good news is that PG&E has a resilient electric grid with interconnected

substations that can play a back-up role and help minimize customer service interruptions. The utility also has a fleet of more than 20 mobile substations that can be dispatched to support impacted areas.

To further reduce the risk, PG&E has elevated three of its substations in San Mateo, Napa and Contra Costa counties.

Treasure Island plans for sea level rise

San Francisco is poised to have a new residential and commercial community built just offshore on the former naval base at Treasure Island. Plans include some 8,000 new homes, 450,000 square feet of commercial and retail space, 500 hotel rooms and a new ferry terminal and transit program. The project will include 300 acres of open space, three miles of shoreline trails and a 400-slip marina. Upgraded wastewater treatment and recycling facilities are also in the works.

Treasure Island's location in the Bay and low-lying terrain makes the proposed development a perfect example of the need to plan for sea level rise.

Using BCDC analysis and project-specific data prepared by Moffatt & Nichol, developer Wilson Meany's engineers have designed an "adaptive management strategy" that provides for flexibility in dealing with rising tides and surging Bay waters.

Plans call for improvements to the shoreline and storm drain system, and elevating the development footprint three feet above the 100-year high tide mark.

Development setbacks were included along the perimeter of the island so that future improvements can be constructed within the island footprint without encroaching on the Bay.

"We have to avoid foreclosing future adaptation strategies while we adapt along today's shoreline," says BCDC's Regulatory Director Brad McCrea. "We have to provide enough room for tomorrow's ideas."

Flood protection along Belmont Creek

In July, the San Carlos City Council approved a $1.7 million contract to dredge Belmont Creek and a channel along Holly Street near Hwy. 101; Redwood City will chip in $200,000 for its portion of the channel.

The project is the result of a study commissioned by Novartis Pharmaceutical Corp., which was ready to pull up stakes and move elsewhere due to the huge costs associated with regular flooding of Belmont Creek.

Novartis hired WRECO, a Bay Area engineering firm with expertise in stream and coastal engineering, to prepare a detailed study of the creek's watershed, which spans the cities of Belmont, San Carlos and Redwood City.

The final project was a collaboration among BCDC, the U.S. Army Corps of Engineers, the Regional Water Quality Control Board and the three cities in the creek watershed.

"Usually, cities and other jurisdictions compete with one another… but for sea level rise they need to collaborate – it's imperative," said Charles Long, co-chair of the Urban Land Institute's Tackling Sea Level Rise initiative.

"The work of BCDC to better prepare for and understand our vulnerability to sea level rise, will help ensure our majestic coastlines and cities are protected for generations to come."

State Senator Mark Leno

Plans to keep the Bay Area moving

"Sea level rise has been described as a slow moving emergency. But every year, as the tides rise higher or the storms become more intense, the risk is greater."

Jim Allison
CCJPA manager of planning

THINKSTOCK

Much of the transportation infrastructure in the Bay Area, including this strech of I-880 near Oakland, is at or near today's sea level.

The nine-county San Francisco Bay Area, home to some 7 million people, is the nation's fifth most populated metropolitan area. A complex public transportation network connects the Bay Area's prosperous businesses, vibrant neighborhoods and productive ecosystem and links the Bay Area to the world and its global markets.

Many of the Bay Area's freeways, tunnels, bridge approaches, seaports, railroads, airports and transit corridors are located near or even below current sea level. There is very little redundancy of regionally significant transportation assets, and where alternatives do exist, many have limited capacity to accommodate additional traffic.

In the event of high tides and storm surges, to say nothing of the long-term implications of sustained sea level rise, the movement of people and goods could, effectively, come to a halt.

Among the challenges faced by transportation systems is the fact they often rely on other agencies or jurisdictions for power, communications, shoreline protection and drainage. They cross city, county and regional lines and are often regulated by multiple agencies.

The Adapting to Rising Tides (ART) program and its partners at the Metropolitan Transportation Commission (MTC), BART and Caltrans District 4 are working with the region's transportation planners, congestion management agencies and local governments to help craft effective adaptation strategies.

Protecting Bay Bridge touchdown

The Bay Bridge touchdown includes the toll plaza as well as the intersection of I-580, I-80 and I-880. Immediately north of the touchdown is the Emeryville Crescent tidal wetland, which currently experiences regular tidal flooding, and Radio Beach, so-called for its three radio towers.

Proposed solutions for protecting the area include improving drainage, retrofitting the toll plaza to elevate water-sensitive elements, constructing a breakwater off Radio Beach and building a living levee immediately north of the touchdown.

The advantages of a "living levee" over a more traditional structure include a flatter seaward slope that can be planted to create a marsh habitat that would both dissipate wave energy and accommodate wildlife. If necessary, the levee could be raised to accommodate future conditions.

Other possible adaptations include raising the road in areas especially prone to flooding and elevating the entire freeway above 100-year flood levels.

Policy makers are looking at changes to building codes, modifying design guidelines and planning policies and establishing multi-jurisdictional partnerships that can plan for and fund adaptation strategies.

Living levees at Coliseum & Amtrak

The area around the Oakland Coliseum complex, including the Coliseum BART station and new BART airport connector, Jack London Square Amtrak station and a section of I-880, is vulnerable to both current and future flooding.

One option is a living levee along each side of Damon Slough. Additional protection would need to be placed along the north edge of the slough to protect BART and Amtrak. The levees would also provide some protection for I-880.

Levees provide a flexible adaptation, as they could be raised if necessary at a later date.

PHOTO COURTESY OF SFO

Seawalls, levees and berms, such as this one at San Francisco International Airport, can be constructed to protect low-lying areas.

BART adaptations

The Bay Area Rapid Transit (BART) system is the backbone of the Bay Area's regional and local public transportation network and an essential part of the region's economy and quality of life. BART, with 44 stations and more than 100 miles of track, serves some 350,000 riders daily.

Inspired by BCDC's Adapting to Rising Tides project, and supported by the Federal

Transit and Highways administrations, BART is taking a comprehensive planning approach to adaptation strategies.

"We are mainstreaming the concerns we have about rising sea levels into our day-to-day priorities and the criteria for capital investments," says BART's chief architect, Tian Feng. BART is also looking at physical changes that can make underground stations, power and tracks more resilient to potential flooding and seepage.

As an example, BART is investing in upgrades to train control systems, such as new or retrofitted roofing and wall systems, to make them more resilient to water intrusion. Projects are underway at the Daly City and San Leandro train control rooms.

"More importantly," says Feng, "we're developing new guidelines and standards for building and modernizing BART infrastructure to make it more resistant to sea level change and heavy downpours."

"We also want to look at additional scenarios and analyze the impact on different parts of the system," says Feng, "as well as looking in depth at specific assets – stations, tracks, power stations – and at each element within those assets."

It's important that BART work with local jurisdictions to ensure sufficient capacity of local storm drain systems, installing one-way drain valves to prevent backflow, simplifying maintenance reports to more quickly identify "trouble spots" and keeping on-site roof and drain systems in good working order.

Capitol Corridor highly vulnerable

The Capitol Corridor 171-mile rail line, connecting Sacramento to Oakland and San Jose, has more linear exposure to the threat of sea level rise than any transit provider in the Bay Area.

Long stretches of the route run along waterfronts, through marshland or on soils that are increasingly vulnerable to earthquakes and rising seas.

"At risk are tracks, rail beds and signals," says Shirley Qian, a planner with the Capitol Corridor Joint Powers Authority.

As the CCJPA looks to add track to expand capacity between Oakland and San Jose, planners are aware of the need to measure sea level design against the lifespan of the project design.

"Sea level rise has been described as a slow moving emergency," says CCJPA's Manager of Planning Jim Allison. "But every year, as the tides rise higher or the storms become more intense, the risk is greater."

A more immediate threat is the ever-rising groundwater table.

"In effect, sea level rise is upon us now," says Allison. "At some point, the maintenance frequency will become excessive and could cause a more intensive capital project to come to the rescue."

"By starting now, BCDC is giving us all a chance to respond in a better way – the way the Bay Area can do historically with its other challenges, like earthquake safety – to the required responses to adapting to sea level rise. If that is not helping the region, I don't know what is."

"The biggest challenges cities face in terms of sea level rise are regional. We critically need the leadership provided by regional agencies like BCDC because no city can go it alone."

San Jose Mayor Sam Liccardo

Regional airports prepare for high waters

The Bay Area's global economy and quality of life are highly dependent on the region's three major international airports: Oakland, San Jose and San Francisco. Two of those, Oakland and San Francisco, are projected to face significant challenges posed by rising sea levels and storm surges.

Oakland International Airport (OAK)

The Oakland International Airport (OAK), owned and operated by the Port of Oakland, is built on 2,600 acres bordered on three sides by San Francisco Bay. Its largest commercial runway is built on Bay fill.

Currently, the airport is protected by tide gates, levees and recently upgraded pump systems, but by 2050, with projected rises in sea level, higher tides and big storms, these structures could be overtopped by wind waves and surging seas.

"We are planning the best ways to protect Oakland International Airport from future rising waters," says Richard Sinkoff, Port of Oakland director of environmental programs and planning. "We've completed a vulnerability assessment of the perimeter dike and are working on a design for rebuilding the perimeter wall around OAK to address seismic risk and sea level rise."

Using a projected 16 inches of sea level rise in the region for 2050, the airport's general aviation facilities and the North Field runway could be inundated if there were also a concurrent extreme storm event. Doolittle Drive provides more than 12 inches of protection above the current daily high tide.

With 36 inches of sea level rise, as predicted by the NRC for 2100, North Field could be underwater daily. If this sea level rise were accompanied by a 100-year storm, it could also inundate the South Field, but only if the Port were to take no action.

Low-lying San Francisco International Airport is in danger of inundation without mitigation measures.

The threat of disruption is heightened by OAK's dependence on connecting roads that are at risk of flooding, although it would take at least 24 inches of sea level rise and an extreme storm to impact access roads and the South Field runway.

Any amount of flooding could affect OAK's ability to handle some of its cargo and passenger flights. More than 10 million passengers use OAK annually. Its air cargo traffic is the busiest in the Bay Area and 13th in the U.S. in terms of tonnage.

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The vital role of wetlands

Baylands are a critical first line of defense against flooding and a rapidly vanishing habitat for wildlife

PHOTO COURTESY OF COASTAL CONSERVANCY

A snowy egret surveys the Hamilton wetlands, where wildlife is again flourishing.

Wetlands prevent flooding by holding water much like a sponge. Over the past 200 years, the intertidal mudflats and tidal marshes around San Francisco Bay (referred to as baylands), have vanished at an alarming rate. It's estimated that 95 percent of the Bay's historic tidal wetlands have been destroyed. The loss of baylands hampers their function in acting as a natural water filtration system, providing a habitat for fish and other wildlife and flood protection.

The baylands serve as a buffer between the Bay and shoreline development. As waves move across these relatively flat areas of shallow water and plants, their height and energy are reduced, which helps protect inland coastal communities from flooding.

In addition, baylands trap sediments, which reduces the buildup in deep water channels, and absorb atmospheric pollutants. They provide an important habitat for plant and animal communities, are an essential feeding and resting place for migratory birds and provide important open space and recreational opportunities.

"Nature-based adaptation is an opportunity to leverage natural processes to build resilience," says Sarah Richmond, coastal planner for BCDC.

"We can't breach a levee, grade a trail and walk away anymore. We have to think about a shoreline that will continually change and we need to start now because it takes time to fund, plan and permit multi-benefit projects that can adapt to changing conditions."

The resilience of baylands to sea level rise depends on their ability to build upward and move landward. Baylands will drown if they do not keep pace with accelerating sea level rise, and the flood risk-reduction benefits they otherwise provide will be lost. Preserving, enhancing and restoring these natural barriers to flooding can reduce the future costs of repairing, raising or building structural shorelines in the face of sea level rise.

A pioneering wetland adaptation project undertaken by BCDC in lower Corte Madera Creek has shown that while the Corte Madera baylands have been keeping pace with the current rate of sea level rise, it may be difficult for them to keep up with an accelerated pace.

The Corte Madera study confirms that protecting and enhancing baylands requires a better understanding of how sediment is transported, completing more field studies to calibrate and validate marsh wave attenuation models at distinct points around the Bay, and integrating baylands management into coastal hazard mitigation to support better planning.

Former Hamilton Airfield now a flourishing wetland

PHOTO COURTESY OF COASTAL CONSERVANCY

The Hamilton wetlands after restoration.

The once-bustling Hamilton Airfield runways in Marin have been transformed into a flourishing, 650-acre wetland with thousands of native plants taking root and native wildlife finding new refuges in tidal and seasonal marshlands.

The $200 million project, advanced by the State Coastal Conservancy and the U.S. Army Corps of Engineers, and permitted by BCDC, involved breaching an old levee built to keep the waters of San Pablo Bay off the airfields. Mud from dredging at the Port of Oakland was used to raise the ground surface to sea level.

Like the restoration of wetlands at Oakland's Middle Harbor, the Hamilton project is an example of the effective re-use of natural material.

The Hamilton wetlands, like other projects around the Bay, took a collaborative effort. Eleven government agencies, four military organizations, and dozens of neighborhood and environmental groups were involved in the decades of planning. Construction began in 2008 and was completed last year.

The new design includes about 400 acres of tidal wetlands, and 76 acres of seasonal wetlands. As the Bay rises, the tidal wetlands will migrate into the seasonal wetlands and continue to provide critical habitat. The rest of the acreage is dry.

The restoration is giving new life to many species of fish, the Ridgeway's Rail, ducks, hawks, the salt marsh harvest mouse, Chinook salmon, snowy egrets and great blue herons that once flourished in the area.

"BCDC's expertise and planning ability has made it the clearing house for information on the risks of sea level rise, a resource to local jurisdictions and the convener of public and private entities to work together to address the issues."

Supervisor John Gioia,
Contra Costa County District 1, Board of Supervisors Chair and BCDC Commissioner

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The airport supports thousands of jobs directly through its operations and indirectly via the industries that depend on a functioning airport, from rental car agencies to hotels, retailers and other visitor-serving businesses.

"As jurisdictions and agencies around the Bay work on these projects, we're creating a 'regional toolbox' of design policies and engineering solutions," says Sinkoff.

San Francisco International Airport (SFO)

Last year, 47 million passengers traveled through SFO. In addition, SFO generates more than 36,400 direct airport jobs and $6.3 billion in business activity. If extended to offsite business that's directly dependent on SFO, the airport's economic impact expands to 155,000 jobs and $35 billion in sales.

Clearly, any disruption to service at the airport would have an enormous impact on the Bay Area.

Even under current conditions, SFO, with its eight miles of shoreline, is challenged to keep runways dry and safe. Annual King Tides can overtop flood protection structures and inundate low-lying areas.

"The good news is we have time to evaluate our options and implement strategies," says Doug Yakel, SFO's public information officer. "Now we need to figure out what will work best for the airport, how to integrate our work with what our neighbors are doing and how we can fund mitigation activities."

The threat of flooding along Hwy. 101, for example, underscores the need for a broader approach.

"If passengers can't get to and from the terminals," says Yakel, "it would negate any stand-alone work we may have done."

Earlier this year, SFO completed a study that's helping planners better understand the improvements needed to protect the airport from a 100-year flood and sea level rise.

"BCDC's been a very good resource," says Yakel.

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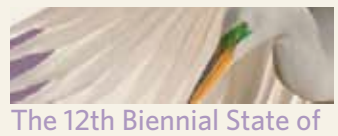

The 12th Biennial State of the Estuary Conference
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Global sustainability leader is keynote at BCDC summit

McDonough

William McDonough, a globally recognized leader in sustainable development, is the keynote speaker for BCDC's "Sink or Swim" summit on September 16 at the Exploratorium.

The summit, which is by invitation only, will celebrate BCDC's 50 years of leadership and kick off their campaign to address the impacts of climate change on San Francisco Bay and how to make the Bay shoreline resilient in the face of rising sea levels.

McDonough's remarks are designed to inspire policy makers, industry leaders and Bay advocates to see rising sea levels as an opportunity for innovation. Solutions, he suggests, will only come from engaging everyone – from developers and designers to the community at large.

In 1996, McDonough received the Presidential Award for Sustainable Development. In 2003, he earned the first U.S. Environmental Protection Agency's Presidential Green Chemistry Challenge Award. In 2002, McDonough and Michael Braungart co-authored *Cradle to Cradle: Remaking the Way We Make Things*, followed by *The Upcycle: Beyond Sustainability – Designing for Abundance* in 2013.

McDonough leads and chairs the World Economic Forum's Meta-Council on the Circular Economy and is also active with William McDonough + Partners, his architecture practice, with offices in San Francisco and Charlottesville, Virginia.

The summit's panel of speakers also includes: Mary Huss, publisher, *San Francisco Business Times*; Greg Dalton, Climate One/Commonwealth Club; John Laird, Secretary, California Natural Resources Agency; David Lewis, executive director, Save the Bay; Elizabeth Ranieri, Kuth Ranieri Architects; Gabe Metcalf, executive director, SPUR; Mike Ghielmetti, founder and president, Signature Development Group; and Kate Lydon, public sector portfolio director, IDEO.

Rising to the Challenge stories by Carol Piasente; Design by Carol Collier

The Bay Planning Coalition (BPC) celebrates the 50 years of success of BCDC.

WORKING COLLABORATIVELY, WE FIND MUTUAL SUCCESS.

Bay Planning Coalition

BPC is a broad coalition that advocates for sustainable commerce, industry, infrastructure, recreation and the natural environment connected to the San Francisco Bay and its watershed.

For more information about BPC, please call 510-768-8310, or go to our website, www.bayplanningcoaltion.org.