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Bayshore Urbanism

Property and Climate Change
Adaptation on San Francisco Bay

NEXT 10 is an independent nonpartisan organization that educates, engages and empowers Californians to improve the state's future.

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UNIVERSITY OF CALIFORNIA BERKELEY

Bayshore Urbanism: Property and Climate Change Adaptation on San Francisco Bay

October 2024

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Executive Summary

We live on a dynamic planet. Landscapes evolve and climates shift. Increasing damage from climate change-related hazards like coastal flooding and wildfires demonstrates that the permanence ascribed to cities, buildings, and infrastructure is a dangerous fantasy. The fallacy of permanence in human settlements is rooted not just in the concrete and steel of buildings and infrastructure, but also in contemporary attitudes toward property.

The purpose of this report is to explore how property regimes shape vulnerability and adaptation to sea level rise around the San Francisco Bay Area of California. Sea level rise (SLR) is projected to inflict enormous damage to Bayshore communities in coming decades. A recent report estimates that it will cost approximately \$110 billion to protect Bay Area communities from SLR by 2050.¹ Residents in flood-prone areas are increasingly facing the need to adapt in place or move to safer ground. Many conventional tools for addressing these risks, such as house-by-house buyouts and insurance, disproportionately benefit already empowered groups. Fragmented and static property divisions impede attempts to adapt to changing conditions.

Dominant property regimes—sometimes described as “the ownership model”²—are ill-suited to the demands of climate change adaptation. While equitable adaptation to climate change will require flexibility, collective action, and a concerted focus on advancing justice, dominant property regimes are rigid, fragmented, and deeply implicated in historical and ongoing injustices.

Even as Bay Area institutions are increasingly planning for climate adaptation, they have not paid enough attention to the question of how property shapes climate vulnerability. This report introduces a framework for three

changes necessary to enable transformative adaptation to SLR, outlining the need to shift from:

1. **static to flexible** property regimes;
2. **fragmented to collective action;** and
3. deeply **unjust** property relations to forms of land governance and property that **advance justice**.

Fortunately, tools and strategies exist that can enable more flexible, collective, and just forms of adaptation.

These tools include strategies that are widely used for a variety of purposes around the world, including: community land trusts, transfer of development rights (TDR) schemes, and land readjustment. Institutions common in the U.S., such as condominium boards and homeowners’ associations also have the potential to play important roles in enabling effective, efficient, and just adaptation. Finally, radical movements for reparative justice, including campaigns for Indigenous land return and reparations, can also be integral to transformative adaptation.

Across the Bay Area and around the world, communities are experimenting with land governance practices that could address the three core challenges of conventional property regimes for transformative climate change adaptation: flexibility, collective action, and justice. This table summarizes some promising strategies.

Table ES1 Transformative Property Strategies

Moving Property Rights	Examples	Applicability for SLR Adaptation in the Bay Area
<p>Rolling Easements</p> <p>Rolling easements are a strategy for allowing property rights to migrate with changing environmental conditions. For instance, once local sea level rises to a pre-determined level, new property regimes or use restrictions come into effect. They can ensure that coastal ecosystems can migrate inland with changing conditions. Rolling easements can take many legal forms.</p>	<p>Maine’s “Coastal Sand Dune Rule” prevents development in areas expected to erode with two feet of sea level rise over the next 100 years. Structures below the mean high tide line must be removed.</p>	<p>Bay Conservation and Development Commission (BCDC) could be empowered to prohibit new shoreline protection structures in specific areas to enable the landward migration of important aquatic ecosystems while allowing some ongoing use of land until the easement is triggered by predefined sea level thresholds.</p>
<p>Transfer of Development Rights</p> <p>Transfer of Development Rights (TDR) is a strategy that enables the voluntary relocation of property or development rights from “sending sites” to “receiving sites.”</p>	<p>Reconstruction following the 1995 earthquake in Kobe, Japan used several schemes to relocate private property rights, typically moving rights from small parcels to condominium rights in new buildings.</p>	<p>TDR provides a way to move SLR-affected rights to upland locations or multi-story buildings on adjacent sites.</p>
<p>Land Readjustment</p> <p>Land Readjustment is a replotting of existing land parcels often used to provide infrastructure and create public open space. It is a method of land value capture, in which each owner contributes part of their land to finance collective public investments that enhance the value of their remaining land.</p>	<p>Land readjustment was used after several earthquakes in Japan and following a 2001 earthquake in Bhuj, India, to widen streets, enlarge parcels, and provide public open space to improve future seismic safety.</p>	<p>Land readjustment could be used to rearrange parcels threatened by SLR, to relocate threatened shoreline infrastructure, or to provide open space for restoration or hazard mitigation. It could be combined with TDR for households who choose to move further inland.</p>
Managing Multiple Parcels	Examples	Applicability for SLR Adaptation in the Bay Area
<p>Land Bank</p> <p>Land banks are typically public or non-profit organizations that acquire, manage, hold, and convey property to serve a public purpose, such as affordable housing, open space, or stabilizing property values.</p>	<p>A land bank in Genesee County, Michigan acquires and maintains vacant properties, creates affordable housing, and activates vacant lands for community spaces.</p>	<p>A regional land bank authority could acquire and convey land for sea level rise mitigation projects, buy and consolidate flood-affected parcels, or accommodate the resettlement of displaced residents.</p>
<p>Land Trust</p> <p>Land Trusts are legal entities that acquire and hold property rights for a wide range of purposes, from wildlife conservation to neighborhood stabilization.</p>	<p>After a flood in Atlanta, Georgia in 2002 left 16 acres of land vacant, the Trust for Public Land created the Rodney Cook Sr Park, which incorporates green infrastructure features such as a stormwater retention pond.</p>	<p>Land trusts could facilitate climate adaptation in several ways, including: Preserving undeveloped land along shorelines, holding land for green infrastructure projects, or acquiring and holding rolling easements.</p>

Collective Ownership	Examples	Applicability for SLR Adaptation in the Bay Area
<p>Community Land Trust (CLT)</p> <p>CLTs are non-profit organizations that own land for the benefit of their community, most commonly to provide affordable housing. While CLTs own the land, families can purchase housing units.</p>	<p>The Caño Martín Peña CLT in Puerto Rico was established to prevent displacement after the dredging and restoration of the neighborhood’s water channel.</p>	<p>CLTs could enable voluntary relocation of property rights from coastal to upland land owned by the CLT, or they could help resist displacement in areas benefiting from green infrastructure investments.</p>
<p>Limited Equity Cooperative</p> <p>In a Limited Equity Housing Cooperative (LEHC) or Limited Equity Cooperative (LEC) residents purchase a share in a development, rather than a unit. LECs maintain affordability by restricting resale prices of coop shares. They are often combined with Community Land Trusts.</p>	<p>The San Francisco Community Land Trust owns the land beneath 53 Columbus Avenue in San Francisco and leases it to residents who collectively own the building through their shares in the co-op.</p>	<p>LECs can provide stable, affordable housing for residents in “receiving communities” relocated from vulnerable areas.</p>
<p>Condominiums</p> <p>Condo owners own the space inside individual units and share ownership interest in the walls, floors, and common areas such as hallways, stairs, and outdoor areas. Condo fees cover common expenses, maintenance, and services.</p>	<p>A common form of residential development in the second half of the 20th century, typically focused on property value preservation while minimizing costs. These governance tensions were involved in the collapse of the Champlain Towers in Surfside, Florida in 2021.</p>	<p>Condominiums that achieve consensus have the means to collectively decide on mitigation, adaptation, or relocation actions.</p>
<p>Homeowners Association</p> <p>A Homeowners Association (HOA) typically owns and enforces rules for shared spaces within residential communities, including roadways, open space, recreational facilities, and pools.</p>	<p>A very common form of residential development beginning in the mid-20th century. Often focused on property value preservation and aesthetic conformity.</p>	<p>Association dues from residents could fund SLR mitigation and adaptation projects, and common open spaces could facilitate relocation of vulnerable homes within community land, as with land readjustment.</p>
Split Tenure Housing	Examples	Applicability for SLR Adaptation in the Bay Area
<p>Manufactured Home Parks (MHPs)</p> <p>Residents of MHPs usually own their own homes, but rent land from park owners. Although rental tenure makes MH owners financially vulnerable, alternative forms of MHP ownership, such as resident-owned communities (ROCs) can give MHP residents increased agency in the face of climate threats.</p>	<p>Pasadena Trails, a resident-owned MHP near Houston, TX, invested in drainage upgrades to reduce vulnerability to flooding like that experienced during 2017’s Hurricane Harvey.</p>	<p>While manufactured homes are rarely moved, they are more “mobile” than many other forms of housing, potentially facilitating adaptation to climate change. Community ownership of shared lands, facilities, and infrastructures can also enable community-led adaptation.</p>

Split Tenure Housing	Examples	Applicability for SLR Adaptation in the Bay Area
<p>Houseboat Marinas</p> <p>Similar to manufactured home parks, residents usually own their own homes but pay rent to a landlord who controls the space and infrastructure. Around the Bay, most marinas lease the space from public trust entities, such as the State Lands Commission.</p>	<p>Galilee Harbor, in Sausalito, CA, is a cooperatively owned houseboat community serving low income artists and maritime workers. The community has been granted permission to remain conditional on providing public benefits including marsh restoration and public waterfront access.</p>	<p>Houseboat marinas are inherently resilient to many SLR-related threats, but they can negatively impact the Bay, and private housing is counter to BCDC's current interpretations of public trust purposes for development on/ around the Bay.</p>
Public Financing Strategies	Examples	Applicability for SLR Adaptation in the Bay Area
<p>Geologic Hazard Abatement District (GHAD)</p> <p>Geologic Hazard Abatement Districts (GHADs) are a type of special district in California created to address "geologic hazards." They can exercise eminent domain, issue bonds, and collect assessments.</p>	<p>The Broad Beach GHAD in Malibu, CA, was formed in 2011 to protect the beach from ongoing erosion.</p>	<p>GHADs could finance projects in areas particularly vulnerable to SLR. Larger GHADs could be created to cover entire municipalities or the entire bayshore, to facilitate financing of improvements across areas with uneven planning capacity and financial resources.</p>
<p>Joint Powers Authority (JPA)</p> <p>Joint Powers Authorities (JPAs) are legal entities that allow two or more public agencies to jointly exercise common powers, such as groundwater management, road construction, habitat conservation, and redevelopment projects.</p>	<p>The Capital Corridor Joint Powers Authority is a partnership among six local transit agencies in the Bay Area served by the Capitol Corridor train. Its current plan includes SLR adaptation projects.</p>	<p>JPAs could allow multiple existing agencies to collaborate on more efficient bayshore management, share resources and expertise, and raise capital sufficient to fund large-scale projects.</p>
<p>Enhanced Infrastructure Financing District (EIFD)</p> <p>EIFDs are a type of Tax Increment Financing (TIF) district used to finance infrastructure projects with community-wide benefits. They differ from traditional TIF districts in that they cannot use property taxes designated for schools.</p>	<p>Redondo Beach and LA County proposed an EIFD in 2019 to redevelop a closed power plant. Tax revenue from private development would finance wetland restoration on the site.</p>	<p>Development in upland areas of an EIFD, possibly including several jurisdictions, could finance infrastructure or environmental restoration along the Bay.</p>
<p>Climate Resilience District</p> <p>SB852 (2022) authorized the formation of climate resilience EIFDs to finance projects that address sea level rise, extreme temperatures, wildfire, drought, and flooding.</p>	<p>SB825 deemed the Sonoma County Regional Climate Protection Authority a Climate Resilience District.</p>	<p>Given the specific focus on climate change adaptation, Climate Resilience Districts have great potential as a regional mechanism to raise funds for adaptation projects.</p>

Redressing Historic Property Injustices	Examples	Applicability for SLR Adaptation in the Bay Area
Land Back	The Sogorea Te' Land Trust is an Indigenous land trust based in the Bay Area that collaborates with private landowners to facilitate the return of land to Indigenous people.	The return of lands to indigenous management along the Bayshore could facilitate wetland restoration, adaptation, and equitable relocation, similar to the potential of community land trusts.
Reparations	The Russell City Reparative Justice Project was created by the City of Hayward to redress the forced relocation of Russell City community members in the 1960s. The project is still in its early phases.	If available, reparation funds could support infrastructure and SLR mitigation projects in the Bay's most vulnerable communities.

Note: See Appendix A for more details

To illustrate pathways towards more flexible, collective, and just adaptation, the report includes simplified scenarios illustrate how some of these strategies might support SLR adaptation (Part III).

If we begin now to apply the creative talents of Bay Area communities to the challenges of adapting to climate change, we can create new mechanisms to enable flexible, collective, and just adaptation, for the rest of this century and beyond.

The report presents recommendations for how actors and institutions across scales can advance alternative approaches to property to enable transformative adaptation. These include specific legislative and regulatory actions, as well as longer-term institutional and governance approaches that can enable more flexible, collective, and just forms of property. Core recommendations are summarized below:

Enable the Bay Conservation & Development Commissions (BCDC) to Become a Vehicle for Transformative Adaptation

While BCDC has embraced a central role in regional adaptation planning, SLR promises to radically change the physical and institutional landscape. Much of the agency's 100-foot shoreline band of jurisdiction is projected to be inundated, and thereby, converted

to public ownership. Thus, BCDC's mandate and jurisdiction will need legislative modification, and BCDC will need to revise some core policies:

- BCDC should begin regulating based on future conditions, rather than assuming that its territorial jurisdiction will remain fixed. The agency would need statutory authority to develop and implement a risk-based jurisdictional boundary, based on future SLR rather than an arbitrary shoreline buffer. Areawide mapping of BCDC's existing jurisdictional boundaries would support this effort.
- BCDC could apply more flexibility to their regulation of "fill" to enable water-adaptive communities that can continuously adapt to rising seas while also helping meet regional demand for housing. A revised Bay Plan could define specific zones where water-based communities would be allowed, depending on ecological sensitivity and connectivity to existing infrastructure, jobs, and services. Such communities also might be appropriate TDR receiving locations for residents affected by SLR nearby.
- BCDC should explore opportunities to promote transformative adaptation goals through its new authority under SB 272 (2023)³ which empowers the agency to develop guidelines and ensure local SLR adaptation plans, policies, and regulations are consistent with those guidelines.

Support Shared Ownership

While coastal land holdings in the Bay Area are very fragmented, much of the land at risk from SLR is owned by various types of private common-interest communities (e.g., HOAs and condo boards). These entities vary widely in their capacity and focus, but, under the right conditions, they could use commonly held lands for a variety of adaptation interventions. However, these shared ownership entities need to have the right incentives and resources in place to manage this responsibility:

- State laws that govern homeowner associations and condo boards should be changed to facilitate adaptation, perhaps by requiring SLR vulnerable communities to raise additional reserve funds, contribute to public adaptation trust funds, hold additional insurance, or create SLR adaptation plans.
- The state should provide adaptation and planning grants to these entities, contingent on offering public benefits such as access, ecosystem restoration, or flood risk mitigation.
- Finally, the state could support common-interest communities in sharing resources and planning collaboratively both with one another and with local governments, such as by pairing TDR sending and receiving sites.

Improve Coordination Between Public, Private, and Shared Ownership Entities

Multiple scales of cooperation are needed to support collective investments in green infrastructure to benefit broader publics, while minimizing practices that pit neighboring property owners and neighboring public jurisdictions against one another. Existing regional entities—public, private, and nonprofit—could convene collaborative councils to coordinate collective investments, and state agencies could provide direct support for such efforts.

Explore a Broader Range of Property Strategies

Alternative property rights strategies would make it easier to move property rights from one location to another, proactively and intentionally share some of the costs of SLR, create new property rights schemes to facilitate future adaptations, and redress past and ongoing injustices. Although implementing such strategies would require policy and legislative changes, potential starting points include:

- Legislatively creating regional or statewide task forces to identify and evaluate a range of strategies, including TDR, land readjustment, rolling easements, land trusts, and other collective ownership structures.
- Including climate change vulnerability and adaptation potential in future deliberations surrounding reparations and Indigenous land return

Under current property conditions, adapting Bay Area communities to sea level rise presents many daunting challenges for governance, planning, and design. The time is right to begin applying the tremendous talents of these communities to seeking more flexible, collective, and just forms of property to enable transformative adaptation.



PART I

Sea Level Rise & The Bay

Introduction

Human-caused climate change is accelerating and expanding the geographic scope of landscape and climate shifts in communities around the world. In the absence of prior human interventions, most ecosystems can gradually adapt to environmental changes like rising sea levels, increasingly severe storms, heat waves, and other climate change impacts. For instance, in areas without human interference, intertidal wetlands can migrate inland with rising sea levels and plant and animal species can gradually change their range to cope with changing conditions.

Many of the devastating impacts of climate change arise from the ways that human activity has weakened, fragmented, and constrained the capacity of landscape and ecological systems to undertake this gradual adaptation process. Seawalls block the upland migration of estuaries. Settlements and road corridors block the migration of species to more hospitable habitats.

Human attempts to establish fixed boundaries and permanent settlements in the face of landscape and climatic dynamism harm non-human species and make communities and settlements vulnerable. Increasing damage from climate impacts like flooding in coastal communities and devastating wildfires in the wildland urban interface (WUI) make it clear that the permanence ascribed to cities, buildings, and infrastructure is a fantasy. The fallacy of permanence in human settlements is rooted not just in concrete seawalls, asphalt highways, and wooden homes. It is also rooted in institutions, perhaps most centrally, those institutions that undergird our contemporary conceptualizations of property.

Rigid, fragmented, and unjust property regimes make adapting to sea level rise (SLR) and other climate change threats difficult, costly, and inequitable. Residents in low lying, coastal, and flood prone areas are increasingly facing the need to adapt in place or move to safer ground to avoid the worst impacts of climate change. Static parcel boundaries mean that a relatively small number of landowners bear the brunt of those changes. Often those who bear the heaviest burdens of hazards belong to groups who are already disadvantaged and marginalized.⁴

Conventional tools for addressing these risks, like house-by-house buyouts and insurance payouts, are not equally available to all residents. They disproportionately benefit already empowered groups.⁵ Fragmented and static property divisions impede attempts to adapt to changing conditions, whether through protective infrastructure (e.g., levees and floodwalls or wetland restoration) or shifting settlement form (e.g., 'managed retreat'). When public entities make investments in collective adaptation and public space improvements, those changes can invite "green gentrification," displacing lower income residents.⁶ Such concerns about the inequitable impacts of climate change adaptation have led to heightened interest in "transformative adaptation," or efforts to adapt to climate change that also address the underlying causes of uneven vulnerability.⁷

The purpose of this report is to explore how property regimes shape vulnerability and adaptation to sea level rise around the Bay Area of California. Sea level rise is projected to inflict enormous damage to coastal communities along the Bayshore in coming decades. A recent report estimates that it will cost approximately \$110 billion to protect Bay Area communities from SLR by 2050.⁸ In recent years, there have been several high-profile efforts to raise awareness and generate innovative physical design solutions to deal with sea level rise in the region.^{9,10}

Even with more adaptation planning, there has been relatively little attention to the question of how property shapes vulnerability to sea level rise. Dominant property regimes in the Bay Area and in much of the world are extremely ill-suited to enabling just adaptation to SLR and other climate threats. Those dominant property regimes

—sometimes described as “the ownership model”¹¹—are static, fragmented, and deeply implicated in historical and ongoing injustices when transformative adaptation demands flexibility, collective action, and a direct focus on advancing justice.

Fortunately, there are alternatives to the ill-suited dominant property regime. Tools and strategies exist that can enable more flexible, collective, and just forms of adaptation. Some of these alternative property regimes and practices have been used in settings that are both contextually and geographically far from the Bay Area—from post-disaster land readjustment in Japan to collective property and slum upgrading in Bangkok. In other cases, there are insights to be gleaned from forms of collective property governance that are common in California, including community land trusts and even condominium and homeowners associations.

This report arose out of research led by Zachary Lamb and Rob Olshansky, in partnership with a group of graduate students from UC Berkeley’s Department of City and Regional Planning with support from Next10.

The report is divided into four sections. **Part 1** includes a brief environmental history of the San Francisco Bay to provide context regarding the historic environmental conditions and the property and regulatory regimes that will shape SLR adaptation in the region. This section then briefly maps and describes patterns of projected sea level rise and ongoing planning efforts to coordinate SLR adaptation around the Bay.

Part 2 introduces a framework for three transformations necessary to enable transformative adaptation to SLR, outlining the need to shift from static to flexible property regimes, fragmented to collective action, and purportedly neutral property relations to forms of land governance and property that advance justice. We examine each of these three property transformations in turn. First, we discuss the need for flexible property and regulatory regimes including a description of how SLR will shift the territorial delineations of public and private property and the regulatory jurisdictions of key actors, including BCDC. Next, we map fragmentation of property holdings around the Bay, revealing distinct spatial patterns of consolidation and fragmentation of property in SLR vulnerable landscapes that will shape distinctive patterns of adaptation in different areas. We

then map the prevalence of forms of private shared land governance (e.g., HOAs, condominiums, and cooperatives) in Alameda County to show how common such forms of existing collective land governance are in SLR vulnerable areas. Finally, we briefly discuss how SLR vulnerability is layered with other forms of socio-spatial marginalization in some Bayfront communities, from East Palo Alto to San Rafael.

Part 3 of the report begins with a brief overview of existing property strategies that address the three transformations (Flexibility, Collective Action, and Justice). An expanded account of these strategies is included as Appendix A. Next, we present a pair of simplified scenarios to compare SLR adaptation under conventional property regimes and under transformative property regimes that enable more flexible, collective, and just action in the face of climate change.

Finally, **Part 4** summarizes the proposals for transformative property-based adaptation developed by students in a Spring 2023 urban design studio at UC Berkeley. The teams developed proposals that linked physical design interventions with innovations in property and land governance to advance transformative adaptation in six Bayshore communities: 1) San Rafael’s Canal District; 2) Bayview-Hunters Point in San Francisco; 3) Alameda; 4) East Bay shorelines in San Leandro and Hayward; 5) Gallinas in Marin County; and 6) East Palo Alto.

Finally, the report closes with a conclusion that includes both key takeaways from the research and recommendations for action through which actors and institutions across scales might advance alternative approaches to property to enable transformative adaptation.

History of Environment and Property on the Bay

San Francisco Bay drains nearly forty percent of California and a small portion of Oregon; it is the largest estuary in the Americas and sustains more than seven million people and countless other species who call the Bay Area home. However, human intervention has created a Bay that is unrecognizable from the one that existed before European colonization.

Before Colonization

The Ohlone people have called the Bay home for thousands of years. Before colonization, the region's Indigenous peoples subsisted off the estuary, catching salmon and trout from the rivers, and collecting mussels, clams, and other shellfish from the Bay.¹² The Indigenous peoples of the Bay developed intricate watercraft and fishing techniques to access abundant resources and to trade with other groups in the wider region.¹³ While their impact on the landscape was modest by the standards of contemporary urbanization, the Ohlone altered the topography of the Bay Area through the creation of shellmounds, built of shells, rock, and dirt over thousands of years.¹⁴

Spanish & Mexican Eras

In 1769, a group of Spanish colonists known as the Portola Expedition became the first Europeans to encounter the San Francisco Bay, arriving by land.¹⁵ The establishment of a permanent Spanish settlement in the Bay in 1774 led to the decimation of the Ohlone through direct violence, displacement, and the introduction of unfamiliar pathogens.¹⁶ During the first fifty years of Spanish occupation, the region's Indigenous population fell seventy-five percent, from an estimated population of 72,000 to 8,000.¹⁷

Spanish colonists were given ownership of the land they "discovered" by royal land grants.¹⁸ Tidal lands were treated as sovereign and under the jurisdiction of the Spanish crown.¹⁹ Additionally, the heads of military forts (presidios) and townships (pueblos) distributed land grants known as "Rancho Grants" to soldiers and settlers to encourage the expansion of agriculture and industry.²⁰ Although the Bay Area became part of a newly independent Mexico in

1821,²¹ Rancho Grant distributions continued with more than 800 land grants awarded by Mexico.²² The Mexican government kept tidal lands in national control, resulting in limited changes to the Bay front during this era.²³ By the 1830s, the Mexican government had closed the Spanish missions. Despite claims that they would grant lands to Indigenous people who had formerly lived in the missions, very few received any.²⁴

United States Control

In 1848, the Treaty of Guadalupe Hidalgo ended the Mexican-American War, ceded California to the United States, and established the rights of Mexicans to retain their land in California.²⁵ The discovery of gold in California in 1848, and the subsequent Gold Rush population boom, led to rapid changes to the Bay, its hydrology, and its settlements. The influx of new settlers into the region brought widespread squatting on granted lands. Because the process of proving legal ownership of Spanish and Mexican land grants was very slow and costly, many landowners were forced to sell land to pay for legal fees²⁶ or to salvage any financial return from land that had been occupied by squatters.²⁷

The Gold Rush transformed the Bay both economically and physically.²⁸ Hydraulic mining (blasting gold bearing hillsides with high pressure water) was the primary form of gold mining from the 1850s until 1884.²⁹ This practice led to as much as 1.5 billion cubic yards of sediment being washed down rivers and into San Francisco Bay, smothering existing aquatic and estuarine ecosystems beneath as much as three feet of new sediment.³⁰

Regulatory History

In 1846 the settlement that is now San Francisco was a small port town called Yerba Buena with less than 1,000 residents. Three years later, the city had been renamed and its population had ballooned to 25,000.³¹

When California became a state in 1850, the State was given the rights to all tidal and submerged areas and the beds of navigable waterways.³² Unlike the Spanish and Mexican governments who placed control of the tidelands in the hands of the national government, the United States gave control to the states.³³

A common law practice dating back to ancient Rome referred to as the “Public Trust Doctrine,” dictated that these tidal lands be protected for the common use of the public.³⁴ However, during the State’s early history, California all but ignored its public trust obligations.

The brief period between the end of Mexican rule in 1848 and the declaration of Statehood for California in 1850 was one of legal ambiguity and confusion that led to the first large-scale sales of tidal lands. In 1847, S. W. Kearney, US military governor of California, sold “water lots,” areas of open water and intertidal marshland, to the City of San Francisco, who in turn sold these properties to private developers in a public auction.³⁵ While Kearney’s actions violated the public trust doctrine, the sales proceeded and would be repeated several times in subsequent years.³⁶

In 1851, the State legislature passed the San Francisco Beach and Water Lots Act, which transferred ownership of State-owned tidelands to the newly formed City of San Francisco.³⁷ The city government sold these newly acquired mudflats and salt marshes as water lots, which were highly valued by private development interests.³⁸ New landowners filled in the tidal land with rubble and garbage to create new (albeit unstable) land for development.³⁹ This move was further bolstered by the federal Swamp Land Acts of 1849, 1850, and 1860, which gave states ownership of all land that required drainage or levees to be cultivated (expanding State ownership beyond the tidal zone).⁴⁰ The State of California sold the newly acquired land to private owners to drain, build levees, and use for agricultural purposes.⁴¹ While the federal government defined swamp lands as “lands lying above the reach of the tide,” many buyers covertly included tidal wetlands in their

grants.⁴² This legislation led to the widespread destruction of wetlands and marshes in the Sacramento-San Joaquin Delta and in the North and South Bay (Fig. 1).

In 1868, the California Legislature created the State Board of Tide Land Commissioners (BTLC) to survey and subdivide all remaining tidal and submerged lands that had yet to be sold to private owners.⁴³ The Board was abolished in 1876, and in 1879, California amended its constitution to prohibit the sale of tidal and submerged lands.⁴⁴ This amendment was motivated by concerns over public access, as many sales of tidelands during the preceding period removed the requirement for a public easement.⁴⁵ The 1892 U.S. Supreme Court decision *Illinois Central Railroad v. Illinois*, permanently ended the sale of submerged lands in the United States.⁴⁶

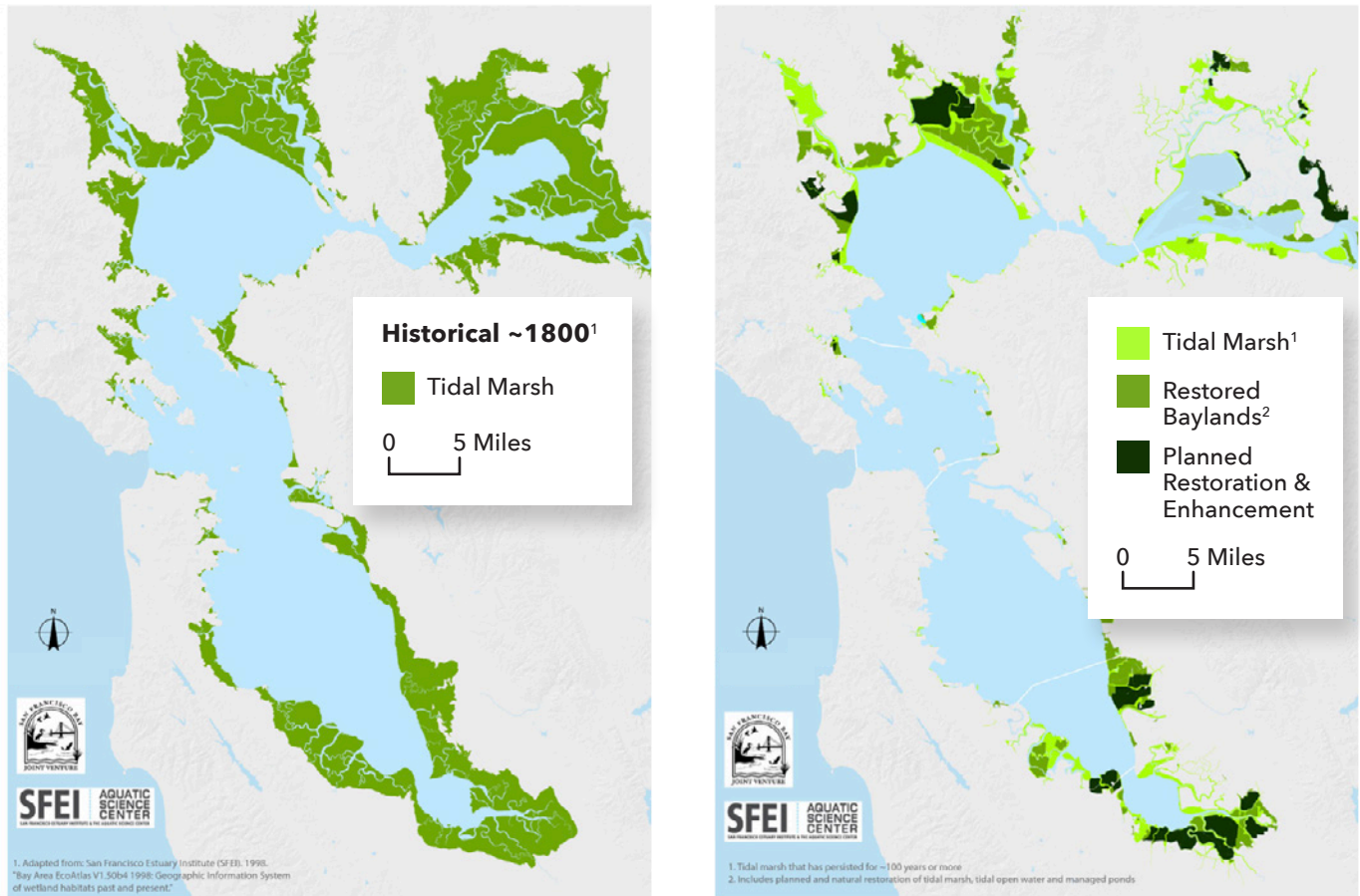
Because large swaths of tidal land were in private ownership, rapid filling of the Bay continued until the mid-20th century. In 1849, the Bay covered 785 square miles. By 1965, it had been reduced to 548 square miles.⁴⁷

The 1938 State Lands Act gave authority to the State Lands Commission—headed by the Lieutenant Governor, State Controller, and the Governor’s Director of Finance—to manage the over 625,000 square miles of submerged and tidal public trust land in California, including the Bay.⁴⁸ Despite the Act’s multiple goals, many believed that the best use of the shallow San Francisco Bay was conversion to land for urban development.

The Reber Plan & The Save the Bay Movement

During the 20th century, many endorsed the filling of the bay for development and no one epitomized bay filling ambitions more than a traveling theater director and actor named John Reber, who, in the 1940s, proposed dramatically reshaping the Bay, including massive new areas of fill, as well as new dams that would transform the Bay into two freshwater lakes.⁴⁹ Despite Reber’s lack of formal engineering or planning expertise, “The Reber Plan” was endorsed by the *San Francisco Chronicle* and gained traction with state and federal officials.⁵⁰

In the late 1950s, the US Army Corps of Engineers released a study identifying an additional 325 square miles of “submerged,” tidal, and marshland available for conversion to developable land (Fig. 2).⁵¹ In re-

FIGURE 1 Loss of Tidal Marsh in San Francisco Bay

Source: Maps by San Francisco Estuary Institute (SFEI) & San Francisco Bay Joint Venture.
<https://cdn.kqed.org/wp-content/uploads/sites/10/2020/01/Screen-Shot-2020-01-31-at-10.08.04-AM.png>

response to these plans to massively expand land reclamation, the organization Save the Bay was formed in 1961, and its advocacy led to the enactment of the McAtter-Petris Act in 1965.⁵²

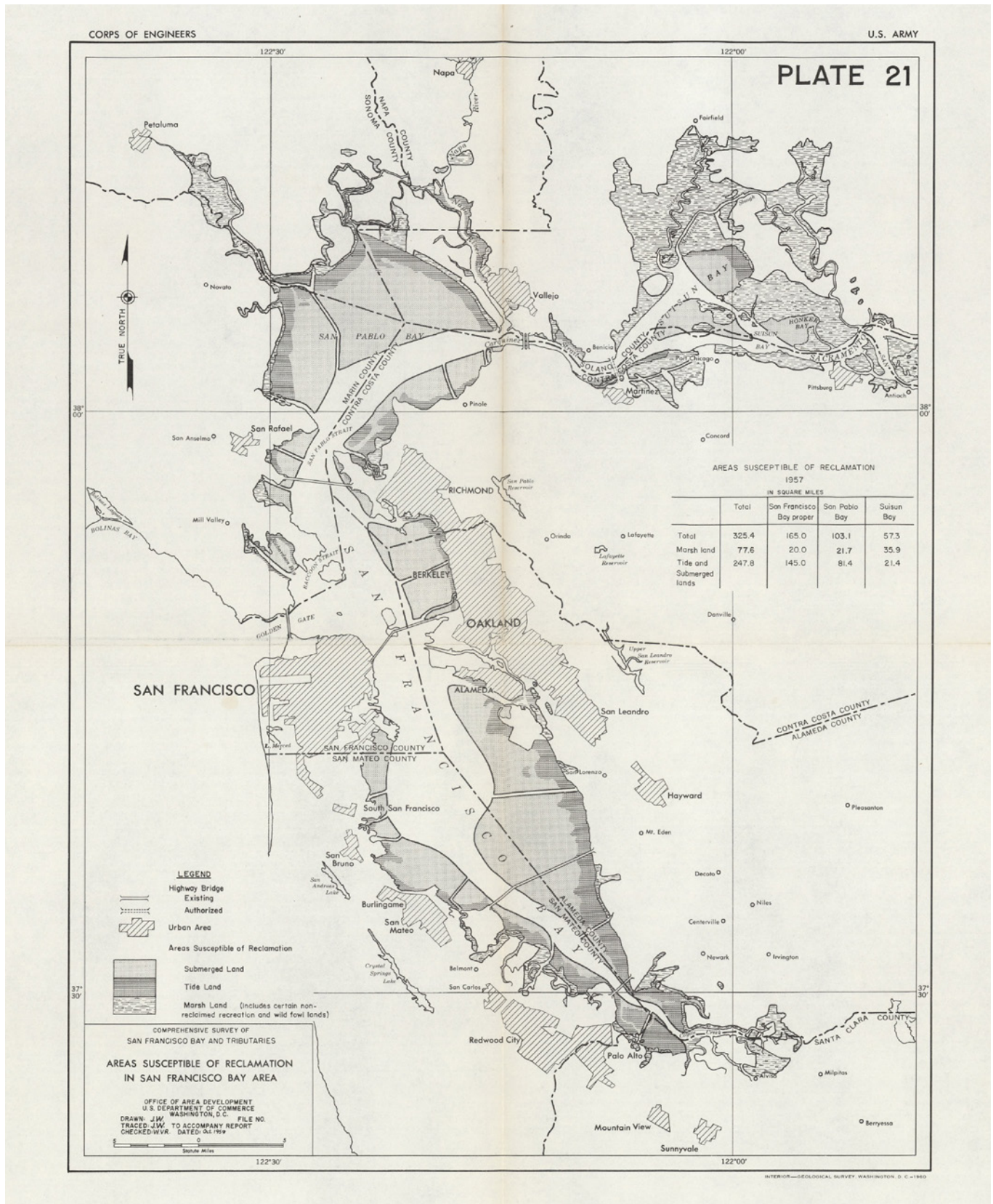
McAtter-Petris Act and The Bay Conservation and Development Commission

The McAtter Petris Act ("Mac Act") created the San Francisco Bay Conservation and Development Commission (BCDC), a state agency with jurisdiction over the Bay, as well as a 100-foot shoreline band, managed wetlands, and tributaries with tidal action.⁵³ The Act also charged BCDC with developing the Bay Plan, "a comprehensive and enforceable plan for the conservation of the San Francisco Bay and the development of its shoreline."⁵⁴ In 1969 the Bay Plan was incorporated into state law, and BCDC became a permanent agency.⁵⁵ The Commis-

sion's 27 members include representatives from each of the nine counties that surround the Bay as well as state agencies and city governments.⁵⁶

The McAtter-Petris Act gave BCDC permitting authority over Bay fill and authority to evaluate individual projects to determine how they would affect the Bay.⁵⁷ The Act instructs BCDC to prioritize "water-oriented land uses" that are "essential for the public welfare of the Bay Area."⁵⁸ These uses include ports, maritime industries, wildlife refuges, water-oriented recreation, public spaces, desalination plants, dredged material disposal sites, and power plants.⁵⁹ An expanded understanding of "water-oriented land uses" also includes "restaurants, specialty shops, private boatels, recreational equipment concessions, and amusements" in certain cases.⁶⁰ When possible, the priority is always to find an upland location rather than further fill the Bay. According to the Mac Act, if a project does not meet these requirements, it should not be located on the Bay.

FIGURE 2 1959 Army Corps of Engineers Map of Potential Bay Land for Reclamation



Source: Map by U.S. Army Corps of Engineers. <https://dabrownstein.com/wp-content/uploads/2021/04/9494033.jpg>

For projects in the 100-foot shoreline band, BCDC can deny a permit if a proposal does not “provide maximum feasible public access” to the Bay shore,⁶¹ but they cannot limit the type of development that happens in the shoreline band unless it is in a designated priority use area in the Bay Plan.⁶² Because the Bay Plan is part of state law, BCDC can only approve a project that is consistent with the Bay Plan.

BCDC is tasked with periodically updating the Bay Plan. In 2011, BCDC amended the Plan to include climate change policies.⁶³ The amendment requires that shoreline projects include a risk assessment prepared by a qualified engineer that considers flood impacts from both the current “100-year flood” and expected sea level rise in both 2050 and 2100.⁶⁴

The Bay Plan was again updated in 2019, incorporating changes related to habitat preservation and restoration in the face of rising seas as well as environmental justice and social equity concerns.⁶⁵ The Bay Fill for Habitat amendment allows for an increase in the amount of fill allowed for habitat restoration projects, recognizing that, in many circumstances rising sea levels will drown intertidal wetlands that require precise mixtures of wet and dry conditions.⁶⁶ The Environmental Justice and Social Equity Amendment requires more robust community involvement as well as the creation of an implementation plan to make BCDC more accessible to the public.⁶⁷

Conclusion

The static, fragmented, and unjust regimes of property around the Bay are relatively recent inventions. European settlers sought to separate the environment into permanent land and permanent water to advance a particular form of settlement and commerce. While this property regime has been very effective in some regards, it has also devastated ecosystems, displaced prior residents, created enormous social inequality, and it is utterly unsuited for the task of adapting to climate change. Since the beginning of European colonization, San Francisco Bay has seen several eras of dramatic change, enabled by these dominant forms of property and land governance. From the mid-19th to the mid-20th century, the Bay’s hydrology was transformed by sedimentation from hydraulic mining and land filling for

urban and industrial expansion. Since the mid-20th century, the degradation of the Bay has been slowed and, in some cases, reversed through pioneering planning and regulatory efforts, including the Mac Act, the Bay Plan, the founding of BCDC, the adoption of the Clean Water Act’s regulation of fill, and, more recently, efforts to restore wetland ecosystems previously destroyed for Bay front agriculture and salt production.

While these 20th century efforts went a great distance in “saving” the Bay from rampant pollution and landfilling, these tools may not be well equipped to cope with the contemporary challenges of climate change. The “Save the Bay” toolkit marshals regulatory and planning powers to keep people from converting the Bay into more land for urbanization. Climate change threatens to turn the tides, swamping filled lands with rising sea and groundwater.

BCDC has become an important institution in planning for sea level rise on the Bay, but these shifts invite a host of other critical questions:

- How could the State Lands Commission and BCDC’s territorial authority evolve with rising sea levels and shifting shorelines?
- Does BCDC’s dual mandate of minimizing bay filling and maximizing public access still address the highest priority concerns?
- Could BCDC and allied agencies play a more proactive role in shaping adaptable urbanization around the Bay by simultaneously 1) guiding “managed retreat” from imperiled areas that are well suited for ecological restoration, 2) permitting land uses based on future sea levels, and 3) enabling new forms of flood adaptive housing and settlement?

In the sections that follow, we analyze projected sea level rise impacts and consider how a next generation of Bay-oriented planning and regulation might take advantage of innovations in property to advance more just adaptive futures. This report’s concluding sections include recommendations for addressing the questions above.

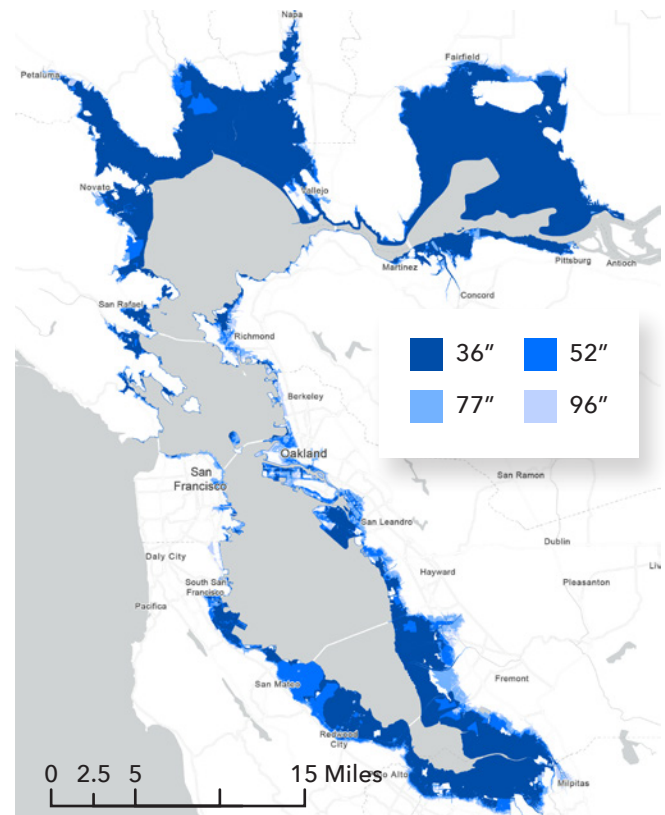
Sea Level Rise Projections

Flooding from rising sea levels and groundwater levels pose a threat to many places across the San Francisco Bay Area, a region that includes nine counties with 7.5 million residents. The Bay Area is already experiencing early impacts from sea level rise, including flooding during storms, increased coastal erosion and periodic inundation during extreme high tides.

Sea levels are expected to rise at an increasing rate and cause more frequent coastal flooding in coming decades. In addition to impacts on community health and well-being, rising seas pose significant environmental and economic risk. A 2023 report estimates that protecting settlements and infrastructure along the Bay from sea level rise will cost \$110 billion by 2050.⁶⁸

These maps visualize the projected sea level rise for both low (Intergovernmental Panel on Climate Changes Representative Concentration Pathways (IPCC RCP) 2.6) and high emission (IPCC RCP 8.5) scenarios by the year 2100, plus 100-year storm surge levels along the Bay-shore. Our projections are informed by the 2018 update of the State of California Sea-Level Rise Guidance, issued by the California Ocean Protection Council (the most recent such guidance at the time of writing)⁶⁹ and by the *Adapting to Rising Tides Bay Area Short Report* issued by BCDC in 2020.⁷⁰ Beyond the localized damage that sea-level-rise-induced flooding will have on homes and workplaces, some impacts will create ripple effects for the wider region as flooding threatens shared infrastructures, from roads, airports, and rail lines to sewage treatment and electric utility installations. The higher sea levels shown in these maps – 77 and 96 inches – represent SLR in the year 2100 plus storm surges. Seen one way, these are precautionary estimates of high levels of flooding, reflecting both SLR and temporary storm events. A 50- to 100-year storm surge event of 36” to 42”, however, is likely to occur prior to 2100, and, when it does, it will demonstrate to recovery planners and community members where sea levels will be in another 60 to 90 years.

FIGURE 3 Sea level rise is projected to impact large areas along the shores of San Francisco Bay.



Source: Adapting to Rising Tides Bay Area Sea Level Rise & Storm Surges Inundation data.

While there is a notable risk across the entire region, specific low-lying areas will bear the greatest burden of damage.⁷¹ As is often the case across hazard types, sea level rise risk in the Bay Area is likely to have the most devastating impacts on people and communities that are already socioeconomically vulnerable because of poverty and other forms of disadvantage.⁷²

FIGURE 4 From Richmond to Mill Valley, both relatively low income and affluent areas face substantial threats from sea level rise.

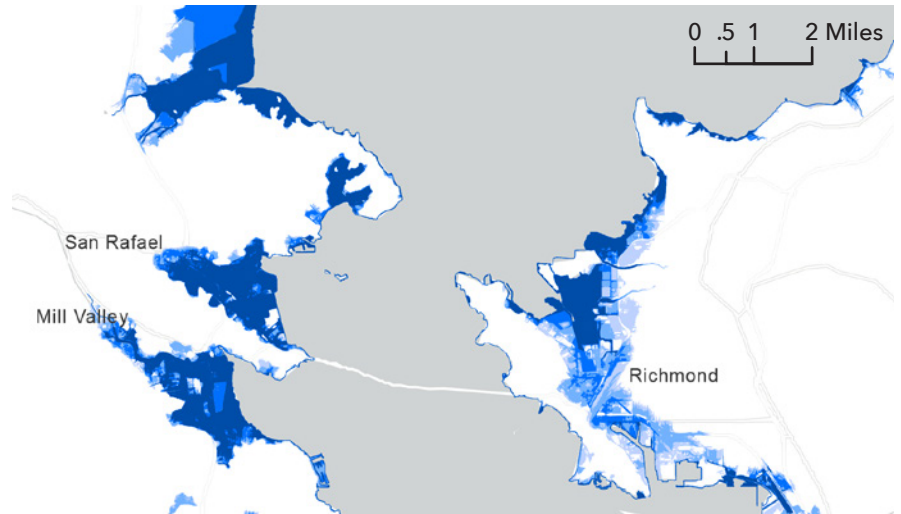


FIGURE 5 The central Bay Area features some of the region's most intensively urbanized zones, including the cities of San Francisco and Oakland. Sea level rise in this area threatens population centers and critical regional infrastructures.

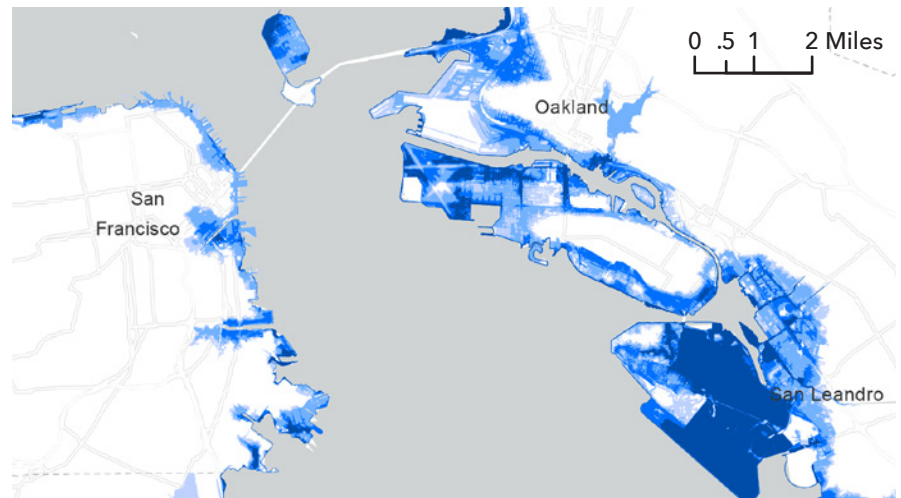
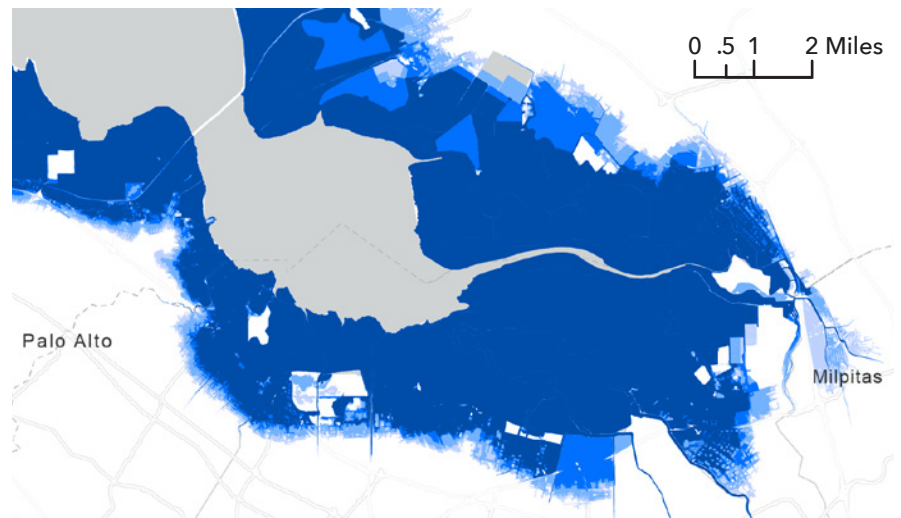


FIGURE 6 Many South Bay communities, from Foster City to San Jose to Fremont, feature intensive development on drained and filled former tidelands. These areas are especially vulnerable to flooding from sea level rise.



Synopsis of Existing Adaptation Planning Efforts on the Bay

As the scope and scale of sea level rise impacts around San Francisco Bay have become clearer in recent years, there have been several efforts to plan for sea level rise. Planning for SLR in the Bay region includes efforts from local governments, regional and state entities (e.g., BCDC), independent research and advocacy groups (e.g., SPUR and SFEI), and design and planning professionals and researchers.

Below is a partial summary of a few important sea level rise planning efforts in the region.

Since 2015, SB 379 has required the Safety Element of local General Plans to address the risks of climate change. Housing Elements must also consider the effect of SLR on potential housing sites. Many local governments have undertaken their own significant SLR planning efforts, including the City of San Francisco's Sea Level Rise Action Plan, adopted in 2016,⁷³ and Oakland's Preliminary Sea Level Rise Roadmap (2017).⁷⁴ San Mateo County issued a Sea Level Rise Vulnerability Assessment report in 2018, and in 2020 created the San Mateo County Flood and Sea Level Rise Resiliency District, an effort known as "OneShoreline."⁷⁵

The San Francisco Bay Plan (revised in 2019 to address sea level rise and social equity) is the current operative planning document regarding Bayshore modification. The plan's implementation is overseen by BCDC.⁷⁶ Although numerous sections of the document address SLR adaptation via BCDC's case-by-case review, the 2019 Plan explicitly asks BCDC to collaborate with other agencies in the region to formulate a regional sea level rise adaptation strategy.

Bay Adapt: Regional Strategy for a Rising Bay⁷⁷ was launched in 2020 as a regional initiative to establish agreement on future actions regarding SLR. Convened by BCDC, the effort is a partnership between many regional stakeholders, including local, state, and federal agencies, as well as relevant nonprofit organizations. The initial product was The Bay Adapt Joint Platform, which is a consensus-based strategy laying out guiding principles.⁷⁸ It was adopted by BCDC and over 50 other agencies and organizations beginning in 2021.

In 2023 California SB 272 was passed, requiring the 47 local governments along the Bay to develop their own sea

level rise plans as part of a "subregional San Francisco Bay shoreline resiliency plan." Following directives included in SB272, BCDC issued guidelines for these local adaptation plans in the draft *Regional Shoreline Adaptation Plan* in September 2024.⁷⁹ Through SB 272, BCDC will now have review authority over local government planning, through which it can require local SLR adaptation policies and regulations.

BCDC also hosts the "Adapting to Rising Tides" platform, which provides guidance, tools, and information to help agencies and organizations to address SLR. Notably, their work includes the *Adapting to Rising Tides Bay Area Regional Sea Level Rise Vulnerability and Adaptation Study (2020)*, which assesses SLR risk for the entire Bay.⁸⁰ To assess the costs of SLR, BCDC, jointly with the Association of Bay Area Governments (ABAG) and the Metropolitan Transportation Commission (MTC), released the *Sea Level Rise Adaptation Funding and Investment Framework Final Report (2023)*.⁸¹ With this increase in information, many federal, state, and regional environmental, transportation, and land use agencies (such as MTC, ABAG, and the San Francisco Estuary Partnership) have begun to incorporate SLR adaptation into their plans and policies.

Other organizations and agencies have also contributed information, analyses, concepts, and frameworks to support SLR planning in the Bay. *The San Francisco Bay Shoreline Adaptation Atlas*, produced in 2019 by the San Francisco Estuary Institute and SPUR, provides a landscape ecological framework for selecting adaptation strategies around the Bay.⁸² *The Resilient by Design/Bay Area Challenge* was a design competition organized by the Bay's regional planning agencies in 2017-2018.⁸³ The competition challenged nine interdisciplinary teams to develop designs for SLR resilience that met the needs of selected communities around the Bay.

FIGURE 7 In the coastal town of Pacifica, cliffs have eroded rapidly in recent decades forcing residents in some areas to abandon their homes.



Source: Base: Google Earth Satellite Image, Parcel data: Zillow.

For the most part, these efforts emphasize risk assessment, future stakeholder involvement processes, and the identification of public investment needs and funding sources. They are all in the early stages of managing what promises to be a challenging set of problems in the coming years and decades. These early planning efforts have not yet begun to substantially grapple with how adaptation infrastructures or changes in settlement form might be implemented to reduce vulnerability to SLR. While the Bay Area is well ahead of many other coastal regions in planning for SLR, none of these efforts directly consider the difficulties of confronting SLR adaptation under the contemporary conditions of static, fragmented, and socially regressive property regimes.

In addition to the significant physical impacts, sea level rise will also move the boundaries between public and private property and shift the territorial jurisdictions of regulatory and planning agencies. Generally speaking, the State of California, through the State Lands Commission, owns and manages all lands submerged below the mean high water line around San Francisco Bay. Sea level rise will change the location of that legal differentiation between land and water and, in many cases, the boundary between the private and public domain. Where coastal topography is abrupt, changing sea levels will not significantly shift the territory of public trust. But where topography is more gradual, small changes in sea level will submerge significant areas of coastal land, shifting ownership to the State.

Similarly, the BCDC has planning and regulatory jurisdiction over a “100 foot shoreline band” defined as the area measured 100 feet horizontally from the mean high water line (Fig 9). BCDC does not have a definitive map of this 100-foot shoreline band, but rather delineates that territory on a case-by-case, project-by-project basis. As SLR shifts

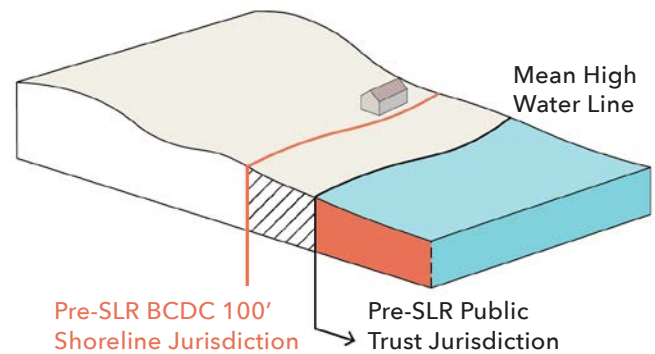
FIGURE 8 Inundation during King Tides in China Camp State Park in San Rafael



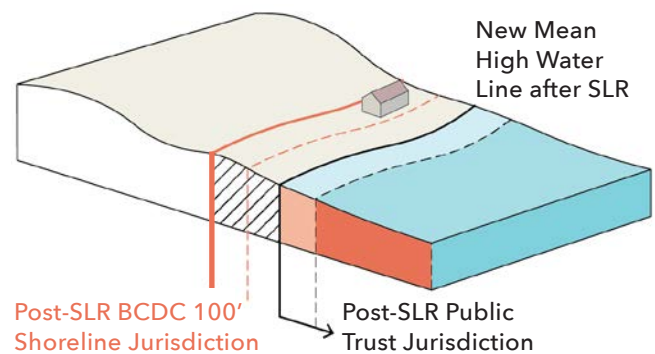
Photos by Cindy A. Pavlinac, www.CAPavlinac.com

FIGURE 9 BCDC’s jurisdiction will shift with Sea Level Rise

JURISDICTION LINES PRESENT



SEA LEVEL RISE IMPACT



the mean high water line, the 100-foot shoreline band will also move (Fig 9). According to BCDC’s climate change policies in the Bay Plan, projects “should be designed to be resilient to a mid-century sea level rise projection” and adaptive to 2100 projections.⁸⁴ This means that proposed projects must protect public access and public safety within the 100-foot shoreline band from projected 2050 sea level rise, and must explain how they could adapt to projected 2100 levels.⁸⁵

A photograph of a waterfront residential building with a rocky shoreline and trees reflected in the water. The building is a multi-story structure with a mix of tan and brown tones, featuring large windows and a balcony. The foreground shows a calm body of water reflecting the scene. The sky is overcast.

PART II

Property & Climate Adaptation: Three Challenges

Before colonization, the Ohlone and other Indigenous peoples of the Bay Area maintained dynamic relations with the region’s landscapes and ecosystems.⁸⁶

Colonization replaced these modes of relating to land and water with governance and property regimes that treat land as an abstract commodity to be bought, sold, and traded for personal profit and for the presumed public benefits of development. Colonial property regimes brought enormous profits for those who were able to skillfully navigate them. The commodification of the land, waters, and estuaries of the Bay Area enabled public and private investment for industrialization and urbanization of the Bay, but it also brought widespread ecological devastation and widening social inequality as favored groups enriched themselves at the expense of others.⁸⁷

While mid-20th century shifts in public opinion and policies curtailed some of the worst abuses, including the rampant filling of the Bay and its wetlands, climate change has introduced a host of new challenges. The threat of increased flooding driven by sea level rise is among the most prominent climate change-related challenges facing the Bay Area. It introduces dynamism to a property regime that, since colonization, has sought to create a stable, fixed landscape. Furthermore, unless adaptation policies emphasize justice and equity, the effects of sea level rise are likely to widen the region’s already vast socio-economic inequality, displacing and otherwise harming disadvantaged groups.⁸⁸

“Transformative adaptation” to sea level rise would address not just the immediate vulnerabilities to climate change, but also the underlying causes of inequality and unequal vulnerability.⁸⁹ Both underlying commodified property regimes and the 20th century institutions created to protect and regulate development on the Bay are profoundly unfit to advance transformative adaptation to climate change.

In this report, we analyze how property regimes can constrain or enable transformative adaptation using a framework of “three challenges” of property for climate change adaptation:



Challenge 1: Flexibility

Where climate adaptation demands *flexibility*, dominant property regimes are largely *static*;



Challenge 2: Collective Action

Where climate adaptation demands *collective action*, dominant property regimes fragment landscapes into atomized parcels;



Challenge 3: Justice

Where transformative climate adaptation demands a focus on advancing *justice* in the face of past and ongoing structural inequity, dominant property regimes are rooted in a fantasy of *neutrality*.

In the sections that follow, we introduce each of these three difficulties in turn.

Static Property in Changing Landscapes

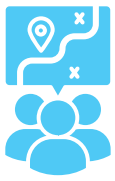
Many landscapes in the Bay Area that were long assumed to be safe and comfortable are increasingly threatened by climate change linked threats, including: flooding, erosion, extreme heat, drought, wildfire, and smoke. Sea level rise along the Bay shore is perhaps the most visible of these threats.

The boundaries between land and water, long considered to be stable, are shifting with climate change. Even in the face of changing climate and landscape conditions, surveyed parcel boundaries are largely fixed in place, reinforced by generations of construction and social practices. There is a long history of legal battles in the U.S. in which property owners have disputed ownership of land eroded (avulsion) or deposited (accretion) by rivers. Climate change promises to shift the boundaries of habitable land at dramatically larger scales and vastly increased speed. These changes will require new practices and institutions that recognize the dynamic nature of landscapes and climates and do not assume that land and its spatial divisions into parcels are permanently fixed in space. In subsequent sections, we explore some precedents for more dynamic forms of property, from Indigenous land relations to land readjustment schemes.

FIGURE 10 An 1871 map showing the rigid gridded parcelization of marsh and baylands near Corte Madera in Marin County. Such parcelization was a precursor to sale and development.



Source: <https://www.bonhams.com/auction/26075/lot/119/marin-county-california-map-no-7-of-the-salt-marsh-and-tide-lands-situate-in-marin-county-state-of-california-to-be-sold-at-public-auction-thursday-may-18th-1871-san-francisco-schmidt-label-and-litho-co-1871/>



Challenge 2

Fragmented Property and Collective Adaptation

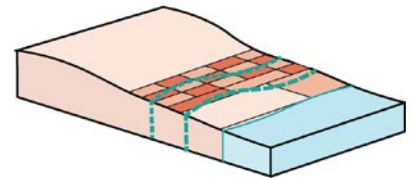
Conventional property regimes have divided the land around the Bay into thousands upon thousands of discrete parcels, each with its own owners and interests.

While zoning and other land use regulations place some limits on what property owners can do on individual parcels of land, property regimes on the Bay, as elsewhere in the US and around the world, are marked by a strong emphasis on the rights of individual owners. This fragmentation presents enormous challenges for climate change adaptation, an endeavor that often requires coordinated action across property boundaries. For instance, both so-called “gray” infrastructures (e.g., levees, floodwalls, and drainage pumps) and “green” infrastructures (e.g., restored coastal wetlands, vegetated swales) often require collective action across large areas to provide equitable protection. Rising sea levels will readily sweep around the ends of a Bayfront levee that only extends along one property owner’s shoreline. Restoring coastal marshes to attenuate waves from rising sea levels will similarly only be effective if planned and carried out across property boundaries in accordance with patterns of hydrology and sediment transport. Similarly, it will be nearly impossible to coordinate “managed retreat” from the most threatened areas without well-planned collective action across hundreds or thousands of property owners and residents in both “sending” and “receiving” communities.

FIGURE 11 Typology of Fragmentation Patterns in Vulnerable Areas

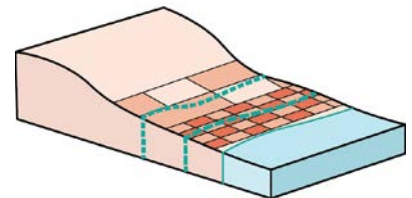
TYPE 1

Less fragmented areas will be inundated first and smaller, more fragmented parcels later.



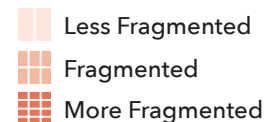
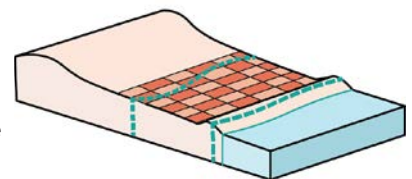
TYPE 2

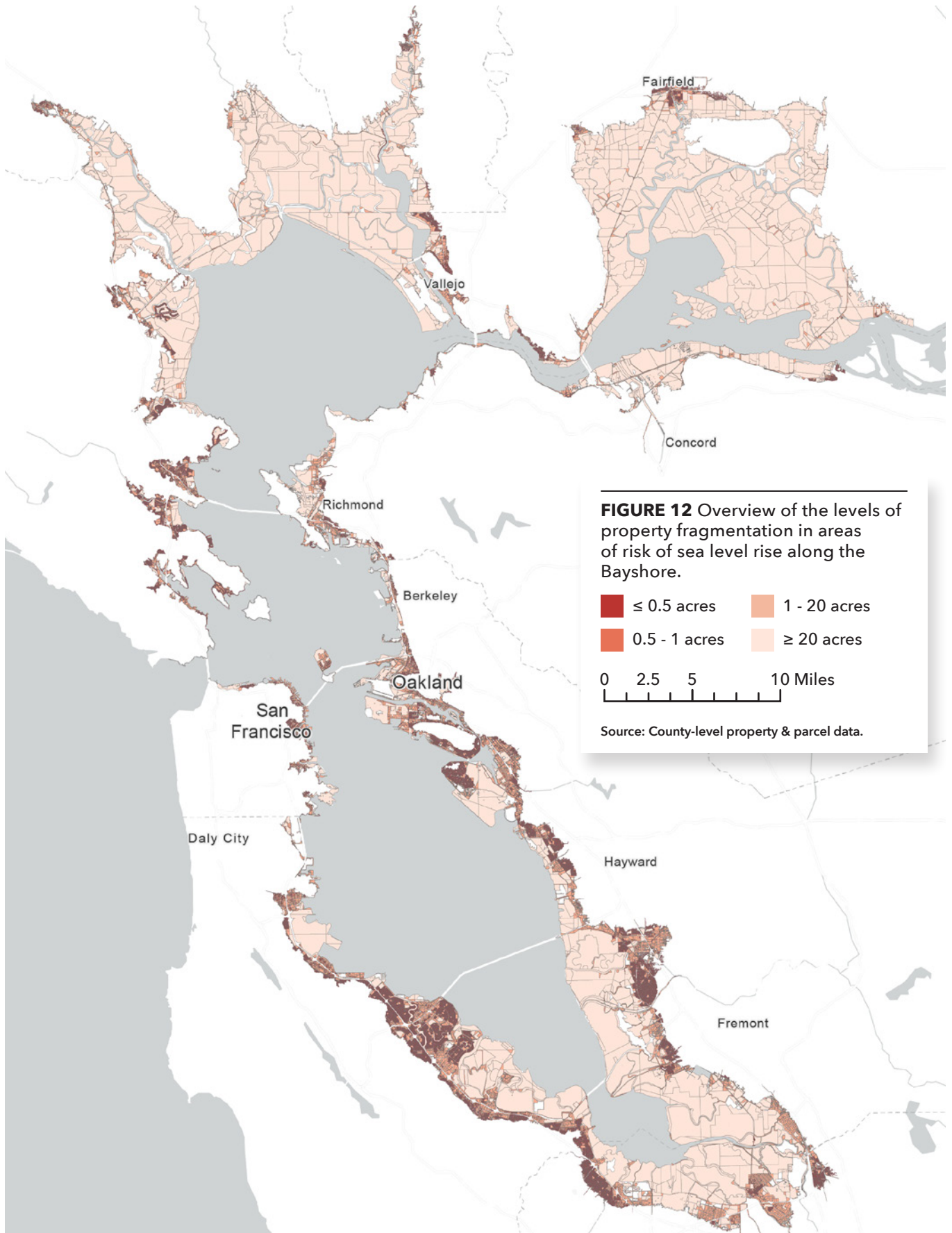
Smaller more fragmented parcels will be inundated first followed by larger, less fragmented parcels.



TYPE 3

Highly fragmented parcels currently protected by shoreline infrastructure are at risk of inundation later.





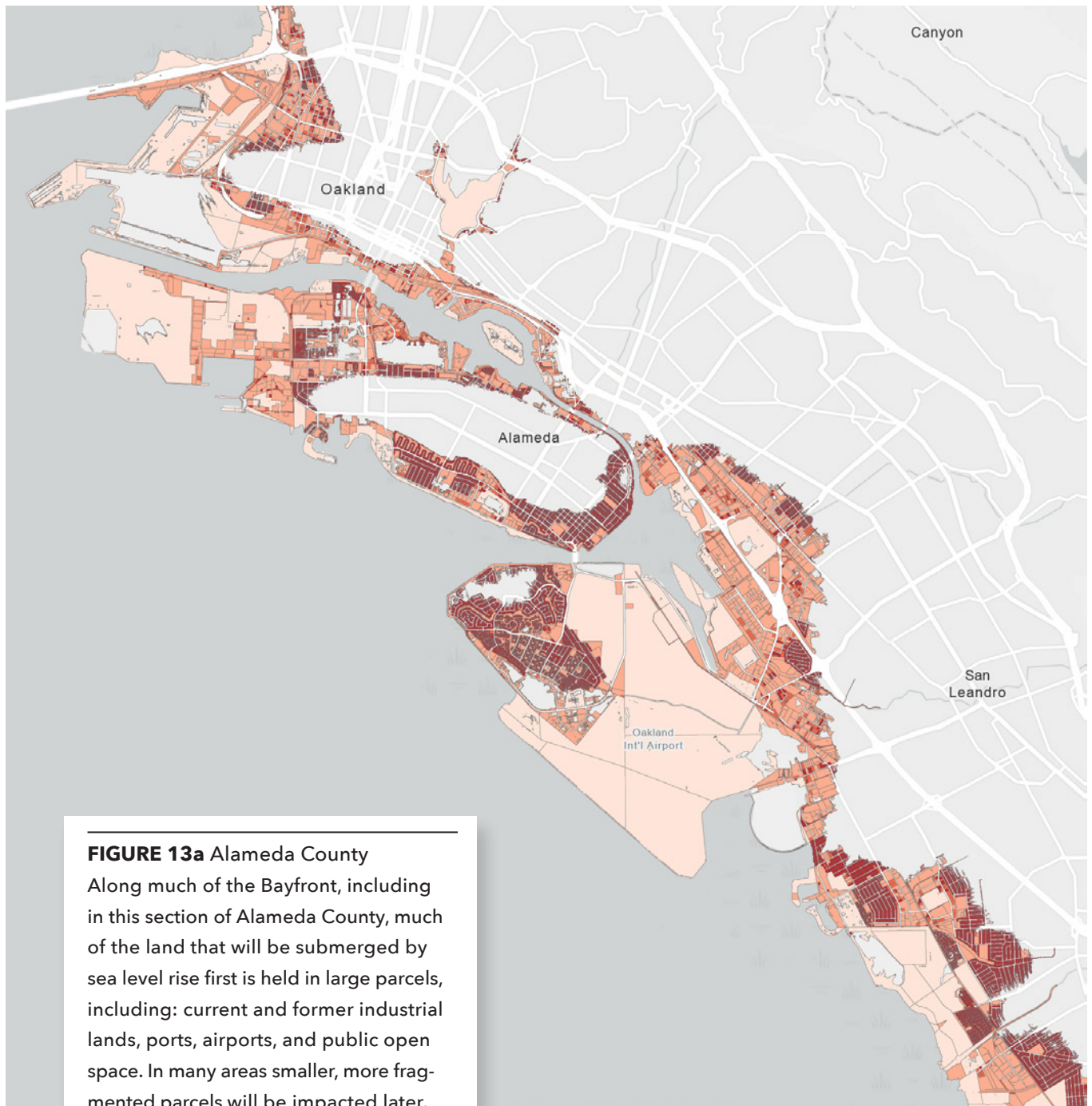


FIGURE 13a Alameda County
 Along much of the Bayfront, including in this section of Alameda County, much of the land that will be submerged by sea level rise first is held in large parcels, including: current and former industrial lands, ports, airports, and public open space. In many areas smaller, more fragmented parcels will be impacted later.

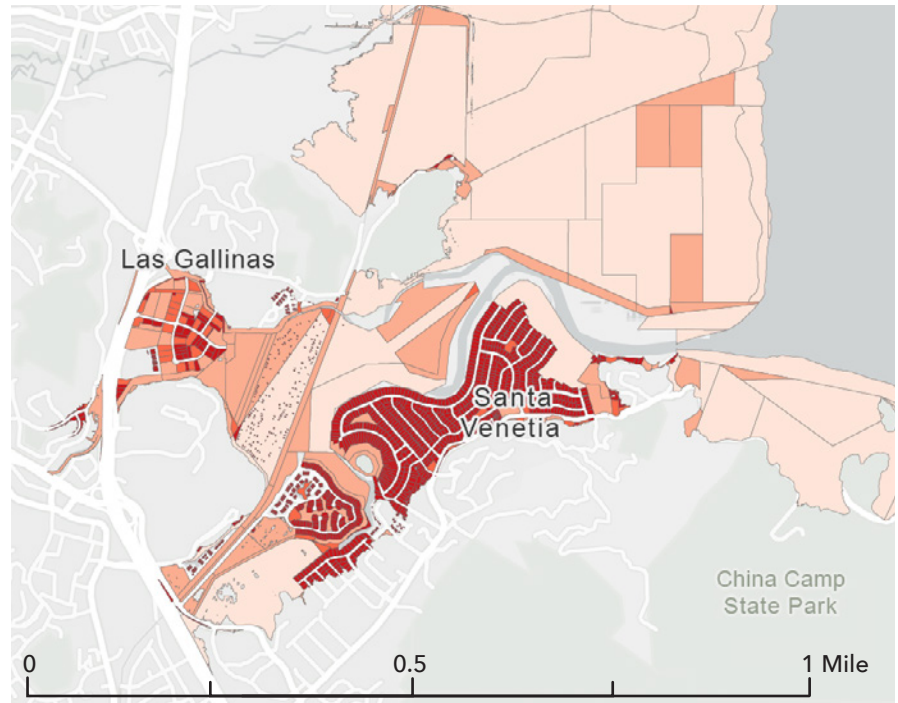
 ≤ 0.5 acres	 1 - 20 acres
 0.5 - 1 acres	 ≥ 20 acres

0 0.5 1.0 2 Miles

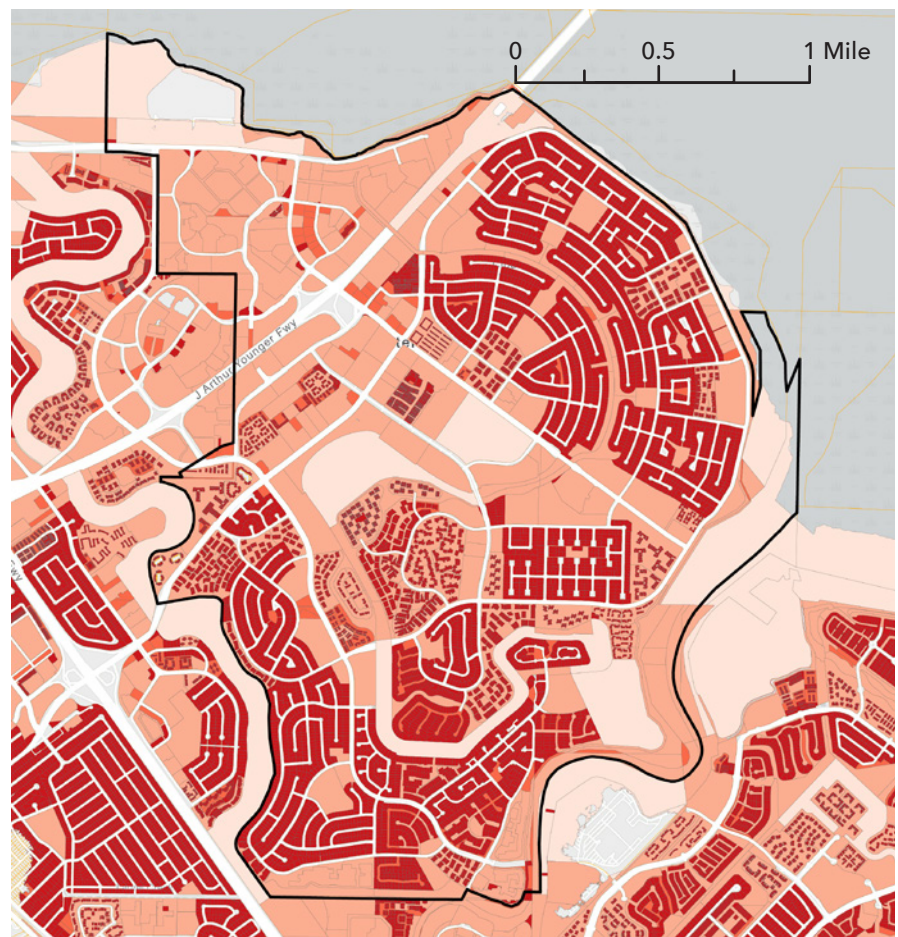
Source: County-level property & parcel data.

FIGURE 13b Gallinas

In other areas along the Bayshore, like Gallinas in Marin County, low lying marshlands were “reclaimed” for 20th century suburban development. In these parts of the coast-line some of the first areas to be impacted by sea level rise will be fragmented landscapes of single family homes. Uplands may be less fragmented, larger land holdings.

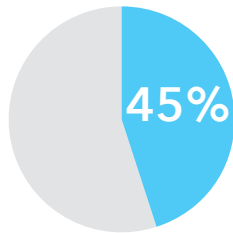
**FIGURE 13c** Foster City

Some Bayshore areas, like Foster City, that were developed in the mid-to-late 20th century, rely on flood protection levees to remain dry. Unless these protections are periodically strengthened and elevated, such communities are at risk from inundation in the event of catastrophic infrastructure failures.

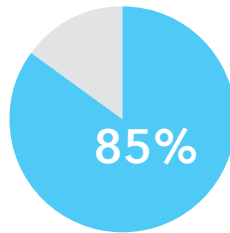


Source: California State Parks, Esri, HERE, Garmin, SafeGraph GeoTechnologies, Inc., MEI/NASA, USGS, Bureau of Land Management, EPA, NPA, US Census Bureau, USDA

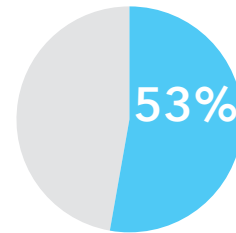
IN ALAMEDA COUNTY:



45% of residential parcels (18,629 parcels) projected to suffer inundation with 96" of SLR have some form of shared governance



85% of residential land area that is projected to be inundated with 96" of SLR has some form of private shared governance.



53% of all land area projected to be inundated with 96" of SLR is under public ownership

Shared Governance

While patterns of fragmented and privatized property ownership present particular challenges for adaptation to sea level rise and other climate and landscape changes, large areas of land are held in various forms of collective ownership with shared governance. By some estimates, half of the world's land is held in some form of collective ownership, supporting some three billion people.⁹⁰ While collectively owned lands found globally are often rooted in Indigenous and customary practices, large areas of the San Francisco Bay shoreline are held in various other forms of formally recognized public and private shared governance, including: government owned open space, ports, airports, private homeowners associations (HOAs), condominium associations, and cooperatives that govern shared residential territory.

In Alameda County, 53% of the land projected to be inundated under 96" of sea level rise is held by public institutions. Private shared land governance institutions are also important and widely underappreciated actors in shaping climate change adaptation. Figure 14 maps the prevalence of various forms of shared land governance across part of the Alameda County shoreline. Over 45% of all residential parcels in Alameda County that are projected to face inundation with 96" of sea level rise are in some form of private shared governance. Nearly 85% of residential land area projected to be inundated under this same scenario are under shared governance.

Since the mid-twentieth century, shared governance regimes, many of which are described as "common-interest communities," have become increasingly com-

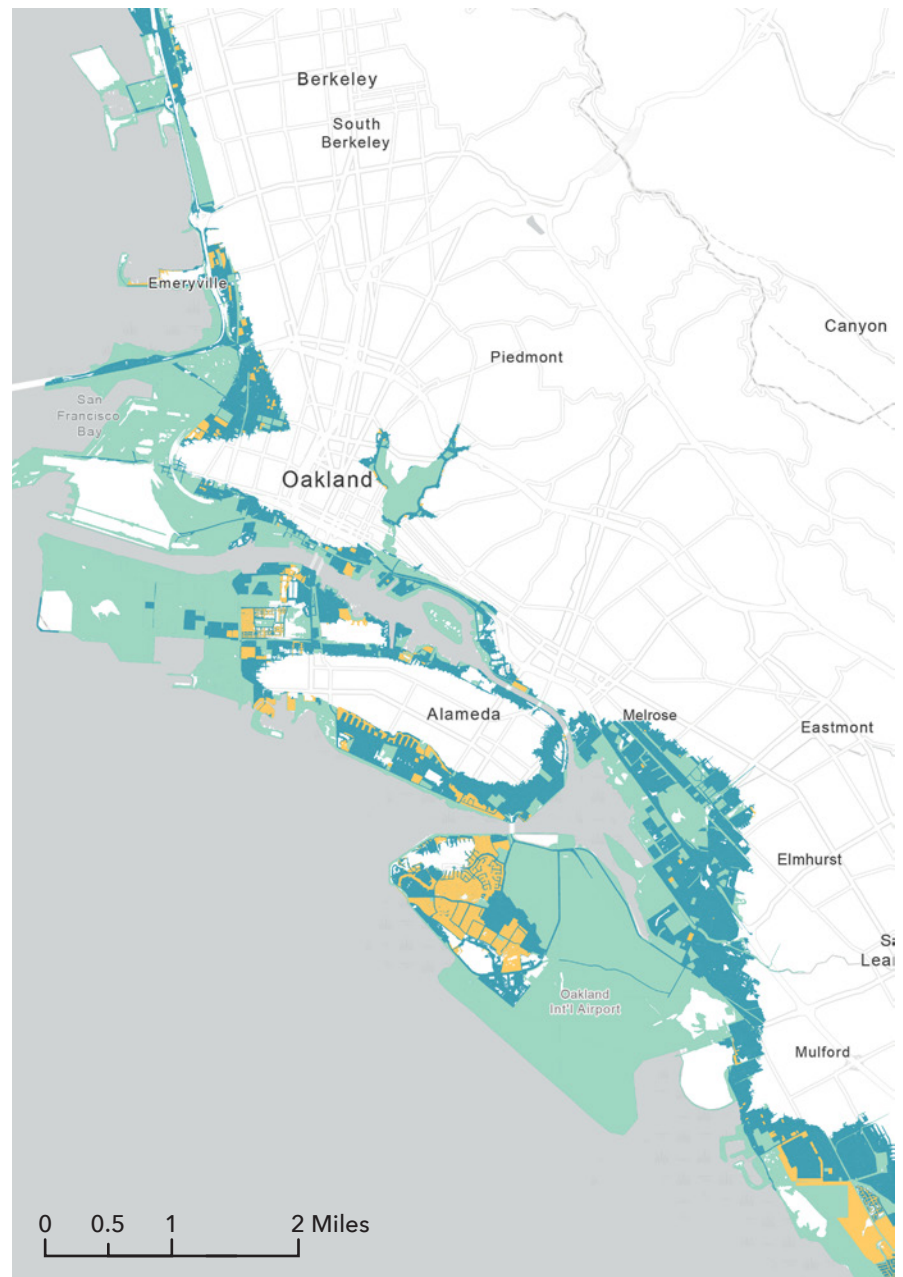
mon across California and elsewhere. An estimated 65% of homeowners statewide are part of homeowners associations.⁹¹ While private shared property governance institutions are widely critiqued as exclusionary and homogenizing,⁹² they will play an increasingly important role in shaping adaptation to climate change because they own and manage land and infrastructures on which millions of people rely. Vegetated landscapes managed by HOA boards can mitigate extreme heat, suffer under drought conditions, and shape wildfire risk. The catastrophic collapse of the Champlain Towers in Surfside, Florida, illustrated the critical role of condominium boards in mitigating risks for residents in climate change exposed zones.⁹³ The following Figures (14-18) are examples of Alameda County residential communities facing sea level rise risk shaped by four different forms of shared governance: homeowners associations, condominium boards, cooperatives, and land trusts.

While shared governance regimes will present serious challenges for adapting to sea level rise and other climate risks in many residential communities, collective ownership and shared governance can also bring transformative potentials for residents to build the power to act in accordance with their values in the face of climate change. While these institutions have often been used to protect property values for relatively well-off communities, there are a growing number of examples around the US and the world in which collective ownership has been used to benefit lower income populations and the wider communities on which they depend. ROC USA has built

a model of limited equity cooperatives that enables residents of manufactured home parks (MHPs) to collectively buy the land and infrastructure on which they live, giving residents greater agency and resources with which to adapt to climate change.⁹⁴ To date, over 20,000 households in over 300 MHPs are a part of the ROC USA network. In San Juan, Puerto Rico, ENLACE and its partner community land trust have successfully enabled a community-led adaptation effort that is voluntarily moving residents from the most flood vulnerable portions of eight informal neighborhoods, creating new floodable greenspace, and protecting the community from gentrification-driven displacement.⁹⁵

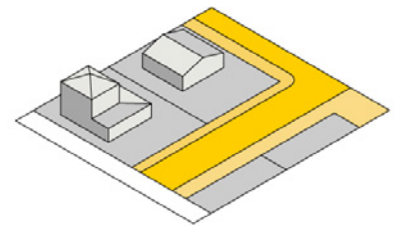
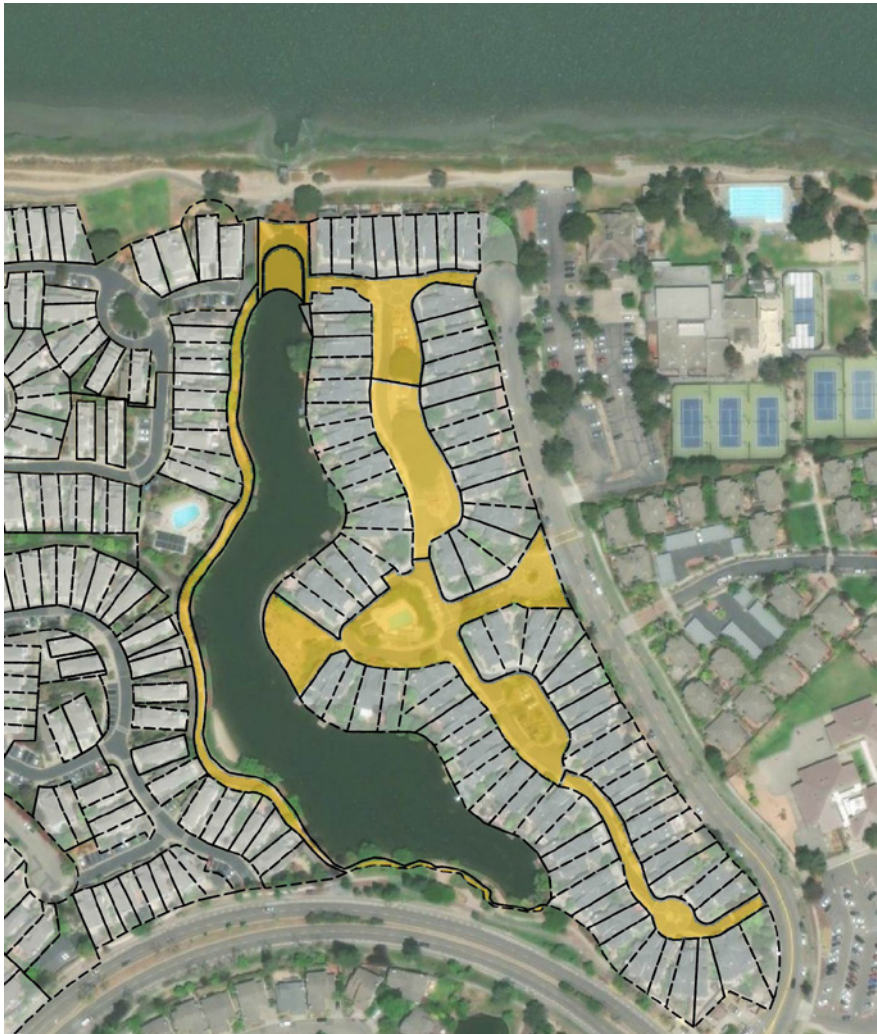
Private residential communities with shared governance represent a critical institutional mechanism for organizing adaptation to sea level rise and other climate threats. While these institutions can provide a crucial middle scale between individual households and larger state-driven adaptation, there is also a danger that these institutions can reinforce inequality by creating enclaves of relative safety for some while leaving others to fend for themselves.

FIGURE 14 Prevalence of shared land governance across part of the Alameda County shoreline projected to be inundated with 96" of sea level rise



- Shared Governance
- Open Space
- Private parcels
- Public Use

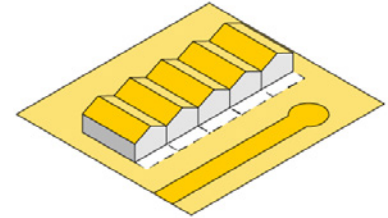
Source: Alameda County Parcel Boundaries Data from Alameda County Open Data.

FIGURE 15 HOA Example: Bay Farm Island, Alameda

Homeowners Association

Since the mid-20th century, homeowners associations (HOAs) have become a common form of private shared governance for residential communities. HOAs have long been criticized for prioritizing property prices above all other values, undermining institutions of public democratic governance and creating homogenous and exclusionary neighborhoods in the process.⁹⁶ Nonetheless, HOAs will play a critical role in shaping adaptation to climate change for millions of California households. HOAs establish and enforce rules for uses of private property (e.g., paint colors, landscaping guidelines). Many HOAs also own and manage shared property within residential enclaves, including roads, common areas,

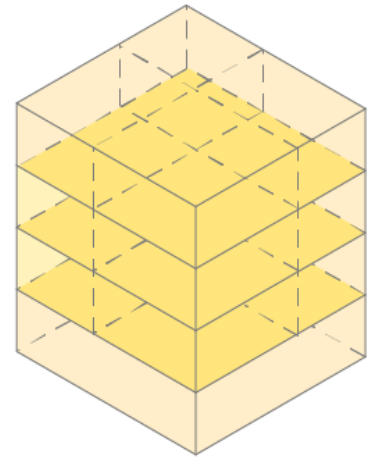
and pools and other amenities. As such, HOAs shape climate risk and adaptation for individual households and entire residential communities. HOAs can enable or obstruct homeowners from taking climate action, including installing drought-tolerant lawn alternatives, using light colored roofing and paint to reduce extreme heat risk, or installing rooftop solar panels to reduce household energy related emissions.⁹⁷ HOAs also control critical capital investments and maintenance regimes that shape community risk, including through floodwalls, drainage and stormwater management upgrades, and vegetation management for wildfire mitigation.

FIGURE 16 Condominium Example: Ballena Bay, Alameda

Condominiums

In a condominium (“condo”), residents own the space inside their individual units and a share in the common features, including roofs, stairwells, outdoor areas, and underlying land. As such, condos like HOAs, are considered a form of Common Interest Development (CID). The condominium form of ownership is used typically, though not exclusively, for developments in which a single structure includes multiple residential units. Condominium boards, elected from resident members, establish rules and make decisions about investments and maintenance in shared assets. As such, condo boards, like HOAs, have considerable power to enable or constrain adaptation to climate change. The collapse of the Champlain Towers in Surfside, Florida in 2021 dramatically illustrates some of the dangers of shared

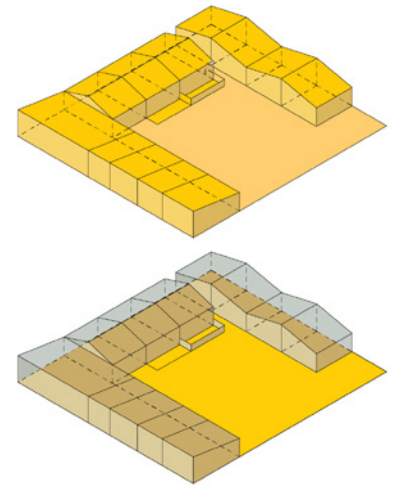
governance under condo boards where dysfunctional governance bodies can struggle to reconcile tensions between the need for investments in adaptation and safety and the desire to keep living costs low. Waterfront condominiums around the Bay will face difficult adaptation decisions as rising seas imperil infrastructure and structures. Forward-thinking boards, however, have opportunities to ease climate adaptation through their management of jointly-owned open space. Because some condominium developments encompass extensive open areas between multiple buildings, collective opportunities exist to physically adapt to sea level rise.

FIGURE 17 Cooperative Example: 1410 Lakeshore Ave, Oakland

Housing Cooperative

In housing cooperatives (“coops”), residents own shares in a corporation that owns a building or buildings. Coop members have a right to access an individual unit and lease that unit from the corporation, but they do not own the unit outright as is the case in a condominium. Coop boards typically have more control over the sale and subleasing of units within a building as compared to a condo. Limited equity housing cooperatives (LEHCs) constrain the appreciation in the value of individual coop shares, thereby maintaining the affordability of housing within the coop. Housing coops can face the same challenges as condos

balancing affordability with the need to adapt to climate change. These challenges can be compounded in coops because accessing financing can be more challenging for both cooperatives as a whole and for individuals hoping to purchase shares in cooperatives or to borrow against their existing shares. In some cases, an LEHC structure can enable a cooperatively owned community to gain access to public and philanthropic resources that might not otherwise be available to help them face climate adaptation and other risks.

FIGURE 18 Land Trust Example: Shade Tree, Oakland

Land Trusts

In a land trust, a trustee holds the title to a property and manages it for the benefit of designated beneficiaries. While land trusts can be used for many purposes, including land conservation, housing focused land trusts may own buildings and underlying land for the benefit of resident beneficiaries. Trustees are often entities such as a nonprofit organization, public agency, or community development corporation. Land trusts are typically governed by a legal trust agreement that could include provisions related to the mission and goals, resale and affordability restrictions, community engagement, and

guidelines for use and alteration of property. Community land trusts (CLTs) are a particular form of land trusts whose governance structure typically requires representation from community members outside of the residential property held by the trust. While land trusts can face many of the same adaptation governance challenges as HOAs, condos, and coops, the CLT model can facilitate access to outside public and philanthropic resources and can encourage a land trust to consider the wellbeing of not only residents, but also surrounding communities.



Challenge 3 Justice

Inequality in the Bay Area and around the US is deeply entrenched by structural exclusion and exploitation, including Indigenous land theft, and racist real estate practices and zoning strategies that excluded non-white Americans from accumulating property wealth.⁹⁸

In 2022, 75% of white households owned their homes while only 45% of Black households did.⁹⁹ These structural drivers of inequality have limited the ability of low income communities of color to build wealth. These groups are also disproportionately threatened by climate change, including flooding and toxins from polluted groundwater.¹⁰⁰ The accelerating impacts of climate change illustrate that “climate justice” is a critical front in the broader struggle for environmental justice.¹⁰¹ Given this existing uneven playing field of propertied wealth, maintaining or reinforcing these purportedly neutral property regimes will inevitably deepen inequality. To avoid exacerbating already extreme socio-economic inequalities, climate change adaptation will require

concerted attention to advancing justice.¹⁰² For instance, basing decisions about protective infrastructure investments on the market value of property can further tip the scales toward already privileged communities with high land and property values and leave low-income disadvantaged communities behind as the waters rise. On the other hand, supporting alternative forms of property and land governance that explicitly advance the security and self-determination of disadvantaged people can ensure that they have the power to act in the face of climate change and other threats.¹⁰³ Figure 19 features three Bay Area communities in which projected flooding from sea level rise threatens to exacerbate existing disadvantages.



1 East Palo Alto, a historically diverse community created from redlining and racial exclusion, continues to have a higher proportion of Black and Latinx populations relative to the region. Compared to its neighboring cities, East Palo Alto’s households have strikingly lower incomes. The area is quite low lying and regularly floods when waters from San Francisquito Creek and the Bay rise.

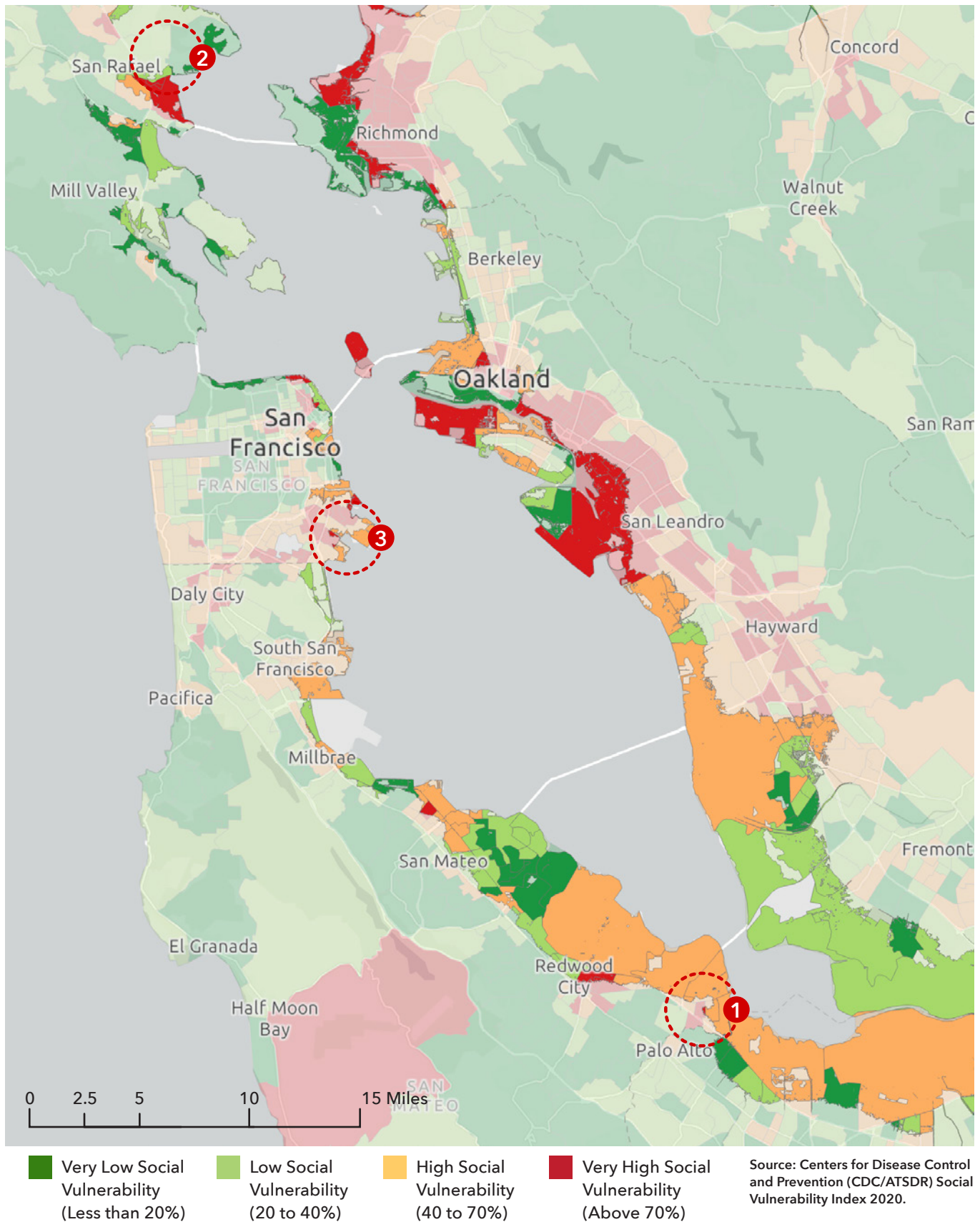


2 San Rafael’s Canal Neighborhood includes rare pockets of relatively affordable housing in Marin County. While the southern portion of the neighborhood has lower densities and a higher proportion of white residents, the northern area has a high concentration of Latin American immigrant households, many of which live in crowded small multi-family rental apartment buildings. The neighborhood is largely built on “reclaimed” marshland and relies on low earthen levees to hold back the tide.



3 Bayview-Hunters Point, San Francisco has a high proportion of residents who are Black and Latinx and has lower rates of homeownership and household income when compared to the rest of San Francisco. The neighborhood, which once housed a massive complex of shipyards, has long suffered from health impacts from a legacy of toxic pollutants.

FIGURE 19 Bay Area communities and social vulnerability from inundation.



A man in a pink shirt and black shorts is pushing a yellow cart on a wooden walkway. The walkway is lined with potted plants and leads through a floating village with colorful houses and solar panels. The sky is blue with light clouds.

PART III

Transformative Adaptation Through Property

Property Strategies

A number of strategies already exist in California and elsewhere for responding to changing environmental conditions, fragmented property, and inequities in land markets. Bay Area communities can use creative combinations of these strategies to facilitate more collective and equitable adaptation to rising sea levels.

Several strategies are summarized below, grouped into six broad categories: 1) Moving property rights, 2) Managing multiple parcels, 3) Collective ownership, 4) Split tenure housing; 5) Public financing strategies, and 6) Advancing justice. More detail is provided in Appendix A.

Moving Property Rights

While dominant property regimes in the Bay Area and across the US are relatively static (Challenge 1), there are strategies that have been used by communities around the world to allow for the relocation of property rights in response to environmental change, hazards, and other threats.

Rolling Easements are a strategy for allowing property rights to migrate with changing environmental conditions or ensuring that coastal ecosystems (e.g., tidal estuaries, beaches) can migrate inland with changing conditions. Rolling easements could be used in a variety of ways to address SLR threats on the Bay. For example, BCDC could be empowered to prohibit new shoreline protection structures in specific areas to enable the landward migration of aquatic ecosystems. Rolling easements could also allow some ongoing use of land vulnerable to SLR until the easement is triggered by specific sea level thresholds.

Transfer of Development Rights (TDR) is a strategy that provides incentives to voluntarily relocate property or development rights from “sending sites” to “receiving sites.” TDR is typically used to preserve land in sending areas by transferring the rights to locations

better suited for development, but it can also be used to relocate rights in post-disaster reconstruction, such as following the 1995 earthquake in Kobe, Japan. For planned retreat, TDR provides an alternative to buy-outs, if suitable receiving sites can be identified. Property rights could relocate to distant upland locations, or threatened properties could move their rights into higher-density clusters on available nearby sites.

Land Readjustment is a replotting of existing land parcels. It is most commonly used as a land development tool, to improve land accessibility, provide infrastructure, and create public open space. Landowners give up part of their land to facilitate improvements that will provide collective benefits. The resultant parcels are smaller, but they gain in value from the public improvements. Land readjustment is also used in post-disaster settings to provide infrastructure improvements and mitigate hazard risk. Land readjustment could be used to rearrange parcels threatened by SLR, to provide open space for shoreline ecosystem restoration or to facilitate TDR.

Managing Multiple Parcels

Although redevelopment authorities were abolished in California in 2012, land banks and land trusts represent two other mechanisms for overcoming the challenge of fragmented property (Challenge 2) in the pursuit of climate change adaptation.

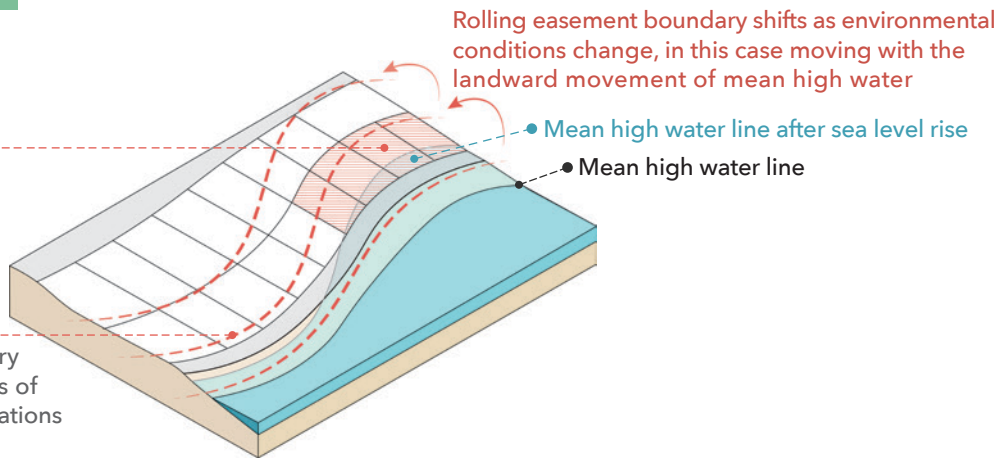
Land Banks are typically public authorities or non-profit organizations that acquire, manage, hold, and convey property to serve a public purpose, such as providing affordable housing, managing open space, stabilizing property values, repurposing vacant lots, or facilitating land

Figure 20 Rolling Easement, Transfer of Development rights, Land Readjustment

ROLLING EASEMENT

As sea levels exceed predefined threshold levels, they trigger rolling easements and facilitate transfer of property rights

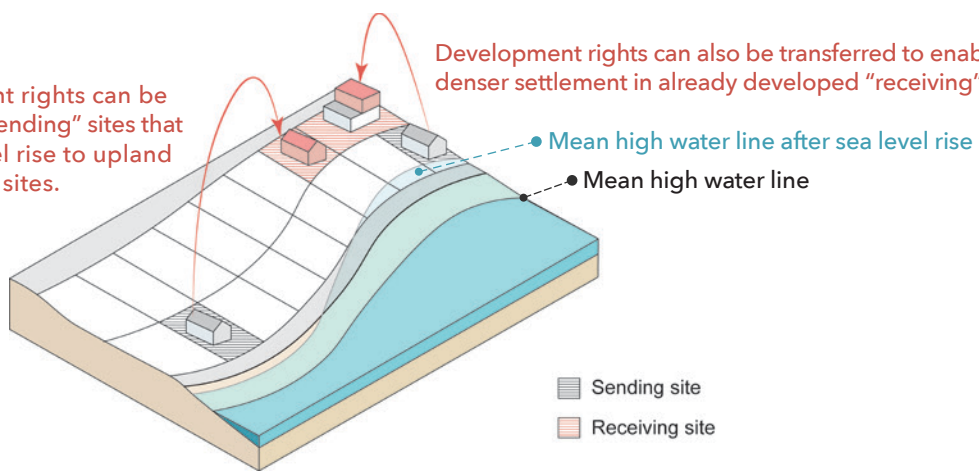
Rolling easement boundary defines the spatial extents of regulations, including limitations on shoreline protection



TRANSFER OF DEVELOPMENT RIGHTS

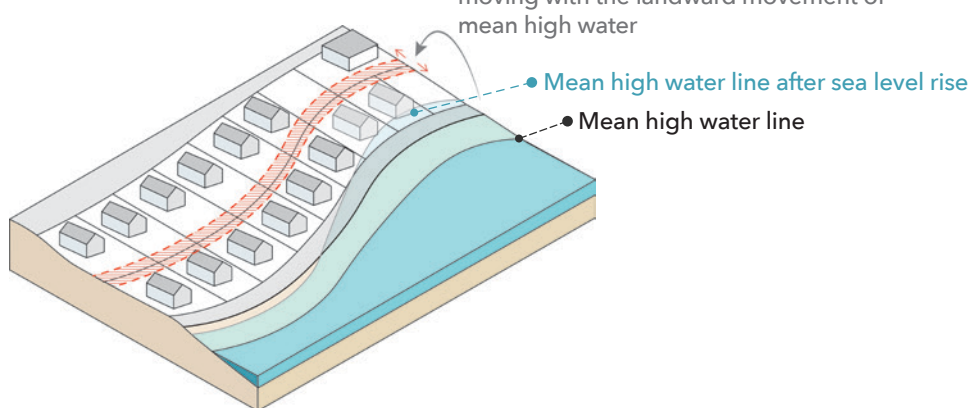
Sending site Development rights can be transferred from coastal "sending" sites that are vulnerable to sea level rise to upland undeveloped "receiving" sites.

Development rights can also be transferred to enable denser settlement in already developed "receiving" sites.



LAND READJUSTMENT

Rolling easement boundary shifts as environmental conditions change, in this case moving with the landward movement of mean high water



value capture from public investments in infrastructure. They can assist with disaster recovery, such as after Hurricane Katrina. A Bay Area regional land bank could acquire land for SLR mitigation projects, buy and consolidate flood-affected parcels, or accommodate the resettlement of displaced residents in new ‘receiving’ communities. High land costs in the Bay Area, however, may pose challenges.

Land Trusts are legal entities that control property at the owner’s request. They have many types and purposes. Conservation land trusts, where owners give up some land use or development rights, are nonprofits that preserve open space or improve ecosystem functions. Community land trusts are another type, described below. Land trusts could facilitate climate adaptation in the Bay Area by preserving undeveloped land threatened by SLR, holding land for green infrastructure projects, or acquiring rolling easements for SLR vulnerable land.

Collective Ownership

Collective ownership is another means of addressing the challenges of fragmented property (Challenge 2). Some of these mechanisms are also oriented towards advancing more just relationships with land (Challenge 3). While dominant property regimes in the US are overwhelmingly focused on individual property holders, there are many existing mechanisms for enabling collective ownership at various scales.

Community Land Trusts (CLTs) are non-profit organizations that own land for the benefit of a defined community. Most commonly, CLTs provide affordable housing through long-term land leases that can limit increases in housing costs. While housing is the most common use for CLT-owned land, CLTs can also host green spaces and mixed/commercial uses. CLTs could be created to equitably facilitate voluntary relocation from vulnerable coastal areas to safer uplands, as does the Caño Martín Peña CLT in Puerto Rico. CLT land could also host green infrastructure adaptation projects to mitigate impacts from SLR.

In a **Limited Equity Housing Cooperative (LEHC)** or **Limited Equity Cooperative (LEC)** residents purchase a share in a development, rather than a unit. LECs maintain affordability by restricting resale prices of coop shares, to keep the price affordable to

future buyers. They are often combined with Community Land Trusts. LECs are a relatively rare homeownership type in the US, but the model could be useful in expanding homeownership access and providing stable, affordable housing for residents in “receiving communities” relocated from vulnerable areas.

Condominiums (Condos) are a common ownership type for residential units in a multifamily housing complex. Condo owners own the space inside individual units and have a shared ownership interest in the walls, floor, and common areas such as hallways, stairs, and outdoor areas. Shared governance may complicate the ability of condominiums to adapt to SLR, but, conversely, condominiums that achieve consensus have the means to collectively decide on mitigation, adaptation, or relocation actions.

Homeowners Associations (HOAs) manage common interests in residential communities with shared spaces, such as roadways, open space, recreational facilities, and pools. As land and facility managers, HOAs can potentially fund mitigation and adaptation projects. Common open spaces owned and managed by HOAs could also accommodate relocation of vulnerable homes, as with land readjustment.

Split Tenure Housing

The relationship between land and building tenure is a key determinant in shaping adaptable settlement form. Manufactured home parks, RV parks, and houseboat marinas are just a few examples of common forms of split tenure housing in which residents typically own their housing unit, but rent space and infrastructure access from landlords. In these situations, the character and incentives of landlords can shape residents’ lives in profound ways, including enabling and constraining adaptation to climate threats.

Manufactured Home Parks (MHPs), otherwise known as “mobile home parks” or “trailer parks,” represent an alternative form of housing tenure that can, in some instances, allow for more flexibility for adaptation. In most cases, residents of MHPs own their own homes, but pay rent to park owners for the space and infrastructure on which they rely. While this form of tenure can lead to compounding vulnerabilities to

both financial exploitation and environmental hazards, alternative forms of MHP ownership show promise for improving both housing security and climate resilience. Resident owned communities (ROCs), nonprofit owned parks, and publicly owned parks can remove the profit motive that is often at the root of MHP resident struggles. ROCs can give MHP residents increased agency and access to resources to take action in the face of climate threats. While manufactured homes are rarely moved after placement, they are more “mobile” than many other forms of housing, potentially enabling changing settlement patterns in response to climate change threats. Recreational vehicle parks, or “RV parks,” share many features with MHPs. While RV parks are generally not considered permanent settlements, many such parks in the Bay Area have become sites of long term inhabitation. Because they have wheels and engines, RVs are much more mobile than largely fixed manufactured homes, enabling residents to move to safer ground when necessary.

Houseboat Marinas are substantially similar to manufactured home parks in their tenure arrangements in which residents tend to own their own homes, but pay rent to a landlord who controls the space and the collective infrastructures on which residents rely. In most marinas around the Bay, private landlords lease the Bay space from public trust entities (e.g., State Lands Commission or local governments) and own and maintain the collective infrastructure, including docks, water, electricity distribution. Some Bay Area houseboat marinas are owned as cooperatives of residents. Because houseboats have buoyant foundations and they often are moored to floating docks, houseboat marinas represent a form of moderate density housing that is inherently resilient to many SLR related threats. In spite of their resilience benefits, state and local authorities are generally not supportive of expanding the number of houseboat berths in the Bay, because of concerns that houseboat marinas can have negative impacts on bay ecologies and that private housing is counter to public trust purposes. Further, while houseboats were once a relatively affordable form of housing, they, like other forms of housing in the region, have become increasingly unaffordable in recent years.

Public Financing Strategies

In California, as across the US, local governments have considerable authority and responsibility for the planning and infrastructure decisions that are essential to shaping climate adaptation. Local governments have used a range of “special districts” to enable cross-municipality cooperation and to overcome limitations on local property tax revenue generation.

Geologic Hazard Abatement Districts

(GHADs) are a type of special district in California designed to address geologic hazards, including erosion and subsidence. GHADs can exercise eminent domain, issue bonds, levy and collect assessments. GHADs have broad authority to raise funds and implement projects to mitigate future impacts of SLR, coastal erosion, and flooding. Coastal municipalities might consider creating GHADs, which would allow broader financing of improvements; they could even finance relocations.

Joint Powers Authorities (JPAs) are legal entities that allow multiple public agencies to jointly exercise common powers. JPAs have independent legal rights and can combine resources from their member agencies for a range of purposes, including: managing groundwater, building roads, restoring habitat, and expanding airports. A Bay Area JPA could help multiple agencies share resources and expertise and raise capital for adaptation projects.

Enhanced Infrastructure Financing Districts

(EIFDs) (created by SB628 in 2015) are a type of Tax Increment Financing (TIF) district that cities, counties, and special districts can create to finance infrastructure projects with community-wide benefits. EIFDs differ from traditional TIF districts in that they cannot use property taxes designated for schools. For SLR adaptation, EIFDs could be designed to encompass adjacent coastal and upland areas to finance both environmental restoration and relocation.

Climate Resilience Districts (created by SB852 in 2022) are a new variety of EIFD designed to finance projects that explicitly address sea level rise, extreme heat, extreme cold, the risk of wildfire, drought, and the risk of flooding. The tool has not yet been widely deployed, but may be useful in funding and planning adaptation interventions on the Bay shore.

Redressing Historic Property Injustices

Several of the strategies described above have been deployed by groups seeking to advance equity and justice goals (e.g., CLTs and LEHCs). Other contemporary social movements focus squarely on redressing historical and ongoing forms of spatialized injustice. In some cases, these movements have explicitly engaged with the role of land and property in shaping fights for justice.

Land Back is a movement advocating for the return of dispossessed land to Indigenous people and tribes. Among other negative impacts, the theft of native lands forced many Indigenous people into landscapes that are disproportionately vulnerable to climate change.¹⁰⁴ The Bay Area is the site of important episodes in the history of Indigenous rights struggles (e.g., the 1971 occupation of Alcatraz) and the site of vital ongoing Land Back efforts (e.g., Sogorea Te' Land Trust). The return of lands to Indigenous management along the Bayshore could facilitate wetland restoration, adaptive redevelopment, and equitable relocation. Restoration of cultural practices can improve community resilience, and studies have shown that Indigenous land management supports biodiversity. Indigenous groups have undertaken ambitious urban development projects on returned land, including in the Seńákw project in Vancouver, which will include some 6,000 rental housing units on 10.5 acres.¹⁰⁵

Reparations are monetary or other compensation for historical wrongs. In the US, the most prominent reparations movement is on behalf of the descendants of enslaved Black Americans. Japanese Americans successfully campaigned for monetary compensation from the US government in response to World War II-era internment, but this settlement did not adequately account for property losses.¹⁰⁶ People marginalized on the basis of their racial identity are frequently more vulnerable to hazards impacts.¹⁰⁷ For SLR, reparations could include wealth transfers or land-based reparations to enhance the ability of marginalized groups to adapt and thrive in a changing environment. In addition to strengthening community resilience, reparation funds could support infrastructure and SLR mitigation projects in the Bay's most vulnerable communities.

Adaptation Scenarios

Addressing the three challenges of property for climate change adaptation will require combining property and land governance strategies with physical interventions to reshape settlements. These may include gray and green flood infrastructure to protect existing communities and voluntary relocation of people and infrastructure from some of the most imperiled places. The scenarios below illustrate the transformative potential of employing more flexible, collective, and justice-focused approaches to property for adaptation.

TODAY

- Upland open space •
- Upland singlefamily homes •
- Big box retail & parking •
- Mixed use neighborhood •
- Flood vulnerable low income neighborhood •
- Existing waterfront open space •
- Bay side industry •



SCENARIO A

'Conventional Property'

In this scenario, property regimes remain predominantly static, individualized, and socially regressive. The primary adaptation mechanisms are “gray” infrastructures like seawalls and drainage pumps. This approach is prone to “lock-in” dynamics wherein investment in expensive hard engineered installations enables more risky development, placing more people and property at risk when infrastructures are inevitably overwhelmed. One widely observed example of infrastructural lock-in is the so-called “levee effect” wherein flood prone landscapes are made available for settlement through levees, floodwalls, pumps, and piped drainage. Once the threat of regular flooding is suppressed, settlement intensifies. With more people and property at risk, planners and engineers call for ever more investment in the same types of expensive, ecologically-destructive, and failure-prone protective infrastructure.

In this scenario, short-term SLR impacts are limited to periodic nuisance flooding in low lying areas occupied by waterfront industry, open space, and low-income residential communities. As nuisance flooding increases, property values in relatively flood-safe upland communi-

ties rise, while low-lying communities are increasingly financially burdened by household-level adaptation and escalating insurance premiums, exacerbating pre-existing inequalities.

Over the long term, even if public agencies invest in flood protection infrastructure, those infrastructures create new problems. New levee rights-of-way displace existing communities. Levees can encourage unwise development in newly protected zones. Eventually, rising seas will overtop seawalls and other coastal protections. Rising groundwater will cause drainage congestion and waterlogging on the “dry side” of flood barriers. Gray infrastructure poses costs to the entire community, for both direct costs for property acquisition and construction, and resultant secondary costs, and these infrastructures provide only temporary solutions. Conversely, in places without protection, all the direct costs of SLR are borne by coastal residents. Without robust coordination and collective action, increasingly frequent and severe inundation in low lying neighborhoods will lead to haphazard migration and abandonment.

FIGURE 21 Scenario A: Conventional Property**2030**

- Property values increase in flood safe areas
- Periodic nuisance flooding damages homes and increases insurance costs.
- Planning for protective grey infrastructure to prevent SLR related flooding. Right-of-way acquisition displaces existing residents.

**2050**

- Residents of flood prone areas who can afford to move, relocate to flood safe zones, leaving behind the most vulnerable groups in partially abandoned neighborhoods.
- Stormwater flooding worsens due to drainage congestion and rising groundwater.
- Protective grey infrastructure (e.g. levees) built, encouraging risky development (levee effect).

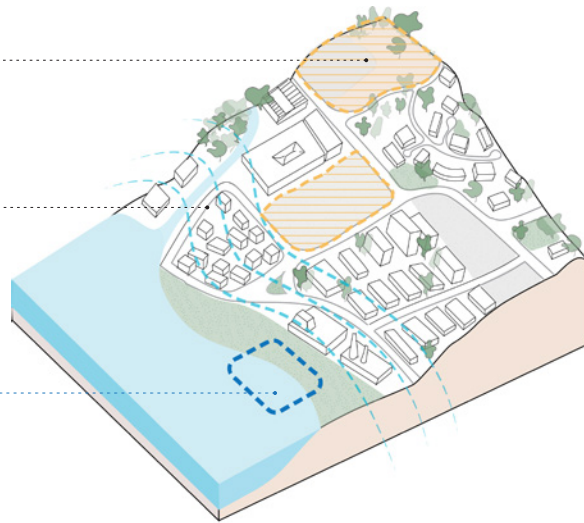
**2100**

- Without regular upgrades gray infrastructures will be overwhelmed by rising sea levels and other climate impacts, leading to catastrophic losses.
- Increasingly frequent stormwater flooding leads to piecemeal displacement & uneven household-level adaptation.

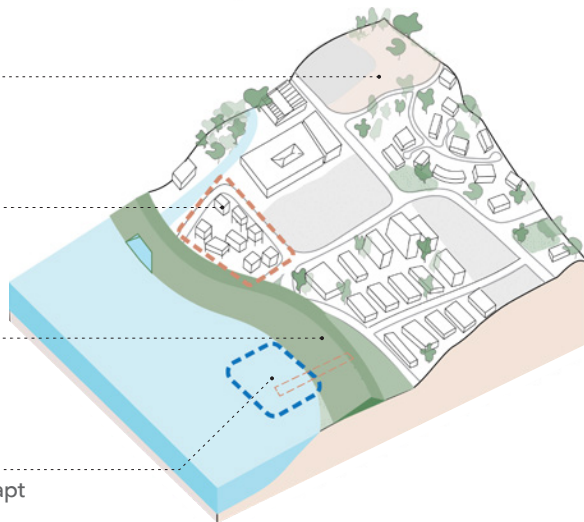


FIGURE 22 Scenario B: Adaptive Property**2030**

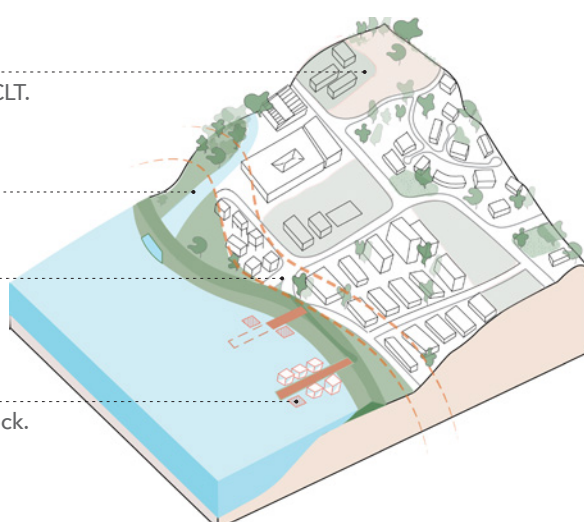
- Establish community land trust (CLT) and begin acquisition and planning for “receiving” sites to accommodate residents displaced from flood prone areas.
- Begin acquisition of rolling easements, prohibiting participating coastal property owners from building private flood protection infrastructures. Easements are purchased by a land trust or public agency in advance and are triggered when SLR conditions reach predefined thresholds.
- Begin negotiation with State Lands Commission & BCDC for leases and permitting for water-based communities to accommodate residents displaced from flood prone areas.

**2050**

- Construction begins on upland receiving sites to accommodate displaced residents from flood prone areas. Permanent affordability maintained through CLT ownership of land.
- Some residents choose to remain in low-lying areas with public and philanthropic support for adapt-in-place measures such as raising homes on stilts and providing boardwalks.
- Ecotone levee & wetland restoration on coastal land acquired through rolling easements. These installations offer both flood hazard mitigation and adaptive pathways for estuary ecosystems.
- Begin building water-based communities designed to adapt to SLR and to replace housing stock lost to flooding.

**2100**

- Upland communities grow with affordability stabilized by CLT.
- Continued wetland restoration for flood mitigation and ecosystem health.
- Continued rolling easement acquisition & periodic relocation, including to water-based communities and upland CLT communities.
- Water based communities grow to replace lost housing stock.



SCENARIO B

'Adaptive Property'

In this scenario, alternative property regimes enable new forms of adaptation that are more cost effective and equitable. They also address the three property transformations, enabling adaptation that is: 1) more responsive to climate and landscape changes; 2) more conducive to collective action; and 3) more oriented to redressing historic and ongoing injustices. This approach allows for incremental adaptation as conditions change and as planners, designers, decision makers, and the public at-large learn from adaptation efforts. Some people and communities will adapt-in-place while others will undertake collective relocation. Proactive planning through tools like rolling easements, transfer of development rights (TDR), and land banks enable more coordinated and equitable incremental relocation. Community land trusts, supported through public and philanthropic funds, acquire flood-safe "receiving" sites to enable resettlement without the threat of climate gentrification. This approach also enables prioritization of zones for ecosystem restoration, green or gray infrastructures, and water-based settlement. Over the long term, upland and water-based communities can grow to accommodate households displaced from inundated areas. Intertidal ecosystems can migrate with rising waters. This approach avoids "lock-in" dynamics and enables incremental adaptation and social learning. This "adaptation with nature" approach reduces ecological damage, avoids environmental side effects, minimizes the social and economic costs of displacement and abandonment, and equitably distributes the costs of adaptation throughout the community. This approach would require some institutional and governance reforms, including: shifts in the BCDC's mandate to support water-based settlement; strengthening the capacity of CLTs to facilitate equitable resettlement; and development and funding of a robust rolling easement strategy.



Property + Urbanism

In the spring of 2023, Professors Zachary Lamb and Rob Olshansky led an urban design studio course for Masters of City Planning students from UC Berkeley's Department of City and Regional Planning exploring how alternative property strategies might enable more just adaptation to climate change in communities around San Francisco Bay. The studio began with precedent case studies of existing alternative property regimes and water-based urbanisms around the Bay and around the world.

Groups of students then began researching patterns of sea level rise and other climate change vulnerabilities in six bayshore communities: 1) San Rafael's Canal District; 2) the Bayview-Hunters Point Neighborhood in Southeast San Francisco; 3) the island community of Alameda; 4) a portion of the East Bay from San Leandro to Hayward; 5) communities around Gallinas Creek in Marin County; and 6) East Palo Alto in San Mateo County. These communities were selected because they represent a variety of urban contexts, landscape conditions, and demographic characteristics. Based on analyses of the

patterns of climate vulnerability, urban conditions, and socio-ecological factors, each team developed proposals for phased adaptation interventions, including both physical interventions (e.g., protective infrastructures, new adaptive urban districts, and relocation) and innovative property regimes (e.g., rolling easements, CLTs, and anti-displacement measures). Teams were tasked with developing not one-off adaptation solutions, but ongoing adaptation strategies with flexibility to respond to uncertain climate change impacts and urbanization patterns decades into the future.

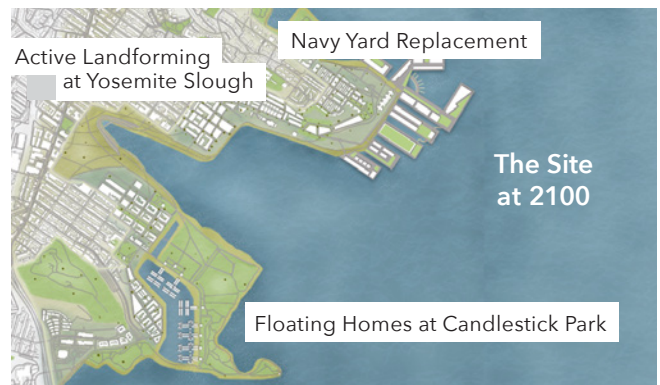
The Canal District, San Rafael

San Rafael's Canal District is built on flood-prone former marshland. The neighborhood's residents are overwhelmingly Latinx-immigrant renters living in low-rise apartment buildings wedged between San Rafael Creek and the 101 freeway, largely isolated from the rest of the city. The proposed interventions here respond to these socio-ecological conditions by integrating flood-adaptive infrastructure with anti-displacement strategies. The proposed measures include new rent control and eviction protections to be implemented in advance of significant investments in SLR resilience to avoid climate gentrification. The proposal includes a new mixed-use urban corridor along the freeway edge, phased adaptive retrofits of existing low-rise multifamily buildings, new floating urban districts, and elevated road corridors.



Bayview-Hunters Point, San Francisco

The Bayview-Hunters Point area of San Francisco has long been characterized by concerns about a legacy of toxic pollution and environmental health hazards. Sea level rise also threatens much of the former industrial shipyard, imperiling the vast new neighborhood that city planners have envisioned for this part of the waterfront. In response to these concerns, this project links toxic remediation strategies to new floodable parks and additional housing, both on flood safe highland areas and in flood adapted floating districts at the bayfront. The project proposes wetland restoration, shipyard redevelopment and adaptive land-forming at Yosemite Slough. Given that much of the land in this area is owned by the City of San Francisco, the proposal suggests establishing a Public Land Trust to support the neighborhood's diverse communities against displacement threats and to redress a history of disinvestment. The land trust would preserve housing affordability for low-income residents and facilitate economic development.



Alameda

The island of Alameda, across the estuary from Oakland, includes both a massive decommissioned naval air station slated for redevelopment and large areas of low density mixed residential fabric. Much of the island also faces inundation from rising sea levels and groundwater. This project focuses on two especially threatened neighborhoods at either end of Alameda: 1) Alameda Point, the former naval air station undergoing redevelopment largely on landfilled areas at the western end of the island and 2) the residential areas around the southeast Alameda waterfront. The project links proposals in these two areas, proposing managed retreat from the most imperiled low-density residential areas and flood adaptive redevelopment on the naval air station. The proposal also includes new multipurpose levee landscapes and ecological restoration of estuary areas to buffer against projected sea level rise.

The project proposes that revenue generated from private redevelopment at Alameda Point would be used to fund a new city-owned land bank that could acquire land to house residents of areas subject to retreat. To enable retreat from the most vulnerable areas of south-



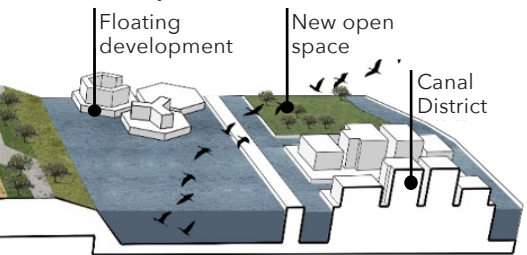
east Alameda, the project calls for using rolling easements to gradually acquire property rights, enabling relocation and ecological restoration.

FIGURE 23 Proposed Phased Adaptation Strategies for the East Bay Shoreline

Phase II-III: Marsh Restoration



Phase II-III: Adaptive



Mural of Russell City Past and Present

East Bay from San Leandro to Hayward

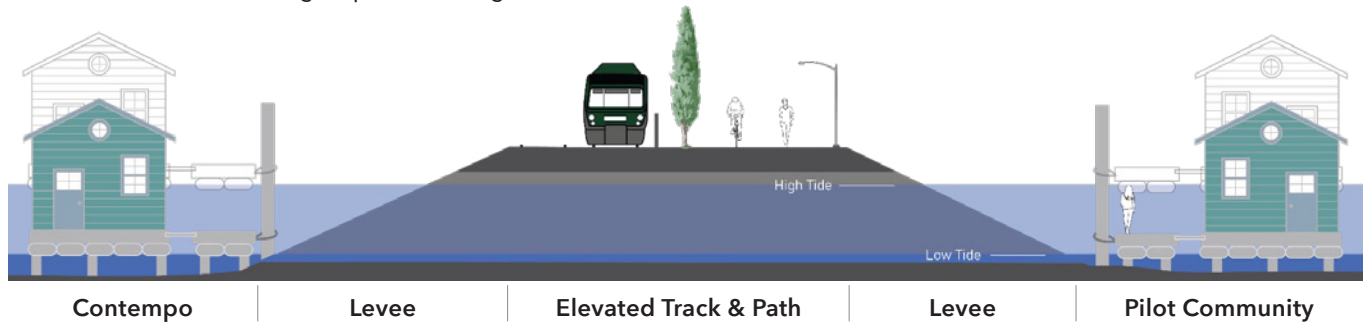
The portion of the East Bay shoreline from San Leandro to Hayward is home to broad swaths of low to medium-density suburban neighborhoods and industrial parks, all built atop former coastal marshlands. The area also hosted rural settlements like Russell City, a thriving Black community that was forcibly displaced to make way for industrial development. The area now faces widespread threats from sea level rise.

To address inundation risk along this portion of the East Bay shoreline, the project proposes to restore marshlands and create new flood adaptive districts. Rolling easements, triggered by sea level rise, would be employed for property acquisition, with newly inundated land reserved as open space under the public trust doctrine.

The former site of Russell City is reenvisioned as a floating cultural district. Taking a reparative justice approach, the project addresses the destruction of Russell City through new development, including first-time homeowner assistance, cultural programming, and land restitution for the descendants of displaced residents.

These proposals would be enabled by a community land trust supporting the relocation of people affected by sea level rise to stable new neighborhoods.

FIGURE 24 Section Showing Proposed Floating Communities on Either Side of an Elevated Train/Trail Corridor.



Gallinas

In the mid-to-late 20th century, low-density residential neighborhoods were built on former coastal marshlands in the lower Gallinas Creek watershed in Marin County. While these communities are protected by small uncertified levees, those protections will be overwhelmed by sea level rise if they are not significantly upgraded.

The project proposes to address the risk of inundation to both residential areas and wetlands through a range of adaptation strategies, including retrofitting a mobile home community using buoyant foundations and strategic relocation from the most hard-to-protect areas. These built environment adaptations would be enabled by regulatory rolling easements that would restrict development and shoreline protection in some of the most vulnerable areas.

Impacted residents would also have the option to join a collectively owned flood-adaptive floating residential development or to relocate using a newly created Transfer of Development Rights (TDR) program.

FIGURE 25 Proposed Adaptation Strategies for the Gallinas Creek Area



- | | |
|--------------------------------------|----------------------------------|
| Emergent Groundwater | Residential Development |
| 2100 High Emissions High Tide Level | Wetland |
| 100 Year Storm Surge (Low Emission) | New Open Space |
| 100 Year Storm Surge (High Emission) | Commercial/Mixed Use Development |

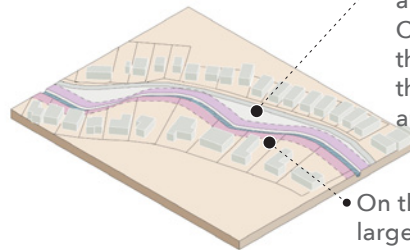
East Palo Alto

East Palo Alto suffers from elevated socio-economic vulnerability and heightened flood risk, both along the Bayfront and in the floodplain of San Francisquito Creek. Situated in the heart of Silicon Valley's soaring property markets and tech office parks, East Palo Alto is an island of relative racial diversity and relatively affordable housing.

The project aims to capitalize on the wealth of surrounding communities to protect East Palo Alto residents against both mounting flood risk and displacement threats. The proposal includes floodplain restoration, creek widening, new Bayfront ecotone levees, and floating neighborhoods on artificial ponds. To fund these adaptive strategies, the project would establish a Geological Hazard Abatement District (GHAD) that would impose a new tax on property owners within the district. The GHAD would include the cities of East Palo Alto, Palo Alto, and Menlo Park, harnessing the broader area's wealth to ensure that East Palo Alto is not marginalized in climate adaptation efforts.



LAND READJUSTMENT

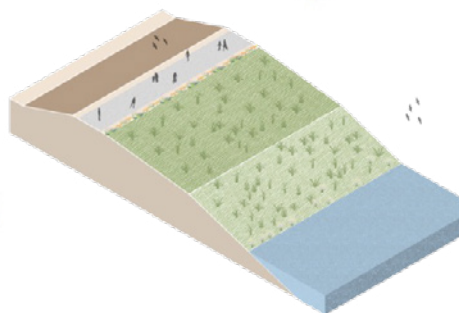


- East Palo Alto is separated from the more affluent city of Palo Alto by San Francisquito Creek. On the East Palo Alto bank, widening the creek along Woodland Ave by narrowing the road to convert it into a one-way street and eventually a pedestrian-bike only path.
- On the Palo Alto bank, the houses have a large setback from the creek. We propose a land readjustment scheme that would make use of some of this land for a new floodable riverfront park.

CREEK RESTORATION



ECOTONE LEVEE



POND URBANISM





PART IV

Conclusions and Recommendations

Key Takeaways

It is now certain that sea level rise will affect the people, property, and infrastructure along the 400-mile shoreline of San Francisco Bay in coming decades. Although the precise rate of SLR is uncertain, we know that there will be serious negative effects by 2100, and SLR will continue to extend its reach for the foreseeable future. Adaptation will be a decades-long ongoing process. Physical adaptations will include: gray and green infrastructure to mitigate areawide impacts of rising seas; elevation and flood-proofing of individual structures; and changes to settlement form, such as relocation, clustering, densification, and floating settlements.

Recent reports and media accounts make clear that these physical adaptation actions will be necessary, but expensive and complex. To date, there has been much less attention to how the ownership and control of tens of thousands of property parcels will shape adaptation. The property regimes represented by these parcels – imposed on the Bay over the past two hundred years since European colonization – presents serious challenges to adapting to a rapidly changing climate. First, dominant economic and legal systems are based on the assumption that property is spatially fixed and static, but the dynamism of changing landscapes demands flexibility. Second, thousands of individual parcels along the Bay present a highly fragmented and contentious decision environment, in which each owner of each small piece of ground acts on their own, often to the detriment of those around them. The very nature of sea level rise—regional and fluid—demands strategies that are collaborative and collective. Third, unjust practices of the past, from expropriations of Indigenous lands to urban redlining, are now “baked into” the property landscape, widening wealth inequality and exposing disadvantaged groups to disparate climate change impacts. Adaptation can provide a means to address historical and ongoing injustices, and to restore pre-settlement environmental functions.

The three challenges to adaptation presented by dominant property regimes are distinct, but also deeply related to one another. For instance, the injustice of dominant property regimes (Challenge 3) follows directly from treating landscapes and ecosystems as commodities that are severable (Challenge 2) and stable (Challenge 1). On the other hand, achieving transforma-

tive adaptation will require addressing more than one of these challenges at a time. If designed and implemented intentionally, enabling pluralistic forms of shared land governance (Challenge 2) can enable greater flexibility (Challenge 1) and more just land relations (Challenge 3). For instance, residents living on SLR-threatened land owned by a community land trust, could relocate to other sites held by the land trust.

It may seem a tall order to transform dominant property regimes, which are rarely acknowledged, much less challenged. However, the dynamics of climate change require such changes to adapt effectively, expeditiously, and equitably. Furthermore, existing systems of property are much more varied than most of us imagine. Around the U.S., there are many active examples of expanded approaches to property rights that address flexibility, involve some degree of collective ownership and governance, and promote justice. As documented in this report, a large proportion of the land at risk of inundation from the Bay has shared or public ownership. This proliferation of collectively governed land is common in many communities across the US, especially those that have seen considerable growth since the mid-20th century. Elsewhere in the world, other models exist – through innovative, Indigenous, and/or informal practices – that have great potential to inspire innovations to more effectively and equitably adapt to climate change.

Sea level rise will be a slow, ongoing process unfolding over the coming decades. It will largely be revealed through more frequent nuisance flooding. SLR will also become more apparent, however, during extreme events, such as intense rainstorms, King Tides, and coastal storm surges. Disasters, such as catastrophic flooding from storm surges and atmospheric river events and severe earthquake damage, will provide brief opportunities for transformative adaptation in Bayshore communities. Flood events will both raise awareness of SLR risk and provide a clear preview of future environmental conditions under which today’s exceptional floods will become tomorrow’s regular inundations. If those moments are to serve as windows of opportunity for transformative adaptation, we need to plan ahead. We need to build public awareness about the need for adaptation generally and the need for more flexible, collective, and just forms of property specifically.

Recommendations

Government agencies, think tanks, researchers, and advocacy organizations around the Bay are already deeply engaged in conversations regarding our shared climate futures. The purpose of this report is to expand the scope of those conversations by identifying property as an overlooked but critical component to implementing adaptation. To that end, we explore how broader views of private property could enable more effective and equitable SLR adaptation. We suggest that now is the time to consider appropriate strategies. Following are our recommendations for priority actions based on this research.

BCDC as a Vehicle for Transformative Adaptation

BCDC has been a pioneering agency, both locally and nationally, in using regional land use regulation to protect environmental resources. Its jurisdiction and mandate were created at a time when humans were rapidly filling the bay and obstructing access to that resource. But now new circumstances have arisen that fundamentally alter the long-standing relationship between human settlements and the Bay's shoreline. To reflect the evolving reality of sea level rise, BCDC's mandate and jurisdiction will need legislative modification.

BCDC's limited land-side jurisdiction is no longer suited to a dynamic world of SLR. For any project that BCDC approves today, its jurisdiction will migrate landward over the life of the completed development. Given the public trust doctrine, some portion of what is now the 100-foot band and more will eventually move into public ownership. Thus, it seems appropriate for BCDC to begin regulating based on future conditions, rather than assuming that its area of jurisdiction will remain the same. BCDC would need statutory authority to develop and implement a risk-based jurisdictional boundary, based on future SLR. This might, in turn, lead to a more dynamic regulatory framework that could include rolling easements or other strategies for allowing movement of water and aquatic ecosystems onto what is now land. In addition, multiple organizations engaged in regional planning would benefit from areawide mapping of BCDC's jurisdictional boundaries; current technology makes it easier to produce and access such maps than when BCDC was created in the 1970s. BCDC may also be able to promote some of the goals through its new authority under SB 272.

In large part because of BCDC's efforts, the Bay is no longer in danger of disappearing. Given this reality, BCDC could apply more flexibility to their regulation of "fill" to enable water-based communities that can continuously adapt to rising seas while also helping meet the regional demand for housing as driven both by typical market conditions and by future SLR-driven displacement of coastal communities. A revised Bay Plan could define specific zones that would allow water-based communities, depending on ecological sensitivity and connectivity to existing infrastructure and services. Such communities also might be appropriate TDR receiving locations for residents affected by SLR in nearby locations. Such a mechanism could even facilitate the transition of a dryland community into a floating settlement as the Bay expands with SLR.

Supporting Shared Ownership

Much of the land at risk from SLR is owned by various types of private common-interest communities (e.g., HOAs and condo boards). These entities will be important actors for planning and implementing SLR adaptation. The substantial open spaces owned by such entities could be used for a variety of adaptation interventions, including green infrastructure, floating communities, or multi-story infill development. Transformative interventions might be especially appealing as properties require renovation or near the end of their useful life. However, these shared ownership entities do not currently have the right incentives or resources in place to manage this responsibility. State laws that govern homeowner associations and condo boards could be changed to facilitate adaptation, perhaps by requiring additional reserve funds, facilitating insurance, or incentivizing SLR adaptation plans. The state could also provide adaptation grants to these entities, perhaps contingent on offering public benefits such as access, ecosystem restoration, or flood water management. Finally, the state could offer opportunities for common-interest communities to share resources and plan collaboratively, such as by pairing TDR sending and receiving sites.

Improving Coordination Between Public, Private, and Shared Owners.

Because the regional risk of SLR does not respect property lines, municipal boundaries, and other human spatial constructs, successful and equitable adaptation

requires multiple scales of cooperation. Adaptation will require action not only from institutions of private shared ownership, as described above, but also collaboration between public, private, and shared owners to facilitate collective investments in green infrastructure that can benefit broader publics, while minimizing practices that pit neighboring property owners and neighboring public jurisdictions against one another.

Exploring a Broader Range of Property Strategies

We hope that this report can expand the scope of adaptation planning to include alternative property rights concepts that could facilitate SLR adaptation around the Bay. Such efforts could include some of the property strategies we describe, creative combinations of these strategies, or other strategies based on successful examples from around the world. In abstract terms, such strategies would make it easier to move property rights from one location to another, proactively and intentionally share some of the costs of SLR, create new property rights schemes that can facilitate future adaptations, and take these actions in ways that recognize and redress past and ongoing forms of injustice.

One potential starting point would be to create a regional or statewide task force to study a wide range of strategies, including various types of TDR, land readjustment, easements, land trusts, and collective ownership structures, as well as a variety of financing mechanisms. This work would include evaluation of the potential uses of each strategy and combinations of strategies, their costs and potential benefits, legislative or policy changes needed to facilitate their use, and feasibility in selected pilot communities.

The goals of these strategies would be to facilitate the future process of adaptation (including relocation of homes and businesses, investments in infrastructure, and ecological restoration), create collective governance structures that could continue to adapt over time, and ensure just transformations such as returning Indigenous lands. If we begin now to apply the creative talents of the Bay Area to this problem, we can create new mechanisms to ensure successful adaptations for the rest of this century and beyond.

Appendix

Strategy	Challenge			Case Examples	Applicability for Sea Level Rise Adaptation in the Bay Area	Key Resources
	Flexibility	Collective	Justice			
Moving Property Rights						
Rolling Easements						
<p>Rolling easements are a strategy for allowing specified property rights to migrate with changing environmental conditions. They allow continued private use of threatened land until reaching some threshold physical condition. For instance, once local sea level rises to a pre-determined level, new property regimes or use restrictions come into effect. Rolling easements can ensure that coastal ecosystems (e.g., tidal estuaries, beaches) can migrate inland with changing conditions.</p> <p>Rolling easements can take many forms, such as: 1) legal prohibitions of shoreline protections that would stop the migration of aquatic ecosystems and 2) public property rights that ensure that aquatic ecosystems can move inland with the movement of a shoreline. These are not typical easements that represent a right to use or enter property without full ownership, but rather they represent a public right to limit private uses as the sea rises.</p>	●			<p>Maine’s “Coastal Sand Dune Rule” prevents development in areas expected to erode in the event of a two-foot sea level rise over the next 100 years. Structures that become seaward of the mean high tide line for six consecutive months must be removed.</p>	<p>Using their jurisdiction over the rolling territory within 100’ of the bay shore, the BCDC could be empowered to prohibit new shoreline protection structures in specific areas to enable the landward migration of especially important aquatic ecosystems.</p> <p>Acquiring partial property rights to facilitate the landward migration of aquatic ecosystems could ease long-term relocation or retreat without requiring immediate property acquisitions. It could allow some ongoing use of land vulnerable to SLR until the easement is triggered by specific sea level thresholds.</p>	<p>Titus, J. G. 2011. Rolling Easements Primer. Environmental Protection Agency Climate Ready Estuaries Program. https://www.epa.gov/sites/default/files/documents/rollingeasementsprimer.pdf</p>
Transfer of Development Rights (TDR)						
<p>TDR is a strategy that enables the relocation of property or development rights. It is a voluntary and incentive-based tool that transfers development rights from “sending sites” to “receiving sites”, sometimes involving complex formulas. TDR is typically used to preserve land in sending areas by transferring the rights to locations better suited for development, but it can sometimes also be used to relocate rights in post-disaster reconstruction.</p>	●			<p>Reconstruction following the 1995 earthquake in Kobe, Japan used several schemes to relocate private property rights, typically involving moving rights from undersized nonconforming ground parcels to condominium ownership rights in new multi-story buildings.</p>	<p>TDRs can be useful in conservation efforts to preserve access to the Bayshore as sea levels rise and shoreline lands are submerged. For planned retreat, TDR provides an alternative to buy-outs, where suitable receiving sites can be identified. Rights could move to distant upland locations, or they could move to clusters, possibly in multi-story buildings, on adjacent sites.</p>	<p>Walls, Margaret, and Virginia McConnell. 2007. Transfer of Development Rights in U.S. Communities: Evaluating Program Design, Implementation, and Outcomes. Resources for the Future, Washington, D.C.</p> <p>Nelson, Arthur C., et al. 2012. The TDR Handbook: Designing and Implementing Transfer of Development Rights Programs. Island Press, Washington, D.C.</p>

Strategy	Challenge			Case Examples	Applicability for Sea Level Rise Adaptation in the Bay Area	Key Resources
	Flexibility	Collective	Justice			
Moving Property Rights						
Land Readjustment						
<p>Land Readjustment is a replotting of existing land parcels. It is most commonly used as a land development tool, to improve land accessibility, provide infrastructure, and create public open space. In the end, each owner receives a land site of at least equal value in the vicinity of the original site. In essence, it is a method of land value capture, in which each owner contributes part of their land to finance collective public investments that enhance the value of their remaining land. It is also used in post-disaster settings, to provide infrastructure improvements and eliminate obsolete hazardous parcels.</p>	●			<p>Land readjustment was used after earthquakes and accompanying fires and tsunamis in Kobe, Japan (1995), the Tohoku coast of Japan (2011), and Bhuj, India (2001), to widen streets, enlarge parcels, and provide public open space to improve future seismic safety.</p>	<p>Land readjustment could be used to rearrange parcels threatened by SLR in order to provide open space for restoration or mitigation. It could involve clustering onto higher ground or combine with TDR for households who choose to move further inland</p>	<p>UN HABITAT. 2018. Global Experiences in Land Readjustment. Urban Legal Case Studies: Volume 7.</p> <p>DeSouza, F., Ochi, T., Hosono, A. 2018. Land Readjustment: Solving Urban Problems Through Innovative Approach. Japan International Cooperation Agency Research Institute.</p> <p>Hong, Y. and Needham, B., Eds. 2007. Analyzing Land Readjustment: Economics, Law, and Collective Action. Lincoln Institute of Land Policy.</p>
Managing Multiple Parcels						
Land Banks						
<p>Land banks are typically public authorities or non-profit organizations that acquire, manage, hold, and convey property to serve a public purpose, such as providing affordable housing, managing open space, or stabilizing property values.</p> <p>Land Banks are commonly used in the U.S. to repurpose vacant or abandoned lots, They have historically been used to promote orderly development or facilitate land value capture from public investments in infrastructure. They can assist with disaster recovery. The Louisiana Land Trust (which operates as a land bank) established in 2005 after Hurricane Katrina and Rita was the state-chartered entity established to temporarily hold land purchased from residents in voluntary buy-out programs.</p>	●	●	●	<p>The Genesee County, Michigan, Land Bank acquires and maintains vacant properties, demolishes blighted buildings, rehabs and sells affordable housing, supports small business development, and activates vacant lands for beautification, recreation, and community spaces.</p>	<p>While there are currently no land banks operating in California, a Bay Area regional land bank authority could acquire and convey land for sea level rise mitigation projects, buy and consolidate flood-affected parcels, or accommodate the resettlement of displaced residents in new 'receiving' communities. However, the Bay Area may not be an ideal market for land banks as they are often used in areas with low land and housing costs.</p>	<p>Alexander, Frank. 2015. Land Banks and Land Banking, 2nd Ed. Center for Community Progress. https://communityprogress.org/wp-content/uploads/2021/08/2015-06-Land-Banks-and-Land-Banking-2-Publication.pdf</p>

Strategy	Challenge			Case Examples	Applicability for Sea Level Rise Adaptation in the Bay Area	Key Resources
	Flexibility	Collective	Justice			
Managing Multiple Parcels						
Land Trusts						
<p>Land Trusts are legal entities that control property at the owner's request. They have many types and purposes. Conservation land trusts (where owners give up some land use or development rights) are nonprofits that preserve open space or improve ecosystem functions. Community land trusts are another type, described above.</p> <p>Land trusts have also been used as a tool to assist with disaster recovery.</p>		●		<p>After a flood in Atlanta, GA in 2002 left 16 acres of land vacant, the Trust for Public Land created the Rodney Cook Sr Park. The TPL worked with the city to raise funds and with community members to design a park that met their needs. The park incorporates green infrastructure features such as a stormwater retention pond.</p> <p>Source: https://www.tpl.org/our-work/cook-park</p>	<p>Land trusts could facilitate climate adaptation in the Bay Area in several ways, including:</p> <ul style="list-style-type: none"> • Preserving undeveloped land along shorelines to prevent future development vulnerable to SLR; • Holding land for green infrastructure projects that mitigate flood effects as in the Rodney Cook Park example; • Acquiring and holding rolling easements for SLR vulnerable land after some pre-specified trigger condition is met. 	<p>Land Trust Alliance, landtrustalliance.org</p> <p>California Council of Land Trusts, calandtrust.org</p>
Collective Ownership						
Community Land Trust						
<p>CLTs are non-profit organizations that own and steward land for the benefit of their community. Most commonly, CLTs are used to provide affordable housing for low to moderate-income residents. While CLTs own the land, a family or individual can purchase housing units with a long-term lease (e.g., 99 years) on the land, which keeps the housing much more affordable than traditional purchases of land and structure. While housing is the most common use for CLT-owned land, CLTs can also host green spaces and mixed/commercial uses for the benefit of the community. CLTs typically have a three -part board, including community members, experts/professionals who represent the public interest, and residents.</p>		●	●	<p>The Caño Martín Peña CLT in Puerto Rico was established along with a state-chartered planning organization, ENLACE, in a flood-vulnerable informal settlement to prevent displacement after the dredging and restoration of the neighborhood's water channel. The territorial government allocated 200 acres of land to the CLT. Residents in imperiled areas receive assistance to move within the CLT. ENLACE and the CLT are developing plans for public uses for the newly unoccupied lands along the channel.</p>	<p>CLTs could be created to equitably facilitate voluntary relocation of property rights from coastal to upland portions of the CLT. Alternatively, CLT land could host green infrastructure adaptation projects to mitigate impacts from SLR and flooding, and CLTs could be used to resist gentrification displacement in areas where SLR mitigation projects might make once vulnerable areas more appealing.</p>	<p>Davis, John E., Ed. 2010. The Community Land Trust Reader. Lincoln Institute of Land Policy, Cambridge, MA.</p> <p>Grannis, Jessica. 2021. Community Land = Community Resilience. Georgetown Climate Center. https://www.georgetownclimate.org/files/report/Community_Land_Trust_Report_2021.pdf</p> <p>Center for Community Land Trust Innovation. https://cltweb.org/about/team/</p>

Strategy	Challenge			Case Examples	Applicability for Sea Level Rise Adaptation in the Bay Area	Key Resources
	Flexibility	Collective	Justice			
Limited Equity Housing Cooperative (LEC)						
<p>In a Limited Equity Housing Cooperative (LEHC) or Limited Equity Cooperative (LEC) residents purchase a share in a development, rather than a unit. As opposed to market rate (full equity) housing cooperatives, LECs maintain affordability by restricting resale prices of coop shares, typically based on the initial sale price adjusted for inflation to keep the price affordable to future buyers. They are often combined with Community Land Trusts.</p> <p>Members buy into the co-op with an initial share purchase and then make monthly payments to cover operating costs. Typically, a co-op is legally organized as a corporation or nonprofit organization and is managed by a board of members that oversees daily operations, property management, and finances.</p>	●	●	<p>The residents of 53 Columbus Avenue in San Francisco's Chinatown were concerned about losing their homes when the building was put up for sale. After eight years of effort, they were able to purchase the building in 2005 and create a limited equity coop. The San Francisco Community Land Trust owns the land underneath the cooperative and leases that land to residents who collectively own the building through their shares in the co-op.</p>	<p>LECs are a rare homeownership type, but they can expand homeownership access for those marginalized by income and racial bias. Well-managed LECs can dedicate funds to collective adaptation projects. LECs can also provide stable, affordable housing for residents in "receiving communities" relocated from particularly vulnerable areas.</p>	<p>Ortiz, Lillian. 2017. "Will Limited-Equity Cooperatives Make a Comeback?" Shelterforce #186, Spring 2017. https://shelterforce.org/2017/04/25/will-limited-equity-co-ops-make-comeback/</p> <p>Ehlens, Meagan. 2014. Community Land Trusts and Limited Equity Cooperatives A Marriage of Affordable Homeownership Models? Lincoln Institute of Land Policy Working Paper. https://www.lincolninst.edu/publications/working-papers/community-land-trusts-limited-equity-cooperatives</p>	
Condominiums						
<p>Condominiums are a common ownership type for residential units in a multifamily housing complex. Condo owners own the space inside individual units and have a shared ownership interest in the walls, floor, and common areas such as hallways, stairs, and outdoor areas. Typically, condo owners finance their individual units with traditional mortgages and are subject to property taxes.</p> <p>Owners are subject to the covenants, conditions, and restrictions of property use as set by the owners association and also responsible for additional dues payments for common expenses, maintenance, and services. A reserve fund is kept for larger maintenance projects, replacement of major equipment/features, and unforeseen expenses.</p>	●			<p>The need for consensus may reduce the ability of condominiums to adapt to SLR, but, conversely, condominiums that achieve consensus have the means to collectively decide on mitigation, adaptation, or relocation actions.</p>	<p>Crace, Miranda. 2023. "Condos: Everything You Need to Know." https://www.rocketmortgage.com/learn/what-is-a-condo</p> <p>Condominiums: National Association of Realtors. https://www.nar.realtor/condominiums#section-170392</p> <p>So, Frank. 1962. Condominium. Association of State Planning Officials, PAS Report 159. https://www.planning.org/pas/reports/report159.htm#:~:text=Condominium%20is%20defined%20by%20Webster,%3B%20such%20as%20yards%2C%20foundations%2C</p>	

Strategy	Challenge			Case Examples	Applicability for Sea Level Rise Adaptation in the Bay Area	Key Resources
	Flexibility	Collective	Justice			
Collective Ownership						
Homeowners Association (HOA)						
<p>A Homeowners Association (HOA) is an entity that enforces rules for living in a community that chooses to be governed. Condominiums have HOAs, but so do many other types of residential communities with shared spaces, such as roadways, open space, recreational facilities, and pools. They can also provide security services. The association typically has legal powers and requires its members to abide by predetermined covenants, conditions, and restrictions. Most HOAs are nonprofit organizations managed by a board of residents. Historically, HOAs have been used as a tool to exclude and racially discriminate. As land and facility managers, HOAs can potentially fund mitigation and adaptation projects.</p>		●		<p>In areas vulnerable to SLR association dues from residents could fund mitigation and adaptation projects (although this may require some consensus building and special assessments). Additionally, if communities are in particularly vulnerable locations, common open spaces could facilitate relocation of vulnerable homes, as with land readjustment.</p>	<p>Associations of HOAs provide information on their potentials and limitations: https://hoa-usa.com/ https://www.caionline.org/pages/default.aspx</p>	
Split Tenure Housing						
Manufactured Home Parks (MHPs)						
<p>Residents of MHPs usually own their own homes, but rent land from park owners. Although rental tenure makes MH owners financially vulnerable, alternative forms of MHP ownership, such as resident-owned communities (ROCs) can give MHP residents increased agency in the face of climate threats.</p>			<p>Pasadena Trails, a resident-owned MHP near Houston, TX, invested in drainage upgrades to reduce vulnerability to flooding like that experienced during 2017's Hurricane Harvey.</p>	<p>While manufactured homes are rarely moved, they are more "mobile" than many other forms of housing, potentially facilitating adaptation to climate change. Community ownership of shared lands, facilities, and infrastructures can also enable community-led adaptation.</p>		

Strategy	Challenge			Case Examples	Applicability for Sea Level Rise Adaptation in the Bay Area	Key Resources
	Flexibility	Collective	Justice			
Split Tenure Housing						
Manufactured Home Parks (MHPs)						
<p>Similar to manufactured home parks, residents usually own their own homes but pay rent to a landlord who controls the space and infrastructure. Around the Bay, most marinas lease the space from public trust entities, such as the State Lands Commission.</p>				<p>Galilee Harbor, in Sausalito, CA, is a cooperatively owned houseboat community serving low income artists and maritime workers. The community has been granted permission to remain conditional on providing public benefits including marsh restoration and public waterfront access.</p>	<p>Houseboat marinas are inherently resilient to many SLR-related threats, but they can negatively impact the Bay, and private housing is counter to BCDC’s current interpretations of public trust purposes for development on/around the Bay.</p>	
Public Financing Strategies						
Geologic Hazard Abatement Districts (GHADs)						
<p>Geologic Hazard Abatement Districts (GHADs) are a kind of special district in California authorized in 1979 that are created to address “geologic hazards” defined as “actual or threatened landslide, land subsidence, soil erosion, earthquake, fault movement or any other natural or unnatural movement of land or earth.”</p> <p>GHADs operate according to an approved Plan of Control, prepared by an engineering geologist, that outlines how its projects will prevent, mitigate, abate, and control the geological hazards. They are governed by an elected board of landowners within the district or by the local government. GHADs are authorized to exercise eminent domain, issue bonds, levy and collect assessments.</p>	●	●	●	<p>The Broad Beach GHAD in Malibu, CA, was formed in 2011 to address beach erosion, which impacts property owners. The GHAD-funded shoreline protection plan included beach nourishment, dune restoration, and maintaining the existing rock revetment.</p> <p>Broad Beach GHAD: bbghad.com</p>	<p>GHADs have broad authority to raise funds and implement projects that can mitigate the future impacts of SLR, coastal erosion, and flooding. GHADs could be created to accumulate funds and finance projects in areas particularly vulnerable to SLR, or one GHAD could be created to cover the entire bayshore.</p> <p>Given their self-financing nature, GHADs would be well suited to adaptation measures that seek to preserve the value of threatened land, rather than to advance just and sustainable adaptation. However, coastal municipalities could consider citywide GHADs, which would allow broader financing of improvements that benefit all; they could even finance relocations.</p>	<p>California Association of GHADs. https://ghad.org/</p>

Strategy	Challenge			Case Examples	Applicability for Sea Level Rise Adaptation in the Bay Area	Key Resources
	Flexibility	Collective	Justice			
Public Financing Strategies						
Climate Resilience District						
SB852 (2022) authorized the formation of climate resilience districts to finance projects that address sea level rise, extreme heat, extreme cold, the risk of wildfire, drought, and the risk of flooding. It also deemed each district to be an EIFD and meet those requirements. Districts could finance these projects by levying a benefit assessment, special tax, property-related fee, or other service charge or fee consistent with the California Constitution.	●	●	●	SB825 deemed the Sonoma County Regional Climate Protection Authority a Climate Resilience District and grants this district the authority and powers available to such a district. This RCPA was formed in 2009 to coordinate countywide climate protection efforts. https://rcpa.ca.gov/	Given the specific focus on climate change adaptation and the identification of addressing SLR and flooding as eligible projects, Climate Resilience Districts have great potential as a regional mechanism to raise funds for adaptation projects. Individual municipalities or counties could create such districts, or a larger Bayshore wide district could be considered.	State Bill Text SB852. https://leginfo.ca.gov/faces/billTextClient.xhtml?bill_id=202120220SB852
Joint Powers Authorities (JPAs)						
Joint Powers Authorities (JPAs) are "legally created entities that allow two or more public agencies including federal and state agencies, counties, cities and special districts to jointly exercise common powers." JPAs have independent legal rights and the ability to hold property and are often used to expand the jurisdiction of a single government agency and to combine resources of their member agencies to save time and money. Many states authorize JPAs, and they are especially common in California. Common activities, which are funded by raising capital through issuing bonds, include groundwater management, road construction, habitat conservation, airport expansion, redevelopment projects, educational programs, and regional transportation projects.	●	●	●	The Capital Corridor Joint Powers Authority is a partnership among six local transit agencies in the Bay Area served by the Capitol Corridor train (primarily between Auburn, Sacramento, and San Jose). In 2014, this JPA conducted a sea level rise vulnerability assessment for its passenger rail route. Sea level rise adaptation projects, such as raising tracks, were included in its most recent (2016) Vision Implementation Plan. https://www.adaptingtorisingtides.org/wp-content/uploads/2015/04/CCJPA-SLR-Vulnerability-Assessment_Final.pdf	While JPAs can be difficult to form because they require mutual trust and coordination, they could be very useful in coordinating the multitude of public agencies already in operation in the Bay Area. A JPA would allow multiple agencies to work together towards more efficient bayshore management, to share resources and expertise, and to raise capital sufficient to fund large-scale projects.	Cypher, Trish, and Grinnell, Colin. 2007. Governments Working Together: A Citizens' Guide to Joint Powers Authorities. Senate Local Government Committee. https://sgf.senate.ca.gov/sites/sgf.senate.ca.gov/files/GWTFinalversion2.pdf Nevada County Grand Jury. 2021. Joint Powers Authorities: What You Need to Know. https://www.nevada.courts.ca.gov/system/files?file=2021-spd-jointpowersauthorities.pdf

Strategy	Flexibility	Collective	Justice	Challenge Case Examples	Applicability for Sea Level Rise Adaptation in the Bay Area	Key Resources
Public Financing Strategies						
Enhanced Infrastructure Financing District (EIFD)						
<p>EIFDs, authorized in California in 2015 by SB628, are a type of Tax Increment Financing (TIF) district that cities, counties, and special districts can create to finance infrastructure projects with community-wide benefits. EIFD tax increments are available for up to 45 years from the date of first bond issuance. One key aspect that distinguishes EIFDs from traditional TIF districts is that they cannot use property taxes designated for schools. Additional legislation has since been passed to specifically allow EIFDs to fund climate change adaptation projects (AB733, 2017) and to issue bonds without public vote (AB116, 2019).</p>	●	●	●	<p>The City of Redondo Beach and the County of Los Angeles proposed an EIFD in 2019/2020 to redevelop a closed power plant. Tax revenue from private development on the site would pay to restore wetlands and establish park space in the 50-acre site area. As of December 2020, the financing plan was under review.</p> <p>https://scag.ca.gov/funding-and-financing-tools-and-strategy/city-redondo-beach-enhanced-infrastructure-financing</p>	<p>Areas vulnerable to SLR could create an EIFD in order to raise funds for infrastructure projects or other climate change adaptation programs. Development in upland areas could finance infrastructure or environmental restoration along the Bay. Multiple jurisdictions could participate. An EIFD could be used in conjunction with other strategies, such as JPAs.</p>	<p>Southern California Association of Governments (SCAG). 2024. Enhanced Infrastructure Financing Districts.</p> <p>https://scag.ca.gov/post/enhanced-infrastructure-financing-district-eifd</p>
Redressing Historic Property Injustices						
Land Back						
<p>Land Back is the return of dispossessed land to Indigenous people and tribes. Land back gives Indigenous people enhanced sovereignty and can also have cultural significance with respect to language, ceremonies, and traditions. Indigenous people and tribes can acquire their land back in a variety of ways, including sale, donation, and land trusts. The specifics of these agreements vary based on the tribe's resources and the land they are acquiring. The State of California in 2023 allocated \$100 million to the Tribal Nature-Based Solutions grant program, giving tribes the opportunity to buy land for conservation and cultural projects, as part of the state's broader strategy to promote land restoration to address climate change. https://www.kqed.org/news/11957413/100-million-grant-to-assist-california-native-tribes-with-buying-back-land</p>			●	<p>The Sogorea Te' Land Trust is an Indigenous women-led land trust based in the Bay Area that facilitates the return of land to Indigenous people by collaborating with private landowners to transfer the land and establish cultural easements, gardens, and ceremonial spaces for Indigenous people, primarily in Oakland and Richmond. Their Himmetka program develops community resiliency centers to prepare for and recover from climate-related emergencies.</p> <p>https://sogoreate-landtrust.org/</p>	<p>The return of lands to Indigenous management along the Bayshore could facilitate wetland restoration, adaptation, and equitable relocation, similar to the potential of community land trusts. Returned Indigenous lands also provide opportunities to redress past injustices regarding human use of Bay Area lands. In addition, restoration of cultural practices can improve community resilience, and studies have shown that Indigenous land management supports biodiversity.</p>	<p>Bearfoot, Cheyenne. 2022. Land Back: The Indigenous Fight to Reclaim Stolen Lands, kqed.org.</p> <p>https://www.kqed.org/education/535779/land-back-the-indigenous-fight-to-reclaim-stolen-lands</p> <p>Sogorea Te' Land Trust https://sogoreate-landtrust.org/</p> <p>Schuster, Richard, et al. 2019. Vertebrate biodiversity on indigenous-managed lands in Australia, Brazil, and Canada equals that in protected areas, <i>Environmental Science and Policy</i>, 101:1-6. https://doi.org/10.1016/j.envsci.2019.07.002</p>

Strategy	Challenge			Case Examples	Applicability for Sea Level Rise Adaptation in the Bay Area	Key Resources
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<p>Reparations</p> <p>In general, reparations are monetary or other compensation to an individual, group, or country for a historical wrong. In response to the history of environmental racism and the unequal exposure of Black communities to toxins and environmental hazards in the US, some scholars and activists call for climate reparations.</p> <p>A reparative approach to climate centers marginalized and vulnerable communities to ensure their ability to adapt and thrive in a changing environment. Reparations could include wealth transfers or land-based reparations (returning land or compensating previous owners or communities with systemic barriers to ownership). Beyond climate-specific policies, alleviating disparities in health and wealth can make disadvantaged communities more resilient to climate hazards and increase the likelihood of effective adaptation.</p>			<ul style="list-style-type: none"> ● The Russell City Reparative Justice Project was created by the City of Hayward for its involvement in the forced relocation of Russell City community members in the 1960s. The project works with former Russell City residents, their descendants, and other community stakeholders to create and implement "appropriate restitution." The project is in its first phase (identifying resident descendants, establishing project team organization, and conducting background research), and shows promise for future reparations. 	<p>With respect to Bayshore adaptation, reparations that focus on investments in traditionally marginalized communities seem most applicable. While there are few examples of reparations tied to climate adaptation, reparation funds could be utilized to support infrastructure and SLR mitigation projects in the Bay's most vulnerable communities. However, support and funding for reparations is limited.</p>	<p>The Case for Climate Reparations in the US, Brookings Institute (2023). https://www.brookings.edu/articles/the-case-for-climate-reparations-in-the-united-states/</p> <p>Hayward's Russell City Reparative Justice Project. https://hayward-ca.gov/russell-city-reparative-justice-project</p>	

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