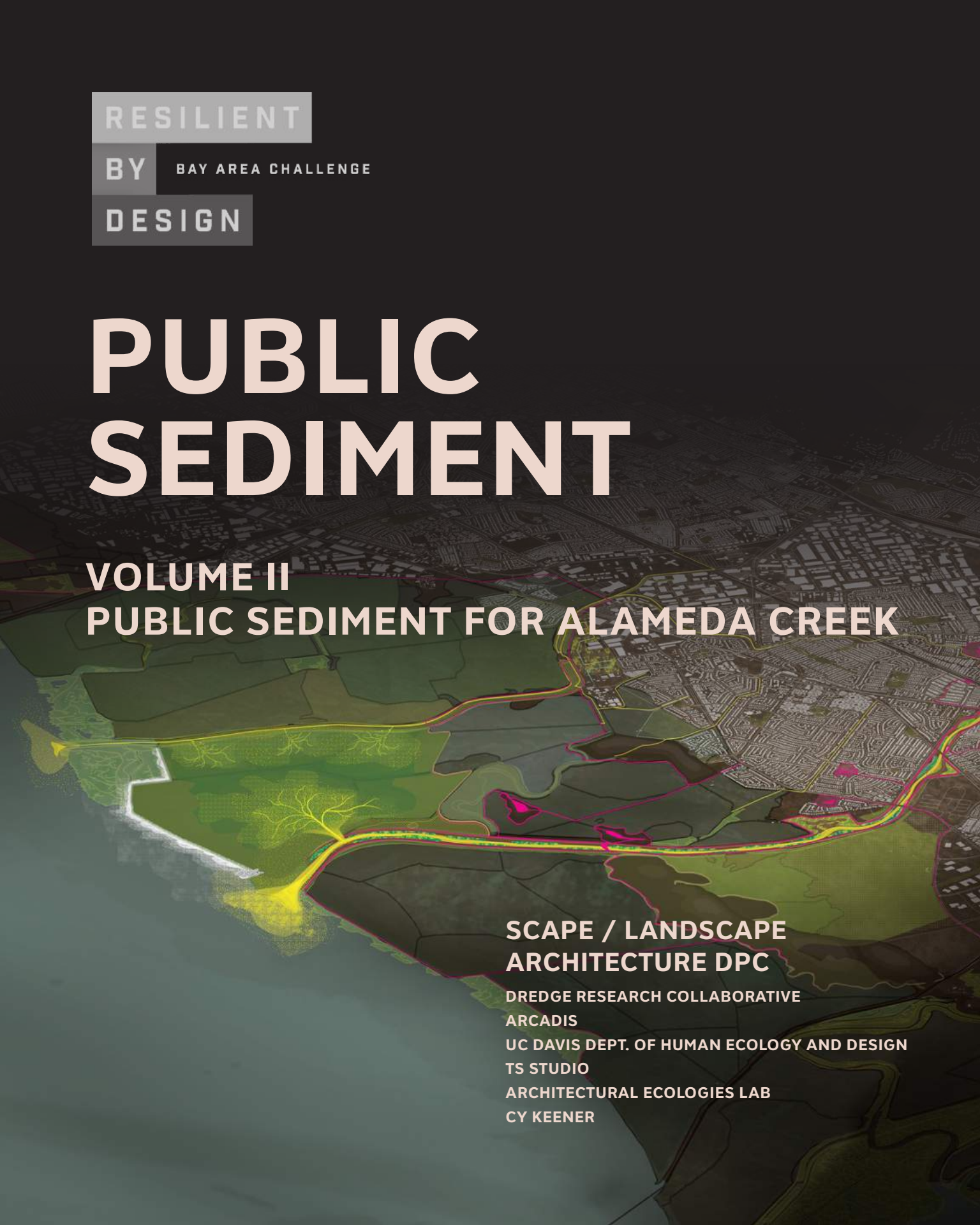
RESILIENT BY DESIGN

BAY AREA CHALLENGE

PUBLIC SEDIMENT

VOLUME II
PUBLIC SEDIMENT FOR ALAMEDA CREEK



SCAPE / LANDSCAPE ARCHITECTURE DPC

DREDGE RESEARCH COLLABORATIVE

ARCADIS

UC DAVIS DEPT. OF HUMAN ECOLOGY AND DESIGN

TS STUDIO

ARCHITECTURAL ECOLOGIES LAB

CY KEENER

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CY KEENER

THIS REPORT HAS BEEN CREATED FOR THE **RESILIENT BY DESIGN BAY AREA CHALLENGE,** A COLLABORATIVE RESEARCH AND DESIGN PROJECT TO DEVELOP INNOVATIVE SOLUTIONS TO THE ISSUES BROUGHT ON BY CLIMATE CHANGE.

PROJECT TEAM

TEAM LEAD
SCAPE / LANDSCAPE ARCHITECTURE

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DREDGE RESEARCH COLLABORATIVE

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ARCADIS

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MONITORING
CY KEENER + JUSTINE HOLZMAN

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The PUBLIC SEDIMENT team believes that the San Francisco Baylands are adaptive, living infrastructure. We propose to DESIGN WITH MUD, to reconnect sediment flows and feed the bay with this valuable material. We aim to MAKE SEDIMENT PUBLIC, to link vulnerable communities to the Bay and spur the long-term stewardship of our public sediment resources.

TABLE OF CONTENTS

Public Sediment for Alameda Creek is a collective work by the Public Sediment team and many partners. The proposal has been created for the Resilient by Design Bay Area Challenge, a collaborative research and community based design project to strengthen the region's resilience to sea level rise and climate change.

The Public Sediment team is led by SCAPE Landscape Architecture, with Arcadis, the Dredge Research Collaborative, UC Davis Department of Human Ecology and Design, Architectural Ecologies Lab, TS Studio, and Cy Keener.

Public Sediment for Alameda Creek stitches together ongoing work into a systemic proposal for delivering sediment to the Baylands. Special thanks to the **Alameda County Flood Control and Water Conservation District** for sharing the landmass concept, the low-flow channel design, and the Don Castro strategy with our team. Thank you to the **South Bay Salt Pond Restoration Project**, **East Bay Regional Park District, State Coastal Conservancy,** and the **Alameda Creek Alliance** for support, ideas, and feedback. Thank you to the **San Francisco Estuary Institute** for science advising, and to the residents and students of many **schools, senior centers, and hospitals** in the watershed that contributed memories, design ideas, and creek impressions to this project. Thank you to collaborators and participants in the Public Sediment working group meetings, which involved over 40 stakeholders in the development of this research and proposal including, but not limited to, the following participants.

A special thank you to the participants of Dredgefest California as they were critical in shaping the direction of the Public Sediment team. A full list of names can be found here:
www.dredgeresearchcollaborative.org

Alameda County Board of Supervisors District 1,2,3
Alameda County Flood Control and Water Conservation District
Alameda County Public Works
Alameda County Resource Conservation District
Alameda County Water District
Alameda Creek Alliance
American High School
Bay Conservation and Development Commission
Cal Trout/Fisheries Work Group/Trout Unlimited
California Fish and Wildlife Service
California State Coastal Conservancy
California State Water Resource Control Board
Cargill
City of Fremont
City of Hayward
City of Livermore
City of Newark
City of Union City
Community Residents
East Bay Regional Park District
FUSE
Kennedy High School
LEAF Community Group
Meritt College
Niles Essanay Silent Film Museum
NOAA/ National Marine Fisheries Service
Peter Baye
Ruggeri Senior Center
SAGE
San Francisco Estuary Institute
San Francisco Public Utility Commission
Sierra Club
South Bay Salt Pond Restoration Project
Sunol AgPark
Teen Center
The San Francisco Bay Trail
Tri City Ecology
Union Sanitary District
US Fish and Wildlife Service
Washington Hospital
Zone 7 Water Agency

PUBLIC SEDIMENT FOR ALAMEDA CREEK

Tidal ecosystems are protective infrastructure that cushion the urban edges of the San Francisco Bay. Yet the Bay Area's tidal ecosystems—its marshes and mudflats—are at risk. These systems require sediment to vertically grow in response to sea level rise – without sediment, our baylands will drown. This represents a slow but devastating scale of loss that threatens ecosystems, recreational landscapes, and places hundreds of thousands of residents and the region's critical drinking water, energy, and transportation systems at risk. To creatively adapt to this challenge, our team has focused on sediment, the building block of resilience in the Bay.

Our team proposes to treat sediment as a public resource, and to **DESIGN WITH MUD**. We propose to connect the uplands and the lowlands – to harvest, retrofit, and remove dams, to unlock tributary channels, and to test new methods of mud placement in the Bay. We must also **MAKE SEDIMENT PUBLIC**, reconfiguring landscape resources to better meet the needs of people and engage them in the long-term stewardship of our public sediment resources.

PUBLIC SEDIMENT FOR ALAMEDA CREEK is a proposal to address the challenge of sediment scarcity along the vulnerable urban edges of Fremont, Union City, and Newark. Alameda Creek is the largest local tributary that feeds the bay. Our work here aims to redesign this waterbody from the uplands to the lowlands, to create functional systems for sediment, people and fish. Our proposal spans four geographies (uplands, creek, baylands, and bay) and results in three proposals:

UNLOCK ALAMEDA CREEK is an implementable project that links the Creek with the Baylands. It provides a sustainable supply of sediment to baylands for sea level rise adaptation, reconnects migratory fish with their historic spawning grounds, and introduces a network of community spaces that reclaim the creek as a place for people, building an ethos and awareness around our public sediment resources.

RETHINK THE SEDIMENTSHED is a long-term, multi-agency collaborative planning process for the sedimentshed of Alameda Creek that balances creek inputs with bayland needs over time. The work would develop strategies to rethink upland dam and reservoir infrastructure, to harvest sediment and move it downstream. It would quantify and monitor the sediment needs of the changing baylands and balance supply with demand over time.

PLAN AND PILOT FOR A FUTURE BAY is a design/science collaboration that develops a plan for the future of the San Francisco baylands with low sediment supply and sea level rise. It is time to translate the investments in science into clear alternatives that directly inform decision-making and policy at the scale of the Bay. This proposal would identify and implement short term pilots crucial for future adaptation.

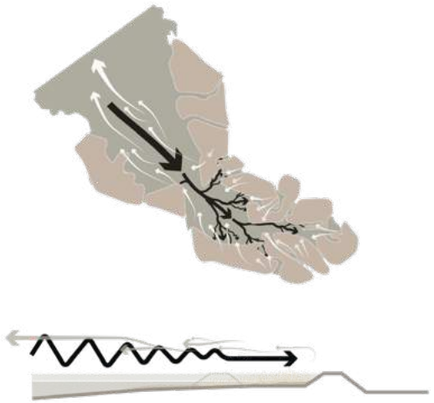
PUBLIC SEDIMENT FOR ALAMEDA CREEK represents a paradigm shift in how we plan for climate change. Rather than hardening the edge and ignoring the long-term consequences, we must recalibrate our relationship with sediment and water resources to invest now in living systems that can adapt to climate change. PUBLIC SEDIMENT must be scaled up – to other tributaries around the Bay, to the Delta, and to the larger Rivers of California. Our current risks are invisible yet increase dramatically over time – it is urgent to act now to revive our ecosystems and sustain our living bayland infrastructure for the future.

PHASE I
SEDIMENT RESEARCH
THE BUILDING BLOCK OF RESILIENCE

THE BAYLANDS ARE LIVING INFRASTRUCTURE

The San Francisco Bay supports a mosaic of estuarine ecosystems. Tidal marshes and mudflats ring the Bay, buffering vulnerable edges and levees from wave action and tidal energy. Constructed ponds and diked agricultural areas are built in former marshlands, and provide unique habitats and economies. Combined, this mosaic of ecosystems known as the Baylands filter the region's water, sequester carbon, reduce coastal erosion, dissipate tidal energy, create recreational space for people, and provide critical habitat for threatened and endangered species.

Our team believes the Baylands are protective infrastructure. Yet the Bay Area's ecological infrastructure—its marshes, mudflats, and coastal edges—are at risk of being outpaced by sea level rise. The slow and methodical drowning of the tidal baylands places hundreds of thousands of residents and the region's critical drinking water, energy, and transportation systems at risk. To creatively adapt to this challenge, our team has focused on sediment, the building block of resilience in the Bay. In short, we propose to design with mud.



BAYLAND ECOSYSTEMS DISSIPATE TIDAL ENERGY AND CUSHION THE SHORELINE

SEDIMENT BUILDS BAYLANDS

Sediment scarcity is a regional problem that could derail current marsh restoration efforts and exacerbate the risks of sea level rise. Historically, the Sacramento and San Joaquin Rivers provided the majority of the Bay's sediment, building historic marshlands and mudflats. During the Gold Rush, hydraulic mining power-washed hillsides and flushed huge volumes of sediment into these rivers. This surplus helped build some of the marshes and mudflats we know today. Today, dams trap sediment far upstream of the bay, leading to sediment scarcity at a time when it is needed most. Without sediment inputs, habitats will transform, and the Bay will flood more intensely.

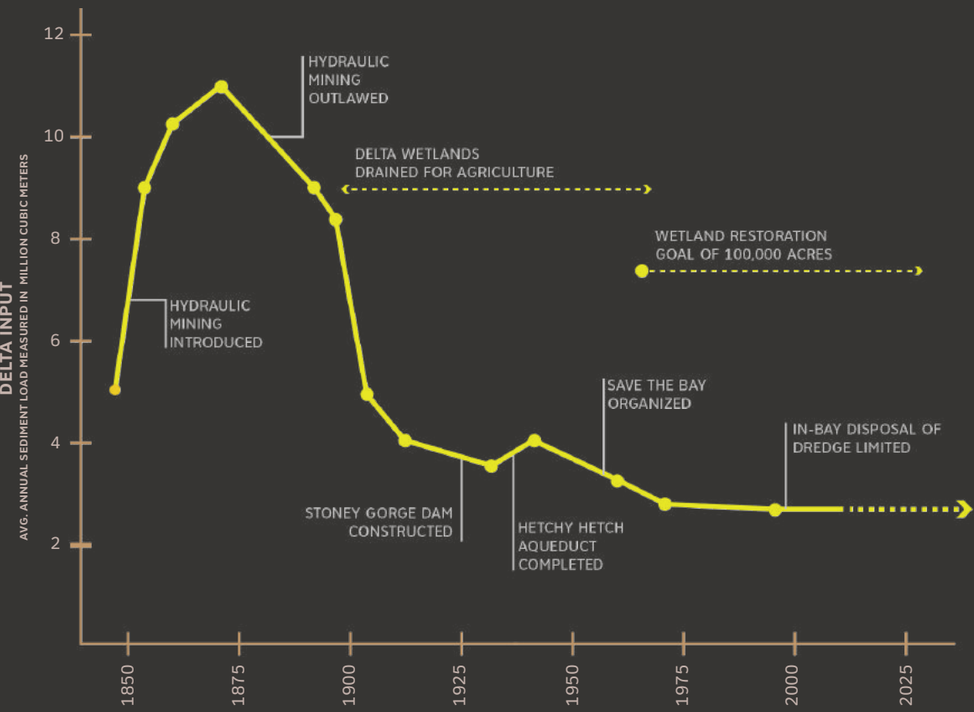
HISTORIC SEDIMENT FLOWS THROUGH TRIBUTARIES

HYDRAULIC MINING INCREASED FLOWS

TODAY DAMS TRAP SEDIMENT UPSTREAM

SOURCES:
Milligan, B. et. al. Dredgefest California: Key Findings and Recommendations, 2016.

SEDIMENT FLOWS OVER TIME



HISTORIC CONDITION
DELTA INPUT
86%

LOCAL TRIBUTARY INPUT
14%

HYDRAULIC MINING
DELTA INPUT
86%

LOCAL TRIBUTARY INPUT
14%

PRESENT DAY CONDITION
DELTA INPUT
38%

LOCAL TRIBUTARY INPUT
62%

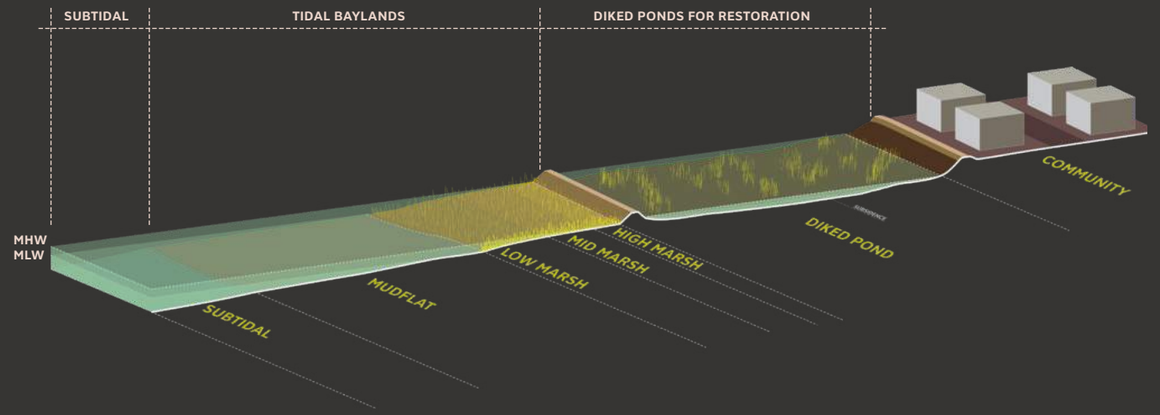
SEDIMENT IS THE BUILDING BLOCK OF RESILIENCE

BAYLAND ECOSYSTEMS. The San Francisco Bay supports a mosaic of estuarine ecosystems. Tidal marshes and mudflats ring the Bay, buffering vulnerable edges and levees from wave action and tidal action. Constructed ponds and diked agricultural areas are built in former marshlands, and subside over time as their soils are exposed to the air. To slow subsidence and restore habitat, there is significant effort underway to restore diked ponds to tidal baylands, often requiring large volumes of sediment to lift them up to marsh plain elevation.

MARSH DECLINE. Marshes are living infrastructure, capable of adapting to slow rates of sea level rise. Marshes can accrete up to 6mm of sediment a year to keep pace with rising seas, however faster sea level rise and low sediment supply create conditions where marshes cannot keep up. Many marshes are projected to convert to mudflats over time, reducing the protective benefits of the Bayland buffer. Bayland drowning presents an entirely new need for additional mud – to enable marshes and mudflats to keep pace with the rising water level.

BAYLAND DROWING. With more aggressive rates of sea level rise and a low sediment supply, it is projected that marshes and mudflats will convert to subtidal baylands, triggering habitat shifts, increased flood intensity, and tidal amplification. While today this change is slow and imperceptible, it presents serious risks to humans and ecosystems over time.

BAYLAND ECOSYSTEMS

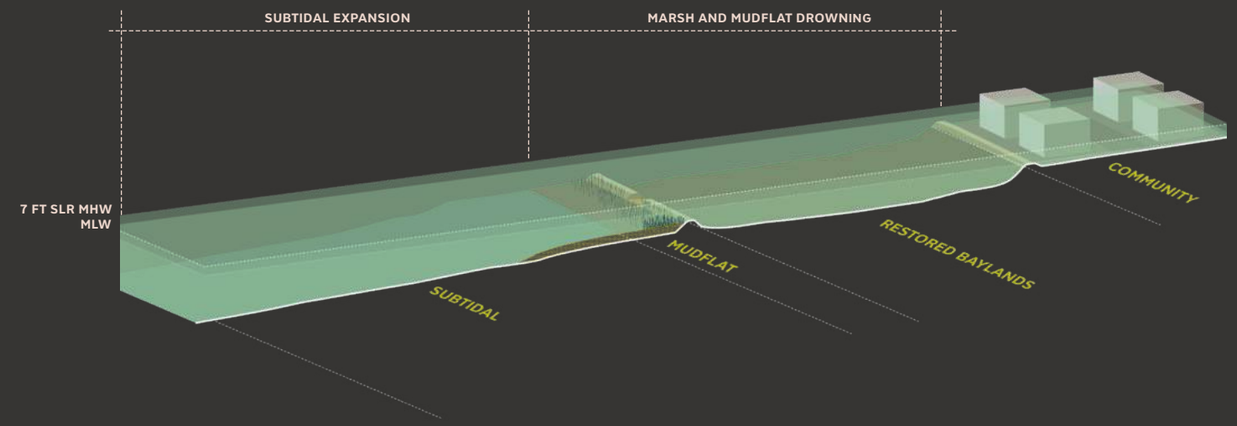


TIDAL MARSH

MARSH DECLINE

MUDFLAT

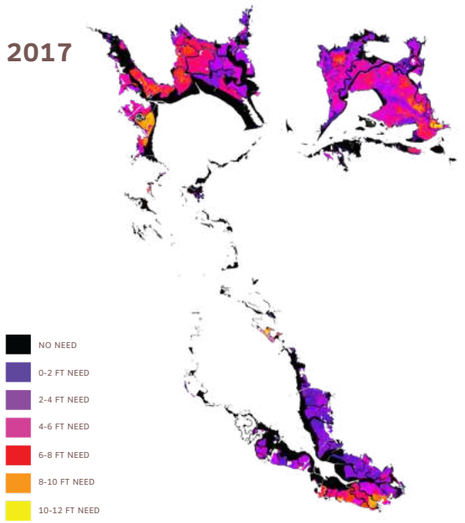
BAYLAND DROWNING



SUBTIDAL

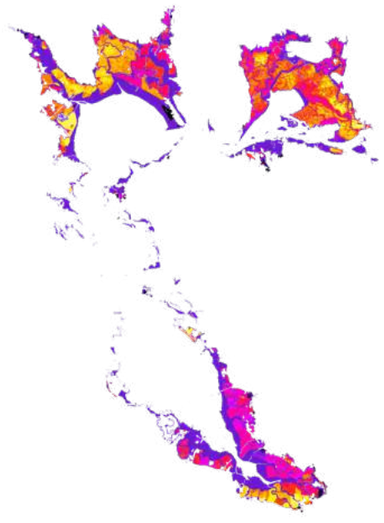
THERE IS NOT ENOUGH MUD

2017



TIDAL AND DIKED BAYLAND SEDIMENT NEEDS TODAY: Public Sediment GIS spatial mapping show the range of sediment needs today, highlighting potential needs of subsided diked baylands.

2100

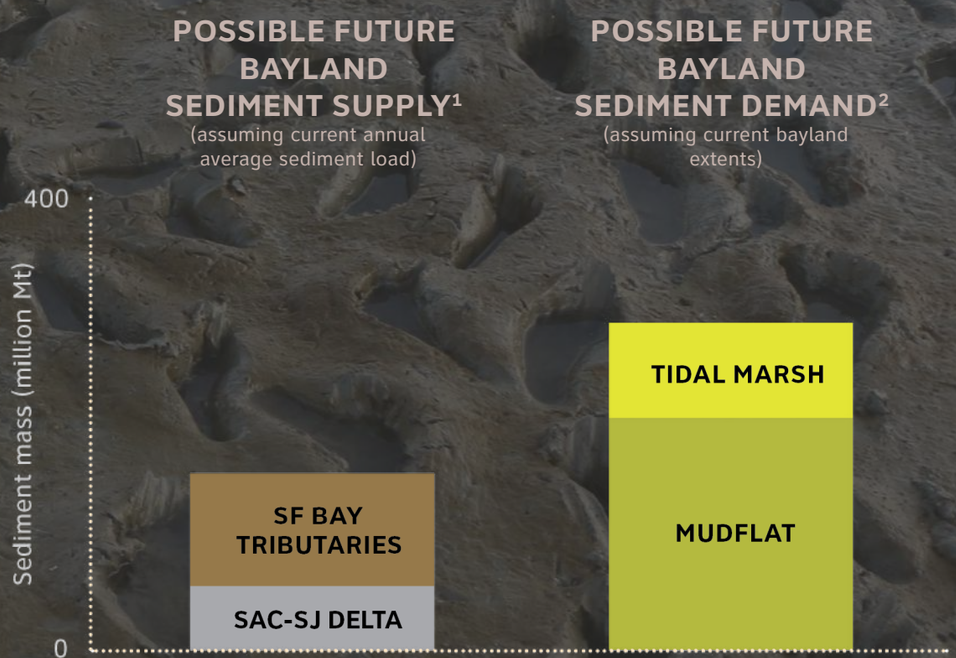


TIDAL AND DIKED BAYLAND NEEDS 2100 WITH 3FT SLR: With increase sea levels, tidal baylands show up to two feet of need after the factoring in an accretion rate of 6 mm/year.

If this era of sediment scarcity continues, projections show significant discrepancies between the sediment needed to sustain today's tidal baylands, and the amount arriving into the system. This scarcity threatens to derail current marsh restoration efforts and exacerbate the risks of sea level rise.
The bar graphs at right represent preliminary findings on sediment supply and demand developed by the San Francisco Estuary Institute. These needs are calculated based on the estimated needs of today's tidal baylands- marshes and mudflats. Newly restored tidal wetlands will also require more sediment to keep up with higher rates of sea level rise, exacerbating this problem. Even with additional sources of sediment coming into the system the need of tidal baylands greatly exceed the supply.

There are many ways to map sediment, but there are very few maps that spatialize the sediment need of the Bay Area. With the most up to date 1 m LiDAR topography, the Public Sediment team developed the elevational analysis maps above to represent sediment needs for all baylands to be brought up to a mid-marsh plane elevation. Maps were produced for today's condition as well as a 3ft SLR scenario by 2100 and assumes that all diked baylands are opened up to tidal action.

PROJECTED SEDIMENT NEEDS AND SOURCES
3.5 FT OF SLR BY 2100



[1]Sediment supply was estimated by multiplying the current average annual sediment load values from McKee et al. (in prep) by the number of years between 2017 and 2100.

[2]Sediment demand was estimated using a mudflat soil bulk density of 1.5 g sediment/cm³ soil (Brew and Williams 2010), a tidal marsh soil bulk density of 0.4 g sediment/cm³ soil (Callaway et al. 2010), and baywide mudflat and marsh area circa 2009 (BAARI v1).

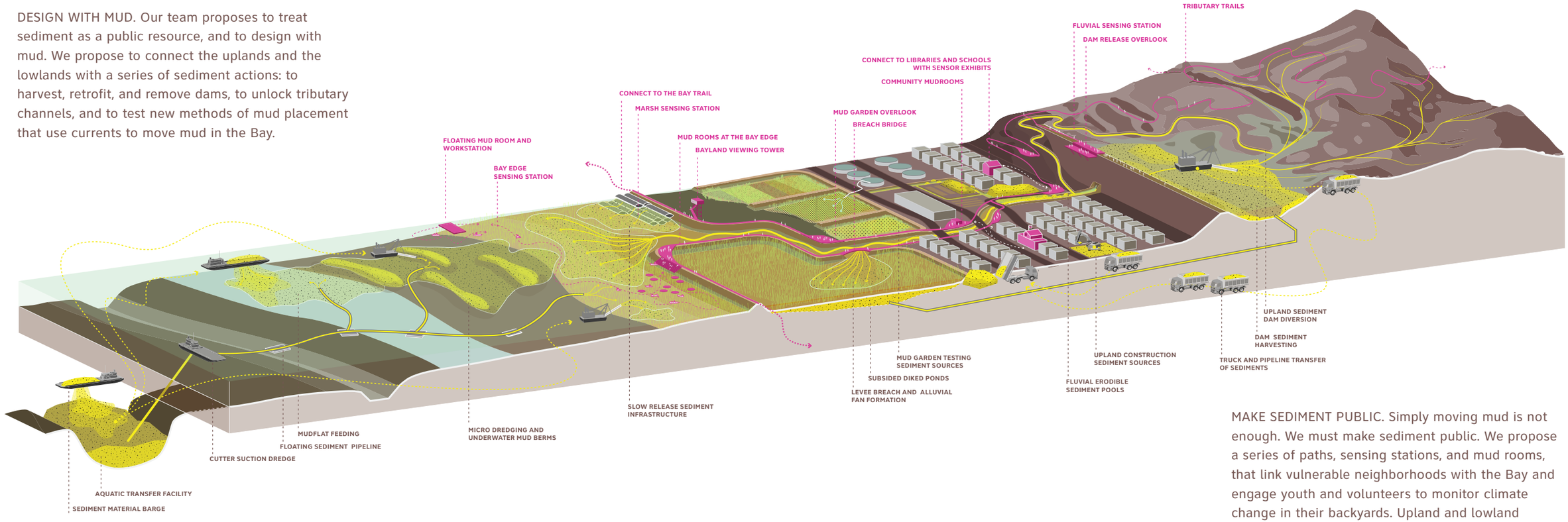
NOTES:
Based on preliminary analysis by SFEI. A more detailed analysis is being conducted as apart of the Healthy Watersheds Resilient Baylands project (hwrb.sfei.org)

SOURCES:
Dusterhoff, S. et. al. Sediment Savvy, Developing a Sediment Strategy for Bayland Resilience, 2017.

DESIGN GOALS: PUBLIC SEDIMENT

We must act now for the future, and design new ways to manage mud and prepare to scale our efforts up in response to sea level rise. We must bend the curve by supplying new sediment to the system more deliberately and intelligently—this requires spending it wisely by developing an ethos and awareness around mud. This is PUBLIC SEDIMENT.

DESIGN WITH MUD. Our team proposes to treat sediment as a public resource, and to design with mud. We propose to connect the uplands and the lowlands with a series of sediment actions: to harvest, retrofit, and remove dams, to unlock tributary channels, and to test new methods of mud placement that use currents to move mud in the Bay.

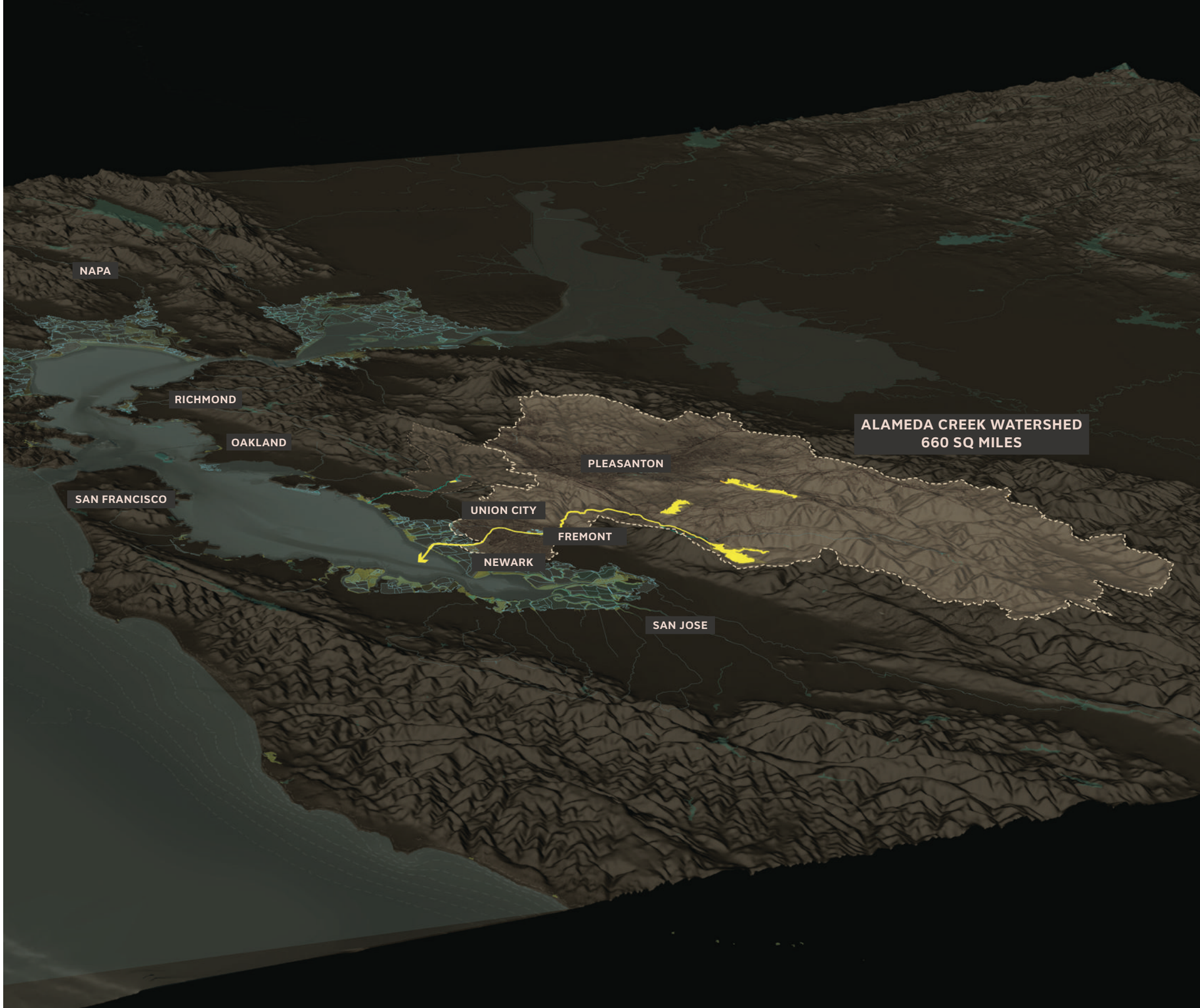


MAKE SEDIMENT PUBLIC. Simply moving mud is not enough. We must make sediment public. We propose a series of paths, sensing stations, and mud rooms, that link vulnerable neighborhoods with the Bay and engage youth and volunteers to monitor climate change in their backyards. Upland and lowland communities will be connected by the flows of sediment, and connective pathways along the water bodies. Community sensing stations and mud rooms will reveal the region's slow and invisible threats, spurring the long-term stewardship of our public sediment resources.

PUBLIC SEDIMENT
FOR ALAMEDA CREEK
DESIGN REPORT

SITE: ALAMEDA CREEK WATERSHED

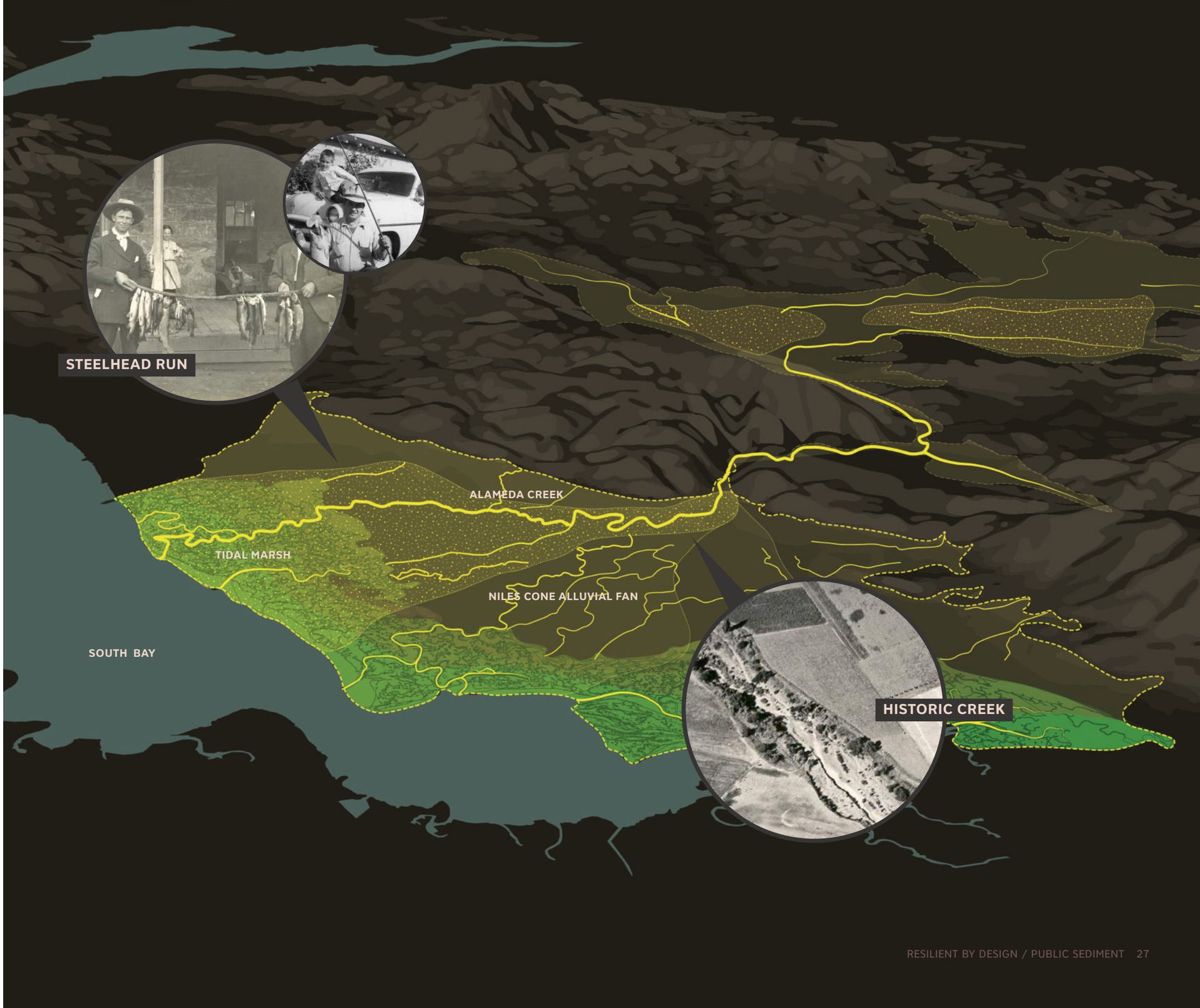
Alameda Creek has the largest watershed that feeds the Bay and it contributes more sediment to the South Bay than any other tributary. Our team proposes **PUBLIC SEDIMENT FOR ALAMEDA CREEK** because its potential is far from realized—the flood control channel was only designed for the flow of water, not for people, sediment, or fish. The communities of Fremont, Union City, and Newark are vulnerable to sea level rise. These risks can be addressed by unlocking the creek to sustain the bayland ecosystems that cushion shorelines from sea level rise, bringing the creek back into the public realm, and improve ecosystem health for human and non-human species.



ALAMEDA CREEK HISTORICAL ECOLOGY

The Creek was Once an Alluvial Fan

Alameda Creek was once a meandering waterbody that spread sediment-rich floodwater across a broad floodplain. Over centuries, this process built an alluvial fan known as the Niles Cone, which fed large scale tidal wetlands and coarse grain beaches at the Bay's edge. The free-flowing creek generated significant habitat for a range of floodplain-dependent species and later supported a robust agricultural economy at its banks.



ALAMEDA CREEK URBANIZATION

The Creek was Locked in Place

After repeat flooding in the mid-1900s, the creek was channelized for flood protection, enabling large scale suburbanization of the dried alluvial fan. While this supported the development of Fremont, Union City, and Newark, the creek itself was sterilized, and lost its role as a connective space for people, as a migration corridor for fish, and as a transport mechanism for sediment. The creek became a barrier to cross with no room for engagement.

DIVERSE COMMUNITIES

ALAMEDA CREEK
FLOOD CONTROL CHANNEL

LIVERMORE

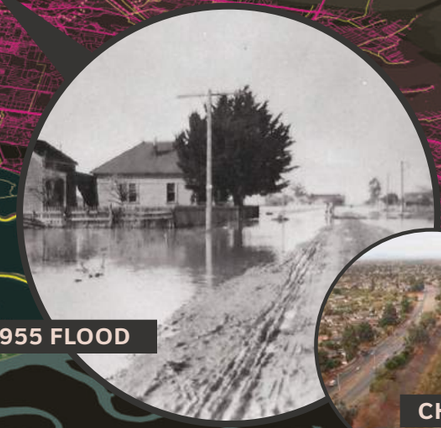
UNION CITY

NILES

FREMONT

NEWARK

SOUTH BAY



1955 FLOOD

CHANNEL CONSTRUCTION

ALAMEDA CREEK VULNERABILITY

The Region is Highly Vulnerable

Today's conditions are unsustainable and vulnerable. Sediment is trapped in the channel, reducing flood capacity and creating the need for expensive dredging. Sediment flows do not reach the baylands, leading to extreme rates of subsidence along the shoreline and accelerating tidal marsh loss. Communities and the critical infrastructure that supports them – wastewater treatment plants, highways, and parks – are at risk. Without a bayland cushion, these sites face increased inundation and extreme tides as sea levels rise.

We propose to **UNLOCK ALAMEDA CREEK,** by reconnecting the Creek with the Bay to adapt to sea level rise and to meet the everyday needs of sediment, people, and fish.

4 GEOGRAPHIES, 3 PROPOSALS

PLAN AND PILOT FOR A FUTURE BAY is a design/science collaboration that develops a plan for the future of the San Francisco baylands with low sediment supply and sea level rise. It is time to translate the investments in science into clear alternatives that directly inform decision-making and policy at the scale of the Bay. This proposal would identify and implement short term pilots crucial for future adaptation.

UNLOCK ALAMEDA CREEK is an implementable project that links the Creek with the Baylands. It provides a sustainable supply of sediment to baylands for sea level rise adaptation, reconnects migratory fish with their historic spawning grounds, and introduces a network of community spaces that reclaim the creek as a place for people, building an ethos and awareness around our public sediment resources.

RETHINK THE SEDIMENTSHED is a long-term, multi-agency collaborative planning process for the sedimentshed of Alameda Creek that balances creek inputs with bayland needs over time. The work would develop strategies to rethink upland dam and reservoir infrastructure, to harvest sediment and move it downstream. It would quantify and monitor the sediment needs of the changing baylands and balance supply with demand over time.

PLAN + PILOT FOR A FUTURE BAY

UNLOCK ALAMEDA CREEK

RETHINK THE SEDIMENTSHED

#1
THE UPLANDS
RETHINK THE SEDIMENTSHED

THE ALAMEDA CREEK SEDIMENTSHED

Alameda Creek is fed by a 633 square mile watershed, an area almost as large as the Bay itself. While it contributes the largest volume of sediment to the South Bay of any local tributary, a large portion of the Alameda Creek Sedimentshed is impounded- limiting sediment flows and trapping sediment upstream. Recent development in the upper watershed has led to sedimentation in areas where it is damaging for local ecosystems. Water management infrastructure, like channels, dams, and recharge ponds, decouple the flows of water with the flows of sediment, preventing movement downhill. Mining removes sediment from the system, exporting it to construction sites and yards for resale.

While our proposal **UNLOCK ALAMEDA CREEK** addresses some of the infrastructural barriers in the lower creek, the upland sedimentshed cannot be ignored. Dams cannot be removed overnight – reservoirs provide critical drinking water for residents of Alameda County and the city of San Francisco. Recharge ponds replenish the local aquifer and protect the water supply from saline intrusion from sea level rise. **Our team proposes a SEDIMENTSHED VISION PLAN, a long-term scientific study and multi-agency plan for the Alameda Creek sedimentshed.**

KEY TRIBUTARIES CONTRIBUTING SEDIMENT TO SAN FRANCISCO BAY

SOURCES:
Dusterhoff, S. et. al. Changing Channels: Regional Information for Developing Multi-Benefit Flood Control Channels at the Bay Interface, 2016.

Bigelow, P. et. al. A Sediment Budget for Two Reaches of Alameda Creek, 2008.

SEDIMENTSHED VISION PLAN

This process would involve a long-term monitoring strategy, establish a sediment budget for Alameda Creek, and develop a vision for balancing the sediment needs of the Bay marshes and mudflats with upland sources of sediment over time. It would quantify sediment accretion rates and bayland adaptation needs, determining where living infrastructure along Niles Cone is most viable as sea levels rise and where it can benefit vulnerable communities the most. The collaboration would engage dam operators, water managers, regional watershed policy makers, and flood control districts to balance lowland needs with upland concerns. It would assess the potential to retrofit and operate dams for sediment transport, harvest sediment from upland reservoirs, and import and reuse sediment currently treated as a waste product.

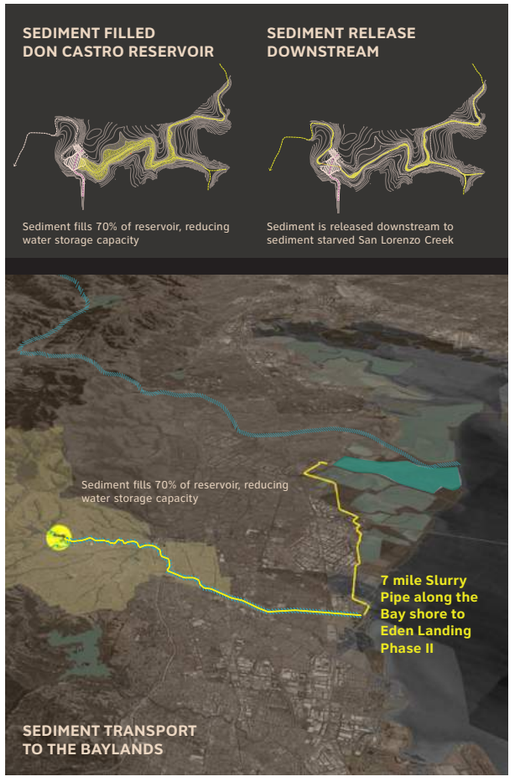
DON CASTRO RESERVOIR IS AN EXAMPLE

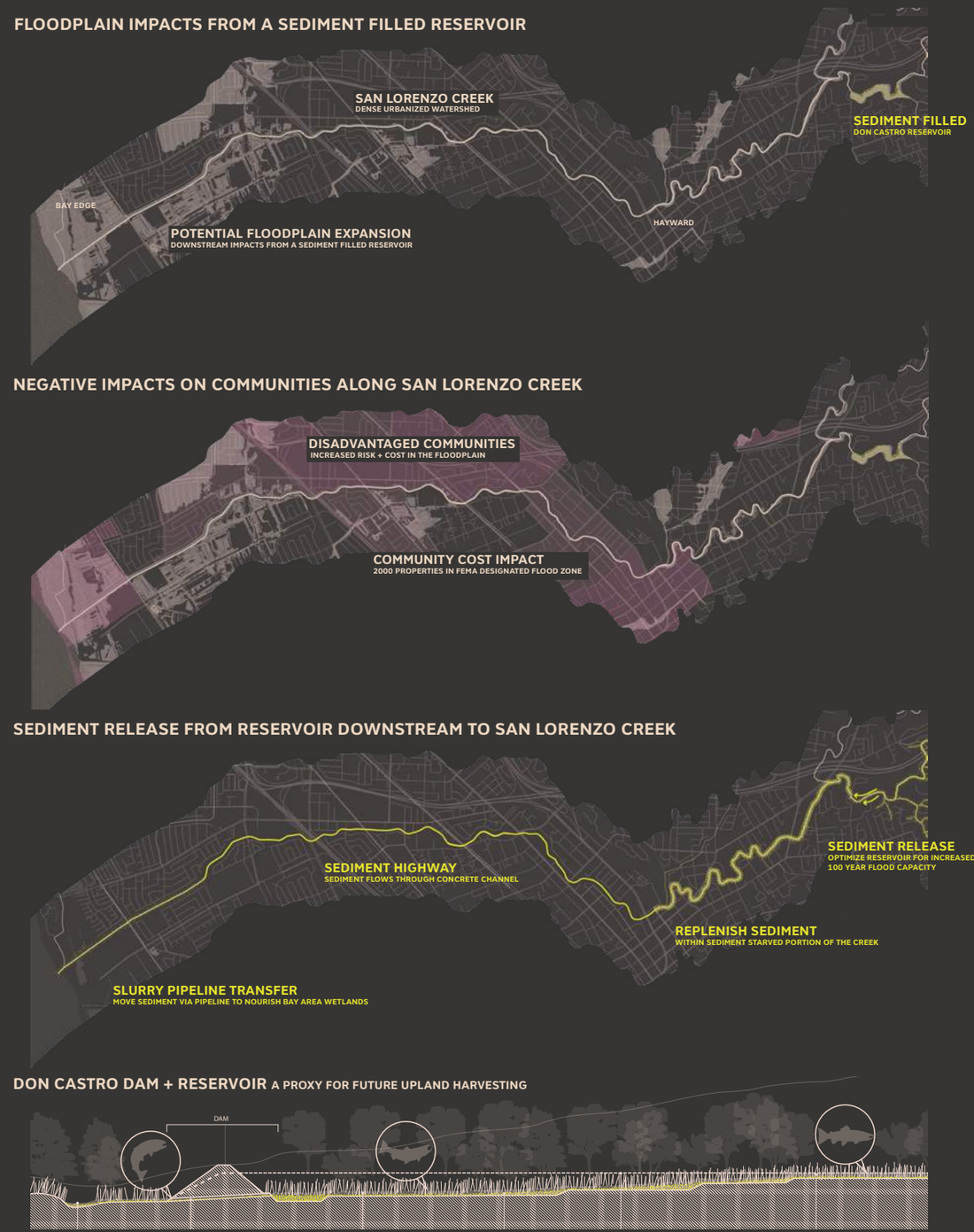
We can also act now – while Alameda Creek's upland infrastructure requires longer-term planning, an adjacent watershed offers an example for the future. **Don Castro Reservoir is filled with sediment, creating significant flood risk downstream**. Harvesting sediment from behind the dam can remove homes from the floodplain and create new opportunities for creek restoration behind the flood control structure. Fed through portions of the channel and piped along existing right of ways, the sediment of Don Castro can be used to regenerate bayland marshes and mudflats. This is a near-term example of new thinking that can be applied to the larger scale of the future Alameda Creek sedimentshed.

Don Castro Dam and Reservoir was built in 1964 for recreational and flood protection purposes. Located of the reservoir, the floodplain downstream has slowly been increasing. Approximately 2,000 properties have been adversely impacted, many of which are located in disadvantaged communities.

Alameda County Flood Control District (ACFCD) is currently exploring methods for sediment removal while restoring the reservoir to its capacity- limiting the negative impacts and cost of increased flooding downstream. By advancing these concepts, we look to explore methods of sediment removal and reuse for wetland nourishment at the Bay's edge.

An optimized opening within the dam will establish 100-year flood capacity while establishing natural hydrological flows throughout the season for sediment and fish passage. Sediment flows would be restored downstream of the reservoir, replenishing the sediment starved creek reaches and quickly flowing through the concrete lined channel of the creek. The sediment will then be connected via slurry pipeline to feed and nourish Eden Landing Phase II wetlands. Over time, a sustainable supply of sediment will continue to move through San Lorenzo Creek and Don Castro reservoir allowing the baylands to grow and adapt with climate change.





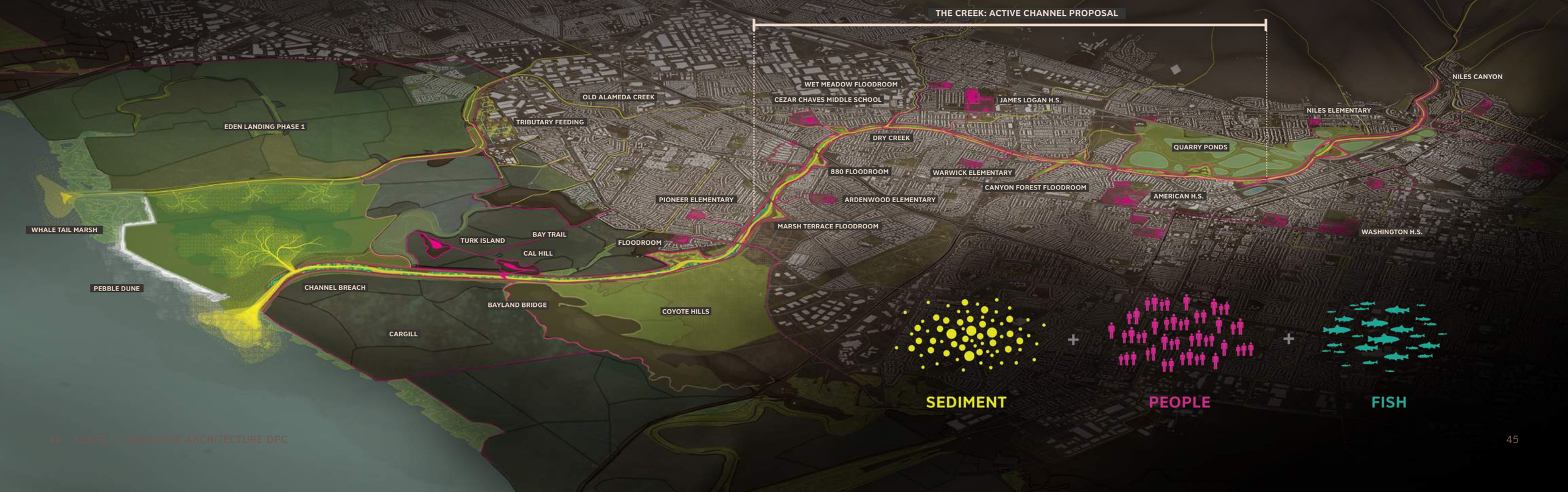
#2
THE CHANNEL
UNLOCK ALAMEDA CREEK

UNLOCK ALAMEDA CREEK: THE FLOOD CONTROL CHANNEL

UNLOCK ALAMEDA CREEK is an implementable project that links the Creek and the Bay. It provides a sustainable supply of sediment to the bayands for sea level rise adaptation, reconnects steelhead with their historic spawning grounds, and introduces a network of community spaces that physically connect to the Creek and Bay.

Today, Alameda Creek is the largest local tributary that feeds the Bay, but sediment remains stuck in the flood control channel, trapped behind dams, and is unable to make it to the Baylands where it is needed for marsh and mudflat accretion. Unlock Alameda Creek is a buildable project that redesigns the creek to enable sediment flows and reconnects it to the Baylands, balancing the needs of people, fish, and sediment in the watershed. The creek levees will be selectively breached near the mouth to feed bay marshes with sediment and manage flood risk at the bay edge. The flood control channel will be redesigned to move sediment, support vegetative diversity, and enable fish passage through critical migration seasons. Public access will be expanded along the 12-mile flood control channel that links Fremont, Union City, and Newark, enhancing recreation, environmental education opportunities, and regional connectivity.

Alameda Creek connects communities that are diverse in race, ethnicity, age, and income, linking them with each other and the bay. **For too long, Alameda Creek has been viewed solely as a flood control channel, and the Public Sediment Team has worked hard to establish a vision for Alameda Creek as living system that is socially inclusive, ecologically functional, and adaptive to future sea level rise and climate change.**

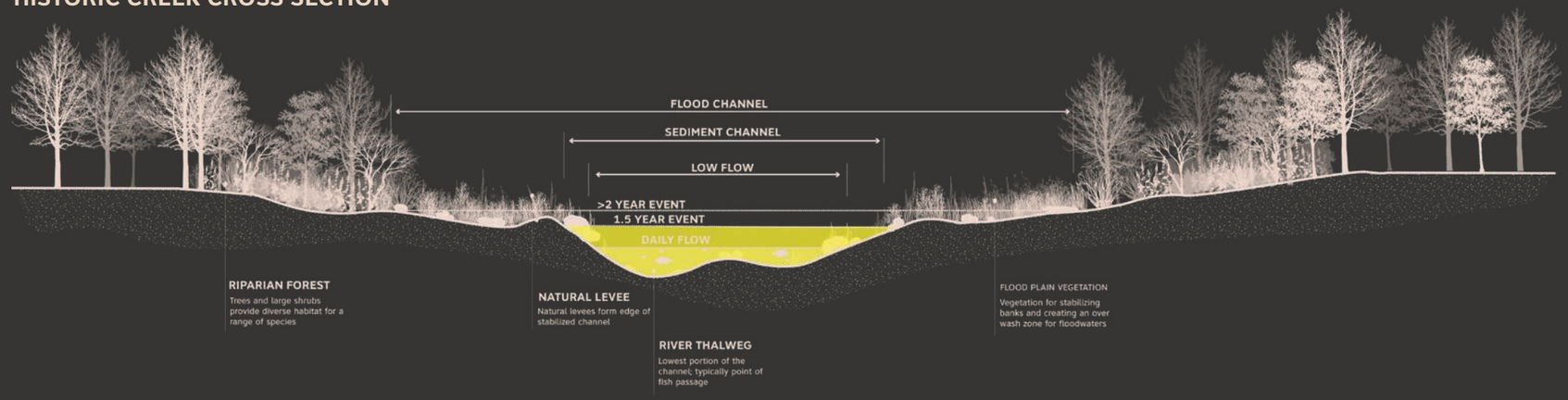


FROM CREEK TO CHANNEL

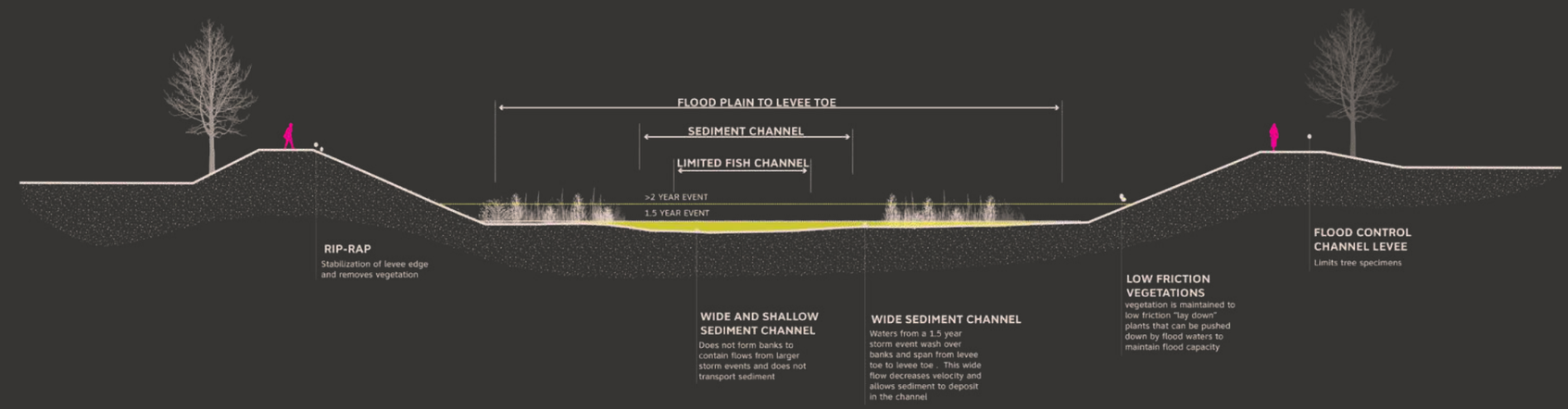
Alameda Creek was channelized in the 1970s by the US Army Corps of Engineers and serves an important role in protecting the neighborhoods of Fremont, Union City, and Newark from extreme floods. This effort dammed the creek, rerouted the channel, and sterilized this living system. The creek once fed the tidal baylands directly with sediment, was a respected resource that served the community, and hosted a migration corridor with refuge for fish and other species. UNLOCK ALAMEDA CREEK proposes to reintroduce these functions back to the creek. While the creek can never return to its past state, UNLOCK ALAMEDA CREEK is a template for addressing today's challenges while adapting to future climate change needs.

In order to understand how sediment moves—or doesn't move—through the creek today, the Public Sediment team synthesized and visualized studies by the Alameda County Flood Control District, San Francisco Estuary Institute, and others. This work was complemented by other on-site methods, using drone-based photogrammetry to construct three dimensional digital models and high-resolution imagery of the existing channel to observe and characterize patterns in vegetation establishment and sediment deposition. Several key themes emerged.

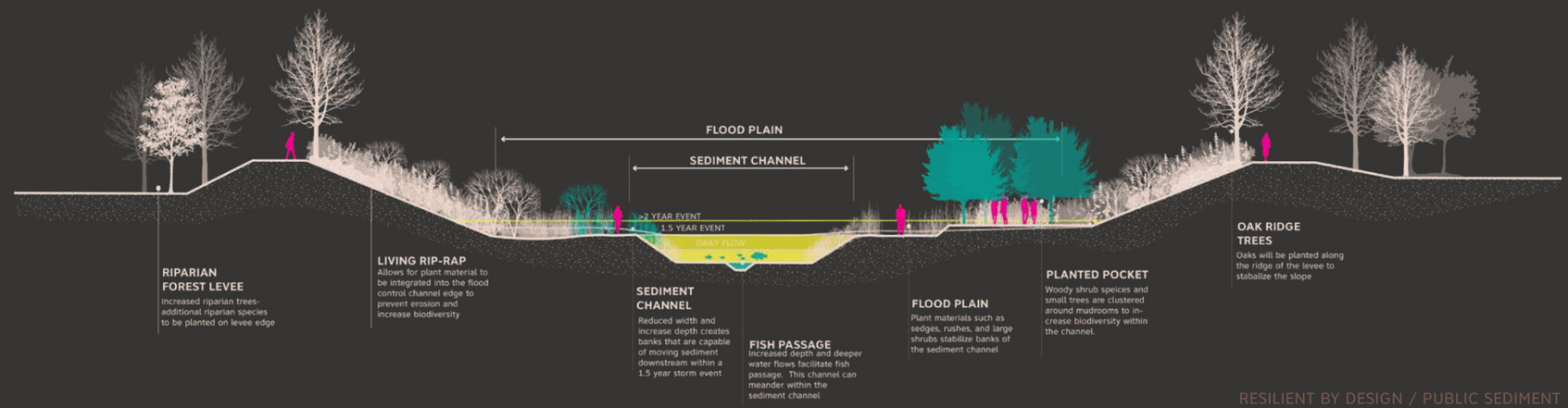
HISTORIC CREEK CROSS SECTION



CURRENT ALAMEDA CREEK FLOOD CONTROL CHANNEL



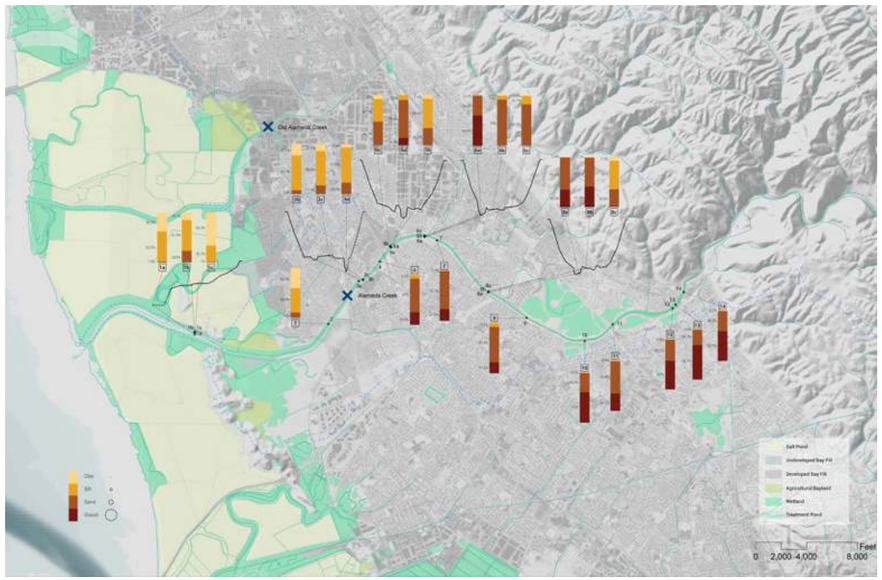
PROPOSED ALAMEDA CREEK ACTIVE CHANNEL



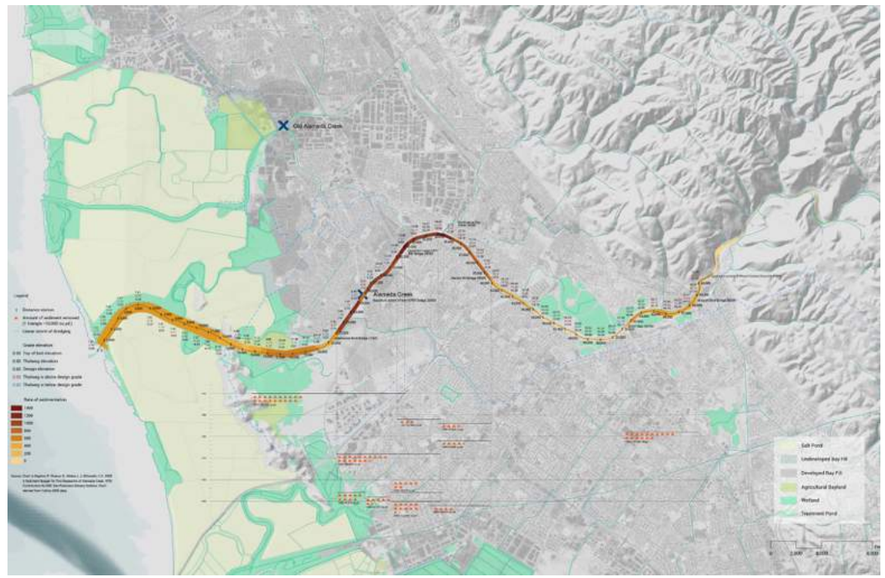
SEDIMENT IN THE SYSTEM

First, the channel is relatively efficient at conveying fines to head of tide, where tidal action carries it out into the Bay. This can be seen in how the majority of sediment that enters the channel at Niles Canyon is fines, but the majority that deposits before head of tide is cobble, gravel, and larger sands. **Ultimately, only about 40% of the sediment that enters the channel reaches the Bay**—the remainder is either trapped in the channel, where it reduces flood conveyance capacity, or desilted, an expensive maintenance activity. This remainder is an important resource that, if unlocked and encouraged to move downstream, could help build marshes at Eden Landing for decades to come.

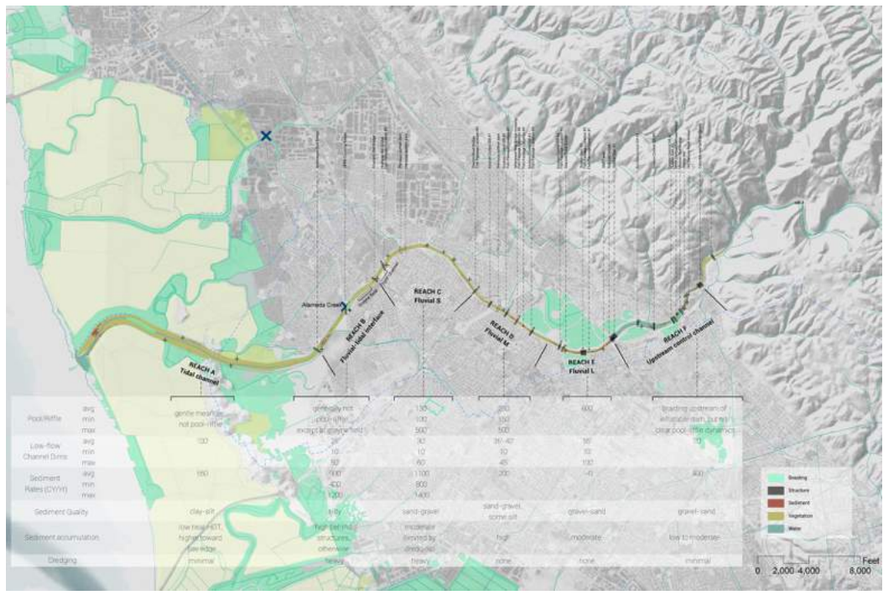
A second key theme is that structures in the channel significantly affect deposition patterns. Sills, bridge piers, rubber dams, and other structures reduce the capacity of the creek to form an effective sediment transport channel. The majority of these structures must stay in place, though, emphasizing that the design of an effective sediment transport channel will require active intervention—the creek cannot form this channel on its own.



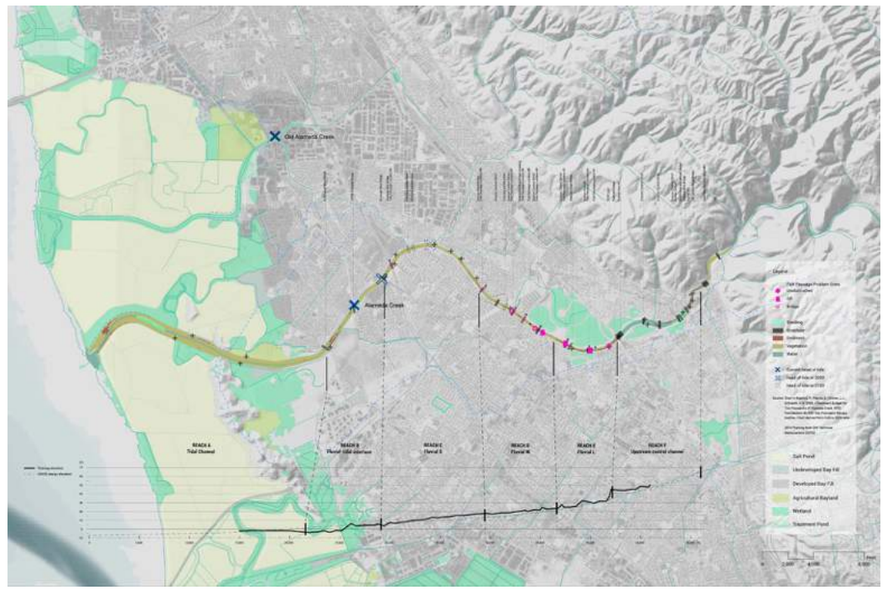
CHANNEL MORPHOLOGY STUDY



CHANNEL DREDGING STUDY



HEAD OF TIDE MIGRATION

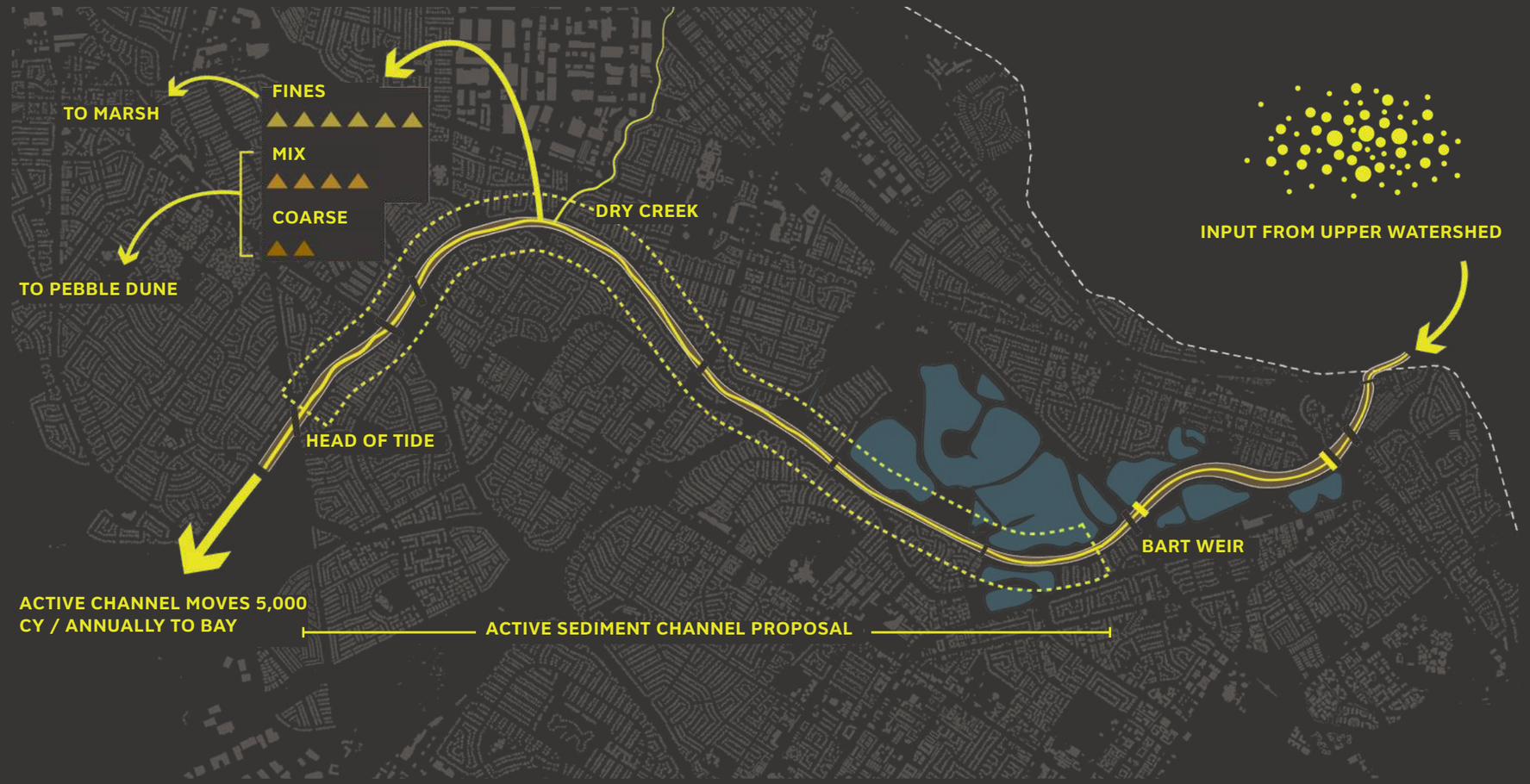


CHANNEL PROFILE

HOW TO MOVE SEDIMENT?

Today, coarse grain sediment builds up in the channel, reducing flood storage capacity and creating the continual need for dredging. Vegetation is removed to prevent friction that would impede floodwater flows and reduce channel capacity. Without stabilizing root systems, a deeper and narrower stream that moves sediment cannot form, and sediment is spread in thin sheets across the full width of the stream bed.

We propose to construct a bankfull sediment channel stabilized with diverse vegetation, to move more sediment downstream during regularly occurring floods. The active sediment channel is deeper and more consistently sloped than today's channel, simultaneously moving sediment and relieving flood capacity concerns. New sediment channel construction allows for the introduction of more diverse vegetation, called planted pockets, and moments of public access that safely bring the creek back into the public realm.



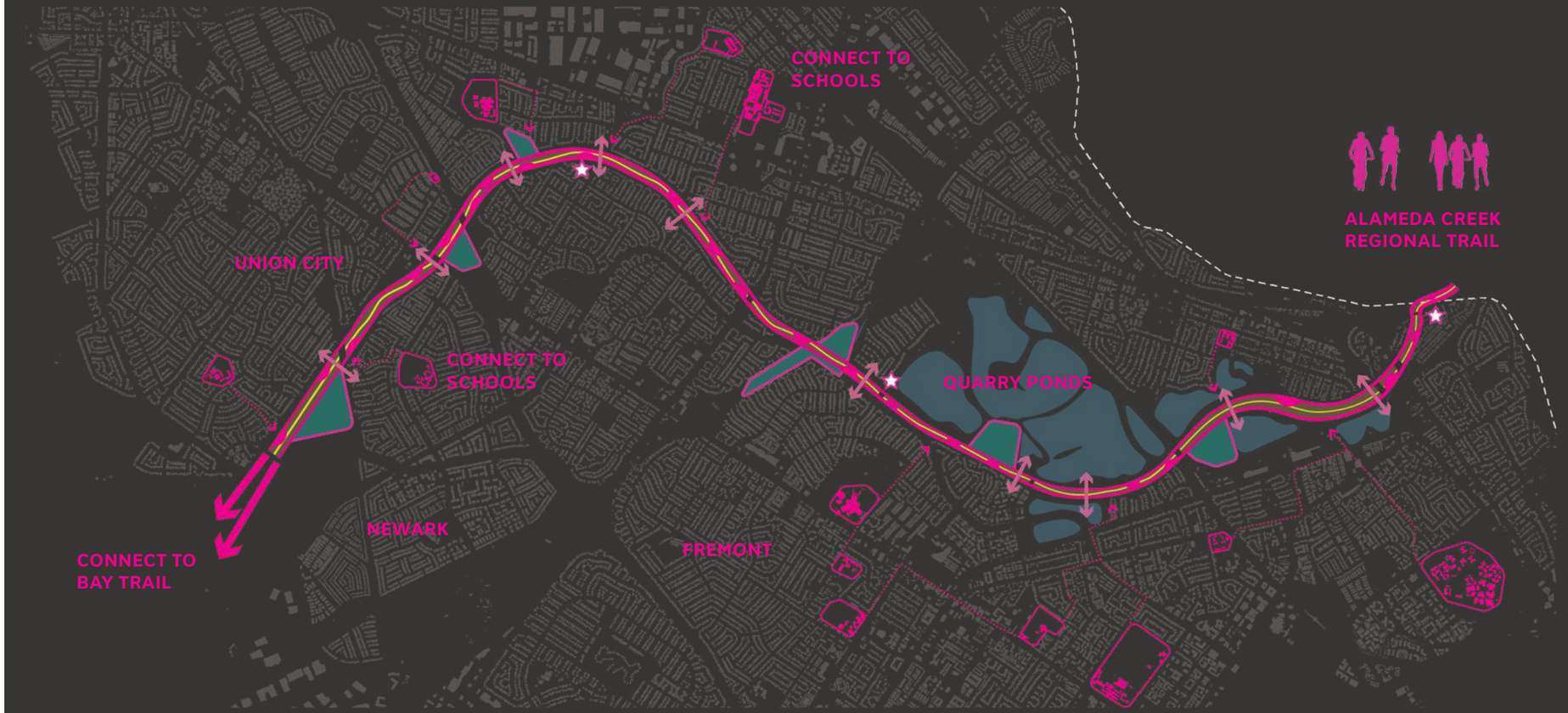
PROPOSED SEDIMENT MOVEMENT IN THE FLOOD CONTROL CHANNEL

SEDIMENT STUCK IN THE FLOOD CONTROL CHANNEL

HOW TO CONNECT PEOPLE?

While creek trails are well-used by local residents, the channel and its levee infrastructure divide Fremont, Union City, and Newark—the Tri City Area. Historically the creek was a social space, a place for fishing, swimming, and enjoying the water's edge. Today, public access is limited and the creek bed itself has been erased from the public realm. Alameda Creek holds great potential to expand equitable public space and create zones of exchange and interaction between culturally distinct neighborhoods. This large suburb is extraordinarily diverse, hosting an Asian-majority population and the region's largest concentration of Afghan residents in Little Kabul. Yet many of these communities are isolated from one another - of the twelve bridges that do cross the 12-mile creek system, only six are accessible to pedestrians and bicyclists, leaving miles of isolated urban fabric between. Access points are unequally distributed along the north and south sides of the creek, and more connections are needed to link schools and neighborhoods in socially disadvantaged areas to the creek.

We propose four techniques to expand the public realm within the Creek: **Mudrooms, Floodrooms, Terrace Trails, and Seasonal Bridges.** Each is managed alongside seasonal flooding, with limited access during the rainy season. This network of public access infrastructure enables people to reach the water, linger along its edge, and to cross the creek—transforming a linear and fast experience to one that is slow and meandering. These interventions bring Alameda Creek back into the public realm, unlock the powerful aesthetic environment of the creek, enable connectivity between neighborhoods, and create new space for public sediment education and creek stewardship. These new, immersive experiences **MAKE SEDIMENT PUBLIC** and build a larger ethos and awareness around the system-scale goals of this work.



PROPOSED PUBLIC ACCESS IN THE FLOOD CONTROL CHANNEL

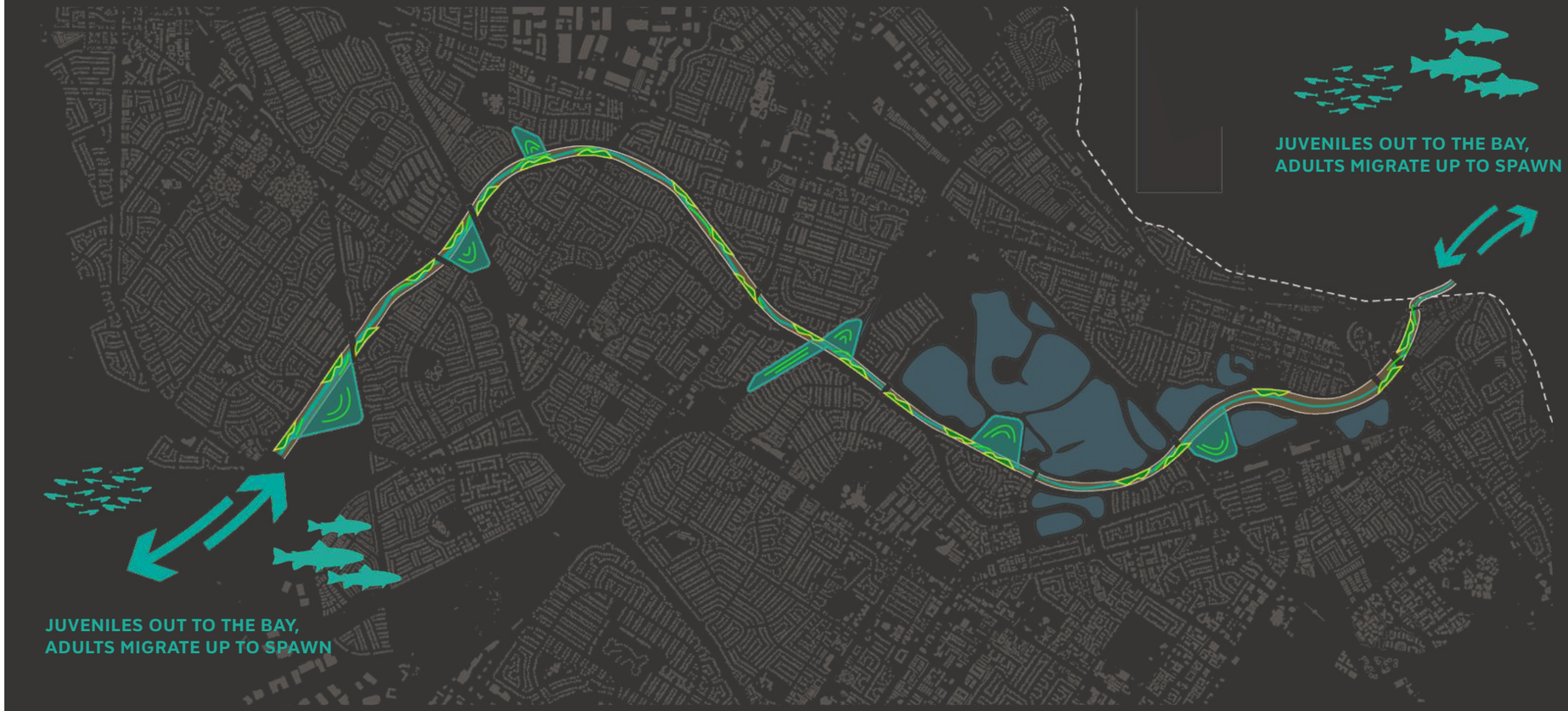
- MUDROOMS
- FLOODROOMS
- BRIDGES
- STAGING AREAS

CURRENT PUBLIC ACCESS CONDITION IN THE CHANNEL

HOW TO DESIGN FOR FISH?

Many species depend on a healthy creek for survival. Our team has focused on the needs of steelhead trout, as their lifecycle depends upon a series of connected ecosystems that link the bay with the uplands. Adults live in the open bay, then migrate up the creek in the winter to spawn in pools and reservoirs upstream. Steelhead born upstream migrate down the creek to the Bay as juveniles, where they seek refuge in tidal wetlands as they physiologically adapt to their new salt water environment. **Alameda Creek likely supported one of the largest historic steelhead runs in the San Francisco estuary**- today, these runs are all but lost. Dam construction, channelization, and barriers in the creek severely limit steelhead and other anadromous fish passage. Upstream steelhead are trapped and have transformed into self-sustaining populations of rainbow trout.

Plans are underway to remove barriers for fish passage, including the construction of a series of fish ladders and access-ways at the Bart Weir and the Rubber Dams. **Even with these improvements, the wide and shallow cross section of Alameda Creek inhibits the successful migration of steelhead.** We propose the design, excavation, and stabilization of a deeper fish channel, inset into the sediment channel, that ensures consistent flows during the in-and out-migration seasons, increasing passage opportunities for fish. Today's migration gauntlet will be alleviated by vegetated banks that provide cover, deeper pools and riffles, and consistent streamflow conditions below bridges and overpasses. In the creek bed, FLOODROOMS and MUDROOMS create expanded floodplain habitat for forage and refuge during major storm events that occur during migration. While we focus on steelhead for this stage of the process, the goal is to design for a wide variety of potential non-human residents of the creek.



PROPOSED FISH DESIGN IN THE FLOOD CONTROL CHANNEL

- FLOODROOMS
- VEGETATIVE COVER
- PLANTED POCKETS
- FISH CHANNEL

EXISTING FISH PASSAGE BARRIERS

DESIGNING AN ACTIVE CHANNEL

ACCESSING THE CREEK

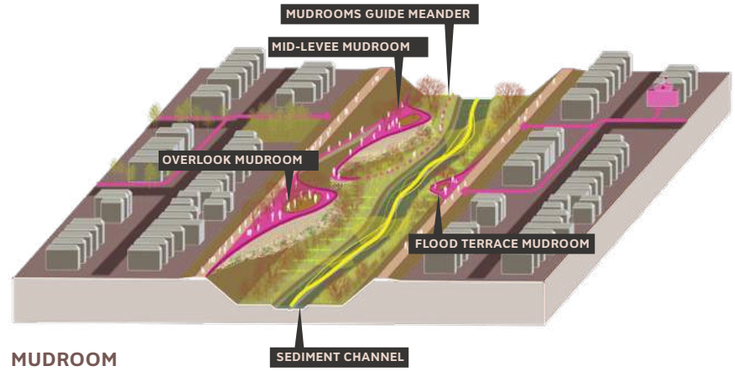
HOW CAN I ACCESS THE CREEK?
We propose four types of public access in the newly formed creek: Mudrooms, Floodrooms, Terrace Trails, and Seasonal Bridges. Each of these establishes connectivity and exchange, unlocks new creek-side experiences, and enables new forms of environmental education and stewardship.

MUDROOMS
Mudrooms are spaces for people inside the levees. They invite people into the channel, creating clear areas for public recreation and education without puncturing the flood protection levee. They are small and occur frequently along the creek, connecting back to parks, schools and urban access points, and are carefully sited to equitably allocate public space along the creek. The mudrooms are built at multiple elevations and supported by a living levee system that retains the bank and controls erosion, providing different relationships to the water. Some mudrooms are high and dry, providing overlooks into the creek, while others are low and muddy, creating micro-playspaces and outdoor classrooms where adults and children alike can touch the water and sediment of the creek. Low elevation mudrooms are closed during the winter months when there is risk of flooding. While mudrooms are primarily created for public access, they are located in relation to sediment flows, helping guide the formation of a meandering sediment channel.

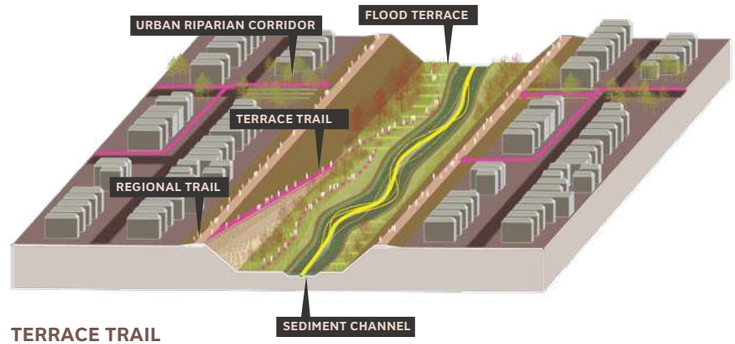
FLOODROOMS
Floodrooms set back the levee and expand the creek's floodplain. Limited in location to where there is space available along the urbanized path of the channel. Floodrooms create significant acreage of new flood terrace habitat, host a much wider range of riparian species, act as critical rest stops and refuge zones for native and adapted fish and bird species. But floodrooms are also for people – they are offset from the creek and accommodate boardwalk structures for public access that are not possible in the high velocity environment of the channel. Open year-round, floodrooms are park-like environments that balance the recreational needs of people with the habitat needs of their non-human residents.

TERRACE TRAIL
The Terrace Trail is a dry-season trail for people to access the creek bed. People want to be close to the water. The terrace trail uses simple construction techniques to transform the creek experience into one that is long, meandering, and immersive. The terrace trail is a catalyst for creek stewardship, providing points of access for plant maintenance near vegetative baffles and planted pockets.

SEASONAL BRIDGES
The creek should not be a barrier. During the majority of the year, the creek has low flow rates, clean water, and is safe and simple to cross. Seasonal crossings are created with small pedestrian bridges that flip down and span the creek during the dry season. In the flood season, they are folded up and locked in place, or removed from the channel. Seasonal bridges are located to enable crossings every half mile along the creek, in response to connectivity needs and social equity.

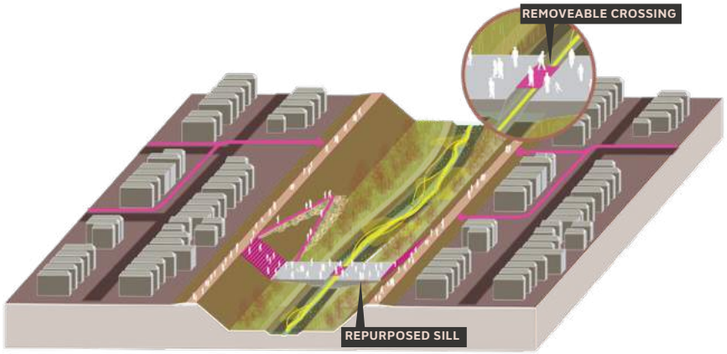


MUDROOM



TERRACE TRAIL

FLOODROOM



SEASONAL CROSSING

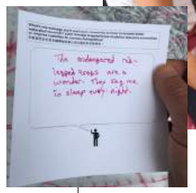
BUILDING A CREEK CONSTITUENCY

The transformation of Alameda Creek from creek to flood control channel has erased the historic image of the creek from the larger consciousness of the community. While there is incredible momentum around enhancing fish passage along the creek, our team found no parallel efforts advocating for greater public use of this same watery system. In short, Alameda Creek has a stronger constituency for fish than for people! While the levee trail is well loved, the creek itself is invisible, out of sight and off-limits. While public access improvements like mudrooms and seasonal bridges will connect people with the creek, a larger creek constituency is needed to value this resource and advocate for its adaptation to climate change. Our team has been holding events in the watershed to understand how people perceive this ecosystem and has synthesized these stories into a CREEK ATLAS- a document that reflects changing perspectives and attitudes towards the creek. People want to access the creek, see the water, and experience the ecosystem. The Creek Atlas is a starting point for organizing this information into a larger campaign that engages students, youth, and residents in this changing environment, building awareness and activism around PUBLIC SEDIMENT resources for the future.

BUILDING A CREEK CONSTITUENCY

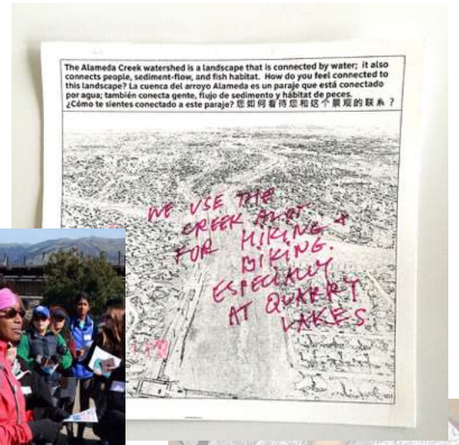
2/24
CREEK CRAWL

4/08
SUNOL SUNFLOWER

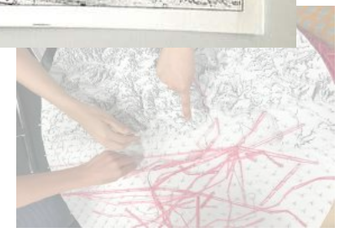


4/11
ATLAS WORKSHOP WITH AMERICAN HIGH SCHOOL

4/05
ACTA NON-VERBA AND SUNOLD AGPARK WORKSHOP

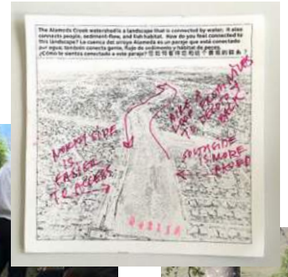


5/02
UNION CITY YOUTH AND SENIOR CENTER STORY SWAP WORKSHOP



JAN | **FEB** | **MAR** | **APR** | **MAY**

PHASE II BEGINS



2/21
UC DAVIS EVENTS "FIELD DISPATCHES" + "MAKING BAY"

3/05
PARTNERSHIP AGREEMENT WITH THE ALAMEDA CREEK ALLIANCE

4/21 -22
LEAF EARTH DAY TABLING

4/21 -22
WASHINGTON HOSPITAL EARTH DAY TABLING

4/19
SENSORS WORKSHOP WITH KENNEDY HIGH SCHOOL ROBOTICS

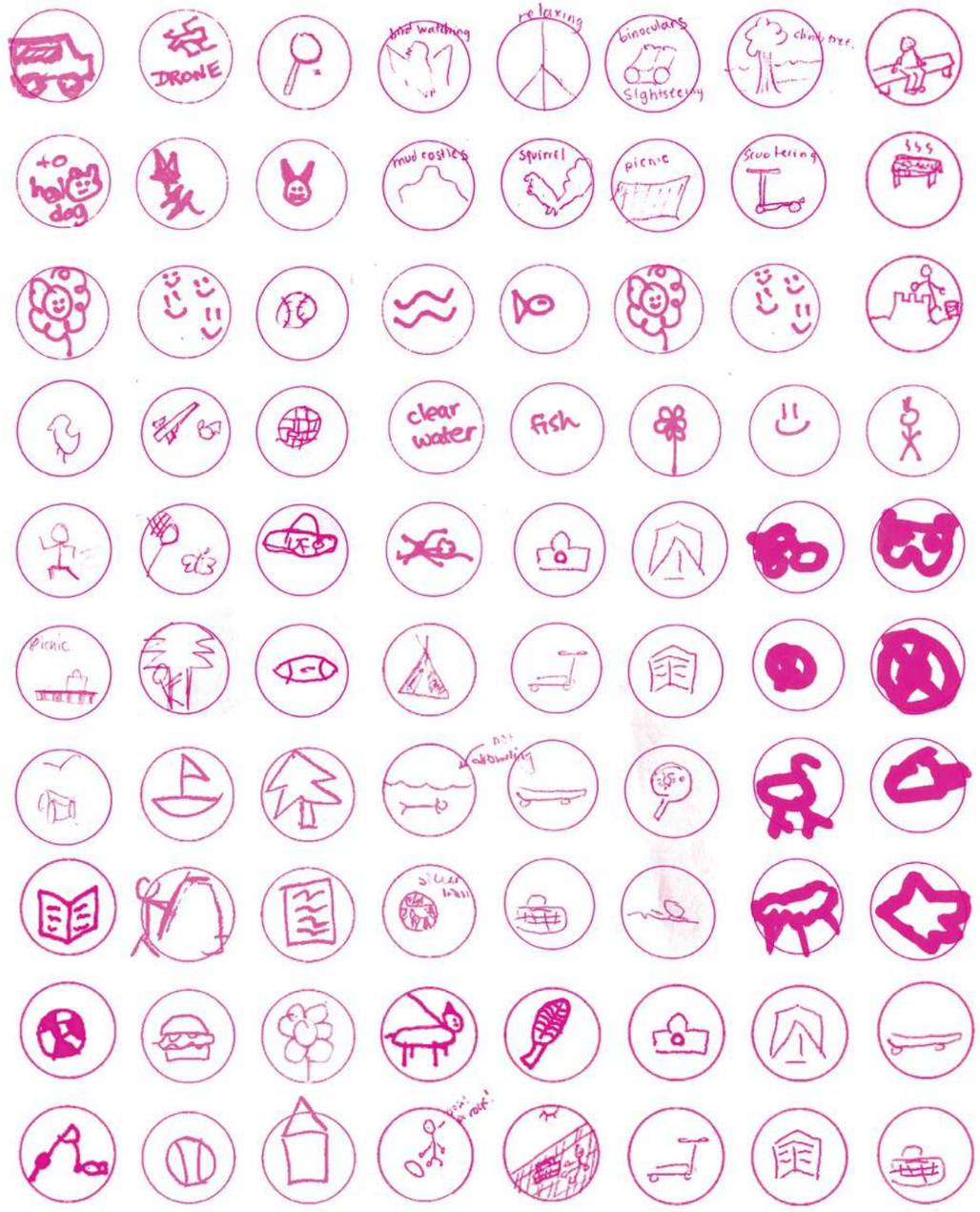
PARTICIPATORY MAPPING IN THE SEDIMENTSHED

IDENTIFYING KEY LANDSCAPES: NILES CANYON

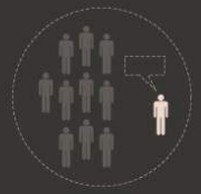
MAPPING MOVEMENTS THROUGH THE WATERSHED

COLLECTIVE COMMUNITY PATHWAYS

COMMUNITY CREATED ICONS FOR ALAMEDA CREEK



COMMUNITY OUTREACH EFFORTS



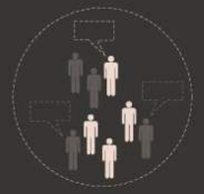
PUBLIC PRESENTATION

WORKING GROUP MEETINGS:
Working group established with existing stakeholders including the Alameda County Flood Control District, Alameda County Water District, South Bay Salt Pond Restoration, San Francisco Public Utilities District, East Bay Regional Parks District, Alameda County Resource Conservation District, the City of Fremont and the Alameda Creek Alliance.

COMMUNITY PRESENTATIONS:
Project presented to Alameda Creek Fisheries Working Group, the San Francisco Planning and Urban Research Organization, the University of California Davis, and the Southern Alameda County Air Quality District.

INTEGRATED COMMUNITY EVENT

TABLING COMMUNITY EVENTS:
Public engagement with community members through the integration with existing programs and events. This includes tabling at public events such as the Sunol Wildflower Festival, the City of Fremont Earth Day celebration, and the LEAF Earth Day event. Project becomes one of many activities associate with event.

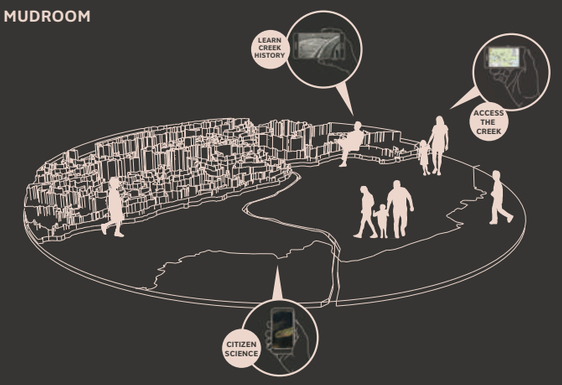


COMMUNITY WORKSHOP

YOUTH-ENGAGED WORKSHOPS:
Co-design activities with community youth in collaboration with community partners, including American , JFK, and Irvington High Schools in Fremont, Acta Non Verba in Oakland, and the Union City Teen Center.

INTERGENERATIONAL STORY SHARE:
Narrative-based community workshop between youth and elders in collaboration with the Ruggieri Senior Center in Fremont.

MUDROOM



FLOODPLAIN TERRACE TRAIL

HIGH FLOW STORM EVENT

BALANCING CREEK DEMANDS

Our team spent time understanding the dynamics of the creek, how it is managed, and what role it plays in the lived experience. The creek's primary role today is flood control. To balance the flood protection function with other demands (increased vegetation, public access, habitat provision for a range of species) we met with people who used the creek, stakeholders that shape its evolution, and plant experts to interpret today's ecosystem of the creek and assess its future potential.

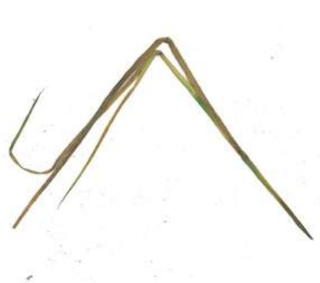
MULEFAT
BACCARIS SALICIFOLIA

COMMON HORSETAIL
EQUISETUM ARVENSE

BRASS BUTTONS
COTULA CORONOPIFOLIA

COMMON TULE
SCHOENOPLECTUS ACUTUS

TALL FLATSEDGE
CYPERUS ERGROSTIS



IRISLEAF RUSH
JUNCUS XIPHIOIDES

CREEK CHARRETTE - NOAA/ NMFS. ACFCD. SBSP. ACA. ACWD. PUBLIC SEDIMENT TEAM

VEGETATIVE SURVEY WITH SFEI + ACRCD

CREEK DIVERSIFICATION

The Public Sediment team used dynamic modeling to study strategic use of vegetation and creek training structures within fluvial portions of the flood control channel, with the aim of improving sediment transport, multi-species habitat, and fish passage. A geomorphology water-table with synthetic sediment was used to physically model the creek at three scales from large to small: the confluence of Dry Creek and Alameda Creek, an abstracted channel length, and modular devices. The model was used to produce imagery for visually interpreting the dynamics and characteristics of the creek, such as sediment transport, meander, and water currents. Using a range of soft to hard materials, strategies were designed to create a meandering low-flow channel with variable morphology and the potential for vegetated habitat within the bankfull channel.

VARYING GRAIN SIZES FOR SEDIMENT MODELING

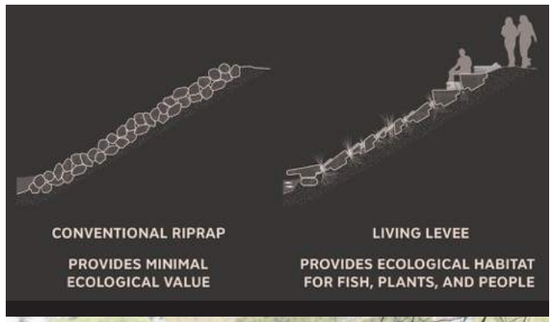
WIRE MESH SIMULATING VEGETATION STABILIZATION

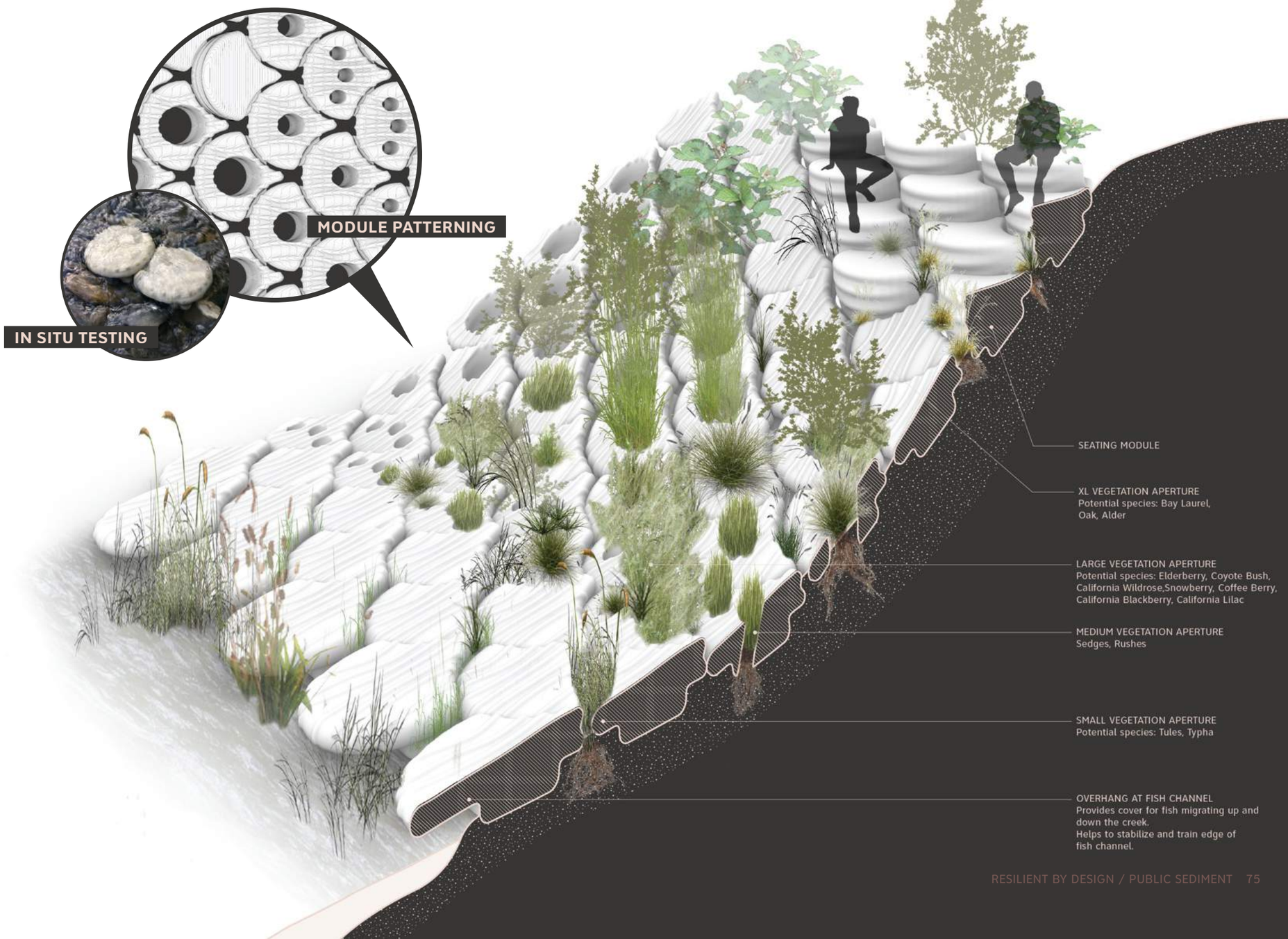
LOW FLOW AND BANKFUL CHANNEL EVOLUTION

LIVING LEVEE

Alameda Creek is a modified system. Residential development abuts the levees and prevents large-scale restoration of the floodplain. While the levees will remain in place throughout a majority of the system, this condition can be improved. Today's levees are sterile spaces that do not contribute to ecosystem function. **The LIVING LEVEE is a blanket of concrete units that weave together to stabilize new edges, create space for people, and enable vegetative growth on the levee edge.** Different surfaces and textures accommodate the needs of different users- people can sit, fish can shelter, and macro invertebrates can settle. The Living Levee unit is shaped to embed itself in the levee with high water flows, and weave together with other units to form a self-stabilizing bank.

The Living Levee is applied on select levee banks to stabilize new mudroom edges, stabilize the levee toe near the meandering channel, and encourage the formation of a sediment channel below bridges and structures, where it is too shady for plant growth.

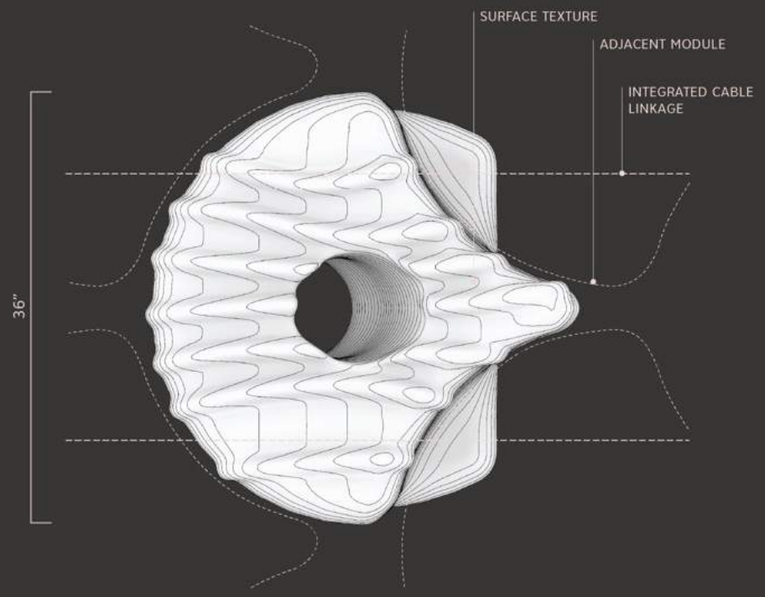




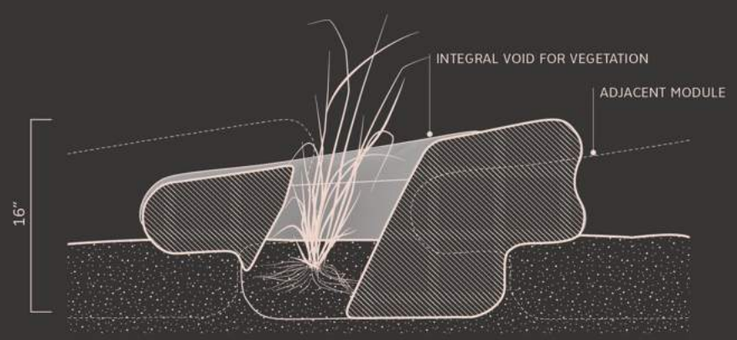
ECOLOGICAL PERFORMANCE & CUSTOMIZATION

The design workflow for the Living Levee module utilizes digital modeling to investigate how overall shape can be optimized to increase habitats for both plants and animals, to provide access for the public, and to armor edges facilitating sediment flow through the channel. The modules will be fabricated from cast concrete using digitally fabricated molds. The process is easily scalable and customizable, allowing for a variety of sizes and variations of the modules. **Working with biologists and ecologists, this process provides the ability to adapt and test the surfaces at a micro scale, which allows for the fine tuning of surface texture for the colonization and recruitment of targeted plant and animal species.**

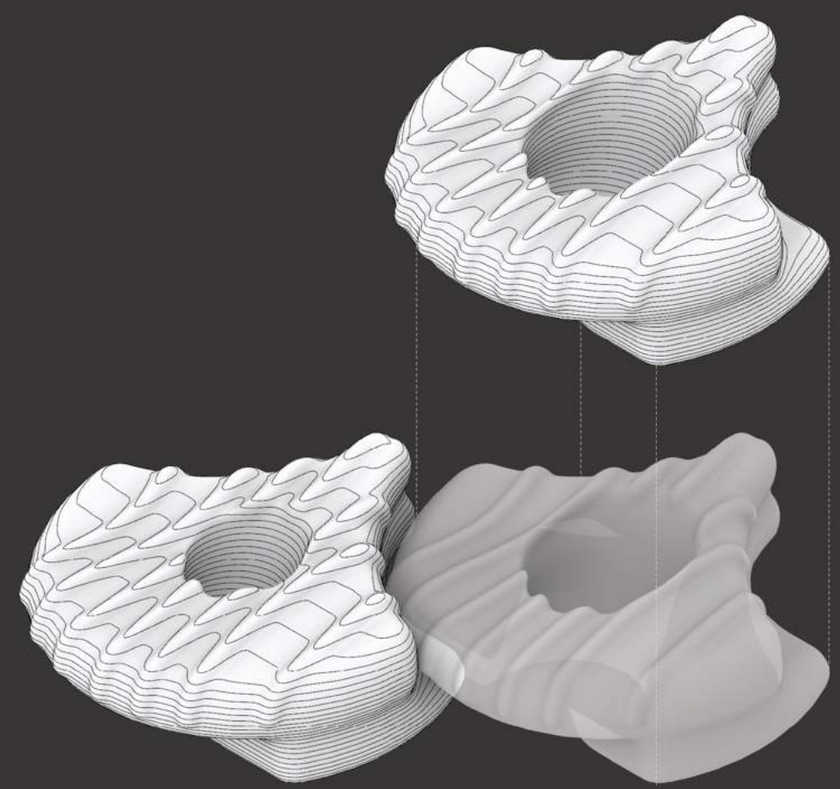
The tiling logic allows for integrated cables to connect the modules and form a mat for better handling and anchoring during installation and assembly. This modular system can be adapted for locations within a fluvial condition or along tidal edges and are capable of being scaled and sculpted to maintain their position in dynamic conditions. The first phase of the Living Levee design development is to seek funding to rapid prototype molds that will allow for testing within the Alameda Creek Flood Control Channel. In partnership with the Alameda Creek Flood Control District (ACFCD), these modules can be adapted to multiple sites within the flood control channel in the fluvial and tidal reaches. Performance will be monitored and evaluated in coordination with the ACFCD engineering staff.



TYPICAL MODULE PLAN



TYPICAL MODULE SECTION



NESTING / TILING LOGIC

TYPE A:
FISH COVER @ FISH CHANNEL

TYPE B1:
STANDARD SOLID

TYPE B2:
VEGETATION / S

TYPE B3:
VEGETATION / M

TYPE B4:
VEGETATION / L

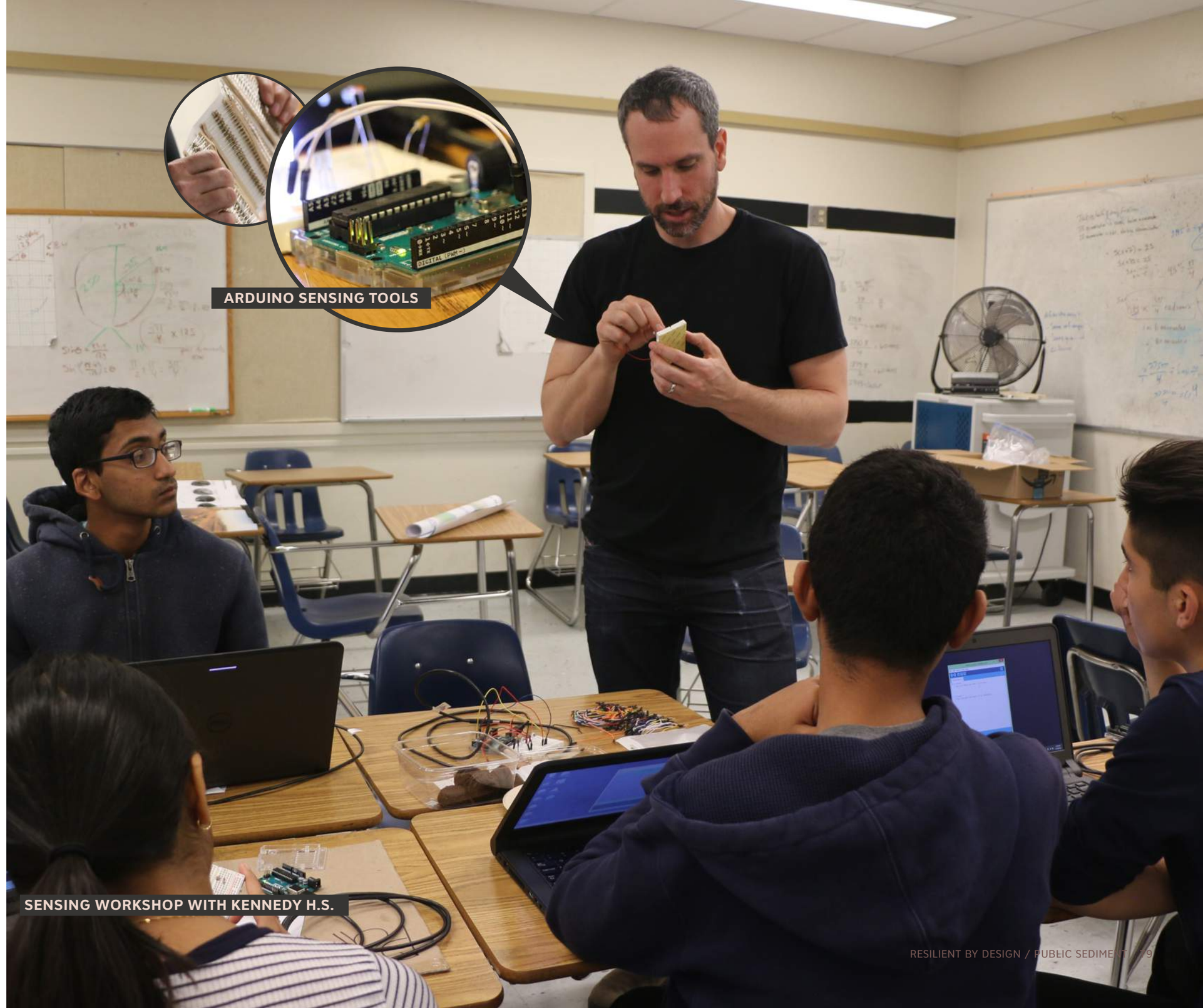
TYPE B5:
VEGETATION / XL

TYPE C:
SEAT / STEP

MODULE TYPES

SENSING SEDIMENT IN SCHOOLS

A comprehensive monitoring strategy is needed to both learn from and adaptively manage our living infrastructure. A range of sensing strategies are proposed for learning more about the current dynamics of Alameda Creek, for supporting the adoption of UNLOCK ALAMEDA CREEK designs, and testing methods for tributary monitoring throughout the Bay. **Across these strategies, sensors and monitoring devices are designed to engage multiple publics--creating visible and didactic moments along the creek for residents, engaging local schools in monitoring activities and creek stewardship, and supporting scientific research.**

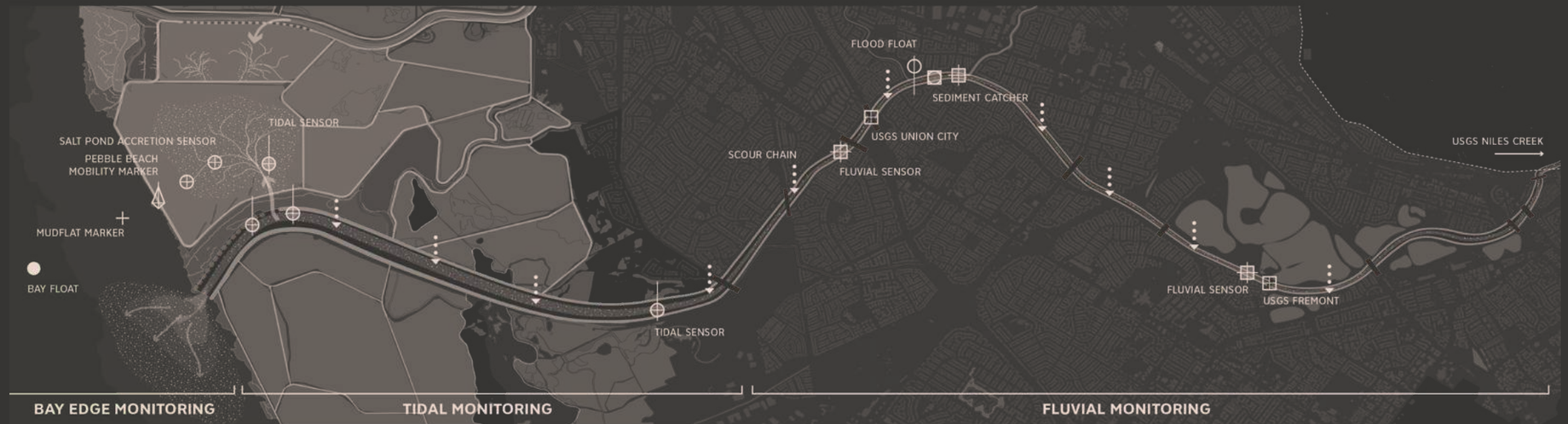


ADAPTIVE MANAGEMENT

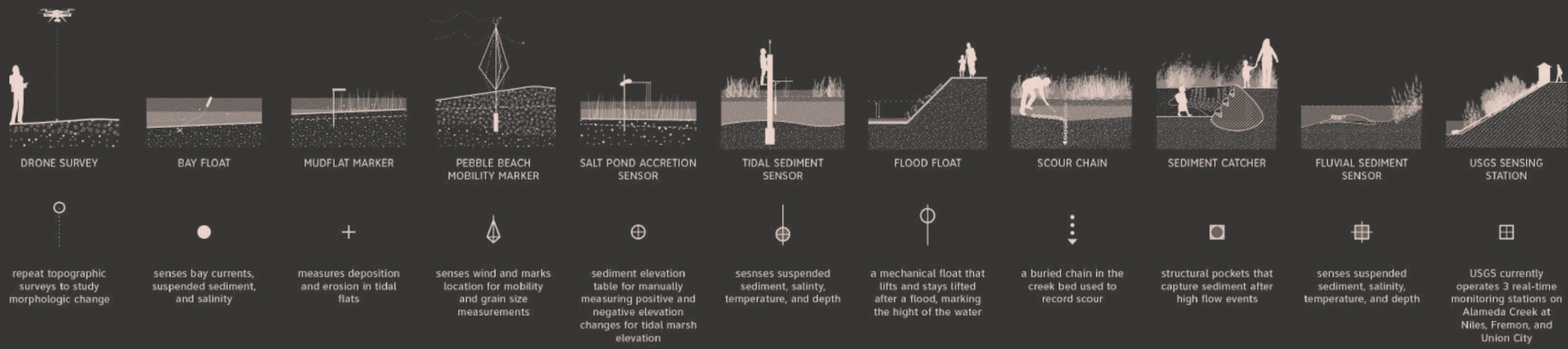
UNLOCK ALAMEDA CREEK proposes a phased strategy for monitoring the ecological system of the creek. In the short-term, sensing stations will be deployed throughout the tidal range where there are currently no permanent sensing installations to study tidal sediment flows and the potential breach location. In the long-term, a comprehensive monitoring strategy is deployed alongside the living infrastructure interventions to ask critical questions about creek and bay morphology as well as ecological health. In the fluvial reach, how does sediment move past head of tide and where does it get deposited in the channel? In the tidal reach, how does sediment move? And at the Bay-tidal interface, how quickly is accretion occurring, and how mobile is the gravel barrier?

The monitoring goals are threefold. One, to create a baseline of pre-intervention data to help inform our proposed interventions and measure their effectiveness. Two, to match instrumentation approaches, sampling frequencies, and physical sample collection methods so that our data will complement existing research efforts within the watershed and throughout the Bay. And three, to make this monitoring infrastructure and the underlying processes it reveals legible to a broader public.

PROPOSED MONITORING SYSTEM



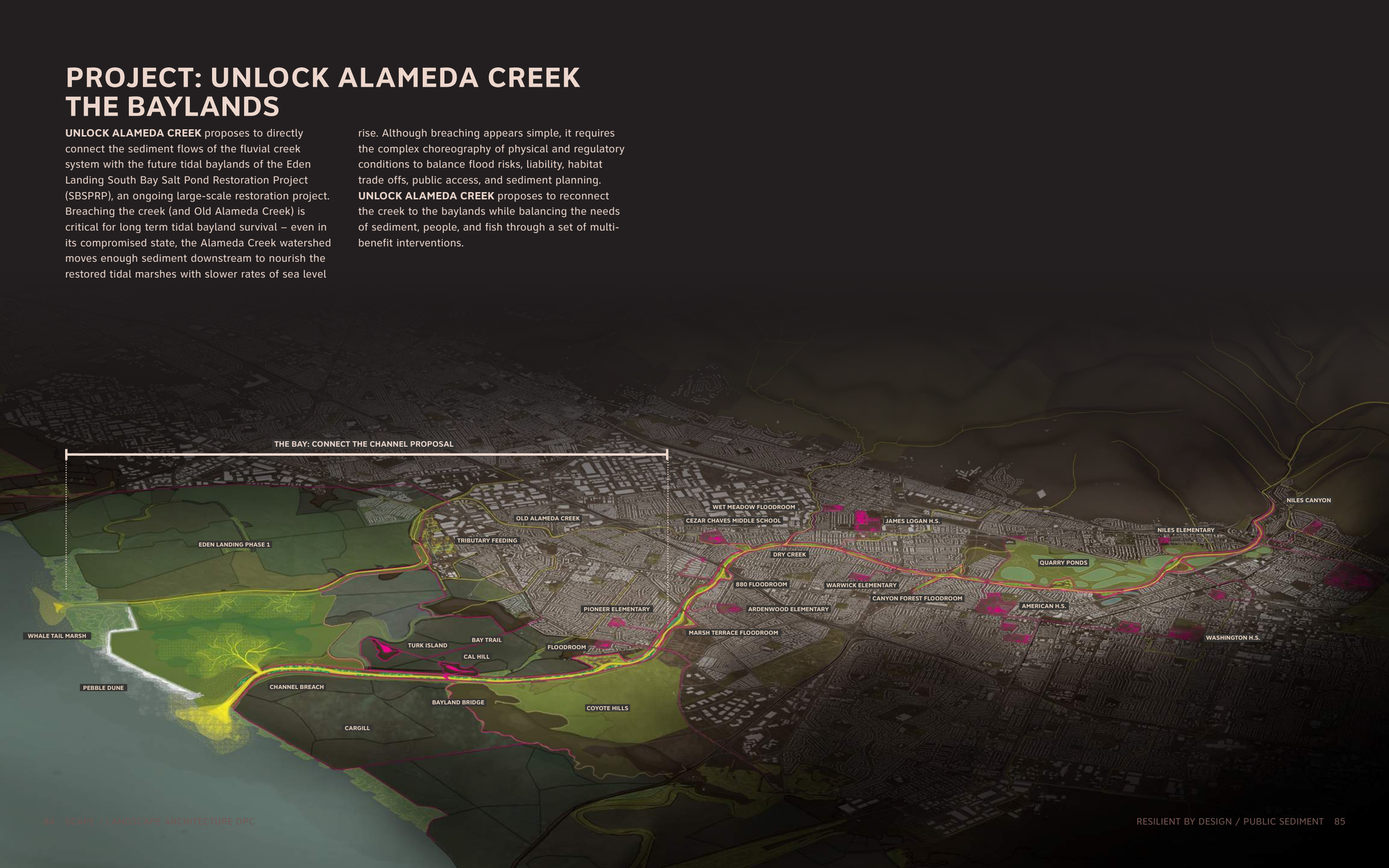
MONITORING INSTRUMENTS



#3
THE BAY
UNLOCK ALAMEDA CREEK

PROJECT: UNLOCK ALAMEDA CREEK
THE BAYLANDS

UNLOCK ALAMEDA CREEK proposes to directly connect the sediment flows of the fluvial creek system with the future tidal baylands of the Eden Landing South Bay Salt Pond Restoration Project (SBSPRP), an ongoing large-scale restoration project. Breaching the creek (and Old Alameda Creek) is critical for long term tidal bayland survival – even in its compromised state, the Alameda Creek watershed moves enough sediment downstream to nourish the restored tidal marshes with slower rates of sea level rise. Although breaching appears simple, it requires the complex choreography of physical and regulatory conditions to balance flood risks, liability, habitat trade offs, public access, and sediment planning. **UNLOCK ALAMEDA CREEK** proposes to reconnect the creek to the baylands while balancing the needs of sediment, people, and fish through a set of multi-benefit interventions.



HOW TO BREACH THE CREEK?

Today's creek bypasses the Eden Landing Ponds, which host important habitats but are currently cut off from tidal inundation. **Because of this disconnection, the ponds are subsiding at an extreme rate, and without action these areas are vulnerable to erosion and overtopping with sea level rise, exposing adjacent neighborhoods to flooding.**

Our team proposes a multi-part strategy to connect sediment with the Baylands. First, large volumes of sediment must be imported to lift the subsided lower ponds to marsh plain elevation before breaching. This provides immediate flood protection benefit and gives marshes a head start on sea level rise. Up to seven million cubic yards of sediment are needed. Potential sources of mud come from dredge material, sediment harvested from upstream reservoirs like Don Castro, and upland construction fill. Sourcing this volume of sediment is no easy task and depends upon an uncertain timeline – **even if this volume can't be imported in time, the ponds should be breached as soon as permitting allows to stop subsidence through slower accretion by tidal means.**

While breaching improves long term flood protection through the creation of sustainable tidal baylands, near- term fluvial and tidal flood risks must be addressed. But first, in order to breach Alameda Creek a series of interventions must occur. These include modifications to the Old Alameda Creek levee to allow fluvial floodwater to leave the system, the construction of a mid-complex levee to separate managed ponds from tidal ponds, **and the construction of a PEBBLE DUNE at the perimeter of the ponds, that performs like a barrier island, by reducing tidal forces and protecting the baylands from wave action and erosion.**

With these interventions in place, the lower northern levee can retire, the creek can be breached, and a new delta can begin to form in the Bay.

OLD ALAMEDA CREEK

ALAMEDA CREEK FLOOD CONTROL CHANNEL

PEBBLE DUNE LOCATION AND SALT PONDS

EXISTING ALAMEDA CREEK FLOOD CONTROL CHANNEL

PROPOSED BREACH OF ALAMEDA CREEK FLOOD CONTROL CHANNEL

HOW TO CONNECT PEOPLE TO THE BAY?

There are very few places in the Bay area to directly access the open water. Although the current Bay trail extends to the water's edge, the north side of the creek trail does not connect to southern paths, and the experience can be flat and monotonous to the average user. Coyote Hills is an incredible resource, it remains difficult to access from the North side of the channel.

Our team proposes to create a series of new destinations in the Baylands that unlock the larger ecological investments at Eden Landing to the wider public. A new segment of the Bay Trail is expanded into the Baylands connecting to the Alameda Creek Levee trail. Turk Island, an exciting topographic destination in a horizontal landscape, becomes a stopover point for travelers on the Bay Trail. At Alameda Creek, the Breach Bridge jumps the channel and moves with the tides, linking the greater path network of Eden Landing and providing a clear overlook to the newly forming delta. A potential floodroom site is also possible to the south of the flood control channel level, providing additional recreational opportunities in Coyote Hills Park.

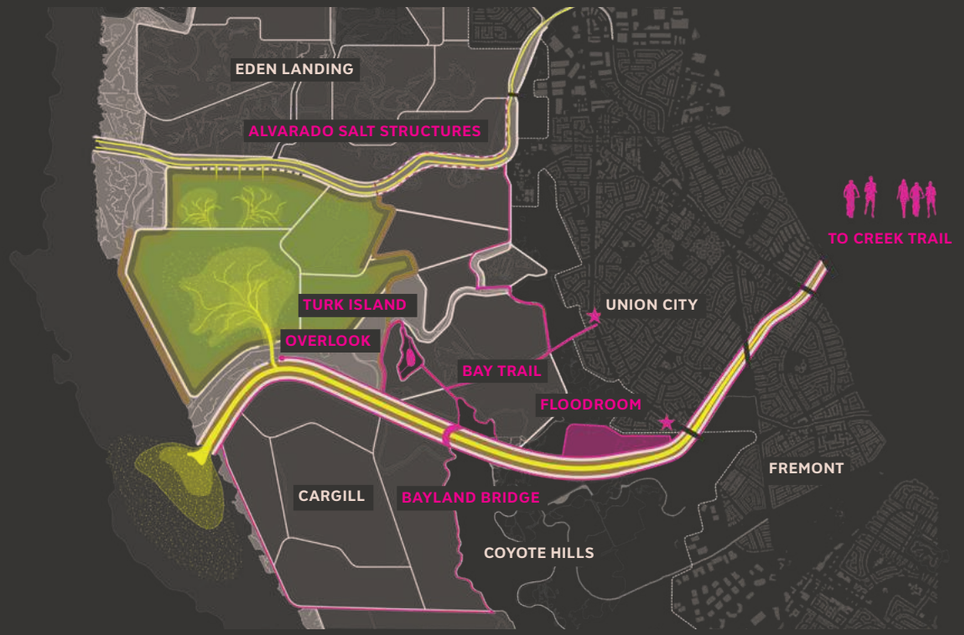
FLOOD CONTROL CHANNEL BAY TRAIL

TURK ISLAND

ALVARADO SALT STRUCTURES
IMAGE CREDIT: GARETH BOGANOFF

EXISTING ALAMEDA CREEK FLOOD CONTROL CHANNEL

PROPOSED BREACH OF ALAMEDA CREEK FLOOD CONTROL CHANNEL



HOW TO DESIGN FOR FISH AND OTHER SPECIES?

Bayland species require estuarine environments, where fresh and salt water mixes. Juvenile steelhead require this transitional space to adapt to a salt water environment. Other threatened species, like the Salt Marsh Harvest Mouse and the Clapper Rail depend on these habitats for long-term survival. The channelization of the creek to the bay's edge has severely limited this estuarine zone, transforming what was historically a wide marsh plain of shallow meandering sloughs into a single linear channel.

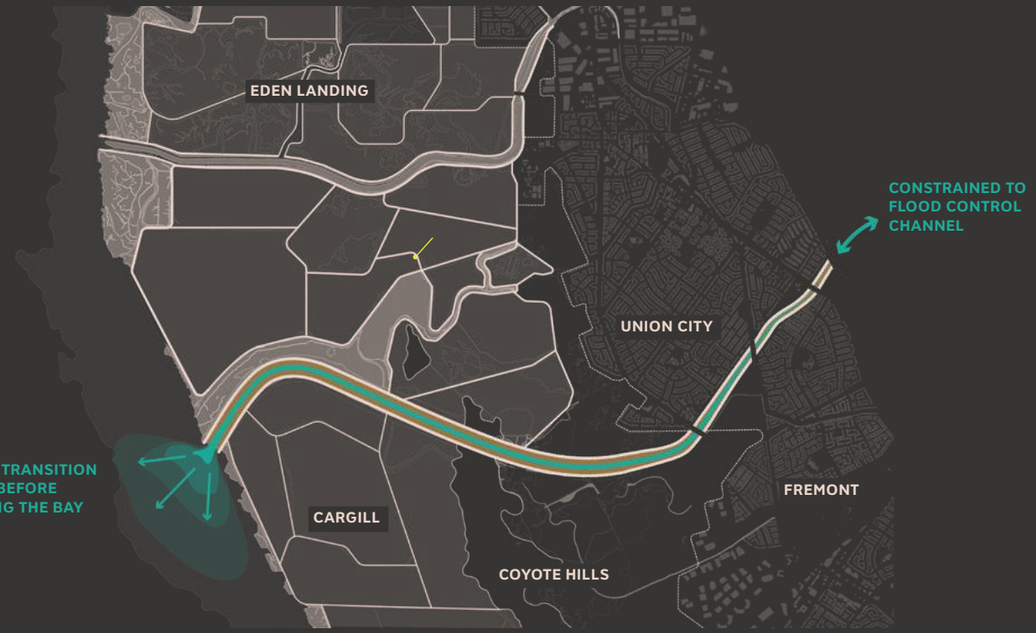
Our team aims to link flood protection interventions with habitat creation potential. The PEBBLE DUNE is designed to create a shifting coarse grain beach over time. Secluded from people, the Pebble Dune is ideal for nesting pairs of terns. Large mudflats, fed by Alameda Creek's sediment, break waves while expanding pupping zones for harbor seals. The BREACH is wide and strategically located for fish to find it on their migration routes, expanding into a new tributary delta at the Bay's edge.

RESTORED SALT POND TRANSITION MARSH

EXPANDED INTERTIDAL MUDFLAT

SUBSTRATE FOR NESTING TERNS

EXISTING ALAMEDA CREEK FLOOD CONTROL CHANNEL



PROPOSED BREACH OF ALAMEDA CREEK FLOOD CONTROL CHANNEL

BREACHING THE CREEK

Currently there is almost no connection between Alameda Creek, Old Alameda Creek, and the Baylands. The former tidal wetlands in the area are leveed salt ponds, no longer in production, and hydrologically separated from the flood control channel, a potential source for tidal flows and suspended sediment. The focus of our work was to find ways to reconnect tidal flow between the creeks, the ponds, and the Bay while facilitating current efforts to recreate tidal wetlands at Eden Landing.

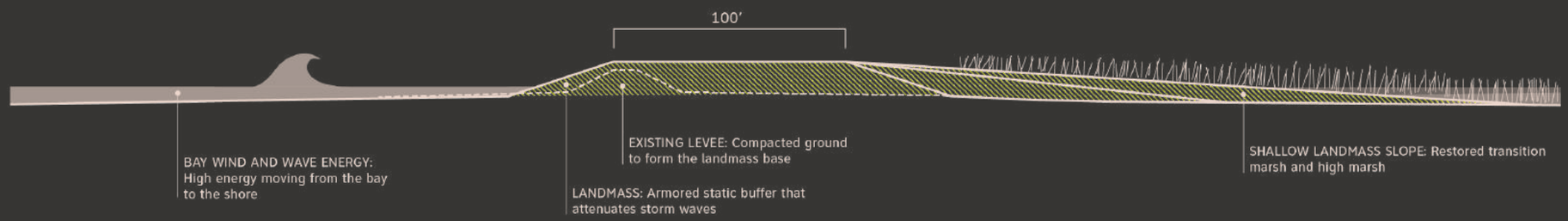
The Public Sediment team organized a charrette between the Alameda County Flood Control District, South Bay Salt Ponds Restoration project, CA Fish and Wildlife, and the Public Sediment team to discuss how to breach Alameda Creek into the Eden Landing Wetlands. While breaching appears simple, it requires a highly complex series of fluvial, tidal, and combined flood control event considerations for it to occur. A breach scenario, with associated flood protection improvements, was developed at this meeting.

UNLOCK ALAMEDA CREEK
THE BAYLANDS

THE PEBBLE DUNE

The **PEBBLE DUNE** is a hybrid between a barrier island and a cobble beach. It is a barrier in that it reduces tidal velocity, breaks waves, and protects against erosion that would threaten the salt marshes and neighborhoods beyond. But it also a highly resilient coarse grain beach, that grows vertically with increasing storm energy and wave action while providing critical habitat to nesting terms. Coarse grain beaches were once found in this environment, but the impounding of the watershed and channelization of the creek has prevented this material from making it to the Bay. **We propose to revive this lost ecosystem and harvest the creek's gravel during channel construction upstream, bringing it to the bay to create new, shifting habitat at the bay's edge that grows with time to respond to sea level rise.**

LANDMASS CROSS SECTION



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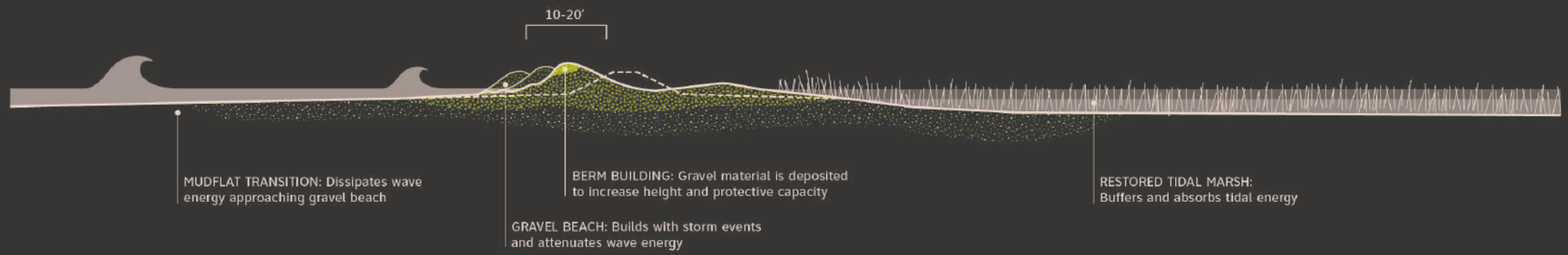
GRAVEL BEACH



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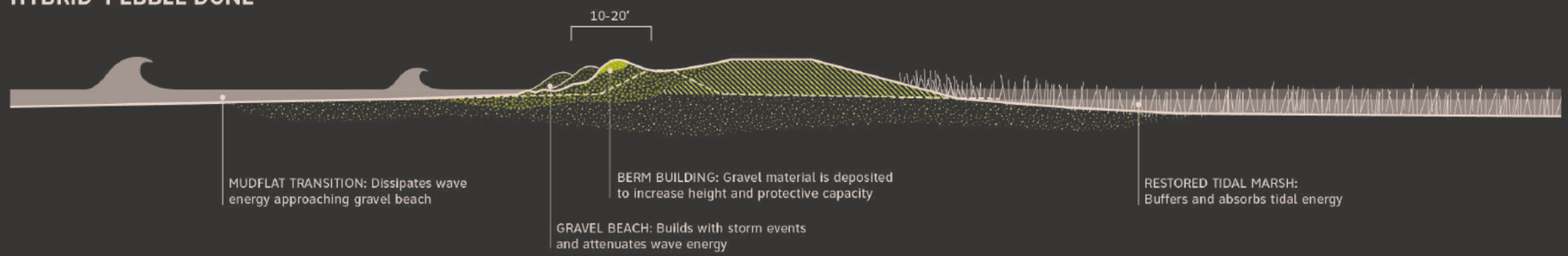
HYBRID 'PEBBLE DUNE'



GRAVEL BEACH INVESTIGATIONS

For the pebble dune feature, a preliminary analysis of beach response to storm conditions was conducted. The primary focus of this analysis was to understand the potential response of the pebble dune to storm wave conditions at various water levels. This model is intended to be exploratory of the possible responses a pebble beach face may have to the storm wave conditions in the vicinity of the Eden Landing Wetland Restoration Project.

The Deltares XBeach-G program was utilized to conduct the preliminary analysis based on historic storms within the South Bay. XBeach-G is a 1-dimension model which is similar to the SWASH model that solves wave-by-wave flow and surface elevation variations due to short waves in intermediate and shallow water depths. This is particularly important for application on gravel beaches, where due to steep slopes swash motion is mainly at incident wave frequencies.

Beach response to storm wave conditions were modeled for varying beach slopes and grain sizes (D50). The beach profile, wave conditions and water levels used in the analysis included:

- Wave heights ranging from 2-4 feet with wave periods of 2-4 seconds
- Tides ranging between mean tide level and 10-25 year return period high water
- Beach face slopes between 6:1 and 4:1 (horizontal: vertical)
- Grain sizes of fine to medium gravel

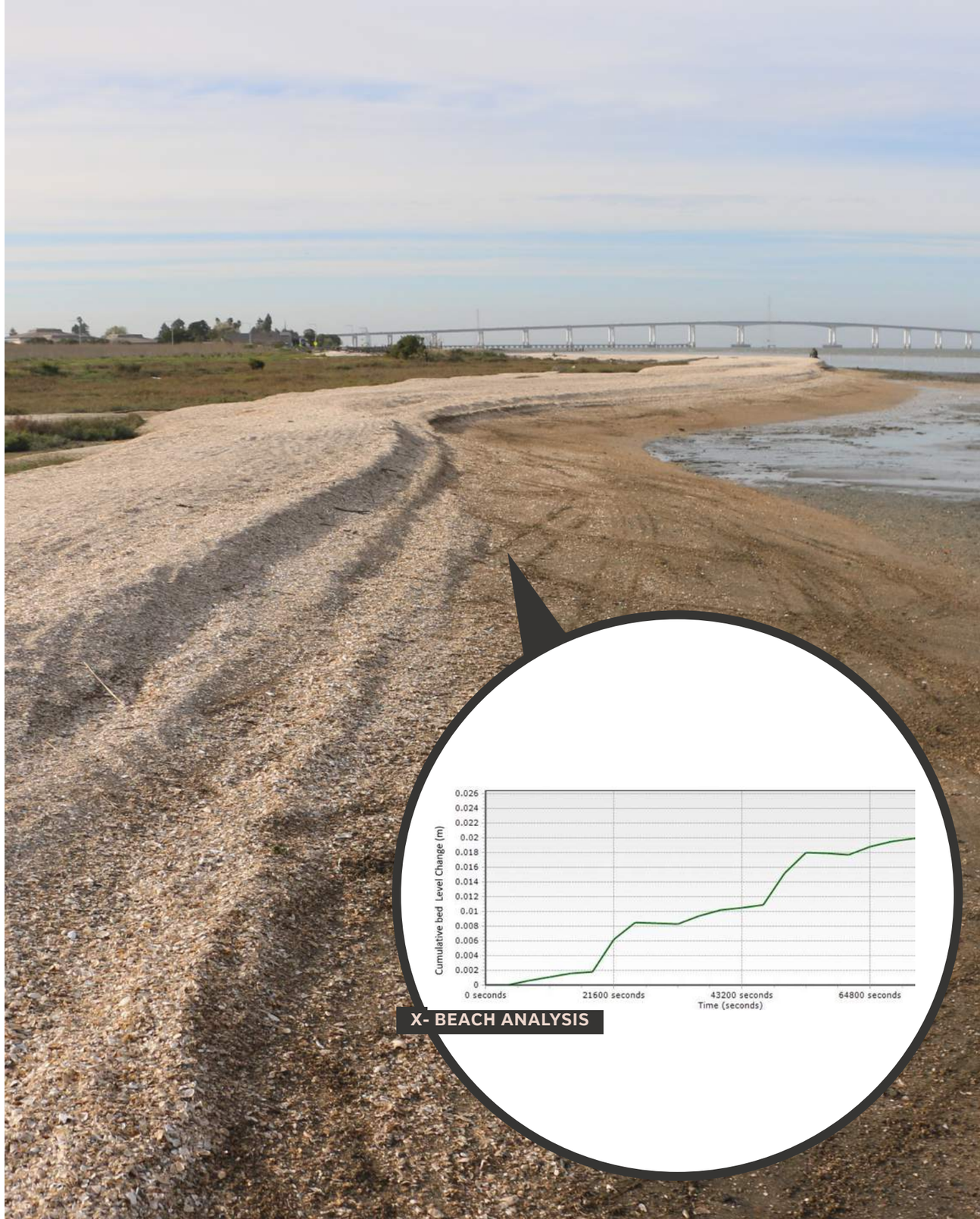
Preliminary analysis results showed that the pebble dune did not show significant cross-shore movement (i.e storm damage) based on the storm wave conditions, sediment grain sizes and profiles modeled. Under multiple storm simulations some minor down slope movement of material was noted for the steepest slope and finest grain size combinations. In general, minor changes to the slope occur for the range of grain sizes tested though no major movements of material are noted.

This indicates that the pebble dune feature is likely stable for the slopes and grain sizes modeled and may reshape slowly overtime in response to storm conditions and sea level rise.

While this preliminary analysis is not intended to provide a robust study of the performance of the pebble dune feature it does **provide insight into the types of grain sizes and slopes which are likely to be dynamically stable in the South Bay wave environment.** Additional modeling of the pebble dune is recommended as design moves beyond the concept phase and ecological goals are further defined.

ARAMBURU ISLAND GRAVEL BEACH

POINT PINOLE SHOESTRING GRAVEL BEACH



X- BEACH ANALYSIS

BAYLAND BRIDGE

ANADROMOUS FISH PASSAGE

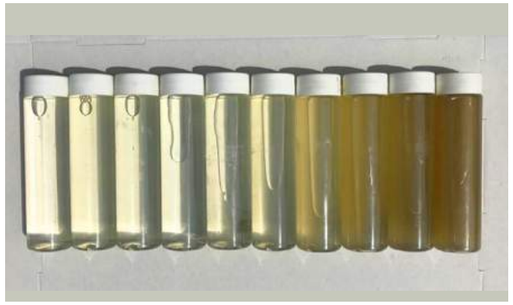
ACCESSING THE RESOURCE

The BAYLAND BRIDGE enables access across the creek, directly linking the trails of Eden Landing and Coyote Hills. Inspired by the bundling and weaving of the historic tule reeds that populated this landscape, the Bayland Bridge is a clear destination in the Bay that reveals the subtle changes of this dynamic environment. The structure is supported by two landings – a vertical tower and an immersive mudroom- that house support structures and provide new experiences in the Bay. The span itself is supported by floating pontoons that rise and fall with the tides, creating a breathing bridge that responds to the patterns of the creek. The Breach Bridge frames the moment where the creek and bay mix, creating a space for people to watch this new tributary delta form over time.

BAYLAND BRIDGE OVERLOOK

BAY SENSOR INSTALLATION

The purpose of the tidal sensor deployment was to determine the net flux direction of suspended sediment at two locations below head of tide. Location T1 or AC below HOT was located just upstream from the bridge at Ardenwood Blvd. This location was selected to provide insight into whether more suspended sediment was moving out with the tide, or coming in with the tide near the upper extents of the tidal reach. Location T2, or AC near the Bay was located at the top of the bend in the channel near the bay. This location was selected to gather information on whether there was potential for the flood cycle of the tide to positively contribute suspended sediment to the existing salt ponds through a breach. The timing of the deployment was close to the peak of spring tides, and therefore should be considered closer to a maximum within the annual cycle of overall tide strength.



WATER SAMPLES WITH SUSPENDED SEDIMENT

SEDIMENT SENSOR

FLOOD CONTROL CHANNEL: TIDAL REACH

BAY SENSOR RESULTS

T1: AC near Head of Tide:
The deployment at T1 used a 3' long PVC tube attached to the bank below the low flow water level to place a data logging sonde that collected turbidity, depth and salinity. This sensor collected about 500 data points at 5 minute intervals for three full tidal cycles beginning March 28, 2018. The data at this location shows a strong pulse of sediment rich water as the tide comes in. The timing of this pulse is concentrated in the first 90 minutes of the incoming tide. The graphs show a clear up stream net flux of sediment at this location.

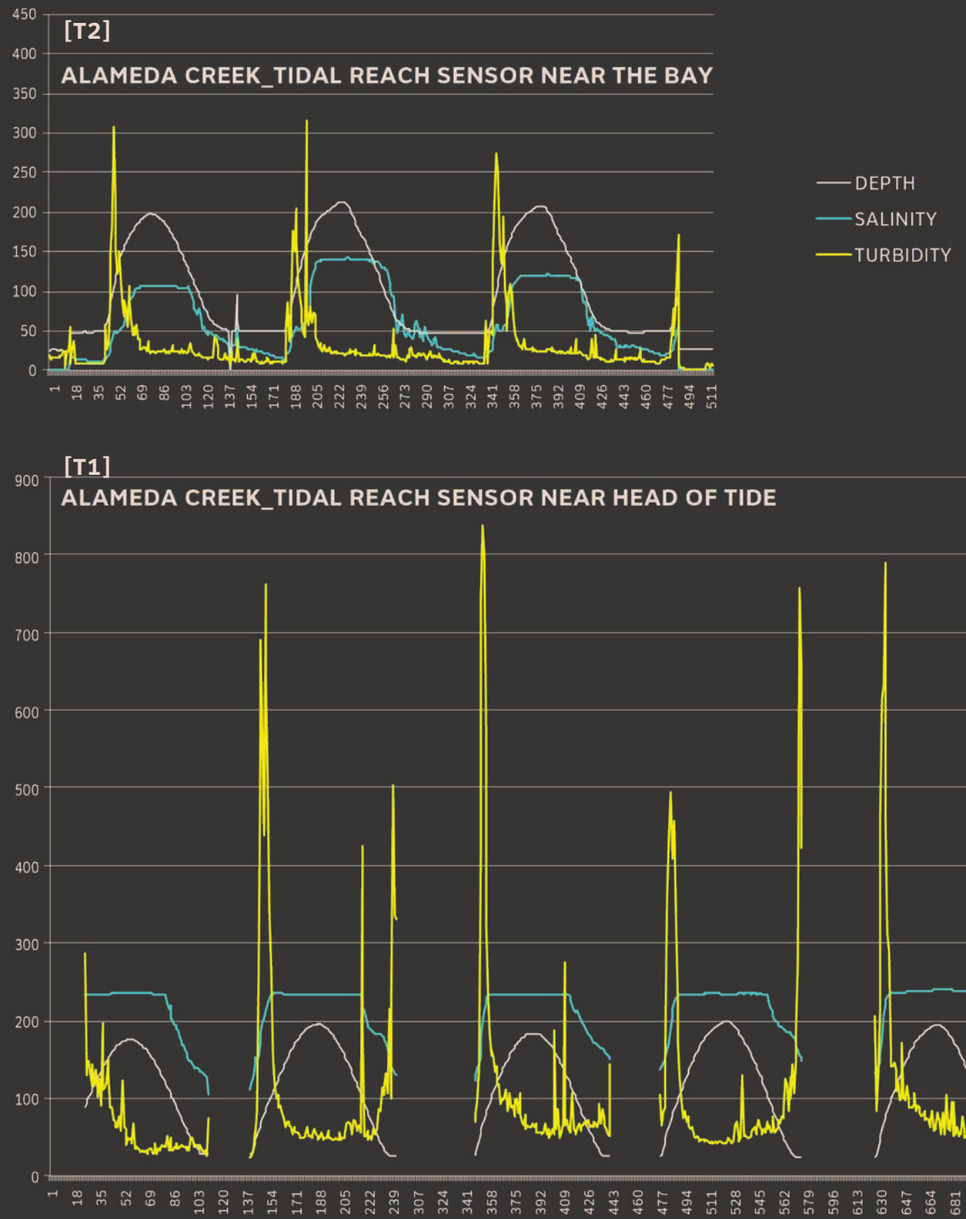
T2 AC near the Bay:
The deployment at T2 used a 10' long PVC tube attached to the channel bank to place a data logging sonde that collected turbidity, depth and salinity. This sensor collected about 800 data points at 5 a minute interval for a total of five tidal cycles beginning March 27, 2018.

The data collected at this location shows a sediment pulse on both flood and ebb. The stronger turbidity signal is on the flood tide, but there is still a significant signal on the ebb. The recorded turbidity spikes to double the amount of the upstream location, but only for about 15-20 minutes. A comparison of flood and ebb shows that there is probably more suspended sediment coming in with the tide, and the net flux could be close to zero.

During these three days, the data collected at these two locations shows that (1) the tidal action within the engineered channel creates a significant pulse of suspended sediment at the mixing area between fresh and saltwater as the tide moves up and down the channel; (2) there is an increase in the amount of suspended sediment both coming in with the flood and going out with the ebb closer to the Bay; and (3) the ebb sediment pulse diminishes closer to the head of tide, but the total amount of suspended sediment on the flood also decreases.

This was a preliminary proof of concept for a longer sensor deployment to understand the net sediment flux in the tidal reach to inform the Public Sediment designs for Alameda Creek. A future sensor deployment would help inform a levee breach location closer to the Bay with the potential to receive more suspended sediment on a flood tide, as well as inform a design that would minimize the the outflow of suspended sediment on the flood cycle.

TIDAL DEPLOYMENT DATA



#4
THE FUTURE BAY
PILOTS FOR BAY NOURISHMENT

THE NEED FOR MUD

UNLOCKING ALAMEDA CREEK challenges the idea that Bayland investment should occur only at the edge. Measure AA, intended to restore Bay Area wetlands, passed as an example of a truly regional ballot measure. As these funds are spent, it is critical to consider future sediment supply as a factor in this equation and invest in new methods of bayland sustenance, including tributary unlocking and alternative methods of actively dispersing sediment.

PILOT AND PLAN FOR A FUTURE BAY is a design/science collaboration that develops a plan for the future of the San Francisco baylands with low sediment supply and sea level rise. Investments in strong science are made – **it is time to translate this science into clear alternatives for decision-making and debate** that opens up this dialogue to a wider audience of policy-makers, agencies, and landowners. We propose a design-science partnership that explores new scenarios of sediment management for the Bay, articulating the physical realities, social dimensions, and long-term landscape implications of investing differently with mud. **From this process, a series of pilots will be identified and constructed that prepare the region's living infrastructure for more extreme rates of sea level rise.**

IS IT REALLY THAT URGENT?

Yes. Our team has prepared concept calculations that compare potential sediment inputs for Alameda Creek and potential sediment needs for its associated wetland sink, Eden Landing Phase I and II. While there are many unknowns, these calculations are shown across a range of sea level rise projections and potential variabilities in local sediment supply (current, 50% of current, and 200% of current) to incorporate future uncertainties. These calculations assume an accretion rate of 6 MM/ YEAR from the Bay annually, and that all of Alameda Creek's sediment is depositing in Eden Landing Baylands, a highly unlikely scenario, as much of the sediment moves directly into the Bay. These calculations also assume that the entirety of Eden Landing is elevated to marsh plain elevation, today (not the current, subsided scenario).

The discrepancy between supply and need shown below is clear and demands more open dialogue around how we plan and invest in Bayland edges. We can start this process now by investing in **UNLOCKING ALAMEDA CREEK** as an implementable project that tests these ideas and provides a replicable pilot for other locked tributaries. We must collaborate now and openly discuss methods for **RETHINKING THE SEDIMENTSHED** of Alameda Creek's upper watershed to feed the Baylands. But we also must think bigger, and **PLAN AND PILOT FOR A FUTURE BAY,** scaling up these ideas and developing a design/ science framework for action that invests wisely in living infrastructure in an era of sediment scarcity and climate change. Collaboration, open discussion, and design/science partnerships are fundamental in meeting this challenge and developing a resilient Bay

METHODOLOGY:
Sediment needs were derived from a spatial elevation analysis of the most recent Adapting to Rising Tides LiDAR data. Existing elevations were subtracted from target marsh plain elevations to obtain sediment needs. Those needs were multiplied by the bayland area obtained from SFEI BARRI data to produce a sediment need volume. Using bulk density conversions, sediment volumes for marsh and mudflat habitat types were converted into mass to obtain numbers that reflect a need that considers soil composition.

ASSUMPTIONS:
1. SLR rates were selected from the Ocean Protection Council update on sea level rise science.
2. An assumption of 6mm per year accretion rate was subtracted from the need numbers.
3. A bulk density of 1.5 sediment/cm3 soil was used for mudflat need and bulk density of 0.5 g sediment/cm3 soil was used for marsh need (referenced from observed bulk density at Whale's Tail Marsh).
4. Numbers reflect the need after diked ponds have been filled and are opened up to tidal action.
5. Bayland extents and habitat types were defined by SFEI BARRI AND CARI datasets.
6. LiDAR data from Adapting to Rising Tides was used to determine diked pond depths.
7. Alameda Creek sediment load data referenced from SFEI Flood Control 2.0 and Changing Channels report.

SEDIMENT SUPPLY VS DEMAND WITH FUTURE UNCERTAINTIES

CURRENT SUPPLY

SEDIMENT INPUTS FROM ALAMEDA CREEK 2018 -2100

7,000,000 MT
(metric tons)

55% NEED MET WITH 3 FT SLR

14% NEED MET WITH 7 FT SLR

0.5X SUPPLY

SEDIMENT INPUTS FROM ALAMEDA CREEK 2018-2100

4,500,000 MT
(metric tons)

28% NEED MET WITH 3 FT SLR

7% NEED MET WITH 7 FT SLR

2X SUPPLY

SEDIMENT INPUTS FROM ALAMEDA CREEK 2018-2100

14,000,000 MT
(metric tons)

110% NEED MET WITH 3 FT SLR

28% NEED MET WITH 7 FT SLR

SEDIMENT NEED FOR EXISTING BAYLANDS AND RESTORED EDEN LANDING: CURRENT SUPPLY

POTENTIAL PILOTS: STRATEGIC PLACEMENT AND TRIBUTARY SEEDING

#3
IMPLEMENTATION ROADMAP
SHORT AND LONG TERM VISION

IMPLEMENTATION ROADMAP
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IMPLEMENTATION ROADMAP
LONG TERM VISION

The Public Sediment team aims to invest in large scale, sustainable living infrastructure that is replicable at many scales over time. Beginning with one tributary, our long-term vision is to recalibrate watersheds of the San Francisco Bay and adapt them to climate change – to repair broken systems that trap sediment, limit ecosystem connectivity, and isolate communities. Scaling-up, watershed by watershed, this methodology would aim to balance sediment inputs from tributary sedimentsheds with the needs of the bayland ecosystems at its edge, keeping pace with sea level rise.

TRIBUTARY SCALE: Alameda Creek is a prime tributary to begin this work, an ideal site for 'investing in mud.' Alameda Creek is the largest sedimentshed that feeds the bay, contributing over of 100,000 metric tons of sediment annually with the potential to provide more over time. The Creek has potential to supply sediment to one of the largest tidal marsh restorations project active in the Bay area, the South Bay Salt Ponds Restoration Project at Eden Landing. This project requires a long-term sediment supply—a supply that Alameda Creek could begin to serve if the Creek was designed to transport sediment and connect to Eden Landing.

Alameda Creek feeds the South Bay, where suspended sediment volumes are highest and marsh survival projections suggest wetland investment is a sustainable option. The watershed holds a limited amount of low density development at its vulnerable perimeter- an area impacted by sea level rise and highly susceptible to subsidence, making expensive hard-infrastructure perimeter 'solutions' like certified levees and seawalls less feasible in the short term and subject to catastrophic failure in the long term. **This site, like many sites around the bay, requires a new approach.**

Living infrastructure, like marshes and mudflats, are a multi-benefit investment for this site that address systemic needs. Marshes and mudflats cushion the impacts of sea level rise and extreme tides over the long term with a host of short-term benefits that begin to be realized immediately upon construction, such as habitat creation for a wide range of threatened and endangered species, increased recreation, upstream connectivity, carbon sequestration, erosion control, and water filtration. The benefits are not small – over 6,400 acres of future bayland are in question at Eden Landing alone. Most importantly, living systems like marshes and mudflats can adapt to uncertain rates of sea level rise. Unlike the hard infrastructure of levees and seawalls, bayland systems fed by functional tributaries can grow with the threats of climate change. **But they can only do so with enough sediment.**

Alameda Creek is an ideal long-term study site for this work. Our near-term project, Unlock Alameda Creek, is a downstream intervention that enables 'unlocking' upstream in the future. Without this intervention, sediment will continue to be viewed as a nuisance—a material that increases liability and flood risk—rather than a resource both in the channel and in the Bay. **Our long-term vision, Rethink the Sedimentshed, builds upon our short-term work in the lower creek and suggests a large-scale unlocking of the upper watershed.** The collaborative planning effort would engage dam operators, water managers, regional watershed policy makers, and flood control districts to balance tidal bayland needs with upstream concerns. This effort would assess the potential to retrofit and operate dams for sediment transport, harvest sediment from upland reservoirs, and import and reuse sediment currently treated as a waste product. It would quantify sediment accretion

TRIBUTARY SCALE : Alameda Creek Watershed (above) and UNLOCK ALAMEDA CREEK (right)

IMPLEMENTATION ROADMAP
LONG TERM VISION, CONT

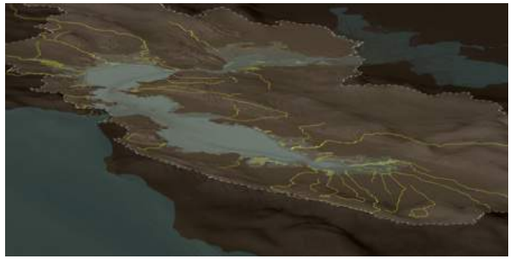
rates and bayland adaptation needs, balancing these with upstream sediment supplies. It would also recognize and plan for a likely future where Alameda Creek is not enough, and through the efforts of our proposal PLAN+ PILOT FOR A FUTURE BAY, be ready to test and implement new sediment delivery solutions to nourish critical living infrastructure.

But dams cannot be removed overnight – reservoirs provide critical drinking water for residents of Alameda County and the city of San Francisco. Recharge ponds replenish the local aquifer and protect the water supply from saline intrusion with sea level rise. **A rethinking of water management infrastructure will take decades—exactly why we need to start this conversation now.** This means developing an open conversation with key stakeholders, landowners, and operators -a partial list of this constituency is included in the stakeholder section of this report.

Who benefits from this tributary scale proposal over time? There are vast ecosystem and recreational benefits to sustaining baylands over time, well documented in reports like the Baylands Climate Change Update. While the ecosystem benefits are known, the flood risk reduction benefits of a stable sediment supply are not well documented in the region. Our strategy, to supply sustainable sediment feeds to the baylands, most directly benefits bay-edge residents who face subsiding ponds, sea level rise, and risks of increased erosion over time by building a wetland cushion at the edge. This has flood risk reduction value.

With the larger sedimentshed unlocked, Alameda Creek could be a critical sediment life support provider for all south Bay wetlands, benefiting the dispersed communities, infrastructure, and non-human residents of this massive system. Today, Alameda Creek supplies 4% of the sediment loads to the entire Bay, including sediment entering through the Delta (Communication with Scott Dusterhoff, SFEI). This is a significant source of sediment, higher than any other South Bay tributary. Alameda provides over 100,000 annual metric tons of sediment on average while the second largest south bay supplier, San Thomas Aquino Creek, provides 20,000 annual metric tons, a fifth of the amount. Alameda Creek is one of the most critical suppliers of sediment to the existing and proposed wetlands of the South Bay, including the 15,000 acres under restoration by the South Bay Salt Ponds Restoration Project. It could also feed new potential tidal wetland restoration acreage of the future, as the 8,000 acres of Cargill Ponds are not guaranteed to continue operation into the future with sea level rise and one day may transition to tidal baylands.

Alameda Creek provides a substantial portion of the sediment in the South Bay, which benefits the entire perimeter of the South Bay. The South Bay edge hosts over 11 waste water treatment plants, four power plants, the bases of the Dumbarton Bridge and San Mateo Bridge, thousands of residents, and high concentrations of low-lying vulnerable populations. Scientific modeling has shown that the restored baylands of the South Bay Salt Ponds restoration project would mitigate tidal range extremes throughout the entire Bay in an era of sea level rise (up to 10 cm of tidal range reduction in the South Bay as studied by Mark Stacey), as compared to a hard-edged scenario. While these coastal protection benefits are meaningful, of equal importance are the vast and irreplaceable ecosystem benefits of the current salt ponds and future wetlands. Tidal baylands will be critical protective infrastructure for this region in the future, and none of these tidal wetlands will be sustainable over time without sediment.



BAY SCALE : Local tributaries to the Bay

BAY SCALE: Public Sediment for Alameda Creek is just a test. Looking beyond the single tributary, the techniques and partnerships piloted in Alameda creek can serve as precedent for bay-wide action. Over the next decade, the Public Sediment methodology and ethos must be applied to other tributaries, particularly tributaries that contribute large volumes of sediment to the bay today, tributaries with large volumes of sediment trapped upstream, or tributaries with the most potential or need for tidal bayland cushions at their mouth. An adaptive sediment management strategy must be developed for the region that balances the sediment inputs to the bay with local tributary inputs, sea level rise rates, and tidal bayland restoration and coastal protection goals. As a region, we must answer the critical question: Where should we invest with mud? What communities get this critical resource and in what areas is long term bayland survival unlikely? How can sediment be equitably managed in areas where its benefits will persist for the long term? These are difficult and fraught questions – but the region has time to plan and implement projects that can realistically and fairly address these critical questions. **A long-term plan for the baylands requires a forthright discussion today.** Our proposal for PLAN AND PILOT FOR A FUTURE BAY acknowledges this need for a larger scale vision for bayland investment. The beneficiaries for such a large-scale effort to sustain the bay are vast, but we also know that, as a constituency, they value the Baylands. Just last year, residents of the 9-county region voted through measure AA to tax themselves to fund large-scale conservation of the Bay—and sediment is a critical future need for the baylands.

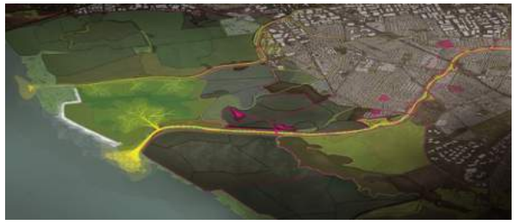
STATE SCALE: The San Francisco Bay is fed by local tributaries, but also by the flows of the two rivers that span the state – the Sacramento and the San Joaquin. Historically, these rivers provided the majority of the Bay's sediment, building historic marshlands and mudflats. During the Gold Rush, hydraulic mining power-washed hillsides and flushed huge volumes of sediment into these rivers. This surplus helped build some of the marshes and mudflats we know today. Today the situation has pivoted - while once a large majority of sediment came from the Sacramento and San Joaquin, today more comes from local tributaries. As the local scale is more manageable, it is reasonable to start addressing the scarcity problem with local tributaries. **Despite the promise of tributary input, to truly provide sediment flows that can sustain bay-scale marshes with aggressive rates of sea level rise, we must look upstream to the impounded waters of the state, to consider higher-impact solutions and long-term landscape changes.** If the delta changes dramatically in the next decade, it could have an outsized impact on bay sediment supply. Equally sizable shifts could occur with changes to upstream water management regimes or upland land management change. Although sediment harvesting from dams as distant as the Sierra foothills may seem far-fetched today, as the undesirable effects of climate change are felt and dam infrastructure continues to age beyond its life expectancy, mobilizing and using this sediment will come to be assessed and valued from new perspectives. A series of scenarios and a strategic long-term planning and visioning process should begin today.

STATE SCALE : Sacramento / San Joaquin Rivers

IMPLEMENTATION ROADMAP
NEAR TERM PROJECTS

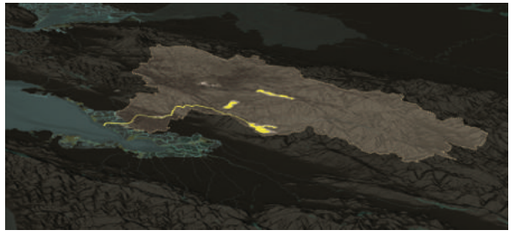
To achieve this long-term vision, we must start now with Public Sediment for Alameda Creek. This proposal has three critical parts:

UNLOCK ALAMEDA CREEK is a near-term project that links the Creek and the Bay. It provides a sustainable supply of sediment to the baylands for sea level rise adaptation, reconnects steelhead with their historic spawning grounds, and introduces a network of community spaces that physically connect to the water body.

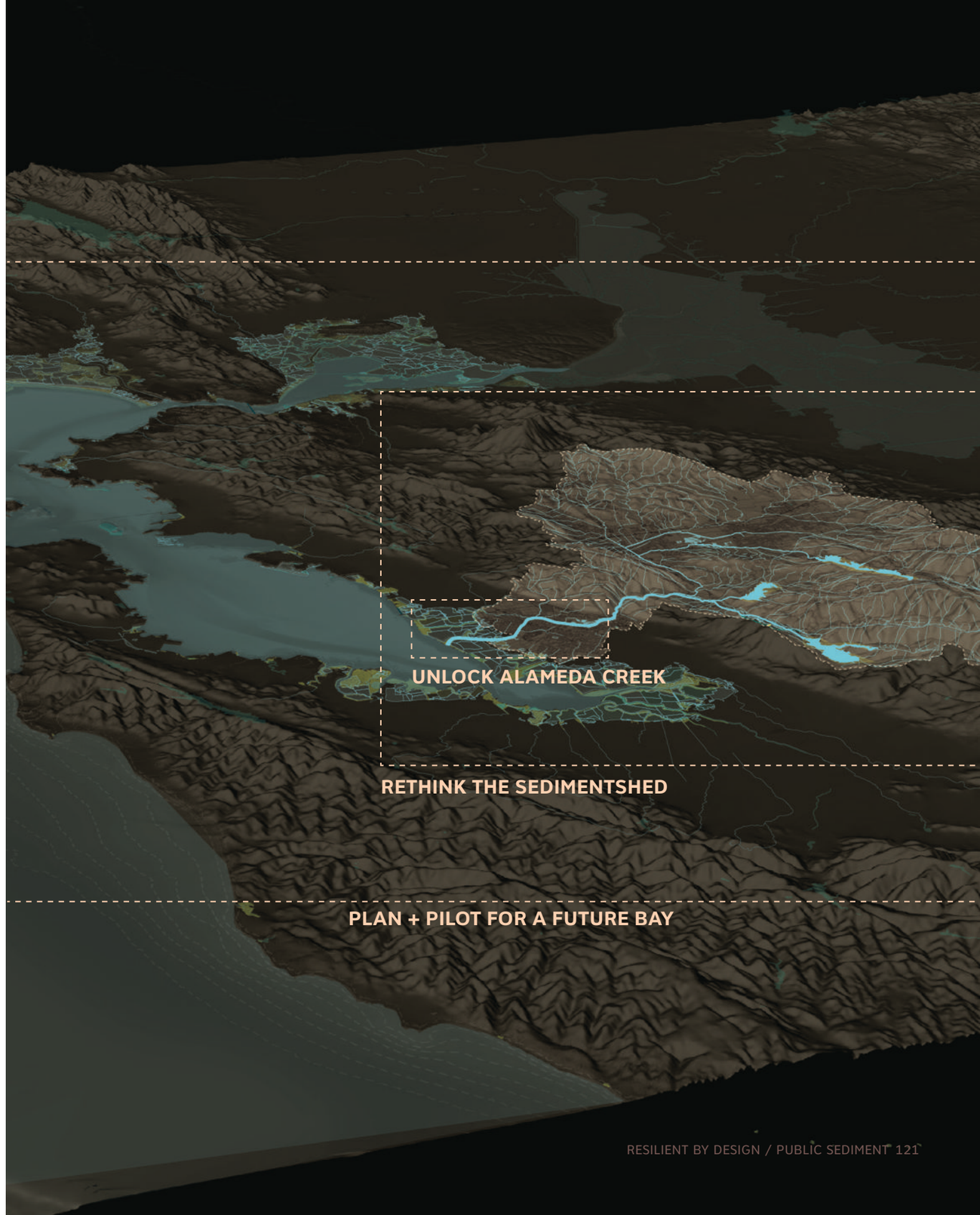


Two additional initiatives will support Unlock Alameda creek and help ensure that strategies developed at Alameda creek can be adapted and scaled to unlock sediment across the bay:

RETHINK THE SEDIMENTSHED is a long-term, multi-agency planning and visioning process for the sedimentshed of Alameda Creek that balances creek inputs with bayland needs over time. The planning process would develop strategies to rethink upland dam and reservoir infrastructure, to harvest sediment and move it downstream. It would quantify and monitor the sediment needs of the changing baylands.



PLAN + PILOT FOR A FUTURE BAY proposes that we plan now for the future of all the San Francisco baylands with low sediment supply and sea level rise. We propose a design-science collaboration that explores new scenarios of sediment management for the Bay, articulating the physical realities, social dimensions, and long-term landscape implications of investing differently with mud. This process will establish a joint vision for bayland sediment sustainability to guide investment over time, identifying and implementing a series of pilots that will help prepare the region and its living infrastructure for more extreme rates of sea level rise.



IMPLEMENTATION ROADMAP
NEAR TERM PROJECTS

For each proposal, we have developed an overview of the phases of work required to advance the project, broken down by sub-project. The identification of funding sources and key grant applications are first step for all projects. In addition, we have developed catalytic 'early phase' projects that can occur with smaller sources of funding and advance in tandem with longer design and planning studies.

			1-2 years	2-5 years	year 6 - 10	10+
UNLOCK ALAMEDA CREEK (PROJECT)			***Project development and grant applications. Early phase proposal (catalytic actions)***	***design & permitting***	***construction***	
			Project development and grant applications. Early phase proposal (catalytic actions). Vet and establish a mitigation credit system to support the project.	Design & Permit (includes design enhancements to current ACFCWD low-flow channel proposal)	construction	Inhabit, monitor, maintain, adapt, replicat
RETHINK THE SEDIMENTSHED (PLAN)						
			predevelopment: planning, feasibility analysis, financing plan development		project identification & design	project development & plan implementation
PLAN AND PILOT FOR A FUTURE BAY						
			predevelopment: planning, feasibility analysis, financing plan development, pilot design		complete pilot design & permitting, implement pilots	monitor, manage, adapt, replicate

UNLOCK ALAMEDA CREEK
A COALITION OF KEY STAKEHOLDERS

We have formed a Coalition of stakeholders through the RBD process to advance the work of Unlocking Alameda Creek. A larger stakeholder working group involving over 40 community, local, and regional stakeholders have been involved in shaping this proposal and would continue to advise on the ongoing work.

Within this larger working group, a coalition of key stakeholders have expressed interest in joint grant pursuits for the implementation of UNLOCK ALAMEDA CREEK, including the **Alameda County Flood Control and Water Conservation District, the State Coastal Conservancy, the East Bay Regional Park District, and the South Bay Salt Ponds Restoration Project.** This coalition has the internal capacity, legal authority, community presence, and mission-alignment to implement this work over the next decade. It is imperative that local community stakeholders and scientific advisors (Alameda Creek Alliance, SFEI) are highly engaged in the process to provide community feedback and apply lessons learned to larger scale regional work.

A coalition, not a single entity, is critical to implementing this work, as no one of these partners has the authority or expertise to realize all the elements of this project. Only as a coalition can they ensure that the multi-benefit goals of the project (around sustainable sediment flows, human access and awareness of the creek ecosystem, and ecosystem benefits particularly for migratory species) remain intact. The Coalition would likely form with a Memorandum of Understanding, that would clearly articulate the goals of the larger project and identify which agencies would lead the permitting on which aspects of the project. The lead agency would shift depending on the geography of the effort – ACFCD in the channel, the Coastal Conservancy and South Bay Salt Ponds Restoration Project at Eden Landing. These agencies have the ability to band together because Public Sediment for Alameda Creek strengthens their ongoing initiatives.
Unlock Alameda Creek links together a number of ongoing, independent efforts happening in the watershed, transforming them into a systemic strategy greater than the sum of their parts.

The Alameda County Flood Control & Water Conservation District has been advancing a low-flow channel concept and drawing set over the past years (currently at 70% permit set completion) for Alameda Creek, to address issues of shrinking flood capacity and increased dredging needs. The Public Sediment team has collaborated with the Flood Control District and built on this ongoing work to add ecological complexity in the sediment and fish channel design, introduce new types of vegetative and non-vegetative bankfull channel stabilization techniques, introduce larger scale ecological habitat regeneration strategies along the creek, and design methods of public access and seasonal engagement with the channel itself. Our work has conceptually transformed a well-considered project developed primarily for flood control into a multi-benefit proposal that improves public access, fish passage, ecological diversification, habitat reconstruction, and sensing and monitoring of the channel. We have tied this work to a great imperative around connecting sediment to the bay, valuing the quantities of sediment that may be generated and articulating their value to the baylands of the future.

The South Bay Salt Pond Restoration Project is currently in the public comment period of the DEIS for Eden Landing Phase II, at the base of Alameda Creek. Our work and collaboration with many partners at the bay's edge utilizes the analysis in the DEIS and proposes a number of design improvements that can be integrated into the FEIS as an additional alternative. Important modifications to the existing proposals are the proposed 100' wide breach of the Alameda Creek levee and reconceptualization of the proposed "landmass" as a dynamic Pebble Dune (gravel beach). The current DEIS plans show the levee breach as a small culvert. Through repeat discussion, collaboration, and creative brainstorming with SBSP and the Alameda County Flood Control District during the RBD Phase II process, an alternative was developed that addressed the fluvial and tidal flood risks posed by the breach, and the breach was proposed.

The Public Sediment team has also furthered the bayland planning work by expanding upon a concept proposed by the Alameda County Flood Control District – the landmass – a wide perimeter berm that dissipates tidal energy and erosion to reduce flood risk and liability. Our team has proposed a "Pebble Dune," hybridizing the landmass idea with a dynamic cobble beach system that can grow vertically in response to increased storm events. The Pebble Dune reinterprets the gravel beach habitat that once existed in the area, is more adaptive to climate change, and provides a nesting site for Least Terns, an endangered species. The dune enables the breach, which enables sustainable flows of sediment to feed Eden Landing over time. Our team has proposed these interventions and done preliminary calculations to suggest the amounts of sediment that the creek will provide to nourish the tidal wetlands.

Finally, our team has incorporated the human experience into the ecologically-driven Eden Landing planning process. While "Provide public access and recreational opportunities compatible with wildlife and habitat goals" is a stated objective of the current restoration project, it is lacking in the current alternatives. The Public Sediment alternative enhances public access through the introduction of new public access routes and Bay Trail extension, the proposed acquisition of Turk Island as a key part of the public access network, and bayland bridge that spans Alameda Creek, creating a new destination in the Bay that links existing multiple miles of path.

The Alameda Creek Alliance has advocated for Fish Passage Improvements and recently has secured $10 million dollars of funding with local partners, including the Alameda County Water District, to construct these critical connections. The Public Sediment team has built upon this work to focus on the migration corridor itself, and how sites between fish ladders, and between repaired barrier and the bay, can become more conducive to fish migration, particularly the threatened Steelhead fish.

East Bay Regional Park District has invested in multiple park facilities that directly line the bay and channel, including Coyote Hills Regional Park and the Quarry Ponds. They maintain the Alameda Creek Regional Trail for public access. We connect and build upon these existing assets with our public access strategy for the flood control channel of strategically located mudrooms, floodrooms, terrace trails, and seasonal bridges.

The San Francisco Estuary Institute has invested numerous years of science into initiatives like Flood Control 2.0 and the Changing Channels report, quantifying sediment inputs to the Bay system. Our work at Alameda Creek is a direct test of this science to an implementable project – we have spent time using SFEI sediment science and the papers of numerous scientists in the bay area (Lester McKee, Scott Dusterhoff) as a test towards implementation – using these references to calculate preliminary needs of Eden Landing marshes and the supply capabilities of Alameda Creek. With significant guidance from these scientists, the project represents a step forward in allowing sediment science to shape the planning process. The new work advanced in Healthy Cities, Resilient Baylands will further inform the development and replicability of UNLOCK ALAMEDA CREEK.

UNLOCK ALAMEDA CREEK
NEAR TERM VISION

UNLOCK ALAMEDA CREEK is an implementable project that links the Creek and the Bay. It provides a sustainable supply of sediment to the baylands for sea level rise adaptation, reconnects steelhead with their historic spawning grounds, and introduces a network of community spaces that physically connect to the Creek, the Bay, and each other.

Today, Alameda Creek is the largest local tributary feeding the Bay. Still, sediment remains stuck in the flood control channel, trapped behind dams, and is unable to make it to the Baylands where it is needed for marsh and mudflat accretion. Unlock Alameda Creek is a buildable project that redesigns the creek to enable sediment flows and reconnects them to the Baylands, balancing the needs of people, fish, and sediment in the watershed. The creek levees will be selectively breached near the mouth to feed bay marshes with sediment and manage flood risk at the bay edge. The flood control channel will be redesigned to move sediment, support vegetative diversity, and enable fish passage during critical migration seasons. Public access will be expanded along the 12-mile flood control channel that links Fremont, Union City, and Newark, enhancing recreation, environmental education opportunities, and regional connectivity.

Alameda Creek connects communities that are diverse in race, ethnicity, age, and income, linking them with each other and the bay. For too long, Alameda Creek has been viewed solely as a flood control channel. The Public Sediment Team has worked hard to establish a vision for Alameda Creek as a living system that is socially inclusive, ecologically functional, and adaptive to future sea level rise and climate change. Unlock Alameda Creek is a realizable project with clear benefits both now and in the future.

The Public Sediment team and its core partners identified specific implementable subprojects to accelerate the implementation of this critical work, each with an early phase proposal to happen concurrent with larger project planning, funding, and design. These are:

A Active Channel construction for people, sediment, and fish within Alameda Creek Flood Control Channel between Head of Tide and the Bart Weir. Early phase proposal: Mudroom and Channel Planting prototype.

B Modular Living Levee system for toe reinforcement, planting, habitat creation, and slope stabilization. Early phase proposal: Fabricate, prototype, and test the unit in Alameda Creek.

C Large Scale Floodroom Creation within AC Flood Control Channel for habitat creation and active channel construction mitigation. Early phase proposal: Vet sites and establish mitigation credit system to support the project.

D Bay Breach and Public Access within Eden Landing Phase II and Alameda Creek Channel, including land acquisition for public access. Early phase proposal: Install sensors at HOT and within channel tidal range to monitor sediment flows from HOT to Bay, with public education component.

E Pebble Dune at the bay perimeter for flood protection and tidal inundation. Early phase proposal: Pilot cobble beach along a 300’ stretch of shore.

F Creek Constituency Building to enable larger, public discussions about the future of the creek and how to improve its function for the community. Early phase proposal: Expand Creek Atlas and outreach events into Creek Charrettes for the public.

G Long term Scientific Sensing Strategy + Schools Outreach within the Alameda Creek watershed. Early Phase item: Expand curriculum developed with Michelle Kerr High School Students.

UNLOCK ALAMEDA CREEK
PROJECT FUNCTION + BENEFITS

UNLOCK ALAMEDA CREEK recognizes that the Baylands and Creek must work together as a connected system. While interventions in the Baylands and interventions in the creek each have great benefit, their collective impact is strongest when they are considered together, as a functional ecosystem.

Functions and benefits of the systemic project are:

ECOSYSTEM FUNCTIONS AND BENEFITS DERIVED FROM PROJECT

A D **1)Increased sediment loads to tidal baylands build resilience for these ecosystems, which have the following well-documented ecosystem benefits:**

a. Carbon sequestration
b. Water filtration and storage
c. Habitat provision to a wide range of migratory and resident species, including threatened and endangered species, including the California Clapper rail, California Black Rail, Salt marsh harvest mouse, and steelhead trout.

D **2) A direct, 100' wide connection between Alameda Creek and the Eden Landing Restoration creates new, large scale estuarine habitat at the Bay's edge, which does not currently exist in the channel. In addition to the benefits associated with marsh creation, this opens up opportunities for species that need to use the creek as a migration corridor, including:**

A more sustainable and resilient Eden Landing Restoration. The proposal dramatically increases sediment supply to the tidal baylands restoration at Eden Landing through the breach of the Alameda Creek Levee to the North. The proposal creates a direct connection to the salt ponds under restoration, supplying a percentage of the Creek's sediment load directly to these wetlands (121,000 metric tons/ annually, plus additional 5700 metric tons of sediment from active channel construction). There are no current methods to directly estimate the percentage of the Creek's sediment that will enter at the 100' width breach point. However basic calculations that assume 100% of this material reaches Eden Landing show that the creek's sediment load is potentially enough to supply Eden Landing Phase II and potentially Eden Landing Phase I with 3' of SLR by 2100. The region is investing approximately $24 million - $33 million dollars of tidal bayland restoration at Eden landing, the breach makes this project more resilient with sea level rise. When compared to the costs of alternative placement techniques (not currently allowed in the Bay), and a conservative assumption that 10% of the sediment loads of Alameda Creek would make it in to the Eden Landing baylands, if artificially supplied through thin layer placement this volume (12,100 metric tons) could cost over $314,000 / year. *(A thesis paper studying the potential of thin layer placement on existing marshlands written by Scott K. Hine at USF estimated thin layer placement costs at 22.75/ cy, totaling a potential additional value of $113,750 annually.)*

b. Transition zone for threatened salmonid species using Alameda Creek. Today, there is no transitional habitat for juvenile steelhead out-migrating from Alameda Creek to transition to the salt water environment, limiting survival and reproductive success of the population. This benefit is substantial for the restoration of steelhead species to this watershed – once one of the largest populations in the bay area. Over 10 million dollars of investment has been allocated for fish passage in the channel, adding this transition zone for out-migrating juveniles builds upon this investment to improve the ecosystem. Salmonids include steelhead trout, pacific salmon, coho salmon, and chinook salmon.

A **3) The active channel construction to transport sediment and improve fish passage within the fluvial reach of the flood control channel has numerous ecosystem benefits:**

a. Help sustain the Eden Landing Restoration project and other South Bay baylands. Ecosystem benefits associated with annual feeds of sediment distributed by landscape process are invaluable. We face an impending sediment scarcity, with a great need for sediment released slowly over time. Tributaries are the most feasible local alternative for addressing this problem in the next decade. Slow releases of sediment nourish marshes and mudflats, allowing them to accrete to adapt to sea level rise. The additional 5,000 cy (5700 metric tons) / year of sediment projected to be released by the active channel construction subproject is comparable to the flows of entire tributary systems – the adjacent Coyote Creek provides just over this amount annually (6500 metric tons). Increasing sediment transport capacity annually in Alameda Creek would be comparable to adding another tributary source to the system. While potential supplements to tributary sources may emerge in the future as regulations change and sea levels rise, these alternatives still have associated costs, and these costs help guide valuation of active channel construction.

b. Improved passage for migrating steelhead trout, other salmonid species, and Pacific Lamprey, building on over $10 million in investment in fish passage structures. Currently the channel is a 'migration gauntlet' -- too shallow (critical riffles and spread out flows) in many segments for fish passage, not meeting minimum criteria. The introduction of a fish channel within the active channel, stabilized by vegetation, creates a more consistent and accessible passage for migrating fish species. The deeper water will be cooler, improving water temperature requirements for passage, and have some vegetation (shading and protective cover).

c. Migratory and side-channel habitat for other migratory (anadromous) fish, including pacific and river lamprey. While these species are less charismatic, the Pacific Lamprey is a federal species of concern and plays a valuable ecosystem role in the Alameda Creek watershed.

d. Increased habitat for other native and resident species in the creek, including birds, fish, and amphibians, due to more diverse vegetation, sediment conditions, meandering / complex channel morphology, and habitat structural diversity. Alameda Creek hosts one of the best assemblages of native stream fishes in the San Francisco region, including hardhead, Sacramento blackfish, Sacramento perch, and tule perch, California roach, hitch, threespine stickleback, Sacramento sucker, Sacramento pike minnow, and prickly sculpin.

e. Mitigation benefits. In-channel fish passage and migration habitat establishment have potential to reduce mitigation requirements for the construction phase of the active channel.

C **4) Floodrooms for floodplain habitat restoration, both fluvial and tidal, are important for ecological health.**

a. Creation of many acres of Floodplain habitat as refuge for in-migrating adult salmonids (rest stops and high-flow refugia) and out-migrating salmonids (foraging and refugia). Beneficial to wide range of birds, fish, and amphibian species.

b. Mitigation credits. Floodroom construction passage and migration habitat establishment have potential to reduce mitigation requirements for the construction phase of the active channel.

c. Additional ecosystem benefits of expanded fluvial and tidal wetland creation include carbon sequestration, urban heat island reduction, and water quality and management.

UNLOCK ALAMEDA CREEK
PROJECT BENEFITS, CONT

E **5) The proposed Pebble Dune at the outer perimeter of the Eden Landing sites has ecosystems benefits including:**

a. Restoration of a historic habitat type (gravel beach) no longer found in this area of the bay
b. Nesting sites for least terns, endangered species of the bay area. Nesting zones are created far from sites of public access, making them particularly valuable for refuge.

b. Haul out zones for harbor seals on the expanded mudflats at the front of the Pebble Dune.

c. Replicability: Project will be a pilot for larger scale gravel beach constructions, which could be used on many edges of the bay.

FLOOD RISK REDUCTION + MAINTENACE FUNCTIONS AND BENEFITS DERIVED FROM PROJECT

A **1) Increased annual sediment transport down Alameda Creek through active channel creation to head of tide. (Potentially 5,000 cy year transported by landscape processes).**

a. Sustains the 'Cushioning' Benefits of Tidal Wetlands: In addition to the ecosystem benefit of sustainable tidal marshes, the additional flows of sediment will nourish marshes and mudflats that cushion the vulnerable edges of the south bay to sea level rise. This benefit is modest with the additional 5,000 cy/year of sediment released but is sustainable over time.

b. Dredging and de-silting costs avoided throughout the fluvial reach of the flood control channel. Dredging and de-silting is an expensive operation, valued at $25.20/cy ($126,000/ year). Cost savings potentially are much higher, given the difficulty in permitting dredging operations and the associated mitigation costs.

c. Fluvial Flood Capacity Improvements: The Flood Control channel is nearing capacity within certain reaches due to sediment aggradation. Active Channel construction has the ability to improve fluvial flood storage capacity. Floodroom construction has the ability to increase fluvial and tidal reach flood storage capacity. These improvements mitigate a modest amount of flood risk and increase capacity in the Alameda Flood Control channel to enable public-space and vegetative installations that are not possible today. While the flood benefits may be modest today, they proactively address known future challenges of sedimentation and flood capacity reductions with future accumulation.

d. Potentially enable the future ability to transport more sediment from the upstream watershed: Alameda Creek provides 4% of the entire bay's sediment supply, including flows from the Delta ,and approximate 12% of the supply from local tributaries. This is an extraordinary volume. However, the watershed holds potential to deliver more sediment - if the upper watershed was reconfigured to transport sediment, through dam removal, pulsing, or diversion, Alameda Creek could provide more sediment to the Bay and serve a role closer to its historic function. Today this conversation is impossible – since the Flood Control Channel traps sediment, and limits flood control function, the concept of adding more sediment to the system from upstream is untenable. While it is unlikely that the Flood Control channel in its current configuration will ever transport sediment loads directly comparable to the historic creek, the active channel construction is one small step towards recalibrating this watershed to open up future projects and possibilities. Without a channel that moves sediment, this conversation can not occur.

e. Generating material for sediment-based landscape features at other locations. Done in tandem with the proposals at the Bay's edge, the active channel construction can 'recycle' the sediment extracted through construction, sort it, and use it to 1) lift salt ponds to future marsh plain elevation (fines and small sands), 2) Build the Pebble Dune feature (coarse grain material). This project artificially replicates the historic sediment transport system, using the material of the creek to build documented historical ecosystems at the bays edge– gravel beaches and silty marshes.

D **2) Increased Sediment flows to Eden Landing: The project creates a direct connection through a breach of the flood control channel to Eden Landing Phase II. This builds resilience to sea level rise and has the following benefits:**

a. Increases sustainable flood risk reduction benefits to the urban edges of Eden Landing. The urban edges of Alameda County are susceptible to sea level rise. Investment in ecological infrastructure that can grow with the threats of climate change offers flood risk reduction benefits in the form of reduced tidal extremes, reduced inundation during storm events, wave attenuation, and erosion.

b. Subsidence reversal at Eden Landing – The salt ponds retired from industrial production are subsiding, increasing edge vulnerability over time. Greater sediment flows and tidal flows into this system from Alameda Creek will help reverse subsidence and build land vertically over time.

c. Serves as a test case for the future Cargill ponds: With rising seas, it is unlikely that the Cargill ponds will remain viable salt production sites for the long term. Increased sediment flows at Eden Landing and their later monitoring and evaluation will provide important data that will inform the long-term future of the Cargill ponds, part of the historic Niles Cone wetland necklace.

C **3) Floodrooms for floodplain habitat restoration, both fluvial and tidal, can benefit sediment management practices in the following ways:**

a. Create sites for future mechanical sediment removal, where sediment can be directed to deposit in a more predictable way that can reduce desilting costs and habitat impacts over the long term.

b. Generate significant clean fill for reuse in wetland restoration to fill ponds to marsh plain elevation prior to breaching, valuable for habitat creation and long term survival.

E **4) The proposed Pebble Dune at the outer perimeter of the Eden Landing sites has habitat benefits including:**

a. Flood Protection benefits accrued from the reduction in tidal energy and delay of the tides behind this landscape feature. This enables the breaching of Alameda Creek.

b. Ability to adapt to sea level rise as the system is not a static structure, it will grow vertically in response to extreme storms. This is a common pattern of gravel beaches.

c. Material reuse opportunities, using coarse grain material harvested from Alameda Creek during the construction and/or de-silting process of the channel.

B **5) The Living Levee module has a number of multi-benefit attributes that link ecosystem benefits with flood control needs. These include:**

a.Erosion reduction and toe reinforcement while adding new vegetation to the channel.

b.Sediment and fish channel stabilization at shaded bridge bases, providing habitat and cover for fish.

c. Edge stabilization at the mudrooms and terrace trail entry points, allowing access to the creek ecosystem.

UNLOCK ALAMEDA CREEK
PROJECT BENEFITS, CONT

SOCIAL FUNCTIONS AND BENEFITS DERIVED FROM PROJECT

D 1) Public Access improvements at the Baylands include a bridge over the AC Flood Control Channel, an enhanced trail system, and land acquisition for further recreational lands.

a. A more connected trail system. The Public Sediment proposal builds upon the work underway at Eden Landing to expand the public trail network to link Eden Landing with Coyote Hills and new lands at Turk Island.

b. New public lands for recreation. The project advocates for the acquisition of Turk Island and Cal Hill as new recreational parks and refuges.

c. New experiences in the bay for education and recreation. The Breach Bridge is a primary intervention here that adds new destinations to the Bay that improve recreation for locals and tourism opportunities for the region. The bridge spans the Alameda Creek Flood Control Channel and is a clear destination. It is a regional icon and can be seen from Dumbarton Bridge. It mitigates the loss of the existing trail at the northern side of Alameda Creek, past the new breach point.

A 2) Public Access improvements in the active channel reconstruction of the creek include mudrooms, seasonal crossings, and a flood terrace trail.

a. Increased stewardship opportunities along Alameda Creek and offset of vegetative management costs. The Flood terrace trail and mudroom allows limited, seasonal access to the creek and creates opportunity for stewardship and plant management of the creek by community partners, potentially reducing the maintenance burden for the county.

b. Every school can have a classroom in the creek. There is potential for each school within a 15 min walk of the creek to access a mudroom as an outdoor classroom to engage in creek processes and monitor the creek ecosystem.

c. Increased connectivity between neighborhoods every half mile. The current neighborhood is fragmented by the creek, with crossing points further than a mile apart and bisected by transportation infrastructure. The seasonal crossings would occur approximately every half mile and enhance local connections for residents, opening up the creek to new users and exchanges across the creek bed.

d. Increased recreational spaces that strengthen social bonds, including moments for social exchange, exercise, education, refuge, outdoor experiences, and play. Strong social networks increase long term resilience over time, our proposal includes this as a foundational element of the project and embeds space in the creek that is explicitly designed for people.

C 3) Floodrooms are new parcels along the channel that would be excavated for habitat creation and opened up to public access for recreation.

a. Increased recreational spaces that strengthen social bonds, including moments for social exchange, exercise, education, refuge, outdoor experiences, and play. Floodrooms introduce a significant amount of new public recreation space to the creek and are evenly distributed along the length of the system.

G 4) The monitoring and sensor strategy is specifically targeted to interpret the systems and performance of the creek to the wider public.

a. Expansion of the awareness of climate change impacts and practices to an engaged public over time.

b. Increased social infrastructure in the creek watershed with higher capacity to respond to climate change threats.

F 5) The Creek Constituency building proposal is specifically targeted to interpret the systems and performance of the creek to the wider public and allow the design to respond to community feedback.

a. Expansion of the awareness of climate change impacts and practices to an engaged public over time.

b. Increased social infrastructure in the creek watershed with higher capacity to respond to climate change threats.

G 6) The Classrooms for the Creek proposal is built to enhance creek education opportunities within the watershed and includes the schools and sensors workshops prototyped in the design phase of the project.

a. Engage multiple schools in the watershed around issues of climate change and ecosystem quality.

b. Create opportunities for hands-on learning in the creek.

c. Create opportunities for STEAM curriculum development around the creek.

UNLOCK ALAMEDA CREEK
IMPLEMENTATION TIMELINE

For UNLOCK ALAMEDA CREEK, we have developed an overview of the phases of work required to advance the project, broken down by sub-project. The identification of funding sources and key grant applications are first step for all sub-projects. In addition, we have developed catalytic 'early phase' projects that can occur with smaller sources of funding and advance in tandem with longer design and planning studies.

Near Term Project Phasing						
		Sub-projects	**1-2 years**	**2-5 years**	**year 6 - 10**	**10+**
UNLOCK ALAMEDA CREEK (PROJECT)			***Project development and grant applications. Early phase proposal (catalytic actions)***	***design & permitting***	***construction***	
Redesign the fluvial channel for people, sediment, and fish	A	**Active channel construction for people, sediment, and fish** within Alameda Creek Flood Control Channel between Head of Tide and the Bart Weir.	Project development and grant application. Mudroom and Channel Planting prototypes.	design & permit *(re-design and re-evaluation of current ACFCWD low-flow channel proposal)*	construct	inhabit, monitor, maitain, adapt, replicate
	B	**New modular living levee system** for toe reinforcement, planting, habitat creation, and slope stabilization.	Project development and grant application. Fabricate, prototype, and test the unit in Alameda Creek.			
	C	**Large Scale Floodroom Creation** within AC Flood Control Channel for habitat creation and active channel construction mitigation.	Project development and grant application. Vet sites and establish mitigation credit system to support the project.			
Reconnect the creek to the baylands	D	**Bay Breach and Public Access** within Eden Landing Phase II and Alameda Creek Channel.	Project development and grant application. Dredge pipeline tours	design & permit *(new design alterntive for SBSP Restoration Phase II)*	construct	inhabit, monitor, maitain, adapt, replicate
	E	**Pebble Dune at the bay perimeter** for flood protection and tidal inundation.	Project development and grant application. Pilot pebble beach along a 300' stretch of shore.			
	D	Land acquisition of Turk Island		fundraise & negotiate	aquire	inhabit
Create a Sediment Public	F	**Creek Constituency Building** to enable larger, public discussions about the future of the creek and how to improve its function for the community**.**	Project development and grant application. Expand Creek Atlas and outreach events into Creek Charrettes for the public.	*sustain*		
	G	**Long term Scientific Monitoring Strategy + Schools Outreach** within the Alameda Creek watershed.	Project development and grant application. Installation of sensors at HOT and within channel tidal range to monitor sediment flows from HOT to Bay, with public education component.Expand curriculum developed with Michelle Kerr Highschool Students.	*sustain*		
	F	Creek Constituency	Project development and grant application. Establish an Alameda Creek Sediment coallition	*sustain*		

UNLOCK ALAMEDA CREEK
FINANCE PLAN : COSTS

Costs for the early phase projects require consideration of many factors which are difficult to account for at such an early stage. Proposed early stage projects require implementation of new techniques untested in the Bay Area creating uncertainty in constructions costs. As such, the early phase projects are designed as pilots to test and refine the approach to implementing a full-scale version. Provided below are estimates of the order of magnitude that should be considered for the implementation of each of the early phase projects. In no way is this a detailed construction cost estimate but rather an estimate of the potential level of cost (i.e. are the improvements likely to cost tens of thousands or hundreds of thousands).

A **Active channel construction:** The revised material and grading changes to incorporate public access to the creek (mudrooms, terrace trail, and seasonal crossings) provide a multi-benefit element to the existing low flow channel design. Ecological elements – fish channel complexity, enhanced vegetative strategies, and revised topography add further multi-benefit elements. It is unknown at this time how extensive the public access and ecological design improvements will be, as this requires future modeling and study of the flood control channel. **The current channel design has been estimated at $28 million ($50 M including fish passage improvements underway) and it is recommended that an additional allowance on the order of millions of dollars be included for the overlay of the proposed multi-benefit elements.**

B **New Modular Living Levee system :** Prototyping and testing of the system is dependent on the methods used and scale of the prototype. Prototyping is likely to be on the order of tens of thousands of dollars.

C **Large scale floodroom creation:** the size and types of restoration and recreational elements for these designs will be site specific and vary by location within the fluvial and tidal portions of the creek. These sites have the potential require investment likely in the order of hundreds of thousands of dollars.

D **Creek Constituency Building:** Constituency building for the Creek is a worthy and long term investment that can be started with tens of thousands per year.

E **Bay Breach and Public Access :** The Proposed breach to Alameda creek is a revision to the existing plan that would like not incur any additional construction costs to the Eden Landing project as it would likely require less excavation compared to the alternative connection to the Bay. Mid complex levee raising would have some additional costs, but the mid complex levee construction is already accounted for in the South Bay Salt Ponds DEIS. Public access improvements such as the breach bridge would depend on methods of construction and materials used, but could be on the order of millions of dollars for a signature element.

F **Pebble Dune:** The pebble dune would be an overlay to the flood protection element of Eden Landing. The pilot project would likely be on the order of 100s of thousands of dollars depending on availability of desired material and methods of delivery.

G **Monitoring, Sensing, and Schools Engagement:** Two scales of implementation are possible - one that could be started this summer or next fall for tens of thousands of dollars using our existing encroachment permit and collaborating with educational partners developed through this design process. As the project develops, a more intensive installation (hundreds of thousands of dollars) investment can be made in a larger scale monitoring effort and educational curriculum development.

UNLOCK ALAMEDA CREEK
FINANCE PLAN : POTENTIAL GRANTS AND FUNDING SOURCES

	Name / Granting entity	source of funds	what it funds	Why is it applicable to unlock Alemeda Creek	Funding availability
State & Local Grants	**Measure AA Grants / SF Bay Restoration Authority**	**Measure AA funds**	Bay Restoration	Measure AA is directly applicalbe to the full extent of Unlock Alameda Creek, as a primary goal of the project is supplying sustainable sediment feeds to existing and new baylands at Eden Landing restoration project nd the wider South Bay.	$25 million a year for 20 years before automatically expiring in 2037
	Climate Ready: Nature-Based Solutions for Climate Adaption / California Coastal Conservancy	**Climate Ready grants**	Projects that use nature-based solutions to adapt to impacts of climate change. Special emphasis on pilots and on-the-ground projects. Projects must have greenhouse gas reductions embedded in the proposal. 75% of selected projects must fall within SB 535 disadvantaged community criteria.	Sediment supply to wetlands provides a nature-based meachanisms for sea level rise adpatation of bayland enviornments and the cushioning of their urban edges. Potential targets - Pebble Dune pilot or vegetative studies for Alameda Creek. Eden Landing and Dry Creek areas comply with disadvantaged community requirements for SB 535.	Grants due July 07 2018
	Coastal Conservancy Prop 1 funds	**Prop. 1 - Water Bond (Assembly Bill 1471)**	Funding from Prop 1 is intended to fund projects that provide more reliable water supplies, restore important species and habitat, and develop a more resilient and sustainably managed water system (water supply, water quality, flood protection, and environment) that can better withstand inevitable and unforeseen pressures in the coming decades.	Unlock Alameda Creek restore important species and habitat and develop a more resilient and sustainably managed water system (linking environment, water supply, and flood protection)	Solicitations due June 8th, 2018
	California Ocean Protection Council	**Prop 84 and Prop 1 Competitive Grants program**	Prop 1: Climate change adaptation, marine managed area protection, fisheries infrastructure and improvement of ocean water quality. Prop 84: Ocean acidification, sustainable fisheries and aquaculture, coatal sediment management, and marine pollution.	Apply directly to climate change adaptation and sediment management.	Proposals closed for the year. Potential to repeat-Prop 1 to have 9.3 million in funding available next year.
	CA Department of Fish and Wildlife 15$ M State appropriation	**State appropriation**	wetland projects that will be managed for 50+ yr benefits		$15M
	Cap and Trade Funds	**Assembly Bill 398**	climate chante mitigation and adaptation		$2B / year
	Climate Adaptation And Resilience Program / Wildlife Conservation Board	**Assembly Bill 109**	60 of funds allocated to conservation easement acquisition. Remained used to develop and implement natural and working lands adaptation and resiliency planning and support	Unlock Alameda Creek aims to develop a resilient sediment supply framework for Eden Landing.	Preapplication deadline of May 18th 2018
	TEP - Transportation Expenditure Plan	**Measure BB Transportation Expenditure Plan**	mprove air quality and provide clean transportation by reducing pollution using innovative technology and expanding bike and pedestrian paths, and BART, bus and commuter rail expansion and operations.	Could apply to Bay Trail expansion and public access strategy (bridge) in Eden Landing	
	CA Prop 68	**Pending**	Proposition 68: This measure is a $4.1-billion bond proposal, with most of the borrowed money going to drought, water, parks and coastal protection programs.	Unlock Alameda Creek has parks, water, and coastal protection benefits. Alignment with all aspects of the funding, including park and open space creation and preservation, climate adaptation, water resource management, and outdoor access for all.	Pending vote June 2018.
	Cal Trans Planning Grant Program	**Cal trans**	Adaptation planning, Sustinable Communities Grants, Strategic Partnership grants. Transportation -centric.	Unlock Alameda Creek proposes enhancements to the Alameda Creek regional trail and Bay Trail.	Closed by 2018, open in 2019.
	Acquisition funds	**Conservancy acquisitions funds**	The State Coastal Conservnacy and other entities provide funding for land acquisision for public acccess and conservation at fair market value.		
Regional Grants	**Bay Area WW Utilities + CA Water Control Board - pending**	**Pending**	The State of California Water Quality Control Board is working with Bay Area wastewater utilities that discharge to the Bay to develop multi-benefit “green” projects as alternatives to traditional wastewater treatment.		

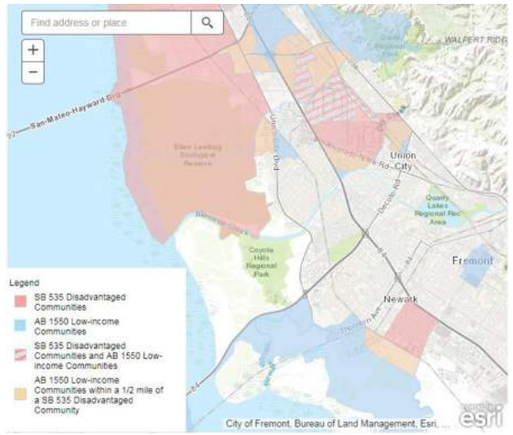
UNLOCK ALAMEDA CREEK
FINANCE PLAN : POTENTIAL GRANTS AND FUNDING SOURCES, CONT.

	Name / Granting entity	source of funds	what it funds	Why is it applicable to unlock Alemeda Creek	Funding availability
Federal Grants	**Continuing Authorities Program (CAP)**	**USACE**	The Corps' Continuing Authorities Program (CAP) is a group of nine legislative authorities under which the Corps of Engineers can plan, design, and implement certain types of water resources projects without additional project specific congressional authorization. The purpose of the CAP is to plan and implement projects of limited size, cost, scope and complexity. Levee and channel modifications are examples of flood control projects constructed utilizing the Section 205 authority.	Unlock Alameda creek proposes changes to levee and channel modifications.	
	SF Water Quality Improvement Fund	**EPA**	The EPA manages a competitive grant program to support projects to protect and restore San Francisco Bay.	Unlock Alameda Creek proposes fluvial and tidal wetland restoration.	EPA selected four proposals totaling 4.3 million in funding in 2017. This year's applicatons are closed.
	NOAA Coastal Resilience Grants	**NOAA**	This competitive grant program funds projects that are helping coastal communities and ecosystems prepare for and recover from extreme weather events, climate hazards, and changing ocean conditions.	Unlock Alameda Creek is a coastal resilience project.	NOAA will not award Coastal Resilience Grants in 2018, but a new competitive grant opportunity will be available later this year. With the passage of the Consolidated Appropriations Act (2018), Congress appropriated $30 million to strengthen coastal communities and protect, conserve, and restore ocean and coastal resources and coastal infrastructure. The National Fish and Wildlife Foundation will administer this funding and establish a new grants program in partnership with NOAA, as authorized under the National Oceans and Coastal Security Act.

IMPLEMENTATION ROADMAP
FUNDING GOALS + DISADVANTAGED COMMUNITIES

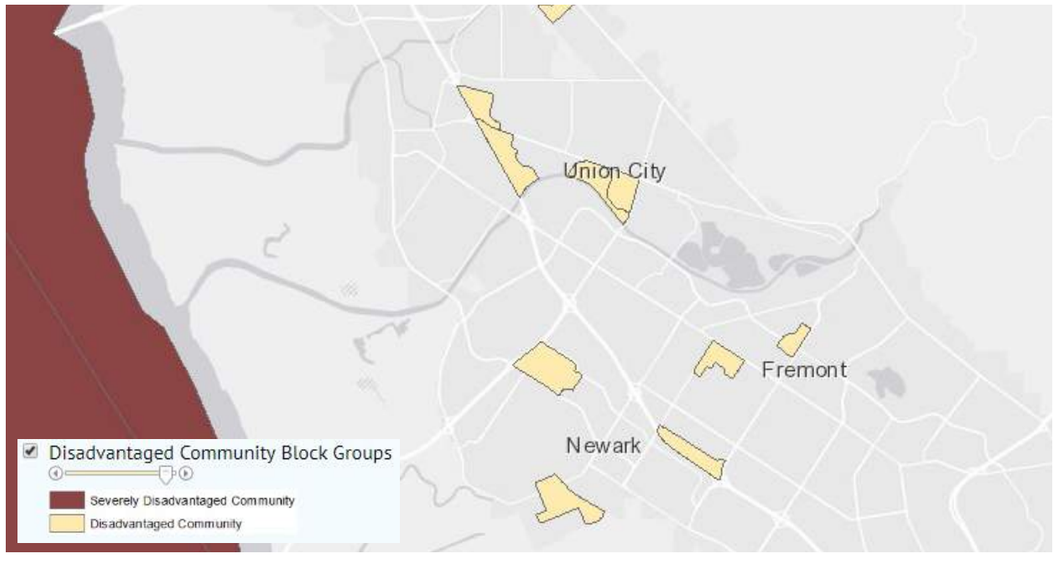
Unlock Alameda Creek prioritizes connectivity and access to the resources of the creek for all communities within the watershed and builds a larger constituency and user base for the Baylands. The Alameda Creek watershed is home to a diverse community spanning a range of racial and socioeconomic districts. The Bay Area has clear priorities around funding and grant allocation around disadvantaged communities, with multiple definitions of disadvantaged communities required by different funding entities. Portions of the Alameda Creek watershed overlap with disadvantaged and low income communities as defined by SB 535, AB 1550, and the Department of Water Resources Disadvantaged communities definition.

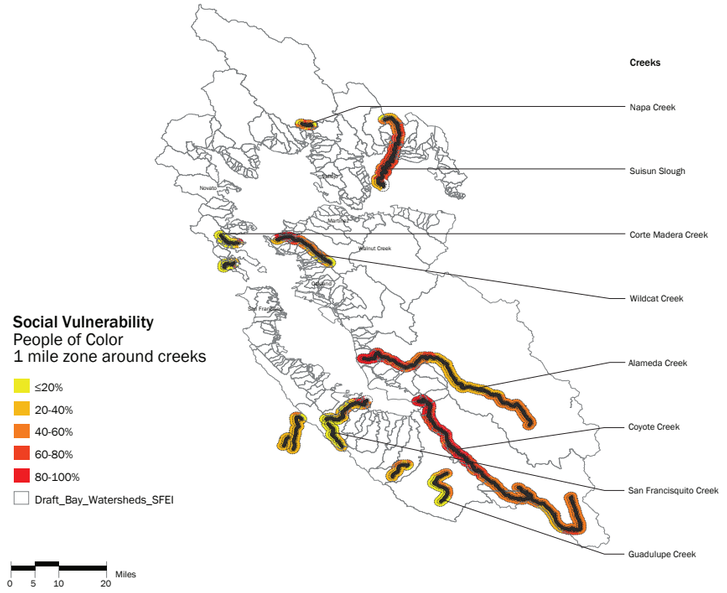
Measure AA: An economically disadvantaged community (EDC) is defined as a census tract with a median household income less than 80% of the area median income (AMI). (no map provided)

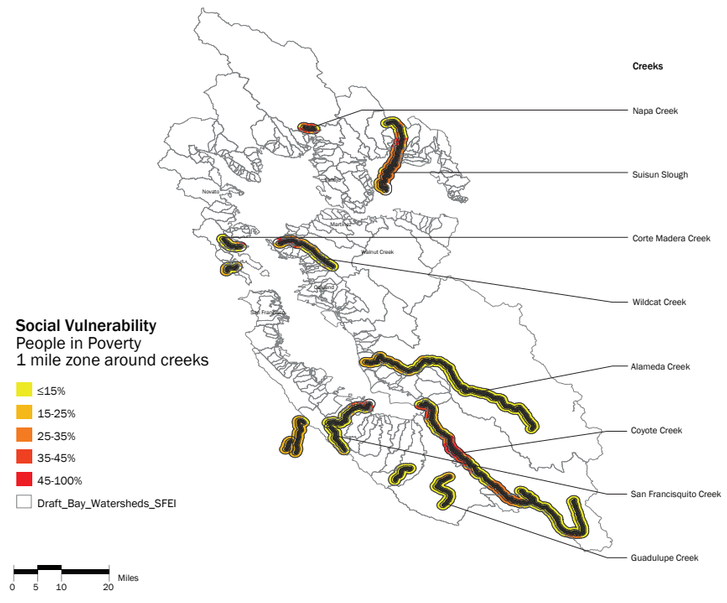


DISADVANTAGED AND LOW INCOME COMMUNITIES AS DEFINED BY SB535, AB 1550, AND THESE COMMUNITIES WITHIN A HALF MILE OF ONE ANOTHER. (ABOVE)

DEPARTMENT OF WATER RESOURCES DISADVANTAGED COMMUNITIES MAPPING TOOL (BELOW)







SITE SELECTION MAPS PREPARED DURING PHASE 1 OF RBD, LINKING DISADVANTAGED COMMUNITIES TO THE BAY THROUGH TRIBUTARY ALIGNMENTS AND TRAILS.

PLAN + PILOT FOR A FUTURE BAY
IMPLEMENTATION OVERVIEW

PILOT AND PLAN FOR A FUTURE BAY proposes a design/science collaboration and planning process for the future of the San Francisco baylands with low sediment supply and sea level rise. Investments in strong science are made – it is time to translate this science into clear alternatives for decision making and debate that opens up this dialogue to a wider audience of policy-makers, agencies, and landowners. This design-science partnership will explore new scenarios of sediment management for the Bay, articulating the physical realities, social dimensions, and long-term landscape implications of investing differently with mud. From this process, a series of pilots will be identified and constructed that prepare the region's living infrastructure for more extreme rates of sea level rise.

We propose that planning, permitting, implementation, and careful monitoring of pilot projects occurs to test new alternatives to supplying sediment to the Baylands. UNLOCK ALAMEDA CREEK, is a large-scale pilot that tests the potential of highly modified creek systems to deliver larger and more sustainable sediment loads to the baylands. **But UNLOCK ALAMEDA CREEK is not enough -other pilots must be advanced that aim to replicate the landscape process of sediment transport and delivery to the baylands for bayland nourishment over time.** Currently there are no permittable mechanisms to nourish baylands through artificial means, and it is unlikely local tributaries will ever provide the full volume needed for bayland survival. Through the Plan for a Future Bay we propose to evaluate, identify, and implement new techniques that supply sediment to the Bay over time. Two options that illustrate the range of potential solutions are

1) Mudflat Feeding: Strategic placement of dredge material in the Bay for transport to bayland ecosystems by landscape processes. This is currently not an approved use of clean dredge material due to environmental quality concerns.

2) Tributary Feeding: Slow pulsing of sediment from upland sources into tributaries that feed the Baylands. Upland sources include de-silting material from channels and construction fill from development.

The Plan for a Future Bay will also address the regulatory environment. The Bay has a legacy of activism, stemming from grassroots action in the 1960's against large scale filling of the Bay by developers and planners. Today, we face different threats - many of the same regulations that support our clean water, clean air, and protect our habitat also limit experimentation in the water. Our practices, technologies, and regulations must adapt to the pace of sea level rise. Mudflat feeding and tributary feeding violate federal and state regulations against bay fill and habitat conversion, yet these techniques could become critical to sustain the ecosystems these regulations protect. Pilot studies are needed to fully understand the implications and potential of these ideas, and regional collaboration and engagement of regulatory agencies will be critical in the planning and piloting process.

KEY STUDIES + POTENTIAL PARTNERS

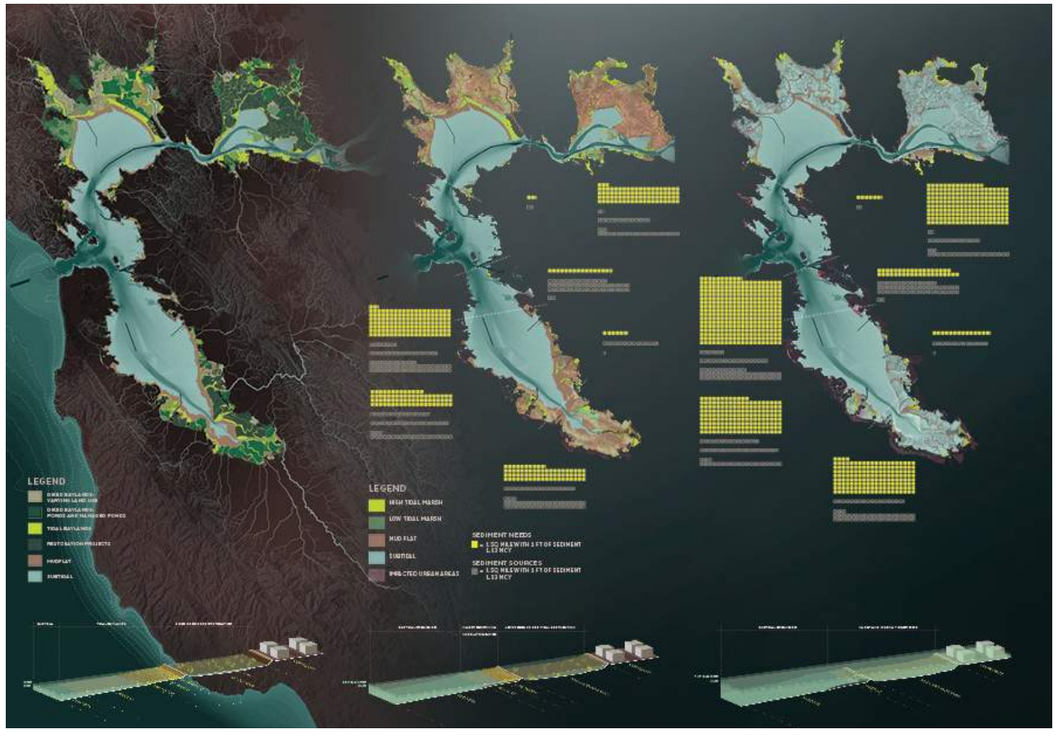
PLAN: The Plan + Pilot for a Future Bay identifies SFEI as a critical partner for the design-science collaboration. SFEI is advancing science updates on these topics, including the Healthy Watersheds, Resilient Bay study that incorporates a detailed analysis of sediment conditions in the Bay. The work will also build upon the work of the Sediment Working Group and regional wetlands monitoring program. The Plan for a Future Bay will build upon these updates and translate this work into understandable future scenarios for discussion and decision making.

PILOT: Planning for some of these pilots are underway – the US Army Corps of Engineers and SFEI have advanced a strategic placement report, modeling potential sites for a strategic placement pilot in the South Bay. We support this work and suggest it happen on a faster timeframe, and propose to link it with the Plan for a Future Bay results. Potential partners are the Coastal Conservancy, Union Sanitary District (potentially for effluent to pulse sediment flows), the Bay Planning Coalition, dredging companies, construction fill providers, the US Army Corps of Engineers, and the Alameda County Flood Control District (for property use and de-silting material.)

TIMEFRAME

PLAN: We propose a 1.5 year planning process for the design-science collaboration that initiates after the issuing of the Healthy Watersheds, Resilient Baylands report.

PILOT: While concept reports have been produced studying strategic placement, an honest assessment of the permitting timeframe for this pilot suggest it is a 5-year process before implementation, and that these strategies will only move forward once significant momentum for these efforts exists. Our team suggest that the time is now, and that this is an urgent issue that must be tested in the Bay on a faster timeframe. If it takes a decade to permit and pilot these techniques, and restoration goals aims to get the tidal baylands to marsh plain elevation by 2030 to gain 'elevation capital' and adapt to sea level rise, then there is little time to wait.



RETHINK THE SEDIMENTSHED
IMPLEMENTATION OVERVIEW

RETHINK THE SEDIMENTSHED: VISION PLAN

Alameda Creek is fed by a 662 square mile watershed, an area almost as large as the Bay itself. While it contributes the largest volume of sediment to the South Bay of any local tributary, 44 % of Alameda Sedimentshed is impounded, potentially retaining over 13.5 million cy of sediment. Over the last century, dams and reservoirs upstream have trapped sediment upstream, preventing sediment flows to the Baylands. Recent development in the upper watershed has led to sedimentation in areas where it is damaging for local ecosystems. Water management infrastructure, like channels, dams, and recharge ponds, decouple the flows of water with the flows of sediment, disrupting movement downhill. Mining removes sediment from the system, exporting it to construction sites and yards for resale.

While our proposal UNLOCK ALAMEDA CREEK addresses some of the infrastructural barriers in the lower creek, the upland sedimentshed cannot be ignored. But dams can not be removed overnight – reservoirs provide critical drinking water for residents of Alameda County and the city of San Francisco. Recharge ponds replenish the local aquifer and protect the water supply from saline intrusion from sea level rise. Our team proposes a SEDIMENTSHED VISION PLAN, a long-term scientific study and multi-agency plan for the Alameda Creek sedimentshed. This process would involve a long-term sensing strategy, establish a sediment budget for Alameda Creek, and develop a vision for balancing the sediment needs of the Bay marshes and mudflats with upland capacity and alternative sources of sediment over time. It would quantify sediment accretion rates and bayland adaptation needs, determining where living infrastructure along Niles Cone is most viable with sea level rise and where it can benefit vulnerable communities the most. The collaboration would engage dam operators, water managers, regional watershed policy makers, and flood control districts to balance lowland needs with upland concerns. It would assess the potential to retrofit and operate dams for sediment transport, harvest sediment from upland reservoirs, and import and reuse sediment currently treated as a waste product.

POTENTIAL PARTNERS

SF Public Utilities Commission, to discuss plans for retrofitting dams to move sediment downstream and harvesting sediment from behind dams. Calaveras Dam is a good example of a project that is underway that may improve sediment passage. Don Castro Reservoir harvesting is a good example of a feasible project where sediment can be moved to the bay.

Alameda County Flood Control District, to discuss sedimentation, dredging, channel maintenance, erosion, and fluvial and tidal flood control risks. Unlock Alameda Creek, if constructed properly and monitored for performance over time, may enable the passage of more sediment downstream and make conversations about upstream sediment release more feasible.

Alameda County Water District, to discuss bypass flows for sediment movement and the operation of the rubber dams within the Flood Control Channel, to reduce modifications of the storm hydrograph that cut off the tail end of storm events and potentially impact sediment flows. This is a long-term discussion that requires study, piloting, and monitoring.

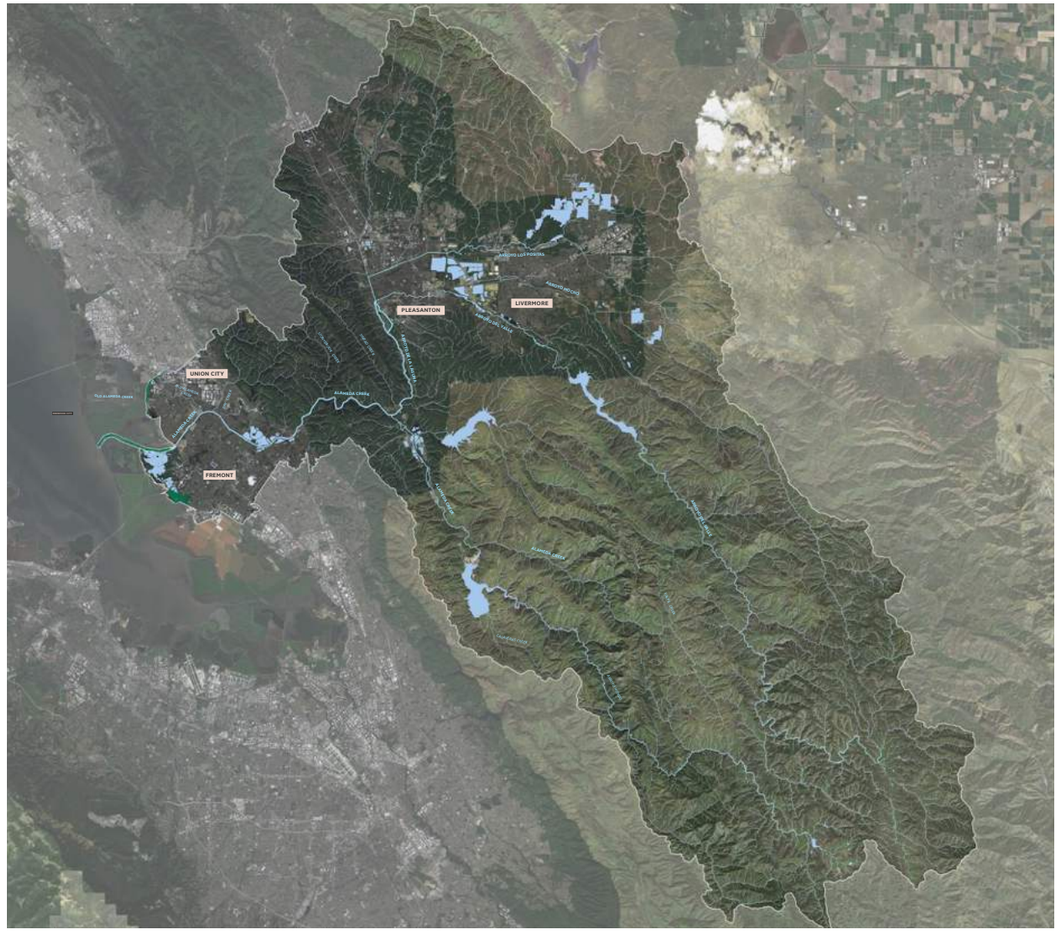
Zone 7, to discuss upstream watershed management, development of the watershed, and patterns of erosion driven by upstream urbanization.

Alameda County Resource Conservation District and the **Alameda Creek Alliance**, to help balance the needs of native fish populations in the creek, including migratory salmonids, with sediment flow modifications and other ecosystem-wide impacts.

The **South Bay Salt Ponds Restoration Project** and **CA Fish and Wildlife** to quantify and monitor sediment needs over time. **SFEI** to contribute sediment science and best practices.

TIMEFRAME

We must start planning now for the future. These long term conversations and negotiations must occur now to address the threats of sea level rise in the future. Alameda Creek provides 4% of the entire sediment load of the Bay – what could this grow to if the full sedimentshed was unlocked? How valuable will this material be in the future with climate change? We anticipate that this would be a 5-10 year planning study with 10-50 year implementation timeframe.



IMPLEMENTATION ROADMAP
STAKEHOLDER PROCESS

Public Sediment implemented a wide and diverse stakeholder engagement strategy to develop Public Sediment for Alameda Creek. This strategy used the following techniques:

Working group meetings: Monthly working group meetings were held near the project area to update key partners on project process and receive input and feedback. This dramatically shaped the process and final project. While not all stakeholders attended every meeting, it built significant energy around the project and approach. Working Group meetings were structured according to design development:

Working Group #1- January 26th:
Sharing of Concept and Research Questions
Working Group #2- February 26th:
Research Report-Back and Project Status Update
Working Group #3- March 28th:
Midreview Presentation
Working Group #4- April 18th:
Public Meeting and Near-Final Project Presentation
Working Group #5- May 17th:
Final Jury Presentations + Summit

Individual meetings with Stakeholders: Our team has held numerous meetings and phone calls with stakeholders throughout the watershed to communicate and develop the proposal. These occurred consistently throughout the process.

Stakeholder Design Charrettes: To advance the design in a meaningful and connected way, we have had multiple design charrettes with invited stakeholders to discuss conflicting agendas and methods to balance priorities in the watershed.

Bay Charrette: Included the Alameda County Flood Control District, South Bay Salt Ponds Restoration project, CA Fish and Wildlife, and Public Sediment team to discuss how to breach Alameda Creek into the Eden Landing Wetlands. A breach scenario, with associated flood control improvements, was developed at this meeting.

Creek Charrette: Included the Alameda Creek Alliance, the Alameda County Flood Control District, the South Bay Salt Ponds Restoration project, NOAA / National Marine Fisheries Service, the Alameda County Water District, and East Bay Regional Parks to discuss how to design the active bankfull channel to enhance fish passage and migration opportunities. An enhanced fish habitat and vegetative strategy was developed at this meeting.

Public Access Charrette: A guided discussion with the South Bay Salt Pond Restoration Project, East Bay Regional Park District, and the Bay Trail was held to discuss public access opportunities at the Bayland edge. A strategy was developed that involved the purchase of Turk Island and Cal Hill for public access, and a bridge over Alameda Creek Flood Control Channel.

Stakeholder Field Trips and Studies

Vegetative Survey of Alameda Creek: We learned that vegetative growth was a major source of conflict in the channel – that the roughness of the vegetation causes flood capacity reductions, yet provides critical habitat. We assembled a group of experts (SFEI, ACRCD) to participate in a vegetative survey of Alameda Creek to identify what vegetation was possible to maintain in the channel (lower, less woody and suckering vegetation) and what vegetation was not possible to maintain in the channel with current practices (woody, sucking vegetation like willows). This helped inform the plant selection for the proposed design and the strategy around planted pockets and maintenance practices.

Sensor Installation: The Public Sediment team worked with the ACFCD to obtain an encroachment permit for the channel to install multiple sensors to monitor sediment movement with the tides. This informed the schools sensor workshop and design process.

IMPLEMENTATION ROADMAP
STAKEHOLDER PROCESS, CONT.

Sediment Grain Size Tour: Peter Bay and Hugh Shipman recommended sites that our team visit to fully understand the dynamic gravel and cobble beaches of the Bay environment. We visited Aramburu Island, Foster City, Point Pinole, and San Leandro delta as examples and this informed the development of the Pebble Dune proposal.

Public Events: Our team held two, fully advertised and open-to-the public events that engaged people in the project and process and built a constituency around sediment in Alameda Creek.

Public Event #1- Creek Crawl. The Creek Crawl was a Saturday-morning guided tour of the Creek with three local experts and the Public Sediment team. Over 100 people in attendance.

Public Event #2 – Open Forum Public Meeting. In tandem with working group #4, we held a fully public and advertised public forum and discussion of the design project, getting critical feedback from community members and interested stakeholders. The format was 1-hour 'science fair' style tables featuring different project elements, 1-hr formal presentation and open discussion of the work. Over 35 people in attendance.

Engagement Events with Schools and Senior Centers organized by the Public Sediment Team:

Our team has held multiple engagement events with local schools, public facilities, and senior centers to share the Public Sediment work and develop a constituency for the creek. These include:

School Sessions with the Alameda Creek Alliance: Multiple sessions with high school students participating in field visits.

Creek Atlas Development Events: The Creek Atlas is a community-informed guide of the creek itself – stories, hand drawn maps, recipes, and perceptions of the creek. Multiple events have been held to generate this Atlas, including a recent event at Ruggeri Student Center.

Sensing Workshop: A sensing workshop was held with the robotics club at Kennedy High School in Fremont, CA. The Public Sediment team worked with local educators to develop content for a day-long sediment sensing workshop, where students developed Arduino sensors for sediment monitoring. The students are carrying forward into the future classroom and robotics club activities.

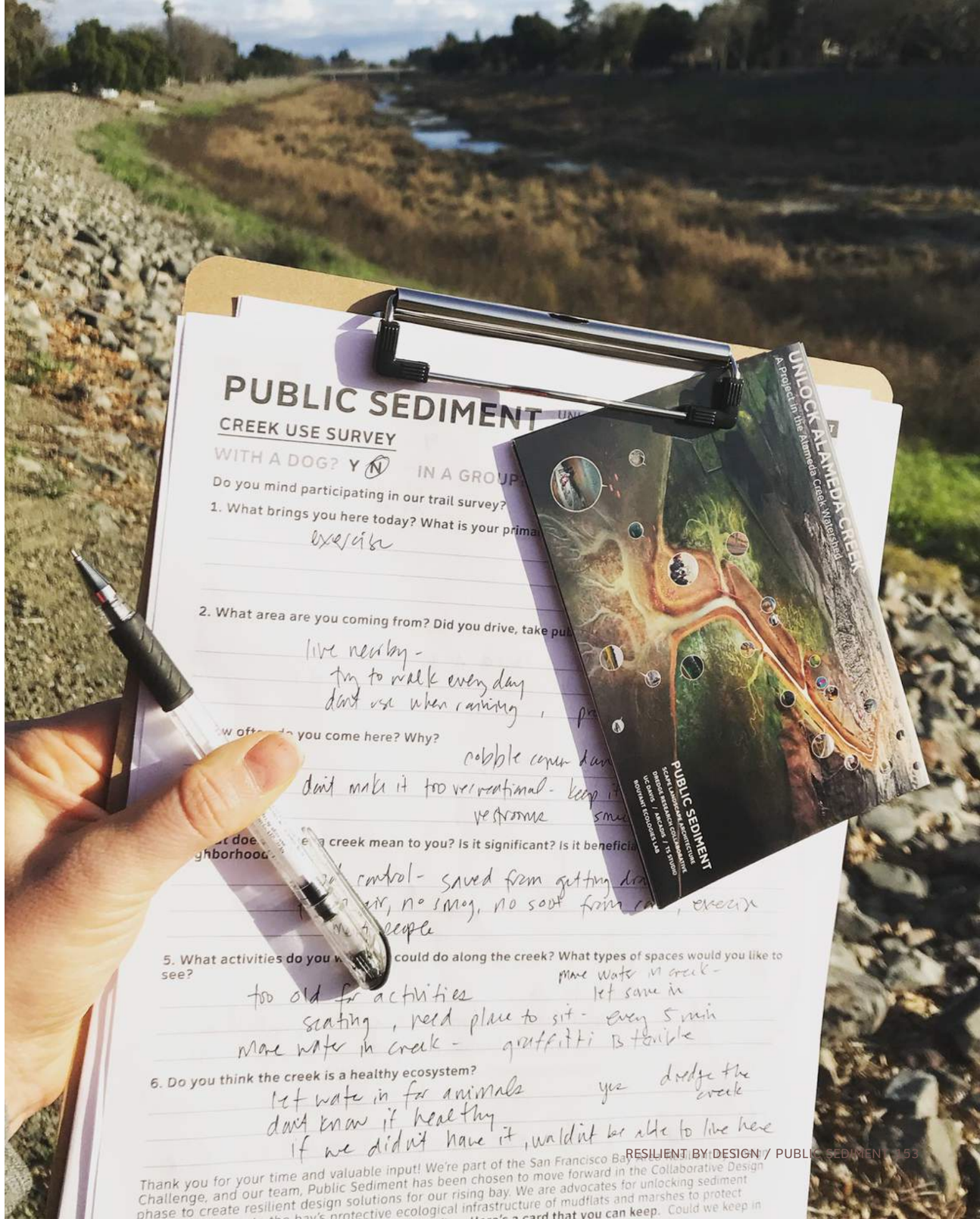
Participating in Engagement Events Organized by Others:

The Public Sediment team has 'tabled' and participated at multiple events in the watershed that were in line with project goals. This includes:
Fish Ladder Funding Announcement: With the Alameda Creek Alliance
Earth Day Festival in Fremont to interview residents and develop content for the Creek Atlas
Earth Day Festival with LEAF to interview residents and develop content for the Creek Atlas

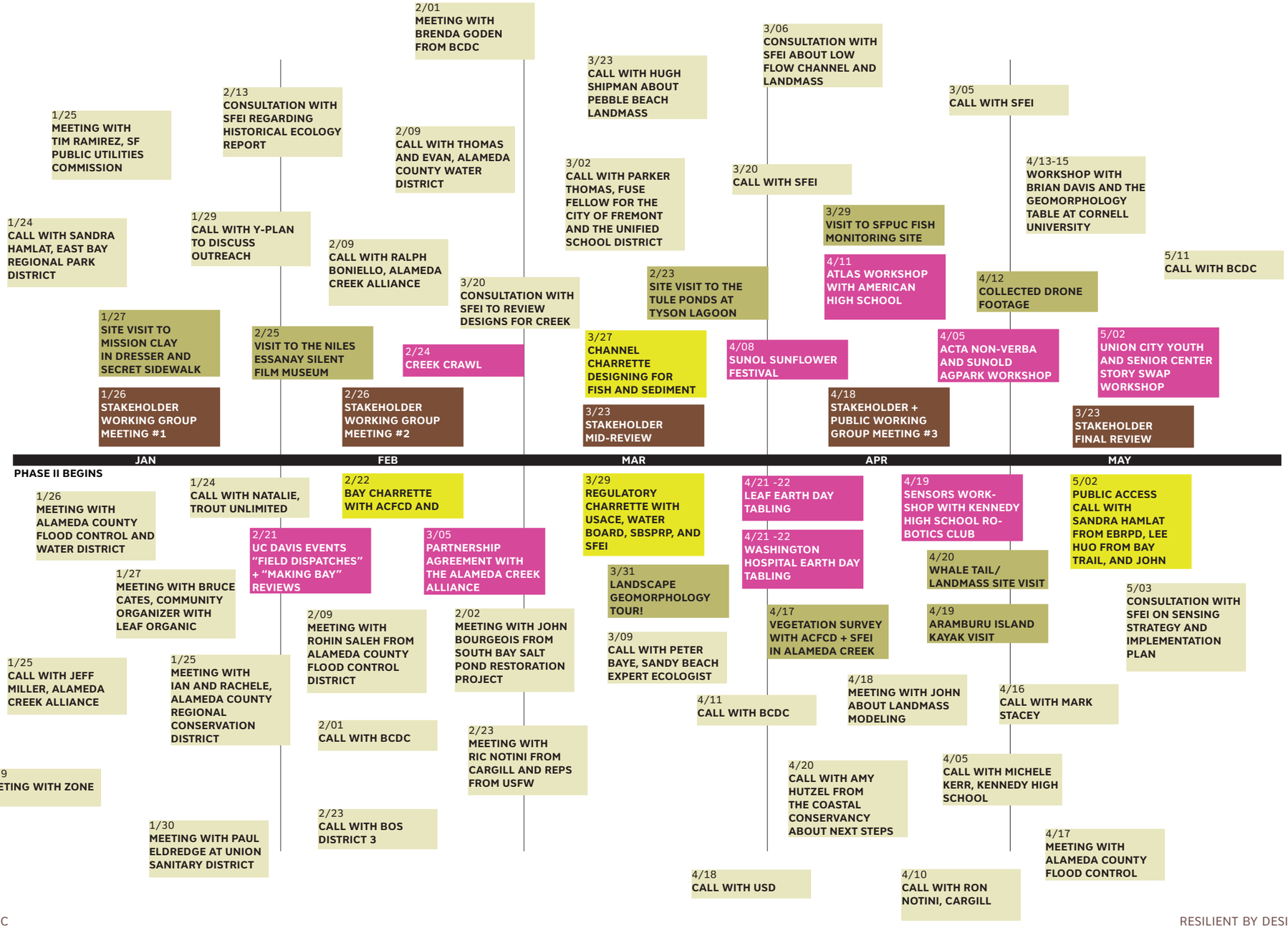
Science Review: We met with SFEI multiple times throughout the process to discuss our sediment supply and need calculations, our design ideas for the creek and bay, and our concepts around sensing and monitoring of the creek.

IMPLEMENTATION ROADMAP
STAKEHOLDER PROCESS, CONT.

1. Alameda County Flood Control and Water Conservation District
2. South Bay Salt Pond Restoration Project
3. East Bay Regional Park District
4. California State Coastal Conservancy
5. Bay Conservation and Development Commission
6. Alameda County Resource Conservation District
7. Alameda Creek Alliance
8. Cal Trout/Fisheries Work Group/Trout Unlimited
9. Alameda County Public Works
10. Alameda County Water District
11. The San Francisco Bay Trail
12. California Fish and Wildlife Service
13. US Fish and Wildlife Service
14. NOAA/ National Marine Fisheries Service
15. California State Water Resource Control Board
16. City of Fremont
17. City of Livermore
18. City of Newark
19. LEAF Community Group
20. Meritt College
21. Alameda County Board of Supervisors District 1,2,3
22. San Francisco Public Utility Commission
23. Sierra Club
24. Tri City Ecology
25. Washington Hospital
26. City of Union City
27. Zone 7 Water Agency
28. City of Hayward
29. FUSE
30. American High School
31. Kennedy High School
32. San Francisco Estuary Institute
33. Teen Center
34. Ruggeri Senior Center
35. Sunol AgPark
36. Community Residents
37. SAGE
38. Private Consultant Peter Baye
39. Washington Hospital
40. Cargill
41. Union Sanitary District
42. Niles Essanay Silent Film Museum



IMPLEMENTATION ROADMAP
COMMUNITY STAKEHOLDER PROCESS



UNLOCK ALAMEDA CREEK
GOVERNANCE + REGULATORY STRATEGY

For Unlock Alameda Creek to move forward into implementation, the collaboration and partnership between Alameda County Flood Control District, Eden Landing Wetland Restoration Project and East Bay Regional Park District established over the past few months will need to be continued. While this does not represent a barrier to the project, it does present a challenge. **Potential partnering mechanisms, such as a memorandum of understanding, will need to be identified and implemented to foster continued coordination among the key stakeholders. The benefits of Unlock Alameda Creek will not be fully realized if each individual entity acts alone.** Additionally, active engagement of other key stakeholders and partners (Alameda Creek Alliance, San Francisco Estuary Institute, Alameda County Water District, Zone 7 and others) will be necessary to realize the full benefit to the community and Bay Area as a whole.

Outside of continuing the collaboration and partnership built through the Resilient by Design process, regulatory approval is another challenge on the path to implementation. Initial discussions and information sharing with regulatory agencies such as Bay Conservation and Development Commission (BCDC), Environmental Protection Agency, San Francisco Regional Water Quality Control Board, etc. indicate that regulatory challenges exist. One major challenge identified is the ability to demonstrate that the benefits created by the placement of material within the Bay or Creek out weigh the impact of the project. This is particularly challenging for new techniques which have yet to be tested in the Bay ecosystem. **Pilot projects identified as early phase proposals are one way to test and refine project ideas to demonstrate and maximize the potential benefits of the proposed projects.** Additionally, the efforts by BCDC to develop a streamlined permitting process for wetland restoration projects is indicative of potential regulatory change which will reduce the challenges to implementation of the early stage projects.

Throughout the research and design phase, the team has held preliminary regulatory conversations about the project that address the specific regulatory opportunities and challenges of Unlock Alameda Creek and our other proposals, outlined below. We have also had general conversations with other regulators about the bigger picture aspirations of these projects.

Brenda Gooden + Brad McCrea / BCDC : Discussions advocating for the need to permit a mudflat feeding pilot in the Bay, a tributary seeding pilot in the Baylands in the near future, and the desire to pilot a small segment (300-500 linear foot) length of Pebble Dune on the proposed Eden Landing perimeter levee.

Naomi Feger / Water Board: Discussions advocating for the need to permit a mudflat feeding pilot in the Bay, a tributary seeding pilot in the Baylands in the near future, and the desire to pilot a small segment (300 linear feet) length of Pebble Dune on the proposed Eden Landing perimeter levee.

Craig Connor + Sahyre Cohen / USACE: Discussions around the decommissioning or modification of the Alameda Creek Flood Control levee at the mouth of the creek. Discussions around tributary seeding, strategic placement of dredge material, and the beneficial use of dredge at Eden Landing.

Gary Stern + Dan Logan / NOAA NMFS: Discussion around the needs of endangered species, such as steelhead, in the design of the flood control bankfull sediment channel construction. Discussed how to make fish passage possible, and parameters for the breach itself.

Anne Morkill + Jared Underwood / USFWS : Discussions around long term habitat associated with bayland sediment supply and short term habitat impacts that will need to be addressed.

Evan Buckland and Tomas Neisser / ACWD: Discussions around water operations at the Rubber Dams for fish and sediment flows, and fish needs in the creek.

John Krause and Conrad Jones/ CAFWS : Discussions around long term habitat associated with bayland sediment supply and bay breaching and short term habitat impacts that will need to be addressed. CA FWS are landowners at Eden Landing.

Additional regulatory conversations with EPA, SFPUC, and others present at RBD regulatory advisor sessions.

UNLOCK ALAMEDA CREEK
ALIGNMENTS WITH OTHER TEAMS

The Public Sediment teams sees alignment between our research and projects with almost all other RBD teams. Pilot and Plan for a Future Bay will benefit and support all projects that include bayland restoration components (Field Operations, Hassel +, Big One Sherwood, Common Ground). In particular, it may provide useful insights on how to implement and prioritize some of the larger scale wetland proposals of other teams (Field Operations) in relation to sediment availability and long term bayland sustainability. Finally, Unlock Alameda Creek will increase sediment loads to the South Bay in a sustainable way, benefiting the entire South Bay and all proposed South Bay edge projects. The Public Sediment team ethos and thinking is highly collaborative, and we welcome the opportunity to define more potential overlap between projects, share resources and research, and engage in joint conversation around building a more resilient Bay.

UNLOCK ALAMEDA CREEK
BUILDING A CREEK CONSTITUENCY

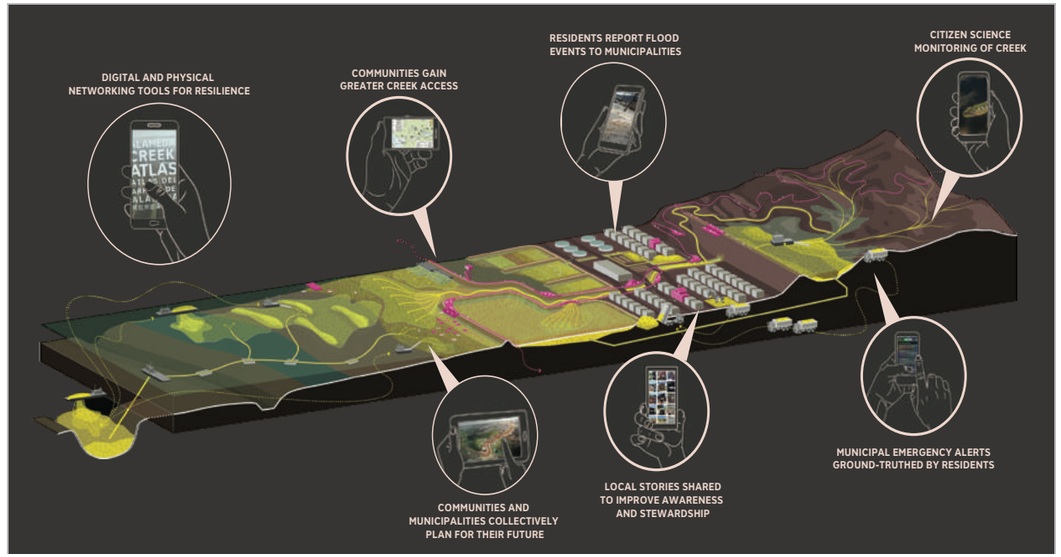
We have started to mobilize a constituency around the Creek. While sediment is generally not a high-priority for the general public, there are hundreds of informed and active citizens living in the watershed that are interested in organizing around the creek and interested in the sediment story. We have spent time assembling this community to discuss the creek and its sediment as a resource. While there is great interest in the creek itself, there are no community groups formed for the creek that focus on human use of this system. We have spent time learning from this community, interviewing residents, and adapting the parameters of sediment design to the expressed needs of people in the watershed- increased connectivity, more social spaces, greater recreational opportunities, and access to the water. The short-term process has built public perception around the value of sediment as a public resource and builds a constituency for the creek. There is significant need to expand this thinking over the long term in the Alameda Creek watershed and a great need to replicate this model in other parts of the Bay.

UNLOCK ALAMEDA CREEK
ALAMEDA CREEK ATLAS

[T]here is an absence of human stories – those that show ordinary and relatable humans engaging with the issue of climate change. (Wang, et. al, 2018)

Climate change is often conceptualized as an impending ecological disaster. However, vulnerability to its impacts are more accurately defined by social factors which present challenges to communities every day (Cooley, et. al, 2012). Moreover, the predicted impacts that will exacerbate vulnerability are often difficult to comprehend or easily ignored given the global scale, extended time frames (Gilbert, 2006), and predominantly negative imagery associated with climate change (Wang, et. al, 2018). Building resilience to these impacts will require engaging communities in defining indicators for vulnerability and co-designing opportunities for adaptation as much as it will require investment in new infrastructures. It will also require communicating projected impacts to communities in a manner

THE ALAMEDA CREEK ATLAS PROVIDES BASIC INFORMATION IN 3 LANGUAGES



THE PHYSICAL AND DIGITAL COMPONENTS OF THE ATLAS DEVELOP A SOCIAL RESILIENCY INFRASTRUCTURE.

that encourages acceptance, dialogue, and action (Corner, et. al, 2015). As such, we need new tools for communicating climate impacts, defining vulnerability indicators, and engaging diverse publics in planning for future resilience. This requires collaboration between designers, decision-makers, and community members and a robust conversation about the full socio-ecological dimensions of climate change through human-centered and participatory methodologies (Paschen and Ison, 2013). The Alameda Creek Atlas demonstrates this possibility.

The Alameda Creek Atlas is an extension of the Unlock Alameda Creek proposal that includes immediate, mid- and long-term goals: 1. Produce open and clear communication about existing socio-ecological conditions related to climate impacts within the community; 2. Develop co-creative opportunities for diverse responses from community members; and 3. Synthesize community responses with our design and research process. The Bay Area has a legacy of environmental justice efforts that have resulted in positive change[1], the success of which lay solely in community action and stewardship. Similarly, as much as Alameda Creek needs to support fish and sediment transport to improve resilience for its surrounding communities, it will also need to support the transport of people, their ideas, and their stories. By engaging people in a greater understanding of their watershed, we can encourage community stewardship. But most importantly, engagement provides new conceptualizations of the creek as understood by its community; these conceptualizations should inform future design and decision-making processes. In essence, the Alameda Creek Atlas helps make sediment public.

The Atlas is a participatory tool community members can use to access their resources (including public access of the creek itself) and decision makers can use to understand more diverse conceptualizations of vulnerability and resilience in the region. It includes opportunities to clearly communicate our team's research and design (in English, Mandarin, and Spanish). Layered with our teams' work is the community members' understanding of the place, expressed through creative making, narrative, and participatory mapping. Coupled together, the Atlas is a more dynamic model for understanding

humanistic and socio-ecological complexities of place and people. Digital components of the atlas allow adaptive understandings of the watershed. and can be discovered through our hastag: #AlamedaCreekAtlas and our website: AlamedaCreekAtlas.org. Most importantly, we see the Atlas as a community building tool: highlighting existing community connections and encouraging new ones.

To date, we have utilized a range of formats for community outreach: public presentations, integrated community events, and community workshops. Our public presentations allowed us to coordinate with local agencies and disseminate our design process with regionally-based organizations; integrated community events tapped into existing local programs and events; and community workshops provided greater collaboration with partners and focused time with participants. At each event, key concepts about the watershed were presented to the community by way of an Alameda Creek Appendix. In it, terms like 'watershed' and 'sediment' were defined and their relationships to community climate risks were described. Participants were then asked to provide their own interpretations of their community by way of the Alameda Creek Field Notes, sharing their connection to the landscape, stories of flood, and messages for stewardship. Additional tools, such as participatory mapping, intergenerational story-sharing, co-creative making, and social media scavenger hunts diversified the opportunities for participants to engage with the Atlas materials. The results of this process form the preliminary Alameda Creek Atlas. It exposes a watershed that has been disconnected from the community that surrounds it, highly engineered yet threatened by the very development its construction sought to encourage. It also reveals a diverse and vibrant community of people, eager to engage in stewardship and advocate for resilience.

We see the Atlas as a community building tool: highlighting existing community connections and encouraging new ones. These connections are the best strategy for community resilience to climate impacts (Department of Homeland Security, 2013 and Aldrich, 2017). Current efforts at understanding social vulnerability to climate change within the region often do not include opportunities for the full public to inform the list of indicators selected, and they can quickly become outdated. We need adaptive models of information sharing, a better merger of social and ecological conceptualizations of climate impacts, and most importantly to employ human-centered approaches to allow climate change to be known. These same tools can also support communication between community-members, municipalities, and scientists -- aiding creek monitoring, communicating important alerts, and most importantly, supporting the networks that provide an essential social infrastructure for resilience.

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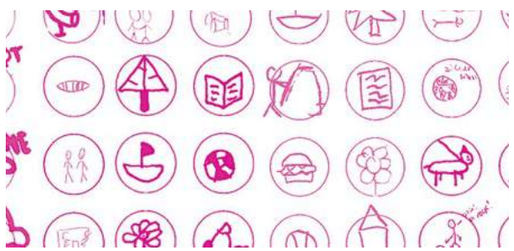
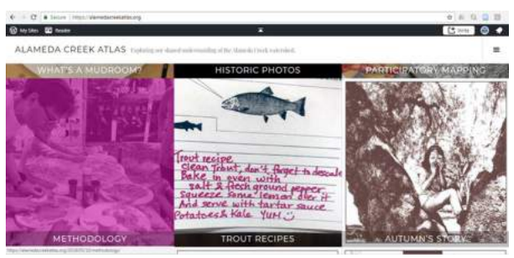
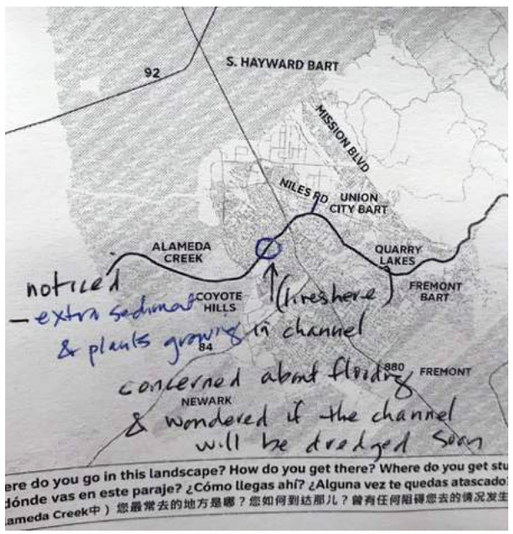
FREMONT YOUTH SHARE THEIR ATLAS RESPONSES AT A COMMUNITY EVENT.



COMMUNITY FEEDBACK ON RECREATION AND PROGRAM AT THE CREEK.



ALAMEDACREEKATLAS.ORG WEBSITE



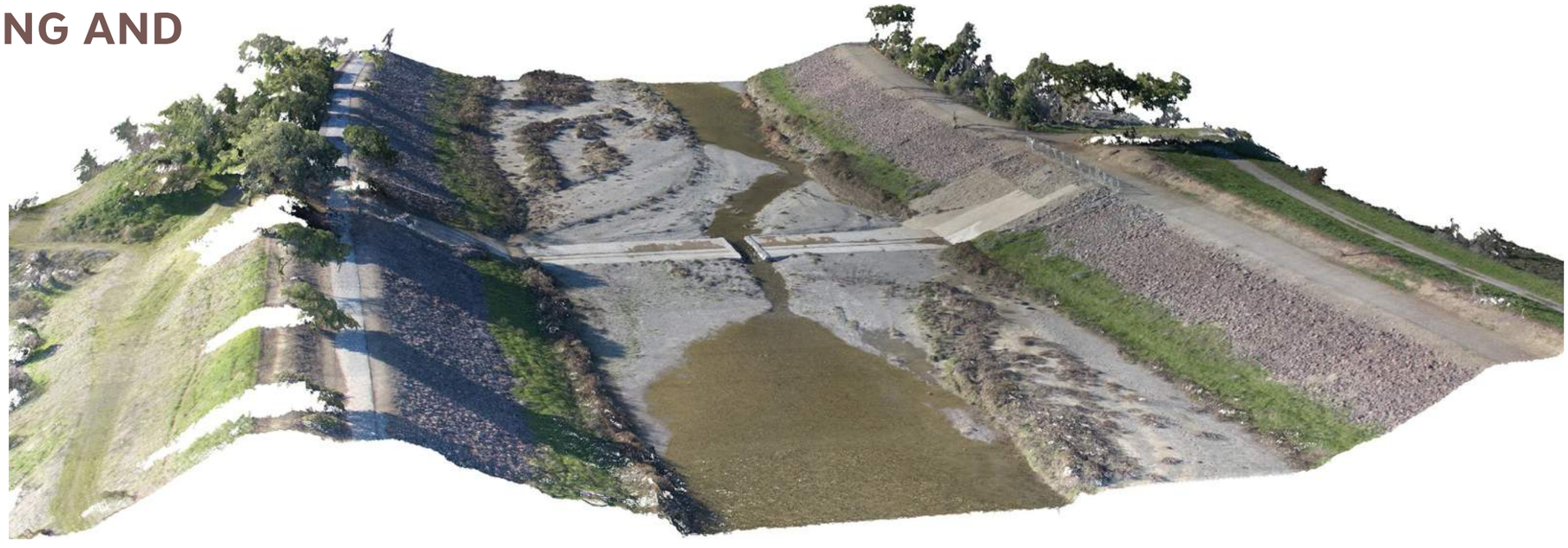
COMMUNITY OBSERVATION OF SEDIMENT AND EXPRESSION OF CONCERN.

UNLOCK ALAMEDA CREEK
CHANNEL MONITORING AND VEGETATION PILOTS

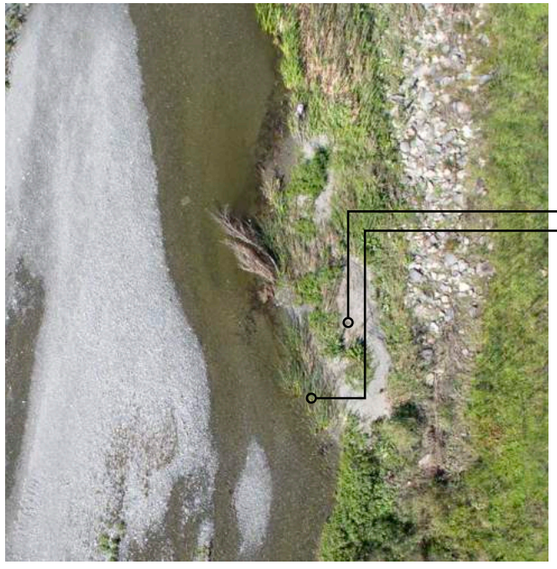
Over the course of phase two Resilient by Design Challenge, our team began surveying and monitoring change in the Alameda Creek flood control channel. Our work focused on observing the interactions between plants, water flows and sediment. For plants, we looked at where different species of plants grow, how they grow (their size and shape), how they affect channel morphology, and how they respond to flooding events. For sediment, we monitored where sediment is scouring and accumulating in the channel and how these behaviors might be influenced by different types of vegetation and management.

Monitoring data was gathered using repeat drone (UAV) surveying of select portions of the flood channel, combined with photogrammetry software, other surveying instruments, and on-ground photographic documentation. Survey products include high-resolution georeferenced orthoimagery, digital elevation models, and 3D photo textured models of sections of the channel. Results from these surveys were preliminary, and given that no sustained, heavy flooding events occurred during the winter of 2018, more data needs to be gathered.

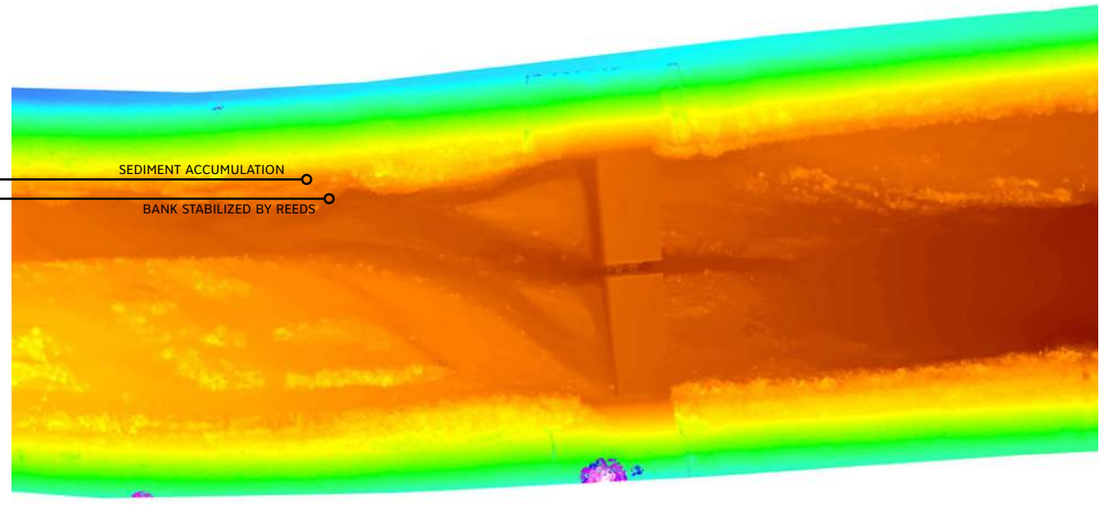
Going forward, we hope to expand upon this monitoring effort to better understand vegetation and sediment interactions in the channel. Additionally, we hope to install small planting pilots – areas within the channel where we can plant and actively test the behavior and performance of different species of vegetation. Findings from this work will inform the redesign of the channel to meet the combined benefits of flood management and sediment and fish passage.



PHOTOGRAMMETRY MODEL OF NOTCHED FOUNDATION OF FORMER RUBBER DAM #2 (CHANNEL STATION 50,000); SURVEYED ON JANUARY 28TH, 2018



AERIAL DRONE IMAGERY, MARCH 27TH, 2018



DIGITAL ELEVATION MODEL OF FORMER RUBBER DAM #2 FROM SURVEY CONDUCTED ON MARCH 27TH, 2008 (2.8cm/pixel resolution)

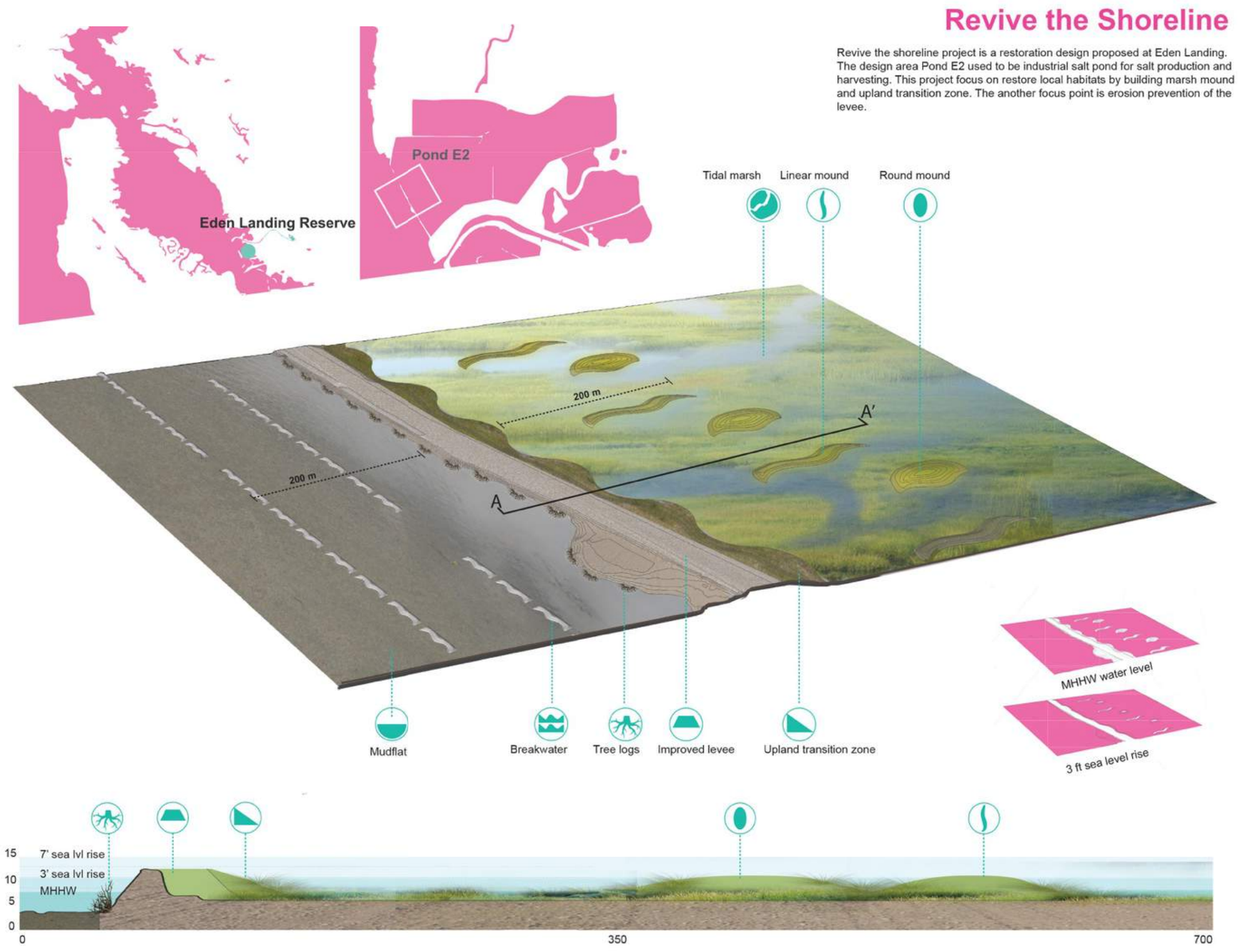
UNLOCK ALAMEDA CREEK
PROTOTYPING AND FABRICATION

The Living Levee is a scalable system that is easy to prototype. At the scale of 1”= 1’, each module type was 3D printed and used to make a mold. The mold was then used to cast multiple concrete Living Levee modules (see image). This scaled model is used to physically manipulate and understand how the system interlocks, adjusts to different slopes, and can optimize vegetative growth. The next step is to secure funding to develop and test this system at a larger scale in-situ. In coordination with the Alameda Creek Flood Control District, we will be seeking funding and permits to develop and monitor the performance of the Living Levee system within the fluvial and tidal reaches of the channel.

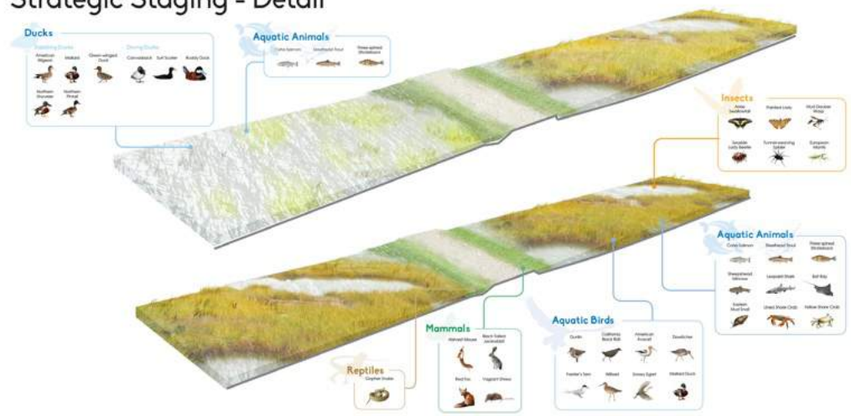
ACADEMIC STUDIOS
MAKING BAY

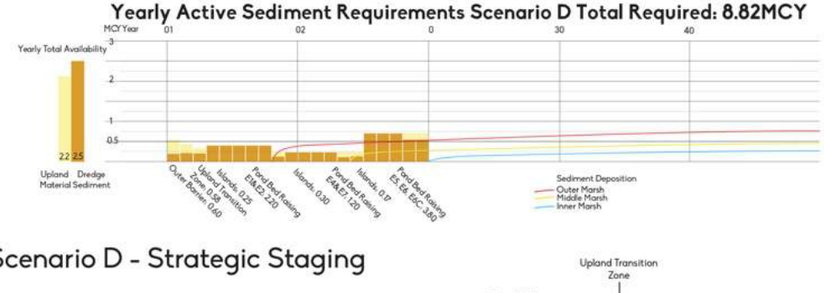
The UC Davis student design studio investigation led by Brett Milligan consisted of several elements. The first is returning the former salt ponds at Eden landing to an elevation (tidally, near mean higher high water elevation) where they can re-establish themselves as salt marsh. This would be achieved through the staged, beneficial application of dredged material from the Bay, as well as the application of suitable upland sources, such as clean construction fill. To support this restoration effort, there is a need for a protective barrier at the western extent of the restored marshes to attenuate coastal erosion impacts and tidal inundation. Once protected and at elevation, strategic breaching and lowering of levees would be made in Alameda Creek and Old Alameda Creek to reestablish tidal connections between them and the bay, facilitating the passage of sediment and fish and the creation of more robust estuary-like historical condition.

This multi-staged design was conducted through design workshops with multiple invested stakeholders and a landscape architecture design studio conducted at UC Davis. The predominate challenge throughout this effort was to find ways to integrate and meet the diverse needs of flood management, ecological restoration, and public access within a rapidly changing, and dynamic landscape condition.

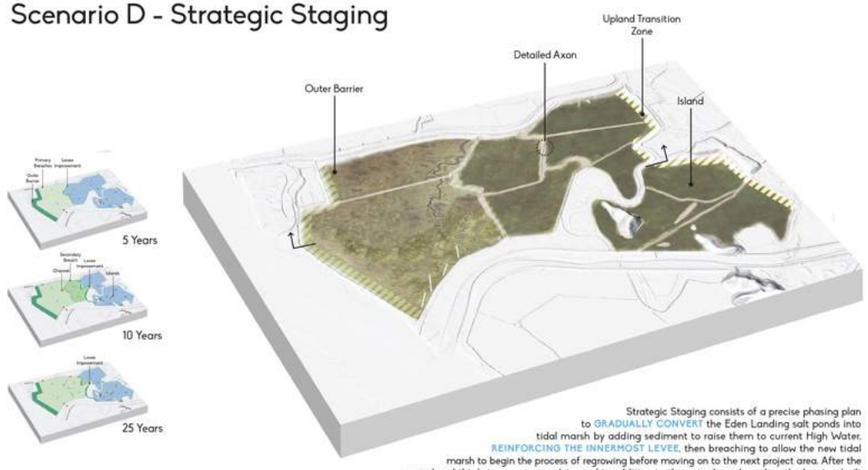


Strategic Staging - Detail

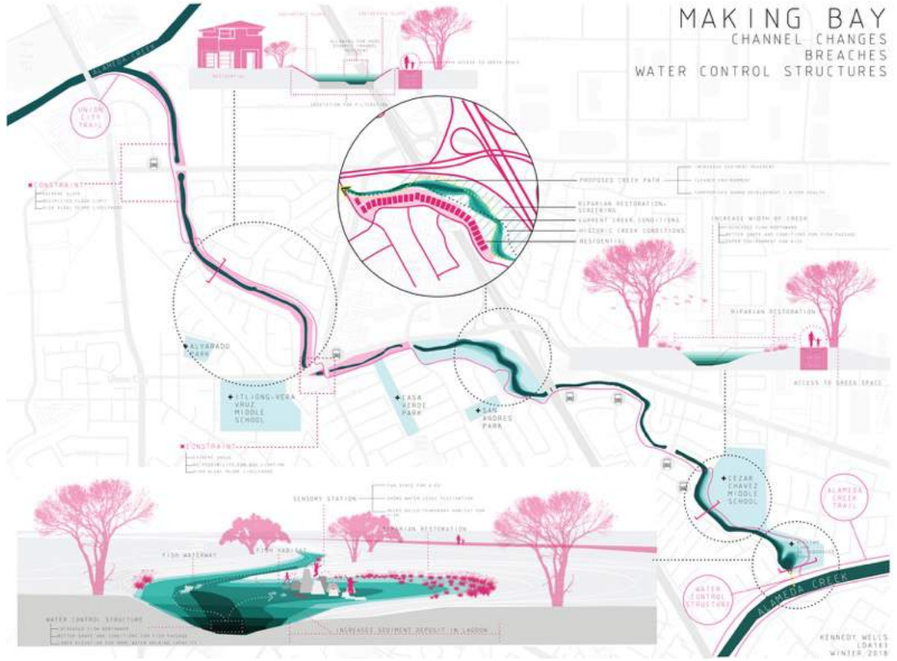




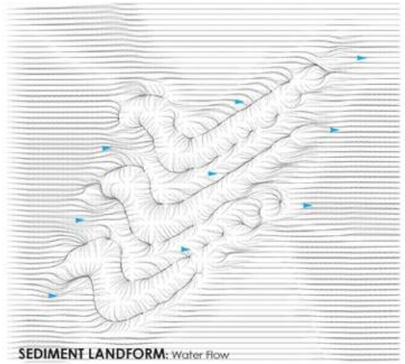
Scenario D - Strategic Staging

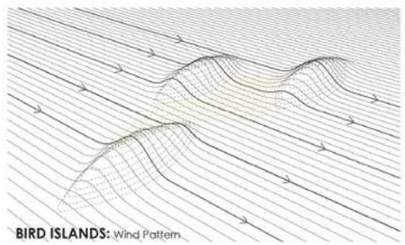


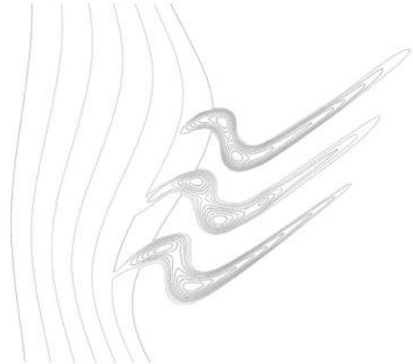
Strategic Staging consists of a precise phasing plan to GRADUALLY CONVERT the Eden Landing salt ponds into tidal marsh by adding sediment to raise them to current High Water, REINFORCING THE INNERMOST LEVEE, then breaching to allow the new tidal marsh to begin the process of regrowing before moving on to the next project area. After the second and third stages are complete, and in addition to the outer levee breaches, the barriers built to separate each stage will be breached in places to create islands as bird habitat. In total this process should take around 15 YEARS to complete all 3 STAGES. While this is the SECOND MOST EXPENSIVE scenario due to the cost of dredge and the management of ponds, this is by far the BEST OPTION due to the insurance the staging provides in terms of consistently available dredge sediment, maximizing habitat area for various impacted species, and oversight of the effects that each stage has on the local ecologies to ensure that each successive stage is not building up to an ecological disaster.



LAND MASS (THE POND SIDE)







Sediment Landform on UTZ
On the back of levee, the upland transition zone has 1:10 to 1:30 slope that create diverse habitats. When water flows in and out from breaches, the meandering sediment landforms can accumulate sediment and create small salt ponds.

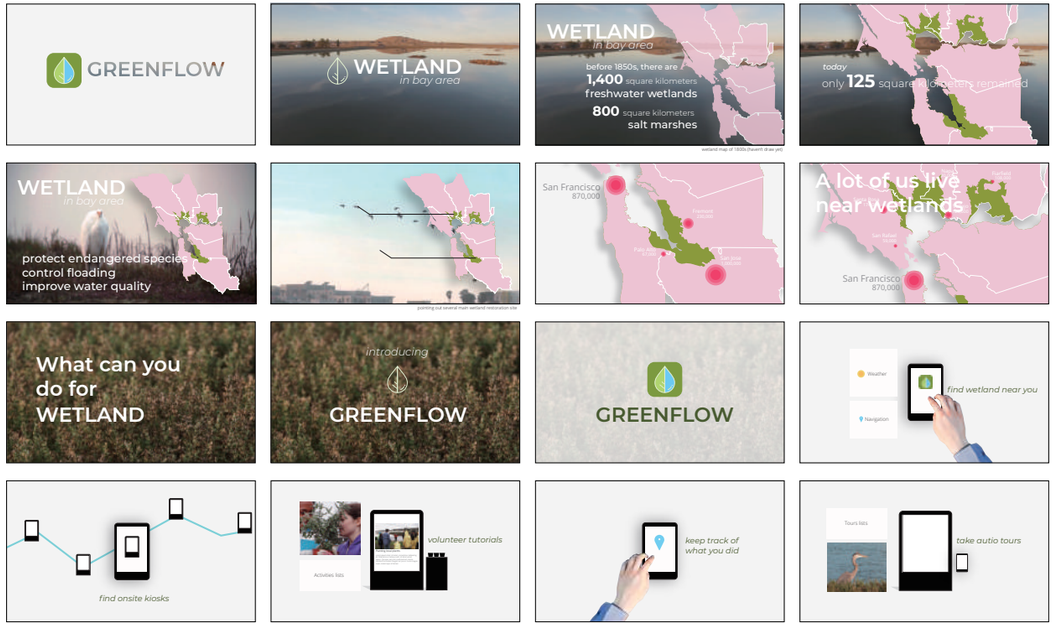
Bird Islands
600 feet away from levee, Cluster of bird island consists of three 1-ha linear islands placed perpendicular to wind direction. During high tides, top of mound is always higher than water level for bird nesting activities. Space between islands will likely to accumulate sediments and promote algae growth.

ACADEMIC STUDIOS
GRAPHITECTURE

Graphitecture was an experimental studio at UC Davis that asked how media and participatory design can have a positive effect on the environment. In the fall of 2017, we used the Resilient by Design Challenge as a springboard for investigation and experimentation. The studio was supported by team members of Public Sediment and the studio work began with a similar conceptual premise: that the San Francisco Bay is not getting enough sediment from its tributaries. The class did case studies around media projects that connect the public to the environment, they investigated various bay ecologies and sea level rise statistics, met with key stakeholders and experienced bay dredging close-up, and finally proposed projects that would address related vulnerabilities. Projects developed around methods for building resilience, especially focusing on ways that media can build social resilience. Final projects range from an app that shows predicted flooding through a photo filter, to an app that would highlight environmental changes to the size of marshes (and encourage walking tours), to a more sediment focused project that connects sediment to the bay area "cargo-shed" using shipping container based exhibits to make the lack of sediment reaching the bay more tangible.

STUDENTS TOURED SUISUN MARSH BY KAYAK TO UNDERSTAND MARSHES AS A NATURAL BUFFER TO SEA LEVEL RISE.

CARGOSHED BY STUDENT VICTORIA CHAU USES THE IDEA OF THE "CARGOSHED" TO MAKE SEDIMENT MOVEMENT MORE LEGIBLE.



Jiaxuan Li & Chenyu Jia DES145 Graphitecture

GREENFLOW BY JIAXUAN LI AND CHENYU JIA USES DIGITAL MEDIA TO HIGHLIGHT THE INVISIBLE FUNCTIONS OF ECOLOGICAL INFRASTRUCTURE.

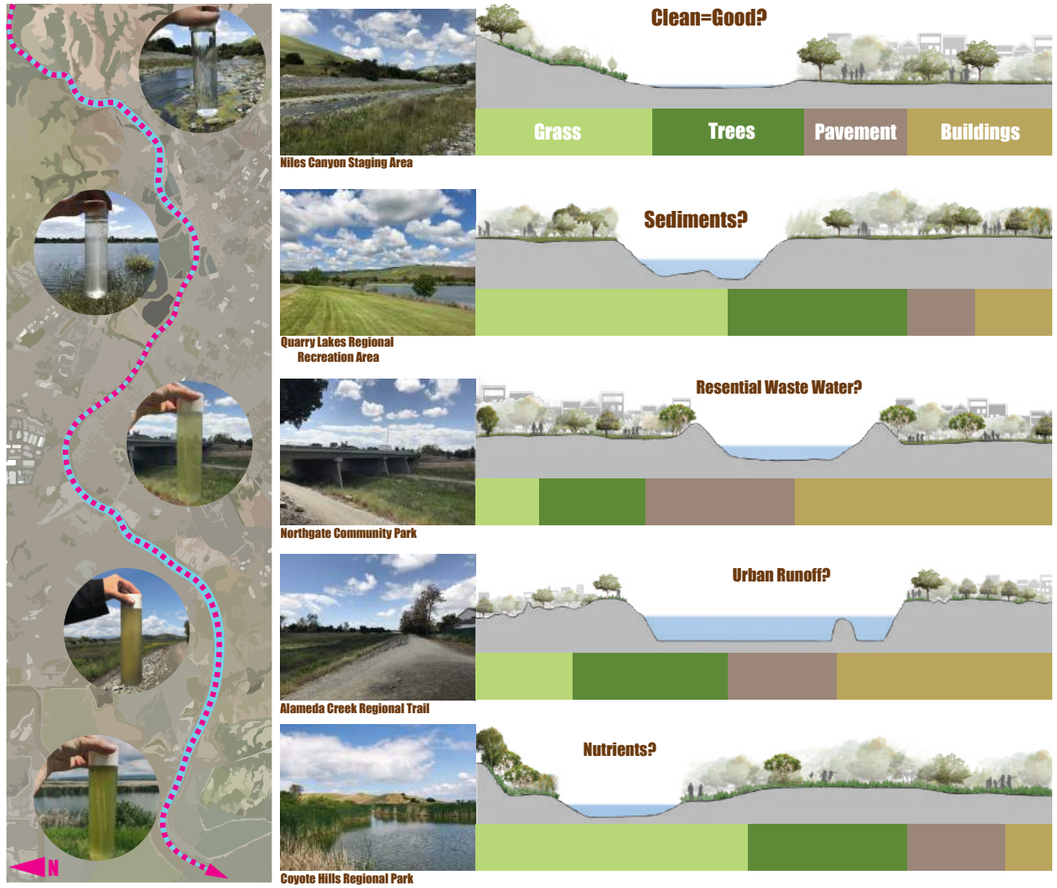
ACADEMIC STUDIOS
RE-IMAGINING RESILIENCE

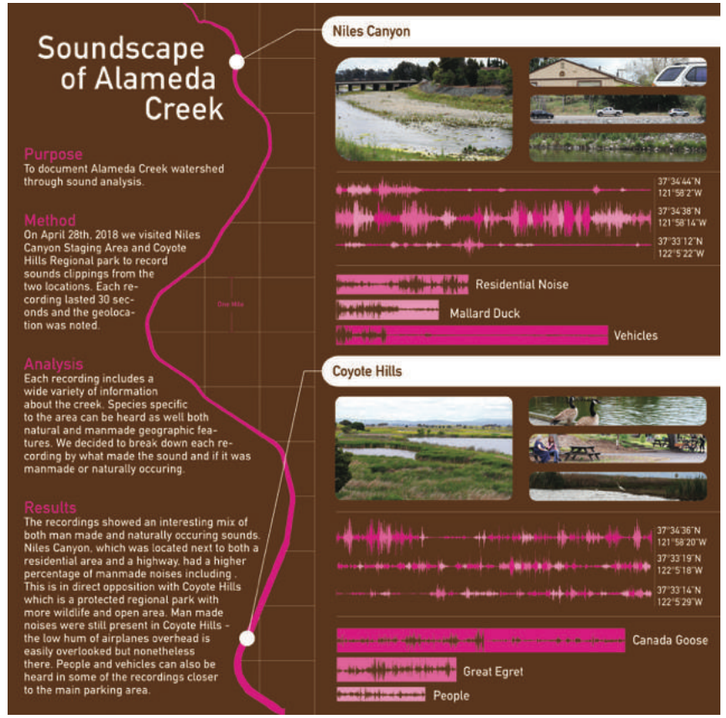
This class was focused on the Resilient by Design Challenge and the Alameda Creek watershed and co-taught by Brett Snyder and Claire Napawan.

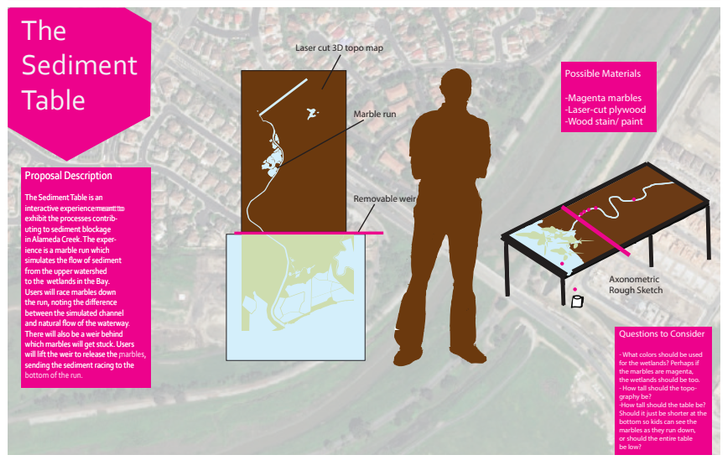
This class emphasized the development of effective tools for communicating climate impacts, defining vulnerability indicators, and engaging diverse publics in planning for future resilience. This studio was focused on developing alternative understandings of climate impacts, vulnerability, and resilience. It explored the use of participatory methodologies for broadening and diversifying who participates in planning for adaptation.

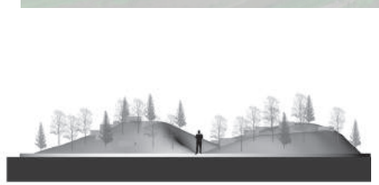
Students designed work in two phases: pages for an Alameda Creek Atlas, meant to parallel the one designed by Team Public Sediment and a second phase, designing a group installation intended to travel to relevant neighborhoods and to engage a variety of publics.

STUDENT PROJECTS BY CALVIN CHAN, BOWEN HUANG, SARAH LOOTAH, AND ARIANA SHEVCHUCK.









ACADEMIC STUDIOS
STUDIO PRACTICES IN INDUSTRIAL DESIGN

This class was focused on the off gride solar charging stations for the Resilient by Design Challenge and Alameda Creek taught by Beth Ferguson.

Playscape: Alameda Creek Watershed- Sunol, CA:
A conceptual feature for the upcoming Alameda Creek Watershed Center that functions as a playstructure, bridge, and viewpoint. Located near the picnic area, Playscape will retain resiliency against flooding in Alameda Creek and utilize solar energy for lighting purposes and other energy possibilities. As a concept, Playscape is an experimental approach to a play/bridge structure, combined with a grid of solar power. Playscape aims to integrate organic form with purpose, resiliency, and sustainability.

STUDENT PROJECT PLAYSCAPE BY OMAR MOHAMMAD AND MARTIN GAONA

The design for “the Restagon” was inspired by the Resilient by Design challenge and the role of Team Public Sediment in place-making around Alameda Creek. The proposed structure brings the community together to build engagement while also making the creek more of a destination within the tri-city area. The Alameda Creek channel is vast. Individuals biking, walking, strolling, or exploring this area may feel the need to stop and rest. The Restagon is large enough for two individuals to sit side-by side and recline. The overhang provides shade. There are bike racks on the back for individuals to safely lock their bikes while they rest or explore by foot.

The Restagon also aims to engage community members by relaying pertinent information about local climate and sea level rise. There is a screen inside the Restagon which would be powered by the two solar panels on the outside shell. These panels are strategically angled to optimize sun exposure. The Restagon can easily be adapted to capitalize on sun power. Outlets to charge electronic devices or climate sensors could be added. Multiple Restagons could create a network for gathering local climate information and data analysis to share with community scientists. form with purpose, resiliency, and sustainability.

STUDENT PROJECT RESTAGON BY SABRINA PERELL AND JOSE AVILA

ACADEMIC COLLABORATIONS
SUNOL WATER TEMPLE PLAYSCAPE AND PICNIC AREA

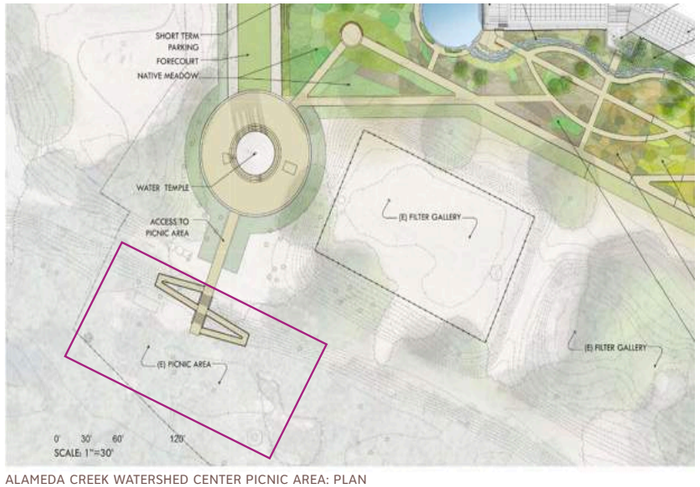
Public Sediment has been working with Amy Dawson who is the Alameda Watershed Community Manager in the Natural Resources & Lands Management Division of the San Francisco Public Utilities Commission. Her office is currently working on plans for the Alameda Creek Watershed Center next to the Sunol Water Temple. Beyond the Watershed Center they would like to create an outdoor picnic and play area for their visitors. They plan to use sustainable materials when possible and proposed using the fallen logs from their properties in the construction. The site location borders the upper part of Alameda Creek and is an important community outreach location to tell the story of the Alameda Creek Watershed. The SFPUC Sunol AgPark, an organic farm were they teach farming and water conservation is next to this site and would benefit from having a new outdoor classroom. Public Sediment had the opportunity to work with students visiting this program in April to teach them about the Alameda Creek Watershed. The SFPUC is also planning to start a native plant nursery for Alameda Creek restoration at this location.

Public Sediment team members plan to continue their community outreach this year with the help of two new grants from the University of California Davis. These grants include the UC Davis Humanities Institute Faculty Award given to Professor Claire Napawan, Professor Brett Snyder and Professor Beth Ferguson. The second grant revived is the Center for Regional Change Faculty Research Award for the Alameda Creek Atlas received by Professor Claire Napawan, Professor Brett Snyder and Professor Beth Ferguson. Workshops are being planned with the Union City Teen Center, the Alameda Creek Watershed Forum, and the SFPUC.

Sources:
Alameda Creek Watershed Center presentation
http://sfwater.org/modules/showdocument.aspx?documentid=8492

Alameda Creek Watershed Center interpretive exhibit presentation
http://sfwater.org/modules/showdocument.aspx?documentid=8491

ALAMEDA CREEK WATERSHED CENTER PICNIC AREA: ILLUSTRATIVE RENDERING



ALAMEDA CREEK WATERSHED CENTER PICNIC AREA: PLAN

PUBLIC SEDIMENT WORKSHOP FOR SUNOL AG CAMP

SUNOL WATER TEMPLE 1922

PUBLIC SEDIMENT FOR ALAMEDA CREEK
LETTERS OF SUPPORT

CAPITOL OFFICE
STATE CAPITOL
ROOM 4085
SACRAMENTO, CA 95814
TEL (916) 651-4010
FAX (916) 651-4910

DISTRICT OFFICE
39510 PASEO PADRE PKWY.
SUITE 290
FREMONT, CA 94538
TEL (510) 794-3900

WWW.SEN.CA.GOV/WIECKOWSKI

California State Senate

SENATOR
BOB WIECKOWSKI
TENTH SENATE DISTRICT

CHAIR
ENVIRONMENTAL QUALITY
BUDGET SUBCOMMITTEE #2

MEMBER
JUDICIARY
TRANSPORTATION
& HOUSING
LEGISLATIVE ETHICS

May 2, 2018

Amanda Brown-Stevens
Resilient by Design Bay Area Challenge
375 Beale Street, Suite 800
San Francisco, CA 94105

RE: Alameda Creek

Dear Resilient By Design Jury and Advisory Board.

This letter is in support of PUBLIC SEDIMENT FOR ALAMEDA CREEK, a proposal developed for the Resilient by Design initiative that proposes to reconnect sediment flows from Alameda Creek to the marshes and mudflats at the Bay edge, creating protective ecological infrastructure that adapts to sea level rise, mitigates flood risk, and introduces space for equitable public access, citizen science, and recreation. The project designs for sediment, people, and fish, and builds resilience in my diverse cities of Fremont, Union City, and Newark.

The Bay's marshes and mudflats are multi-benefit resources. They provide habitat, cushion the urban edges of Alameda County from extreme storms and tidal events, filter water, and sequester carbon. Yet these resources, and the general public, are at increasing risk. The San Francisco Baylands likely face a large-scale transformation from marsh to open water, exposing communities to more intense flooding from the Bay. PUBLIC SEDIMENT FOR ALAMEDA CREEK is a template for action in the Alameda Creek watershed.

Alameda Creek is the largest local tributary that feeds the Bay, but sediment remains stuck in the flood control channel, trapped behind dams, and is unable to make it to the Baylands where it is needed for marsh and mudflat accretion. The flood control channel will be redesigned to move sediment and enable fish passage through critical migration seasons. Public access will be expanded along the 12-mile flood control channel that links Fremont, Union City, and Newark, enhancing recreation, environmental education opportunities, and regional connectivity.

I support PUBLIC SEDIMENT FOR ALAMEDA CREEK. Please don't hesitate to contact Derek Chernow, my Chief of Staff, at (916) 651-4010 with any questions.

Sincerely,

Robert A. Wieckowski

Bob Wieckowski
Senator, 10th District

PRINTED ON RECYCLED PAPER

Flood Control & Water Conservation DISTRICT

Daniel Woldesenbet, Ph.D., P.E., General Manager

399 Elmhurst Street • Hayward, CA 94544 • (510) 670-5480 • www.acgov.org/pwa

May 11, 2018

Amanda Brown-Stevens, Managing Director
Resilient by Design, Bay Area Challenge
375 Beale Street, Suite 800
San Francisco, CA, 94105

Subject: Alameda County Flood Control & Water Conservation District Support of Public Sediment Team's "Unlocking Alameda Creek" Project

Dear Resilient by Design Jury and Advisory Board:

The Alameda County Flood Control & Water Conservation District (District) appreciates the spotlight that the Resilient by Design Bay Area Challenge is shining on improving shoreline resiliency around the San Francisco Bay.

The District has been actively working with our Bay Area colleagues since 2014 to develop regional solutions to the growing threat to the Bay Area's social, economic, and environmental well-being caused by sea level rise and extreme tides. The District recognizes that the Resilient by Design Challenge holds great promise for helping to solve some of the sticky issues that local agencies face related to project permitting, funding, and regional coordination.

The Public Sediment team chose "Unlock Alameda Creek" as its project. Alameda Creek is within the District's jurisdiction and under District management and operation. The District has been responsible for Alameda Creek, from its original conversion to a leveed channel by the U.S. Army Corps of Engineers in the early 1960s to prevent flooding, through many cycles of major maintenance, and through our development of more sustainable solutions to managing the creek. For example, our staff have developed a sophisticated hydrologic and sediment transport model for Alameda Creek and have performed several major studies of the creek. Similarly, our staff have worked for more than a decade in collaboration with and support of the South Bay Salt Pond Restoration Project, and we are an active partner with the Alameda County Water District (ACWD) in the construction of a fish ladder in Alameda Creek over the so called "BART weir" and ACWD's Rubber Dam No. 1.

Throughout the design competition, the District has been working very closely with the Public Sediment team and has willingly shared our experience, expertise, and the results of our many studies. We have provided a vast amount of information, data, and reports to the team; have met with the team on many occasions; and have offered our facilities and expertise to further the design process.

We appreciate the work, enthusiasm, and fresh perspectives that the Public Sediment team has brought to the design challenge. In particular, we are pleased that the District's *Low-Flow Channel, Landmass Levee, Fish Passage,* and *Don Castro Reservoir Sediment Removal* projects were incorporated by the team into the overall Unlock Alameda Creek design scheme. We also appreciate that part of the design solution includes an *Alameda Creek Levee Breach* to allow better connectivity with the Eden Landing Ecological Reserve, another project the District has been studying and planning for many years. To supplement these core District projects, the Public Sediment team has offered a number of fresh new ideas about public access and ecological and habitat restoration.

Sediment replenishment is a vital component for improving shoreline resiliency, not only from Alameda Creek, but throughout the San Francisco Bay region. The Resilient by Design competition offers an excellent platform for positive, multi-discipline discussions among agencies and parties about shoreline resiliency.

The District will continue to be closely involved with the design challenge and will continue to offer our support and expertise to the Public Sediment team and ongoing Resilient by Design efforts. As the District continues to address potential flood risks from sea level rise and extreme storms, we welcome the opportunity to incorporate implementable components of the Unlock Alameda Creek project. In this rapidly changing world, the threats from sea level rise are looming and the needs of local agencies will only become greater.

Please feel free to contact me (510-670-5553 or hank@acpwa.org) to discuss ways we can help build on the momentum that the Resilient by Design competition has established and how we can continue to support the important work of the Unlock Alameda Creek project.

Sincerely,
Alameda County Flood Control & Water Conservation District

Hank Ackerman, PE
Flood Control Program Manager

CONSERVATION PARTNERSHIP
ACRCD • NRCS

ALAMEDA COUNTY RESOURCE CONSERVATION DISTRICT

3585 GREENVILLE RD. STE 2
LIVERMORE, CA 94550

PHONE: 925-371-0154
FAX: 925-960-1550

May 9, 2018

Amanda Brown-Stevens
Managing Director
Resilient by Design Bay Area Challenge
375 Beale Street, Suite 800
San Francisco, CA 94105

Dear Resilient By Design Jury and Advisory Board,

This letter is in support of PUBLIC SEDIMENT FOR ALAMEDA CREEK, a proposal developed for the Resilient by Design initiative that proposes to reconnect sediment flows from Alameda Creek to the marshes and mudflats at the Bay edge, creating protective ecological infrastructure that adapts to sea level rise, mitigates flood risk, and introduces space for equitable public access, citizen science, and recreation. The project designs for sediment, people, and fish, and builds resilience in the diverse cities of **Fremont, Union City, and Newark**.

The Bay's marshes and mudflats are multi-benefit resources. They provide habitat, cushion the urban edges of Alameda County from extreme storms and tidal events, filter water, and sequester carbon. Yet these resources are at risk – land subsidence and sea level rise threaten to damage or destroy the Bay's marshes and mudflats by 2100. Projections show that with 3.5' of sea level rise by 2100, the region's current sediment supply will not sustain these ecosystems over time. The San Francisco Baylands likely face a large-scale transformation from marsh to open water, exposing communities to more intense flooding from the Bay. This risk is invisible to the general public and increases year by year. The Bay Area has the tools and the capacity to address these urgent problems – PUBLIC SEDIMENT FOR ALAMEDA CREEK is a systemic proposal for action in the Alameda Creek watershed and we strongly support the continuation of this work.

PUBLIC SEDIMENT FOR ALAMEDA CREEK is a three-part proposal that includes 1) an implementable project called 'Unlock Alameda Creek,' 2) a series of Pilots for Bay Nourishment to feed the bay with sediment over time, and 3) a long-term Sedimentshed Plan for the region. Today, Alameda Creek is the largest local tributary that feeds the Bay, but sediment remains stuck in the flood control channel, trapped behind dams, and is unable to make it to the Baylands where it is needed for marsh and mudflat accretion. **Unlock Alameda Creek** is a buildable project that redesigns the creek to enable sediment flows and reconnects it to the Baylands, balancing the needs of people, fish, and sediment in the watershed. The creek levees will be selectively breached near the mouth to feed bay marshes with sediment and manage flood risk at the bay edge. The flood control

channel will be redesigned to move sediment, support vegetative diversity, and enable fish passage through critical migration seasons. Public access will be expanded along the 12-mile flood control channel that links Fremont, Union City, and Newark, enhancing recreation, environmental education opportunities, and regional connectivity. In addition to this important work, the Public Sediment team has also identified critical **Pilots for Bay Nourishment** and the need for a larger **Alameda Creek Sedimentshed Plan** for adaptation of the larger upland area.

Alameda Creek connects communities that are diverse in race, ethnicity, age, and income, linking them with each other and the bay. For too long, Alameda Creek has been viewed solely as a flood control channel and the Public Sediment Team has worked hard to establish a vision for Alameda Creek as living system that is socially inclusive, ecologically functional, and adaptive to future sea level rise and climate change. We support PUBLIC SEDIMENT FOR ALAMEDA CREEK and strongly encourage the continuation of this important work.

Sincerely,

Katherine Boxer

Katherine Boxer
Chief Executive Officer
Alameda County Resource Conservation District

South Bay Salt Pond Restoration Project

Restoring the Wild Heart of the South Bay

7 May 2018

Amanda Brown-Stevens
Managing Director
Resilient by Design Bay Area Challenge
375 Beale Street, Suite 800
San Francisco, CA 94105

Re: Public Sediment for Alameda Creek

Dear Resilient By Design Jury and Advisory Board:

This letter is in support of Public Sediment for Alameda Creek, a proposal developed for the Resilient by Design initiative that proposes to reconnect sediment flows from Alameda Creek to the marshes and mudflats at the Bay edge, creating protective ecological infrastructure that adapts to sea level rise, mitigates flood risk, and introduces space for equitable public access, citizen science, and recreation.

The Bay's marshes and mudflats are multi-benefit resources. They provide habitat, cushion the urban edges of Alameda County from extreme storms and tidal events, filter water, and sequester carbon. The SBSPRP is the largest tidal wetland restoration project on the West Coast. When complete, the project will restore 15,100 acres of industrial salt ponds to a rich mosaic of tidal wetlands, transition zones, and other habitats. Restoration of South Bay salt ponds provides an opportunity to begin to reverse the loss and degradation our wetlands have suffered by improving the health of San Francisco Bay for years to come.

Yet these resources are at risk – land subsidence and sea level rise threaten to damage or destroy the Bay's marshes and mudflats by 2100. Projections show that with 3.5' of sea level rise by 2100, the region's current sediment supply may not sustain these ecosystems over time. The San Francisco Baylands could face a large-scale transformation from marsh to open water, exposing communities to more intense flooding from the Bay. This risk is invisible to the general public and increases year by year. The Bay Area has the tools and the capacity to address these urgent problems – PUBLIC SEDIMENT FOR ALAMEDA CREEK is a systemic proposal for action in the Alameda Creek watershed and we support the continuation of this work.

Public Sediment for Alameda Creek is a three-part proposal that includes 1) an implementable project called 'Unlock Alameda Creek,' 2) a series of Pilots for Bay Nourishment to feed the Bay with sediment over time, and 3) a long-term Sedimentshed Plan for the region. Today, Alameda Creek is the largest local tributary that feeds the Bay, but sediment remains stuck in the flood control channel, trapped behind dams, and is unable to make it to the Baylands where it is needed for marsh and mudflat accretion. The Public Sediment team has coordinated closely with us and many other stakeholders on their **Unlock Alameda Creek** portion, and we have developed a vision that redesigns the creek to enable sediment flows and reconnects it to the Baylands, balancing the needs of people, fish, and sediment in the watershed. In addition to this important work, the Public Sediment team has also identified critical **Pilots for Bay Nourishment** and the need for a larger **Alameda Creek Sedimentshed Plan** for adaptation of the larger upland area.

Alameda Creek connects communities that are diverse in race, ethnicity, age, and income, linking them with each other and the bay. For too long, Alameda Creek has been viewed solely as a flood control channel and the Public Sediment Team has worked hard to establish a vision for Alameda Creek as living system that is socially inclusive, ecologically functional, and adaptive to future sea level rise and climate change. We support Public Sediment for Alameda Creek and encourage the continuation of this important work. Please feel free to contact me if you have further questions at John.Bourgeois@scc.ca.gov or 408.314.8859.

Sincerely,

John Bourgeois
Executive Project Manager
South Bay Salt Pond Restoration Project

California State Coastal Conservancy
1515 Clay Street, 10th floor
Oakland, California 94612

Coastal Conservancy

May 2, 2018

Amanda Brown-Stevens
Managing Director
Resilient by Design Bay Area Challenge
375 Beale Street, Suite 800
San Francisco, CA 94105

Dear Resilient By Design Jury and Advisory Board,

The State Coastal Conservancy wishes to express support PUBLIC SEDIMENT FOR ALAMEDA CREEK, a proposal developed for the Resilient by Design Bay Area Challenge that proposes to reconnect sediment flows from Alameda Creek to the marshes and mudflats at the Bay edge, creating protective ecological infrastructure that adapts to sea level rise, mitigates flood risk, and introduces space for equitable public access, citizen science, and recreation.

The San Francisco Bay's tidal marshes and mudflats are multi-benefit resources. They provide habitat, cushion the urban edges in the Bay Area from extreme storms and tidal events, filter water, and sequester carbon. Yet these resources are at risk – land subsidence and sea level rise threaten to damage or destroy the Bay's marshes and mudflats. Projections show that with 3.5' of sea level rise by 2100, the region's current sediment supply will not sustain these tidal habitats over time. The San Francisco Baylands likely face a large-scale transformation from marsh to open water, exposing communities to more intense flooding from the Bay. PUBLIC SEDIMENT FOR ALAMEDA CREEK is a proposal for action in the Alameda Creek watershed.

PUBLIC SEDIMENT FOR ALAMEDA CREEK is a three-part proposal that includes 1) an implementable project called 'Unlock Alameda Creek,' 2) a series of Pilots for Bay Nourishment to feed the bay with sediment over time, and 3) a long-term Sedimentshed Plan for the region. Today, Alameda Creek is the largest local tributary that feeds the Bay, but sediment remains stuck in the flood control channel, trapped behind dams, and is unable to make it to the Baylands where it is needed for marsh and mudflat accretion. **Unlock Alameda Creek** redesigns the creek to enable sediment flows and reconnects it to the Baylands, balancing the needs of people, fish, and sediment in the watershed. In addition to this important work, the Public Sediment team has also identified critical **Pilots for Bay Nourishment** and the need for a larger **Alameda Creek Sedimentshed Plan** for adaptation of the larger upland area. The proposal directly benefits the State Coastal Conservancy's long-term efforts to restore Eden Landing as part of the South Bay Salt Pond Restoration Project, as well as our efforts to increase beneficial use of dredged material in San Francisco Bay.

Alameda Creek connects communities that are diverse in race, ethnicity, age, and income, linking them with each other and the Bay. For too long, Alameda Creek has been viewed solely as a flood control channel and the Public Sediment Team has worked hard to establish a vision for Alameda Creek as living system that is socially inclusive, ecologically functional, and adaptive to future sea level rise and climate change. We support the continuation of the important work of PUBLIC SEDIMENT FOR ALAMEDA CREEK.

Sincerely,

Brenda Buxton
Deputy Bay Area Program Manager

1515 Clay Street, 10th Floor
Oakland, California 94612-1401
510-286-1015 Fax: 510-286-0470

California State Coastal Conservancy

East Bay Regional Park District

2950 PERALTA OAKS COURT P.O. BOX 5381 OAKLAND CALIFORNIA 94605-0381 T: 1-888-EBPARKS F: 510-569-4319 TRS RELAY: 711 WWW.EBPARKS.ORG

May 8, 2018

Amanda Brown-Stevens, Managing Director
Resilient by Design Bay Area Challenge
375 Beale Street, Suite 800
San Francisco, CA 94105

Dear Resilient by Design Jury and Advisory Board,

The East Bay Regional Park District appreciates participating in the Resilient by Design process with the Public Sediment team on Alameda Creek. The Park District operates Coyote Hills Regional Park, Quarry Lakes Regional Park, and the Alameda Creek Regional Trail. These facilities serve an important recreation need while providing sustainable transportation, water storage, habitat protection, and green infrastructure. We support the Alameda Creek proposal that would reconnect sediment flows to the marshes and mudflats at the San Francisco Bay edge, creating protective ecological infrastructure that adapts to sea level rise, mitigates flood risk, and introduces public access.

The Bay's marshes and mudflats are at risk – land subsidence and sea level rise threaten to damage them by 2100. Projections show that with 3.5 feet of sea level rise by 2100, the region's current sediment supply will not sustain these ecosystems over time. The San Francisco Baylands will probably face a large-scale transformation from marsh to open water, exposing communities to more intense flooding from the Bay. This risk is invisible to the public and increases year by year. The Bay Area has the tools and capacity to address these urgent problems. Public Sediment for Alameda Creek is a systemic proposal for action in the Alameda Creek watershed, and the Park District supports continuation of this work.

Public Sediment proposal includes 1) an implementable project called *Unlock Alameda Creek*, 2) a series of Pilots for Bay Nourishment to feed the Bay with sediment over time, and 3) a long-term Sedimentshed Plan for the region. *Unlock Alameda Creek* is a buildable project that redesigns the creek to enable sediment flows and reconnects it to the Baylands. The creek levees will be selectively breached near the mouth to feed bay marshes with sediment and manage flood risk at the Bay edge. The flood control channel will be redesigned to move sediment, support vegetative diversity, and enable fish passage through critical migration seasons. Public access will be expanded along the 12-mile flood control channel that links Fremont, Union City, and Newark, enhancing recreation.

Alameda Creek connects communities that are diverse in race, ethnicity, age, and income, linking them with each other and the Bay. For too long, Alameda Creek has been viewed solely as a flood control channel and the Public Sediment Team has worked hard to establish a vision for Alameda Creek as living system that is socially inclusive, ecologically functional, and adaptive to future sea level rise and climate change. We support Public Sediment for Alameda Creek and encourage the continuation of this important work.

Sincerely,

Sandra Hamlat
Senior Planner

cc: Brian Holt
Chief of Planning/GIS

STATE CAPITOL
P.O. BOX 942849
Sacramento, CA 94249-0020
(916) 319-2020

DISTRICT OFFICE
22320 Foothill Blvd, Suite 540
Hayward, CA 94541
(510) 583-8818

Assembly
California Legislature

BILL QUIRK
ASSEMBLYMEMBER, TWENTIETH DISTRICT

STANDING COMMITEES:
CHAIR: ENVIRONMENTAL SAFETY AND TOXIC MATERIALS
APPROPRIATIONS
PUBLIC SAFETY
REVENUE AND TAXATION
UTILITIES AND ENERGY

May 4, 2018

Amanda Brown-Stevens, Managing Director
Resilient by Design Bay Area Challenge
375 Beale Street, Suite 800
San Francisco, CA 94105

RE: Support for Public Sediment of Alameda Creek

Dear Resilient By Design Jury and Advisory Board:

I am writing to express strong support for the Public Sediment of Alameda Creek initiative, which proposes to reconnect sediment flows from Alameda Creek to the marshes and mudflats at the Bay's edge to eradicate the impacts of sea level rise and mitigate flood risk.

Alameda Creek is the largest sediment shed in the Bay. However, sediment remains stuck in the flood control channel, trapped behind dams, and is unable to make it to the Baylands where it is needed for marsh and mudflat accretion. The direct result is land subsidence and sea level rise, which threaten to destroy ecosystems and expose our communities to more intense flooding from the Bay.

Public Sediment of Alameda creek is a systematic approach that will regenerate our protective ecological infrastructure, create new access for fish, and expand public access for recreational and educational opportunities.

I strongly encourage the Resilient By Design Jury and Advisory Board to continue to fund this important project. Should you have any questions, please do not hesitate to contact me through my District Office at 510-583-8818.

Sincerely,

Bill Quirk
Assemblymember, 20th District

bq:lm

Amanda Brown-Stevens
Managing Director
Resilient by Design Bay Area Challenge
375 Beale Street, Suite 800
San Francisco, CA 94105

Dear Resilient By Design Jury and Advisory Board,

This letter is in support of PUBLIC SEDIMENT FOR ALAMEDA CREEK, a proposal developed for the Resilient by Design initiative that proposes to reconnect sediment flows from Alameda Creek to the marshes and mudflats at the Bay edge, creating protective ecological infrastructure that adapts to sea level rise, mitigates flood risk, and introduces space for equitable public access, citizen science, and recreation. The project designs for sediment, people, and fish, and builds resilience in the diverse cities of **Fremont, Union City, and Newark**.

The Bay's marshes and mudflats are multi-benefit resources. They provide habitat, cushion the urban edges of Alameda County from extreme storms and tidal events, filter water, and sequester carbon. Yet these resources are at risk – land subsidence and sea level rise threaten to damage or destroy the Bay's marshes and mudflats by 2100. Projections show that with 3.5' of sea level rise by 2100, the region's current sediment supply will not sustain these ecosystems over time. The San Francisco Baylands likely face a large-scale transformation from marsh to open water, exposing communities to more intense flooding from the Bay. This risk is invisible to the general public and increases year by year. The Bay Area has the tools and the capacity to address these urgent problems – PUBLIC SEDIMENT FOR ALAMEDA CREEK is a systemic proposal for action in the Alameda Creek watershed and we strongly support the continuation of this work.

PUBLIC SEDIMENT FOR ALAMEDA CREEK is a three-part proposal that includes 1) an implementable project called 'Unlock Alameda Creek,' 2) a series of Pilots for Bay Nourishment to feed the bay with sediment over time, and 3) a long-term Sedimentshed Plan for the region. Today, Alameda Creek is the largest local tributary that feeds the Bay, but sediment remains stuck in the flood control channel, trapped behind dams, and is unable to make it to the Baylands where it is needed for marsh and mudflat accretion. **Unlock Alameda Creek** is a buildable project that redesigns the creek to enable sediment flows and reconnects it to the Baylands, balancing the needs of people, fish, and sediment in the watershed. The creek levees will be selectively breached near the mouth to feed bay marshes with sediment and manage flood risk at the bay edge. The redesigned flood control channel will better move sediment, support vegetative diversity, and enable fish passage through critical migration seasons. Public access will be expanded along the 12-mile flood control channel that links Fremont, Union City, and Newark, enhancing recreation, environmental education opportunities, and regional connectivity. In addition to this important work, the Public Sediment team has also identified critical **Pilots for Bay Nourishment** and the need for a larger **Alameda Creek Sedimentshed Plan** for adaptation of the larger upland area.

Alameda Creek connects communities that are diverse in race, ethnicity, age, and income, linking them with each other and the bay. For too long, Alameda Creek has been viewed solely as a single-purpose flood control channel. The Public Sediment Team has worked hard to establish a vision for Alameda Creek as living system that is socially inclusive, ecologically functional, and adaptive to future sea level rise and climate change. We support PUBLIC SEDIMENT FOR ALAMEDA CREEK and strongly encourage the continuation of this important work.

Sincerely,

Jeff Miller, Executive Director
Alameda Creek Alliance

Amanda Brown-Stevens
Managing Director
Resilient by Design Bay Area Challenge
375 Beale Street, Suite 800
San Francisco, CA 94105

Dear Resilient By Design Jury and Advisory Board,

This letter is in support of PUBLIC SEDIMENT FOR ALAMEDA CREEK, a proposal developed for the Resilient by Design initiative that proposes to reconnect sediment flows from Alameda Creek to the marshes and mudflats at the Bay edge, creating protective ecological infrastructure that adapts to sea level rise, mitigates flood risk, and introduces space for equitable public access, citizen science, and recreation. The project designs for sediment, people, and fish, and builds resilience in the diverse cities of **Fremont, Union City, and Newark**.

The Bay's marshes and mudflats are multi-benefit resources. They provide habitat, cushion the urban edges of Alameda County from extreme storms and tidal events, filter water, and sequester carbon. Yet these resources are at risk – land subsidence and sea level rise threaten to damage or destroy the Bay's marshes and mudflats by 2100. Projections show that with 3.5' of sea level rise by 2100, the region's current sediment supply will not sustain these ecosystems over time. The San Francisco Baylands likely face a large-scale transformation from marsh to open water, exposing communities to more intense flooding from the Bay. This risk is invisible to the general public and increases year by year. The Bay Area has the tools and the capacity to address these urgent problems – PUBLIC SEDIMENT FOR ALAMEDA CREEK is a systemic proposal for action in the Alameda Creek watershed and we strongly support the continuation of this work.

PUBLIC SEDIMENT FOR ALAMEDA CREEK is a three-part proposal that includes 1) an implementable project called 'Unlock Alameda Creek,' 2) a series of Pilots for Bay Nourishment to feed the bay with sediment over time, and 3) a long-term Sedimentshed Plan for the region. Today, Alameda Creek is the largest local tributary that feeds the Bay, but sediment remains stuck in the flood control channel, trapped behind dams, and is unable to make it to the Baylands where it is needed for marsh and mudflat accretion. **Unlock Alameda Creek** is a buildable project that redesigns the creek to enable sediment flows and reconnects it to the Baylands, balancing the needs of people, fish, and sediment in the watershed. The creek levees will be selectively breached near the mouth to feed bay marshes with sediment and manage flood risk at the bay edge. The flood control channel will be redesigned to move sediment, support vegetative diversity, and enable fish passage through critical migration seasons. Public access will be expanded along the 12-mile flood control channel that links Fremont, Union City, and Newark, enhancing recreation, environmental education opportunities, and regional connectivity. In addition to this important work, the Public Sediment team has also identified critical **Pilots for Bay Nourishment** and the need for a larger **Alameda Creek Sedimentshed Plan** for adaptation of the larger upland area.

I would like to speak to the increased environmental education opportunities. Already, Resilient by Design has brought my students out to Alameda Creek and educated them about how Alameda Creek is related to sediment flow and protection from future sea level rising. Students were able to connect climate change to direct impacts in their neighborhoods. Redesigning the channel to include access points will greatly increase the educational opportunities, not just for students, to be able to connect with the ecological services provided by Alameda Creek and ultimately increase the quality of life in this watershed.

Alameda Creek connects communities that are diverse in race, ethnicity, age, and income, linking them with each other and the bay. For too long, Alameda Creek has been viewed

solely as a flood control channel and the Public Sediment Team has worked hard to establish a vision for Alameda Creek as living system that is socially inclusive, ecologically functional, and adaptive to future sea level rise and climate change. We support PUBLIC SEDIMENT FOR ALAMEDA CREEK and strongly encourage the continuation of this important work.

Sincerely,

Kyra Wheaton
American High School Science and Engineering teacher (Fremont, CA)

May 11, 2018

Amanda Brown-Stevens
Managing Director
Resilient by Design Bay Area Challenge
375 Beale Street, Suite 800
San Francisco, CA 94105

Dear Resilient By Design Jury and Advisory Board,

On behalf of the San Francisco Bay Trail Project, I'm am writing in support of PUBLIC SEDIMENT FOR ALAMEDA CREEK, a proposal developed for the Resilient by Design initiative that proposes to reconnect sediment flows from Alameda Creek to the marshes and mudflats at the Bay edge, creating protective ecological infrastructure that adapts to sea level rise, mitigates flood risk, and introduces space for equitable public access, citizen science, and recreation. The project designs for sediment, people, and fish, and builds resilience in the diverse cities of **Fremont, Union City, and Newark**.

The project area that the Public Sediment team selected includes the area covered by the Eden Landing Phase II –South Bay Salt Pond Project which is an extremely complex project with difficult challenges in balancing the many competing goals of a wide variety of public agencies and private organizations. Throughout their design process, the Public Sediment team has worked to understand the goals and issues of each stakeholder and facilitated productive dialogue between the various stakeholders.

Public Sediment's final proposal fulfills the mission of balancing the complex and sometimes competing goals of sea level rise adaptation, restoration, flood control, and public access if it is fully implemented including the full set of proposed public access improvements. Public Sediment's public access proposal achieves the goals of completing a Bay Trail that provides a "Bay" experience, will survive the expected levels of sea level rise, and will connect the existing Bay Trail segments at Eden Landing Phase I and Coyote Hills Regional Park for a continuous Bay Trail that stretches from Hayward to Fremont.

We believe that Public Sediment's proposal balances and resolves the many competing goals at Eden Landing and strongly support the continuation of their efforts to work with the many Eden Landing stakeholders to implement Public Sediment's vision for this area.

Sincerely,

Lee Chien Huo
Bay Trail Planner

BOARD OF SUPERVISORS

SCOTT HAGGERTY
SUPERVISOR, FIRST DISTRICT

May 1, 2018

Amanda Brown-Stevens
Managing Director
Resilient by Design Bay Area Challenge
375 Beale Street, Suite 800
San Francisco, CA 94105

Dear Resilient By Design Jury and Advisory Board,

This letter is in support of *Public Sediment for Alameda Creek*, a proposal developed for the Resilient by Design initiative that proposes to reconnect sediment flows from Alameda Creek to the marshes and mudflats at the Bay edge, creating protective ecological infrastructure that adapts to sea level rise, mitigates flood risk, and introduces space for equitable public access, citizen science, and recreation. The project designs for sediment, people, and fish, and builds resilience in the diverse cities of Fremont, Union City, and Newark.

The Bay's marshes and mudflats are multi-benefit resources. They provide habitat, cushion the urban edges of Alameda County from extreme storms and tidal events, filter water, and sequester carbon. Yet these resources are at risk – land subsidence and sea level rise threaten to damage or destroy the Bay's marshes and mudflats by 2100. Projections show that with 3.5' of sea level rise by 2100, the region's current sediment supply will not sustain these ecosystems over time. The San Francisco Baylands likely face a large-scale transformation from marsh to open water, exposing communities to more intense flooding from the Bay. This risk is invisible to the general public and increases year by year. The Bay Area has the tools and the capacity to address these urgent problems – *Public Sediment for Alameda Creek* is a systemic proposal for action in the Alameda Creek watershed and I strongly support the continuation of this work.

Public Sediment for Alameda Creek is a three-part proposal that includes 1) an implementable project called "Unlock Alameda Creek," 2) a series of Pilots for Bay Nourishment, to feed the bay with sediment over time, and 3) a long-term Sedimentshed Plan for the region. Today, Alameda Creek is the largest local tributary that feeds the Bay, but sediment remains stuck in the flood control channel, trapped behind dams, and is unable to make it to the Baylands where it is needed for marsh and mudflat accretion. Unlock Alameda Creek is a buildable project that redesigns the creek to enable sediment flows and reconnects it to the Baylands, balancing the needs of people, fish, and sediment in the watershed. The creek levees will be selectively breached near the mouth to feed bay marshes with sediment and manage flood risk at the bay edge. The flood control channel will be redesigned to move sediment, support vegetative diversity, and enable fish passage through critical migration seasons. Public access will be expanded along the 12-mile flood control channel that links Fremont, Union City, and Newark, enhancing recreation, environmental education opportunities, and regional connectivity. In addition to this important work, the Public Sediment team has also identified critical Pilots for Bay Nourishment and the need for a larger Alameda Creek Sedimentshed Plan, for adaptation of the larger upland area.

Alameda Creek connects communities that are diverse in race, ethnicity, age, and income, linking them with each other and the Bay. For too long, Alameda Creek has been viewed solely as a flood control channel. The Public Sediment Team has worked hard to establish a vision for Alameda Creek as a living system that is socially inclusive, ecologically functional, and adaptive to future sea level rise and climate change. I support *Public Sediment for Alameda Creek* and strongly encourage the continuation of this important work.

Sincerely,

Scott Haggerty
Alameda County Board of Supervisors
First District

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BOARD OF SUPERVISORS

RICHARD VALLE
Vice President
Supervisor, District 2

May 14, 2018

Amanda Brown-Stevens
Managing Director
Resilient by Design Bay Area Challenge
375 Beale Street, Suite 800
San Francisco, CA 94105

RE: Support for Public Sediment for Alameda Creek

Dear Resilient By Design Jury and Advisory Board,

This letter is in support of **Public Sediment for Alameda Creek**, a proposal developed for the Resilient by Design initiative that proposes to reconnect sediment flows from Alameda Creek to the marshes and mudflats at the Bay edge, creating protective ecological infrastructure that adapts to sea level rise, mitigates flood risk, and introduces space for equitable public access, citizen science, and recreation. The project designs for sediment, people, and fish, and builds resilience in the diverse District Two cities of Fremont, Union City, and Newark.

The Bay's marshes and mudflats are multi-benefit resources. They provide habitat, cushion the urban edges of Alameda County from extreme storms and tidal events, filter water, and sequester carbon. Yet these resources are at risk – land subsidence and sea level rise threaten to damage or destroy the Bay's marshes and mudflats by 2100. Projections show that with 3.5' of sea level rise by 2100, the region's current sediment supply will not sustain these ecosystems over time. The San Francisco Baylands likely face a large-scale transformation from marsh to open water, exposing communities to more intense flooding from the Bay. This risk is invisible to the general public and increases year by year. The Bay Area has the tools and the capacity to address these urgent problems – **Public Sediment for Alameda Creek** is a systemic proposal for action in the Alameda Creek watershed and District Two strongly supports the continuation of this work.

Public Sediment for Alameda Creek is a three-part proposal that includes 1) an implementable project called 'Unlock Alameda Creek,' 2) a series of Pilots for Bay Nourishment to feed the bay with sediment over time, and 3) a long-term Sedimentshed Plan for the region. Today, Alameda Creek is the largest local tributary that feeds the Bay, but sediment remains stuck in the flood control channel, trapped behind dams, and is unable to make it to the Baylands where it is needed for marsh and mudflat accretion. **Unlock Alameda Creek** is a buildable project that redesigns the creek to enable sediment flows and reconnects it to the Baylands, balancing the needs of people, fish, and sediment in the watershed. The creek levees will be selectively breached near the mouth to feed bay marshes with sediment and manage flood risk at the bay edge. The flood control channel will be redesigned to move sediment, support vegetative diversity, and enable fish passage through critical migration seasons. Public access will be expanded along the 12-mile flood control channel that links Fremont, Union City, and Newark, enhancing recreation, environmental education opportunities, and regional connectivity. In addition to this important work, the Public Sediment team has also identified critical **Pilots for Bay Nourishment** and the need for a larger **Alameda Creek Sedimentshed Plan** for adaptation of the larger upland area.

Alameda Creek connects communities that are diverse in race, ethnicity, age, and income, linking them with each other and the bay. The Public Sediment Team has worked hard to establish a vision for Alameda Creek as living system that is socially inclusive, ecologically functional, and adaptive to future sea level rise and climate change. We support **Public Sediment for Alameda Creek** and strongly encourage the continuation of this important work.

Sincerely,

Richard Valle