Hassell

COLMA CREEK ADAPTATION PLANNING

Design Report
N0004 (Final)

Prepared for
BARC, San Mateo County & City of South San Francisco

8th July, 2020

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CHS Consulting
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City of South San Francisco
Jake Gilchrist / Phillip Vitale / Christina Fernandez

Special thanks to our community partners_

SSF Parks & Rec Summer Camp
San Francisco Estuary Institute
San Bruno Mountain Watch
SSF Councillmember Mark Nagales
SF Philippine Consulate General
Martin Elementary school

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EXECUTIVE SUMMARY

The Colma Creek Adaptation Study – 'Colma Creek Connector' is a continuation of work done by Hassell and San Mateo County for the Resilient by Design Bay Area Challenge which focused on the Colma Creek Watershed over 2017-18.

In 1959 the San Mateo County Flood Control District was formed, with one of its key objectives being to address the recurring flooding problems along Colma Creek that had been impacting the community. Subsequent changes along Colma Creek were designed to protect against a 50-year storm event, which has a 2% probability of occurring in any given year. With the emergence of global climate change and the increased intensity of storms, it is now necessary to re-evaluate the carrying capacity of the creek. This process also presents the opportunity to evaluate the public amenity potential and provide improvements along the channel given changes to accepted best practice since the channelization occurred.

The Colma Creek corridor currently has limited public access and is identified within Plan Bay Area as a Priority Conservation Area and a key link to the Bay Trail.

During the previous stage of the project, the team facilitated community engagement and an inclusive design process to map out a range of ways to make the City of South San Francisco (City) stronger and reverse the area's real and symbolic separations from the water by restoring public access to and along it, and establishing more open spaces and parks.

This study aims to explore the design options and feasibility of adaptation along Colma Creek using publicly owned land, in order to:

→ **MANAGE FLOODING AND SEA-LEVEL RISE;**

→ **RESTORE CREEK ECOLOGIES;**

→ **INCREASE PUBLIC ACCESS TO THE CREEK;**

→ **IMPROVE PUBLIC ACCESS BETWEEN COLMA CREEK, THE BAY AND THE BAY TRAIL.**

The adaptation planning begun with a focus on the creek between Orange Memorial Park and Highway 101. Additional grant funding allowed for that scope to extend from Highway 101 to the Bay. With the guidance of the Bay Area Regional Collaborative, San Mateo County and the City of South San Francisco, this study was aligned with long-term planning for the area, in particular the General Plan Update currently being prepared.

The Colma Creek corridor currently offers few benefits and has little to no relationship to the community. The creek acts more as barrier than a public service. The corridor has enormous potential for an ecological and open space connection between the community and the Bay. By restoring the native ecology, more wildlife could return and create a more holistic natural community.

The planning study aims to establish key information for assessing the feasibility of various adaptation scenarios along the creek corridor to drive cross-sectoral discussion around the right path forward. Further the scenarios will serve to raise awareness within the community around a range of feasible options for a balanced approach to improving the creek corridor.

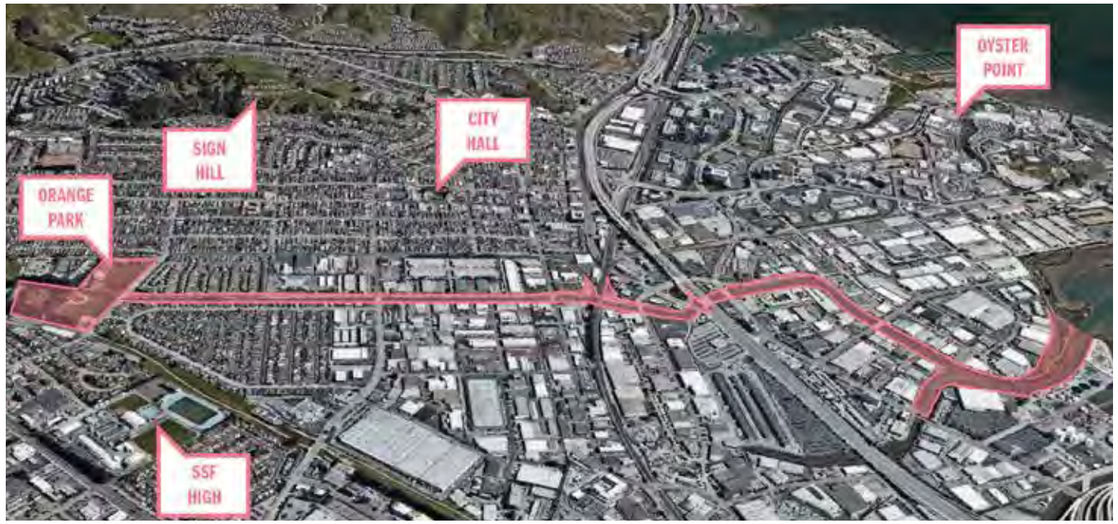
This project is a critical planning pilot that will inform other areas across the County and the region with similar features and challenges. The adaptation toolkit has been developed with this in mind and will be packaged separately as a regional resource for other creek restoration project teams and aspiring communities.

67k

residents of South City

2¼M

of linear creek edge from Orange Park to the Bay



"The waterfront isn't far away – just over a mile as the crow flies – but it's practically impossible to walk to."

Alastair Bland, Estuary News
June 2018

Below are the six key stages of the project that structured our investigation, community engagement and design across the project...

Stage 1
Detailed Work Program & Budget

→ Project Plan
→ Detailed Workplan
→ Detailed Program

Stage 2 (Ongoing)
Engagement

→ Stakeholder Working Group
→ Community Engagement
→ Planning Department & General Plan Consultant Engagement

Stage 3
Data & Analysis

→ Coordination of Existing Data Goals
→ Additional Data Collection
→ Site Analysis - Opportunities & Constraints

Stage 4
Adaptation Tool Kit

→ Project Principles
→ Creek Restoration/Adaptation Benchmarking
→ 'Tool Kit' Parti/Section/Axons

Stage 5
Adaptation Scenarios

→ Priorities Assessment
→ 'Park to Bay' Access Scenarios
→ Mobility Planning Assessment
→ Conceptual Adaptation Design Proposals (Key nodes)

Stage 6
Implementation

→ Feasibility/Benefits Assessment
→ Delivery Road Map
→ Funding Opportunities
→ Stakeholder Goals

Stage 7
Report

→1st Draft, May 2020
→2nd Draft, June 2020
→Final, July 2020

PROGRAM 2019

Legend

- Client Meetings
- Workshops
- Internal Meetings
- Key Deliverables
- External Deliverables
- Engagement

Task	JANUARY 21.01	28.01	FEBRUARY 04.02	11.02	18.02	25.02	MARCH 04.03	11.03	18.03	25.03	APRIL 01.04	08.04	15.04	22.04	29.04	MAY 06.05	13.05	20.05	27.05	JUNE 03.06	10.06	17.06	27.06	JULY 01.07	08.07	15.07	22.07	29.07
01 Detailed Work Program & Budget																												
02 Engagement																												
Stakeholder Working Group	✕										✕			✕								✕			✕			
Public Engagement		✕		✕		✕				✕			✕	✕	✕	✕	✕		✕	✕				✕		✕	✕	
Online Engagement & Awareness Building																												
Planning Department & General Plan Consultant Engagement																												
03 Data & Analysis																												
Coordination of Existing Data Goals																												
Additional Data Collection																												
04 Design																												
Identify 'Park to Bay' Access Scenarios																												
Feasibility/Benefits Assessment																												
Conceptual Adaptation Design Proposals																												
Mobility Assessment of Design Proposals																												
05 Implementation Framework																												
06 Final Report																												
Other																												
General Plan Update (Consultant: Raimi)															▲													
Colma Creek Advisory Council																												
San Mateo Adaptation Plan (Consultant: ENE)																												
San Mateo Sustainability Office														▲														
Meetings										●			●								●							

- Internal Kick-Off Meeting
- City of South San Francisco Briefing
- Public Engagement Workshop
- Parks Alive! Streets Alive!
- Mission Blue Nursery Native Plant Sale
- Design Team Meeting
- Public Engagement: Youth Creek Walk
- Design Progress Meeting
- Public Engagement: Youth Creek Walk

PROGRAM 2020

Legend

- Client Meetings
- Workshops
- Internal Meetings
- Key Deliverables
- External Deliverables
- Engagement

Task	FEBRUARY 03.02	10.02	17.02	24.02	MARCH 02.03	09.03	16.03	23.03	30.03	APRIL 06.04	13.04	20.04	27.04	MAY 04.05	11.05	18.05	25.05	JUNE 01.06	08.06	15.06	22.06	29.06	JULY 06.07	13.07
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02 Engagement																								
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Online Engagement & Awareness Building																								
03 Data & Analysis																								
Additional Data Collection																								
Site Analysis - Identify Opportunities & Constraints																								
04 Adaptation Toolkit																								
Workshops										○					○					○				
Design Reviews								○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
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Mobility Assessment of Design Proposals (by others)																								
06 Implementation Framework																								
Feasibility/Benefits Assessment																								
Delivery Road Map																								
Funding Opportunities																								
Stakeholder Goals																								
07 Report																△				△		△		

Updated Scope Team Kick-Off

Public Engagement: Youth Creek Walk

Mark Nagales Online Storytime

Draft

Philippines Consul General Storytime

Draft

SSF Summer Camp & Online Bike Raffle

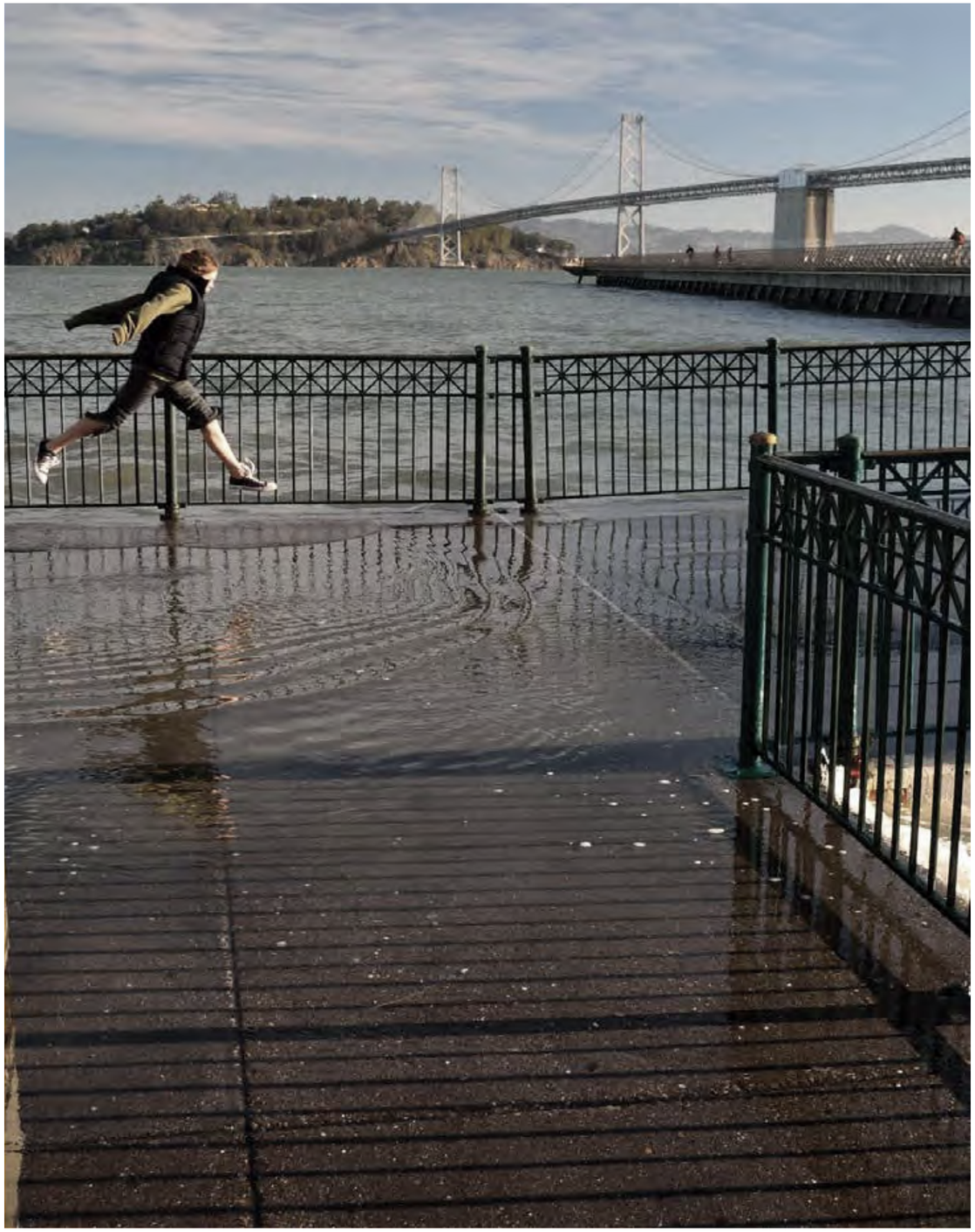
Final

CREEK PARK

Refer pp. 190 - 199

PROJECT CONTEXT

This project originated with the HASSELL+ team's design proposal from the Rockefeller Foundation sponsored Resilient By Design Bay Area Challenge. This phase of work was commissioned by the Bay Area Regional Collaborative (BARC) with Caltrans SB1 Grant funds in February 2019. A working group was formed including San Mateo County and the City of South San Francisco. Additional funds were accessed through the Metropolitan Transportation Commission's (MTC) Priority Conservation Grants program in late 2019. Extending the study area and work schedule to mid 2020.



“In those days, one would head for the beach with his bathing trunks and a towel. No lunch, no snacks, no bottled water, etc. Just salt water and sunshine”

Karl Rolih, 87
South San Francisco Resident

The 'Colma Creek Connector' project looks to maximise community benefit and improve creek health by leveraging public land adjacent to the corridor. Envisioned as the first stage of the Resilient South City strategy (developed in the Resilient By Design Challenge), the project focuses on versatile tools that can be translated across the many other channelized creeks around the Bay Area. This work is also positioned in the context of the larger climate change adaptation work that is being supported by regional agencies around the Bay Area.

The objectives of the two grants supporting this project align around the 4 major project objectives mentioned in the previous chapter. Further information on the Caltrans SB1 Grant and MTC Priority Conservation Area (PCA) Grant can be found on the following spread. PCA Grant eligibility for this project is the result of the connection between Orange Park and the Bay Trail being identified in the Plan Bay Area as a key potential access corridor. This connection existed previously, prior to urban development, and the construction of the Caltrain corridor and Highway 101 has severed access.

Here in California and across the globe, communities are feeling the impacts of climate change. Extreme weather events are increasing, and trends in precipitation and temperature are quickly departing from those that existed as human life emerged on this planet. Many scientists have now begun to refer to this new climate era as the Anthropocene, a distinct geomorphological epoch shaped by human activity. While the continued transition away from fossil fuels and onto renewable energy sources continues to be critical, dovetailing climate mitigation and climate adaptation has become imperative.

Climate change has presented an opportunity to re-imagine our relationship to the natural world and to each other. As we plan for the impacts of climate change in the Bay Area, we must seek transformational change toward true long-term prosperity. This transformation will require confronting our shared history, and centering social equity in our decision-making practices. When solutions center social equity, they are best positioned to result in positive outcomes across social-ecological systems. Climate adaptation provides a tremendous opportunity to facilitate innovation.

South San Francisco is a small city at the fringe of the Bay Area’s largest city center. The population of South San Francisco is small (only around 63,000 people) but rapidly growing and extremely diverse, with more than 40% born outside the United States. South San Francisco has major transport connections (including the 101 Highway, BART, and the adjacent international airport) and one of the world’s largest clusters of biotech companies. But many of its residents meet several criteria as ‘Communities of Concern’ and there is significant vulnerability within the population, particularly around the downtown area. However, the City retains a strong sense of identity, distinct from neighboring San Francisco, with historic industries on the Bay and diverse cultures of its downtown. The South San Francisco community is rightfully proud of its social and cultural heritage and have great hopes for its future.

Colma Creek is a major drainage corridor through the area, incorporating the cities of South San Francisco, Colma and parts of Daly City and San Bruno. The lower sections of Colma Creek connect key places in South San Francisco including the BART station, sites for the new Civic Campus & PUC developments (under design), Orange Memorial Park, the Lindenville Industrial Precinct, the underside of the rail line, 101 Highway, and the South San Francisco Water Treatment Plant at the Bay’s edge. The Creek corridor is a place of community meaning – a place where people could (in a time past) swim, fish, meet and move throughout South San Francisco.

According to our discussions with the community, Colma Creek has flooded regularly over the last several decades. Businesses and street infrastructure have been greatly affected by these floods and there is a sense of concern about the potential impacts of future flood events in the context of a changing climate.

of South San Francisco resident are born outside of the United States

RESILIENT BY DESIGN
BAY AREA CHALLENGE

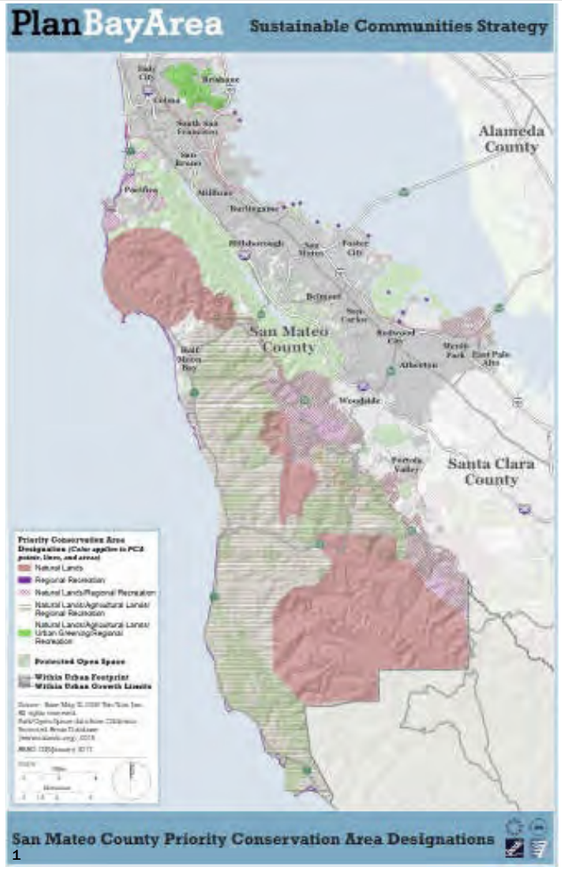
Resilient By Design (Bay Area Challenge)

RBD was a year-long collaborative design challenge bringing together local residents, public officials and local, national and international experts to develop innovative community-based solutions that will strengthen our region’s resilience to sea level rise, severe storms, flooding and earthquakes. The project aims to:

- → Address multifaceted, dynamic issues through collaboration, coordination and connection.
- → Prepare vulnerable communities for a resilient future by addressing our shared history, ecological, economic, and social vulnerabilities that still exist today.
- → Integrate social and ecological systems through rigorous research and a strong understanding of ecosystems, local community, and government challenges.
- → Integrate principles to sustain biodiversity and ecological functions.
- → Merge local, regional, and international knowledge with technical expertise toward implementable and creative design-driven ideas.
- → Acknowledge place and the First Nations of the Bay Area.
- → Develop equitable planning and development practices where community members are true collaborators and participate as equal partners at every level of design formation.
- → Leverage community knowledge and integrate in design to improve and not displace community members.
- → Lead with race and systematically tackle social inequality and environmental degradation while proactively engage diverse community members, especially disadvantaged communities

SB1 Grant Objectives

- → Advance transportation related GHG emission reduction project types/strategies (i.e., mode shift, demand management, travel cost, operational efficiency, accessibility, and coordination with future employment and residential land use, etc.)
- → Identify and address deficiencies in the multimodal transportation system, including the needs of environmental justice and disadvantaged communities, including Native American Tribal Governments and rural communities
- → Encourage stakeholder collaboration & Involve active community engagement
- → Result in funded and programmed multimodal transportation system improvements



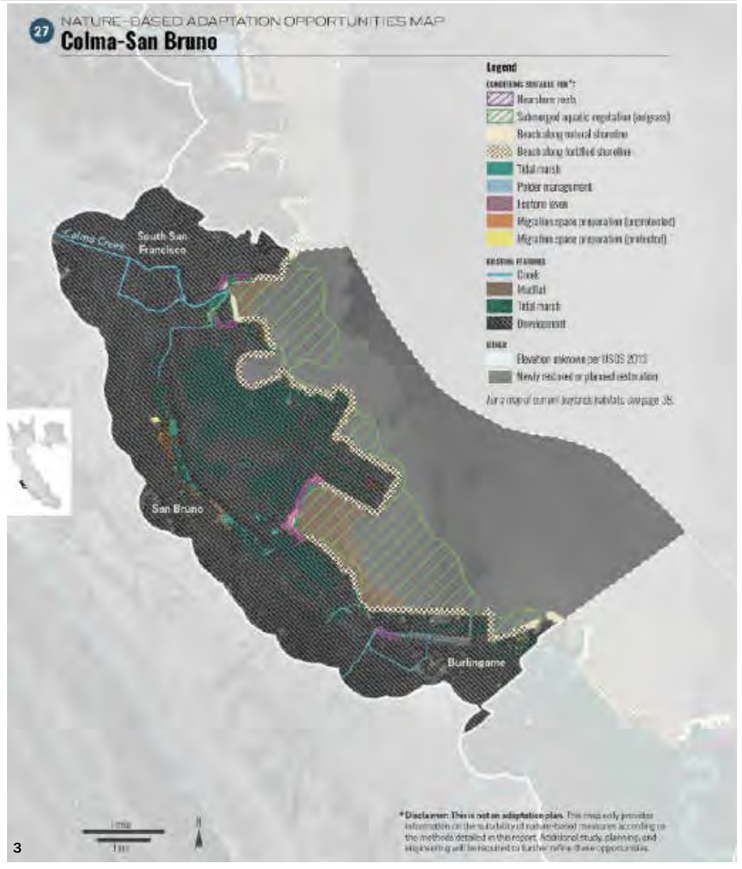
San Mateo County Priority Conservation Area Designations
1


2

PCA Grant Objectives

- → Protect or enhance critical habitats, ecosystems, watersheds, and resource areas as defined in California Government Code Section 65080.01
- → Provide or enhance bicycle and pedestrian access to regional parks, trails, open spaces and recreation areas. Notable examples are the San Francisco Bay Trail and Bay Area Ridge Trail systems.
- → Provide or enhance parks and green spaces in urban areas to improve community health, increase habitat connectivity, capture carbon emissions, and address stormwater.

Images:
1. Plan Bay Area, Priority Conservation Areas
2. San Bruno Mountain Watch Volunteer Planting Day
3. SFEI Adaptation Atlas
4. SFEI Adaptation Atlas
5. RBD flyer featuring historic flooding events near Colma Creek



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COMMUNITY ENGAGEMENT

We have engaged the local South San Francisco community through digital and in-person forums over an 18 month period. Our focus has been on raising awareness within the community about flood risk, and the potential for the creek to be transformed into an ecological asset that improves public amenity. We have built a following of supporters of the project, primarily through local South City families.

Youth engagement at SSF Parks & Rec Summer Camp

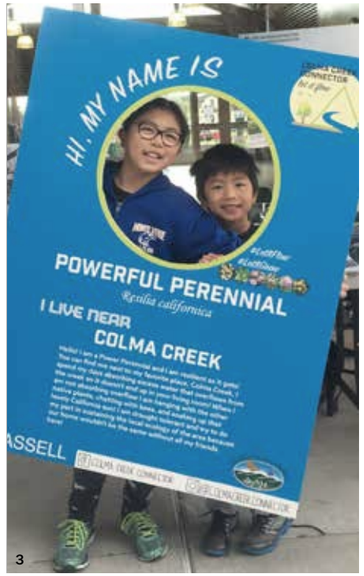
The first half of the project saw successful engagement events held as part of South San Francisco Parks & Rec's 'Parks Alive Streets Alive' and Youth Summer Camps, both in Orange Park by the Creek. Additionally we shared the project with community members visiting the Mission Blue Nursery's Native Plants Sale, the venue for much of the restoration plants used on San Bruno Mountain.

Throughout 2019 we introduced the community to the Adaptation Planning scope of the project and the challenges being addressed in the Colma Creek corridor. Over our community events, youth summer camps and Mission Blue Nursery plant sale day we talked to the community about stormwater, landscape amenity and access. These were discussed across the entire watershed, and with a specific focus on Colma Creek from Orange Park to the Bay.

At these events we shared a map of the city's stormwater system and conducted an activity where residents pinned their house and traced the stormwater network from their street down to Colma Creek. This was to display that every drop of water that enters the City's stormwater system ends up in the Creek. We also shared historic photographs of flood events impacting the blocks surrounding the Creek, fostering the sharing of personal stories from residents of flood events they had experienced in their time living in South City.

We shared information with residents on native plants from the City. Residents were keenly interested in learning about the plants, touching and taking home the samples that we gave away. Local kids were also interested in our Native Plant Cards that explained the preferred home and unique features of each plant from across the watershed.

The local kids were further inspired on our 'Creek Walks'. They enjoyed our VR simulation of sea-level rise along the corridor, talked about where they could and could not ride their bikes safely, and collected and swapped our temporary tattoos of native birds, fish and flora from Colma Creek. Many of the kids shared information with the parents and grandparents, spreading the word about the project.



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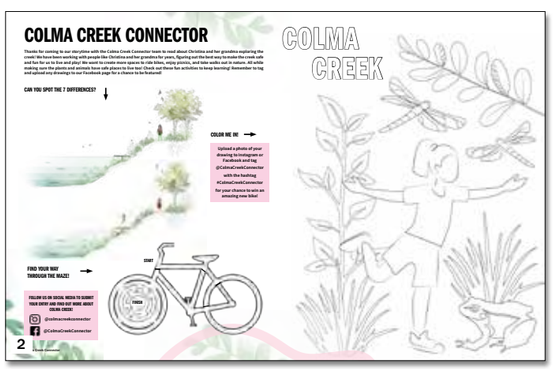
Images:
1. Parks & Rec Summer Camp Event
2. "Parks Alive, Streets Alive" in Orange Park
3. "Parks Alive, Streets Alive" in Orange Park
4. Historic flooding of Colma Creek (former Drive-in theatre pictured)
5. Mission Blue Nursery Native Plants Day
6. Historic Flooding in Lindenville Industrial Area next to Colma Creek
7. Parks & Rec Summer Camp event

The CODVID-19 crisis and subsequent 'Shelter-in-Place' order that was implemented in March resulted in the cancellation of planned engagement events with the Boys & Girls Club of San Mateo, South San Francisco Parks & Rec Summer Camp, and the Silicon Valley Bike Coalition. Our project engagement approach adapted to the situation and looked to focus on online engagement for children and youth stuck at home looking for activities to fill their days.

1



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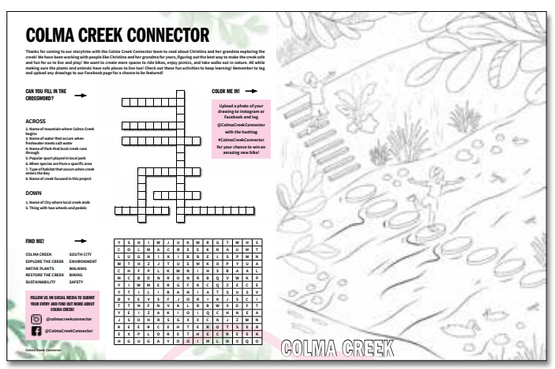

SSF City Councilmember Mark Nagales and his kids read "Christina Lives by a Beautiful Creek"

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4

The early illustrations prepared by the design team aimed to distil the objectives of the project and the approach to climate adaptation, restoration, and public access. Through the early design process, these illustrations took on a level of detail beyond their original intended use and were also able to simply and easily communicate complex, technical ideas.

As a result we conceived of the idea to create a children's story book using these illustrations to explain the approach and benefits of the project. This tool has allowed us to engage more families across South City and surrounding towns, reaching out to them with a clear understanding of the struggles they were encountering during these unprecedented times (home-schooling fatigue!)

Christina Lives By A Beautiful Creek is a story about a young girl that bikes and plays by a natural restored creek and learns about the community-led restoration process from her Grandmother as they plant new seedlings by the creek.

Images:
1. *Christina Lives by a Beautiful Creek* story book
2. Story book work sheets
3. YouTube video of City Council Member reading *Christina Lives by a Beautiful Creek* to his kids
4. City Library website

The story was read online by local South San Francisco Council-member Mark Nagales, with his two children. The video was shared through the City Library website's children's page and various local social media channels. Local news site Everything South City also shared the video and link to the downloadable story book. This was shared to hundreds of local families with versions in 4 languages (English, Spanish, Tagalog and Mandarin).

The downloadable book also came with kids activity sheets, including educational word games and puzzles, as well as a coloring competition to win a bike.

Copies of the story book were mailed to almost one hundred families who requested a copy. Community groups, local Primary Schools and the City Library were also sent multiple bound copies to share with the community once 'Shelter-in-Place' concludes.

We received an overwhelming response to the bike/coloring competition and were able to share entries through our social media channels to further draw attention to the project and the issue of adaptation in the City of South San Francisco.

COMMUNITY RESPONSE

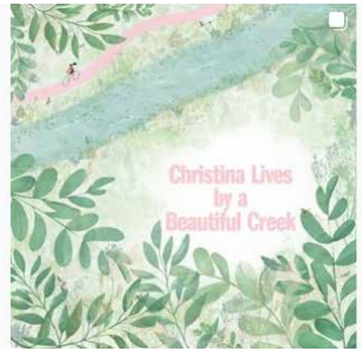
“Thank you for writing and for your efforts to find new ways of engaging the community with the project. The storybook is fantastic, it shares the vision of the project beautifully.”

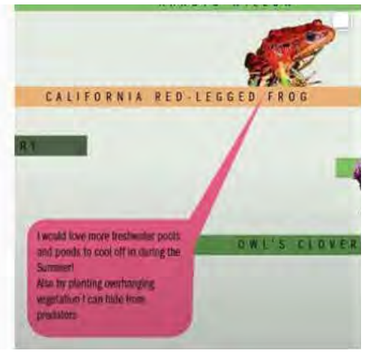
Ariel, Director of San Bruno Mountain Watch

Coloring in from worksheets

Opposite: Various instagram posts from the project account (@ColmaCreekConnector) sharing the project background and approach with the local community

Christina Live by a Beautiful Creek - Spanish, Mandarin, English, Tagalog





"I teach preschool [in SSF], I would love one for my son and one for my classroom! I grew up playing in Colma Creek near Orange Park in Mayfair Village. I tell my son how we use to ride bikes, find frogs and tadpoles. Such fun childhood memories."

Miles, from Sign Hill, SSF

"This is so helpful. My husband actually took our kids today to the Orange Park area after being inspired by the book! My 4 year old noticed all the pretty birds."

Lindsay, South City Resident

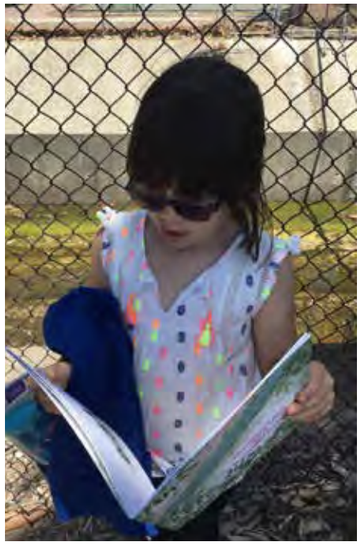
"Heard about this through Facebook. I live not too far from Colma Creek, and teach kinder/TK in South San Francisco. Very excited as since it is a local area, I can encourage kids to visit the area and surrounding areas with their families, having a book will make it tangible for them! And get them excited to explore as well."

Ann from Lindenville, SSF. She teaches at a school in SSF and requested a book for each student in her class

"Heard about this from Katie DeLeuw, PTA president at Sunshine Gardens Elementary"

Lindsay from Winston Manor, SSF

Images: Community submitted photos from story book and activity sheet
Quotes: Community submitted feedback from outreach program



“Love the book, so excited to learn about Colma Creek and share the importance of caring for our waterways with my kids and the SSG and SSF communities!”

Katie from Sign Hill and PTA president at Sunshine Gardens Elementary School

San Francisco Philippines Consul General reading *Christina Live by a Beautiful Creek* in Tagalog

"I grew up at the base of the San Bruno Mts on Irving St and love what you do to protect and educate people about this area. Thank you."

Susan in San Jose

Images: Community submitted photos from story book and activity sheet
Quotes: Community submitted feedback from outreach program

EXPANDED FLOODPLAIN

Refer pp. 200 - 211

DESIGN PRINCIPLES

Both the community engagement process and the design process for the project were based on an agreed set of Design Principles. The principles were formed across three themes based on the project objectives; water, ecology and access. These principles form the basis for our approach to creating multi-benefit solutions across both the Adaptation Toolkit and the final Adaptation Scenarios for Colma Creek.

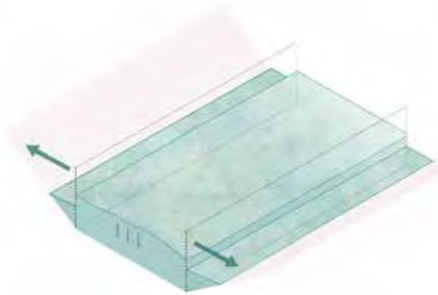
WATER

#LETITFLOW

Mitigate flooding & sea-level rise

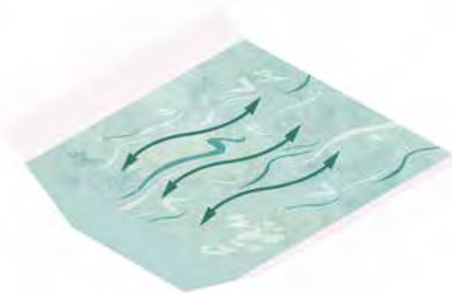
Reducing flood risk and adapting to climate change and sea-level rise are the primary drivers of adaptation along the creek corridor. Through creating more room for the creek and reducing obstructions, the project aims to increase the capacity of the creek during peak flow events.

At the same time, the project also acknowledges the large fluctuation in water levels on an annual basis, with Colma Creek's daily flow for the vast majority of the year being less than 1'. As such, the improvement of water quality and the daily experience of water will be critical at the lower water levels.



Increase capacity of canal for flood + sea-level rise

- → Expand the creek section to manage increased flooding and additional flood risk with sea-level rise
- → Design to accommodate for additional barriers for future sea-level rise at the Bay edge

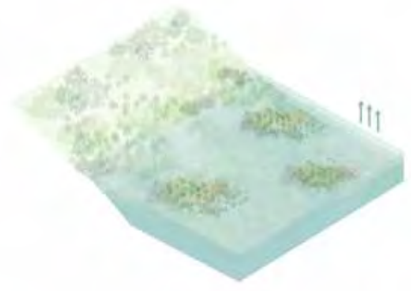


Reduce flood obstructions within the creek

- → Design interventions to provide for uninterrupted flow during flood events
- → Adaptations focused primarily at the edges and without impact of flood water flows

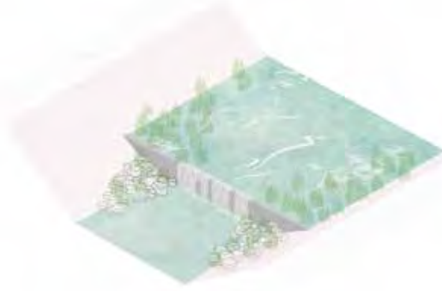
Improve water quality through combined grey + green infrastructure

- → Use planting and rough surfaces to improve water quality during low flow
- → Treat stormwater at point of entry into the creek
- → Explore emerging combinations of natural and engineered systems



Prioritise nature based solutions for sea-level rise

- → Use horizontal levees and marshland to better absorb storm impact
- → Create space for habitat to migrate with sea-level rise
- → Use islands to create protected habitat while reducing storm surge impact



Maintain daily water level + flow

- → Design adaptation for daily water levels
- → Optimize low water levels and flow to improve water quality while creating habitat

Design for public safety + egress

- → Meet requirement of safe egress from accessible areas of the Creek
- → Integrate egress within the design of creek edges

Design for inundation in flood events at varying levels and frequencies

- → Acknowledge the frequency of various flood events and design for access at a variety of water levels
- → Use of resilient materials able to withstand inundation

ECOLOGY

#LETITGROW

Restore native ecologies

Restoring ecologies within the creek offers the potential to transform the corridor and surrounds from a piece of grey infrastructure to a community amenity and positive ecological asset. Restoring native ecologies along the creek and across some adjacent public land, offers an opportunity to build resilience through ecosystem services.

The approach to restoration needs to consider the future impacts of climate change. The impacts of sea-level rise on zones of habitat, as well as the impacts of more frequent flooding on sensitive species, are a key consideration for design. Additionally, designing opportunities for community involvement in the restoration process will provide for a pragmatic approach to adaptation scenarios, and ensure the success and longevity of the project.

Increase ability for people to engage with nature

- → Establish a greener creek as a shared amenity for South City
- → Create opportunities for nature play and exploration
- → Create opportunities for distant appreciation of habitat

Improve conditions for aquatic life

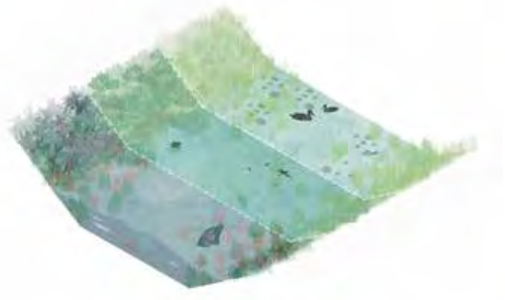
- → Create habitat for aquatic life connecting from the Bay up the creek to the park

Create connected ecological corridors

- → Create connected habitat along the creek
- → Create connected habitat areas adjacent to the creek

Design for community participation in restoration and stewardship

- → Use simple construction and restoration techniques should where possible to allow for community participation
- → Design for stewardship to ensure the community can take ownership of the project into the future



Develop specific strategies for fresh, brackish and salt water conditions

- → Restoration strategies to address these zones separately, and design for the transition between them
- → Adaptation designs to account for climate change impacts on these zones

Support layers of habitat (tidal/wet + ground cover + canopy)

- → Integrate habitat zones within the daily water level, as well as frequent flood event levels
- → Access to various levels to be coordinated to as not to fragment habitat zones

Futureproof for species transition + migration in raised sea level conditions

- → Incorporate sloped edges for species migration in flood events
- → Sloped edges and connected corridors for species migration in future sea-level rise (up sides and along tidal zones)

ACCESS

#LETUSGOTOTHECREEK

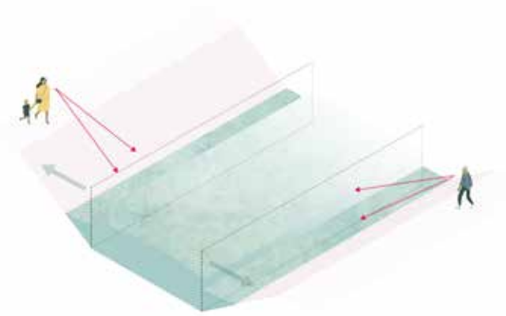
Increase access to and along the creek

Public access is a primary objective of restoration, connecting the public to the creek edge and along the creek to the Bay and Bay Trail. The South City community is currently disconnected from the Bay through a lack of access paths and currently impassable barriers like the CalTrain and 101 corridors.

The connection to and along the Creek should prioritize a legible and accessible path for pedestrians and bikes. While the creation of habitat is also a priority, the considered design of access to the corridor and to nature is a key opportunity for education related to climate change.

Increase ability for people to engage with water

→ Provide opportunities for people to get close to the daily water level
→ Improve the water quality to support this experience



Increase visual connectivity from to water from surrounds

→ Change the shape of the creek section to improve sight lines
→ Control the water level where appropriate

Create a continuous and legible access route

→ Create a singular legible route that connects people from the Park to the Bay

Increase connectivity across the creek

→ Incorporate low cost opportunities for crossing the creek safely during average daily flows
→ Provide additional pedestrian safety measures on bridges and streets to connect to the multi-use path

Provide comfortable and accessible connections

→ Design for a maximum 5 degree slope to meet ADA requirements and avoid additional handrails
→ Provide shade for pedestrians and cyclists

Provide singular and consolidated bike + pedestrian path

→ Provide a minimum 8' width path for shared use between pedestrians and bikes
→ Ensure paths are clearly marked for safety of shared use

Provide safe + welcoming connections that encourages dwelling

→ Front active uses or areas with 'eyes on the street' where possible
→ Lighting, shade and seating to provide safe and comfortable places to spend time

FLOODABLE TERRACED PARK

Refer pp. 212 - 227

SITE ANALYSIS & INSIGHTS

This study is focused on Colma Creek & adjacent public land from Orange Park to the Bay. The research and analysis looked to understand the changing sectional profile of the creek, key zones of flood risk, areas with no public access or significant barriers, as well as opportunities and constraints to adaptation based on creek adjacencies (now and in the future General Plan Update).

The stretch of Colma Creek addressed within this study includes a diverse range of sectional profiles and a transition from concrete channel upstream to a more natural Baylands condition downstream. The Creek width grows from less than 40' to over 180' and the depth shrinks from 12' to 2'. It meanders beneath a series of roads and between changing land uses that impact it's adaptation potential.

The following site analysis is structured to understand the unique aspects of each section of the creek, as well as how the corridor functions itself and how it connects into the surrounding City fabric.

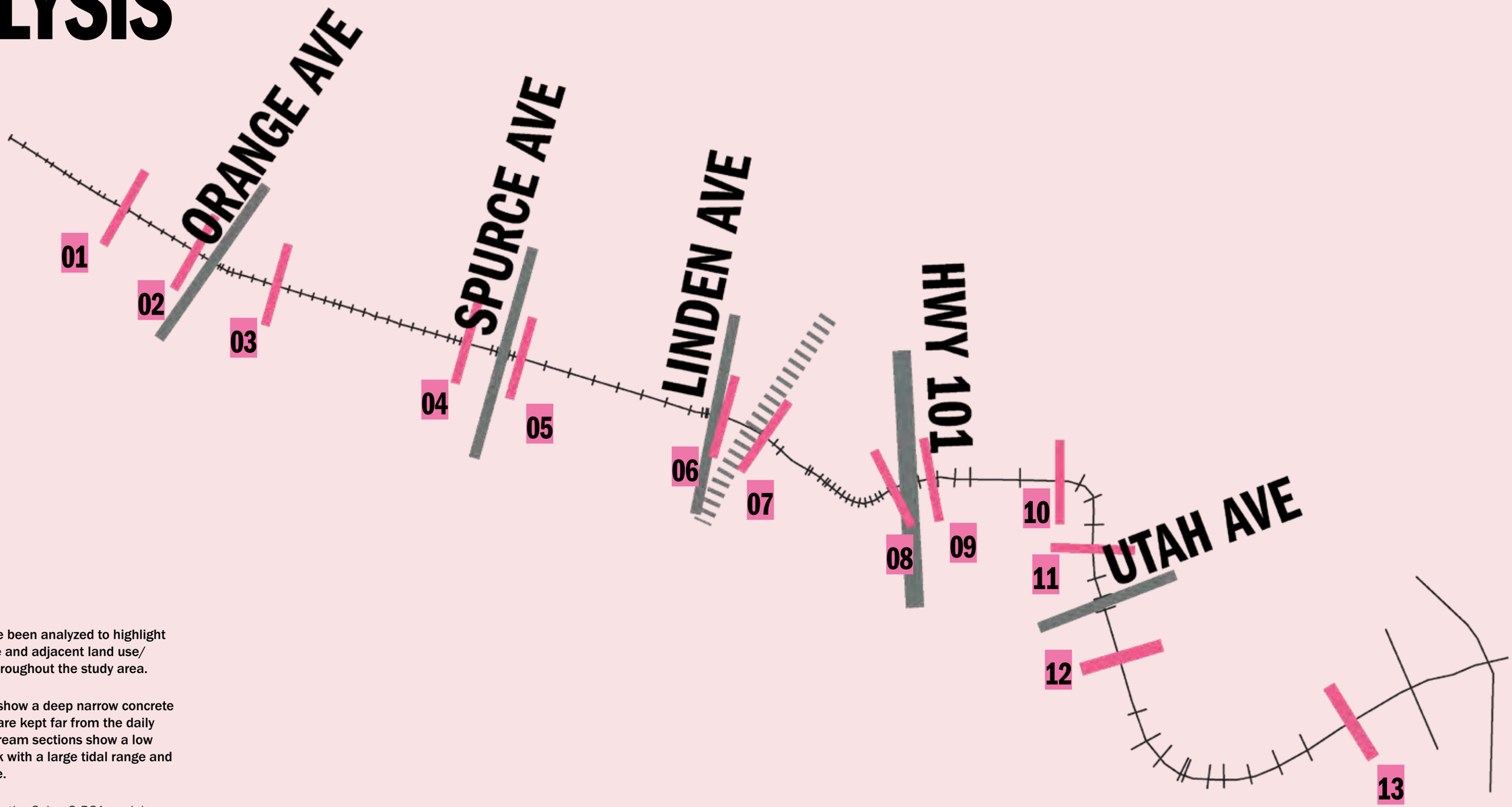
Through 12 unique sections we identify the changing conditions along the creek. A series of maps identify opportunities and constraints along the entire corridor. The understanding resulting from this analysis allows us to group areas to help define them as character zones. Finally look at analysis of the long section to help define opportunities for habitat creation relative to flood and tidal zones.

The spatial character along the creek changes from a tight enclosed tree-lined condition upstream to the wide open marsh-edged creek downstream. Access remains a consistent challenge along all of these sections, whether through vertical or horizontal separation from the water's edge.

Potential Value Creation

- Public amenity in an area with a growing residential population nearby and about to undergo land use change next to the creek.
- Health benefits for residents able to exercise along a continuous path from the Park to the Bay.
- Opportunities for outdoor learning and engaging the community in restoration.
- Reduced heat island and increased comfort for pedestrians and cyclists.
- A safe and direct connection between BART, CalTrain and the Ferry providing new affordable commuting opportunities to residents.
- Ecosystem benefits for resilience in a changing climate.

KEY SECTION ANALYSIS

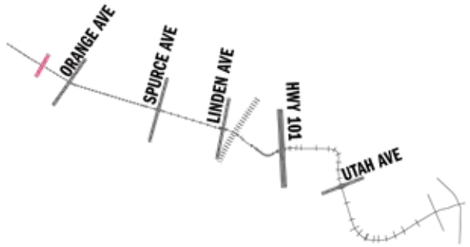


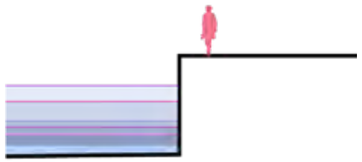
13 unique sections have been analyzed to highlight the various creek profile and adjacent land use/ ownership conditions throughout the study area.

The upstream sections show a deep narrow concrete canal where people on are kept far from the daily water level. The downstream sections show a low wide more natural creek with a large tidal range and sea-level rise to manage.

**Water levels taken from the ColmaCrROA model dated August 8 2019*

KEY SECTION 01

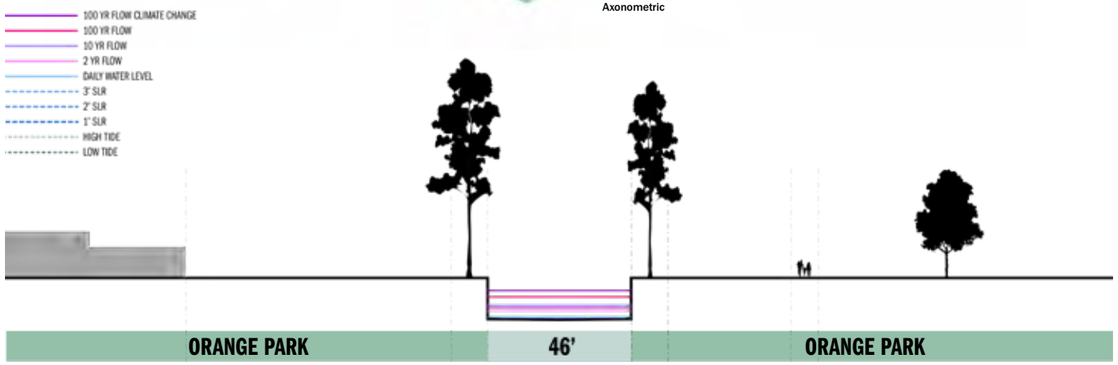




A narrow vertical concrete edged section with tightly planted mature eucalyptus close to the banks on either side. Park on either side offers flexibility for adaptation.

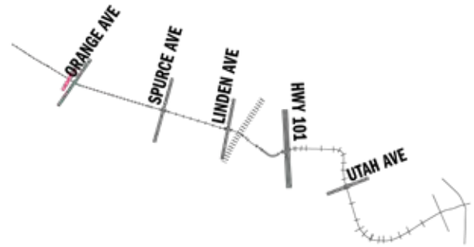
Edge Condition

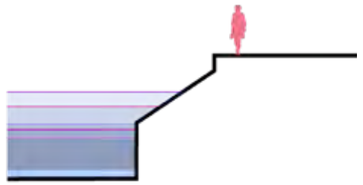
Axonometric



Section

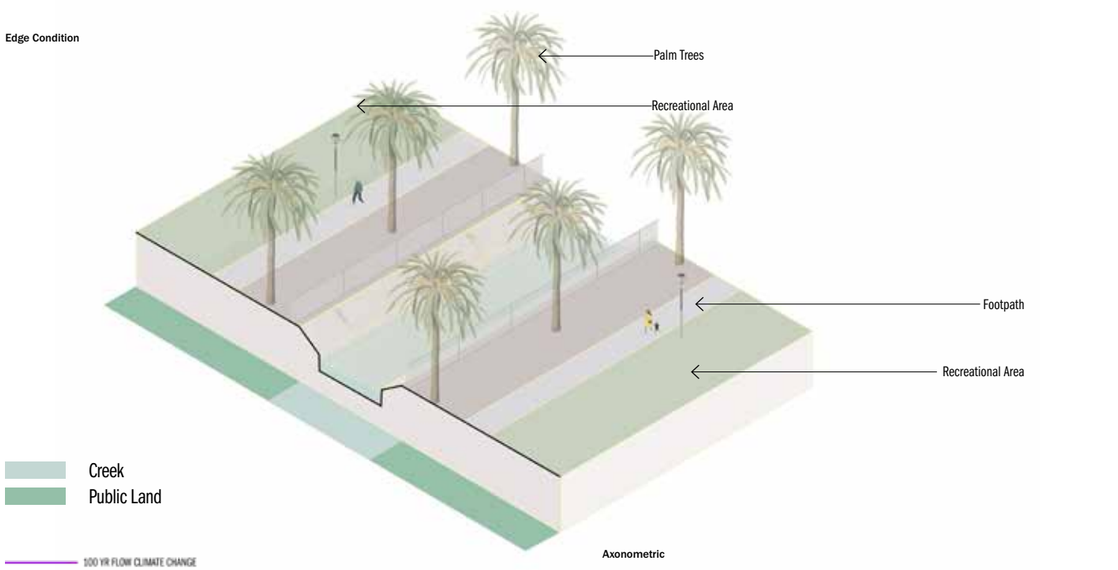
KEY SECTION 02





A deep concrete section with mixed vertical and chamfered edge. Fenced from public access and lined with public paths and date palms. Park on either side offers flexibility for adaptation.

Edge Condition



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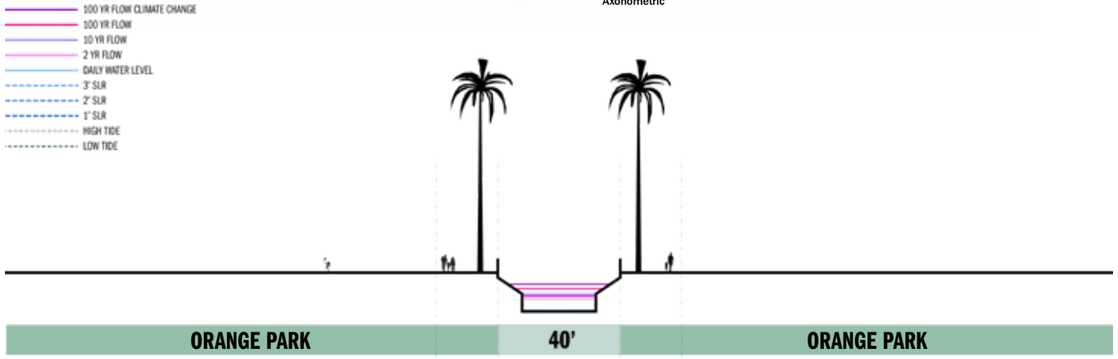
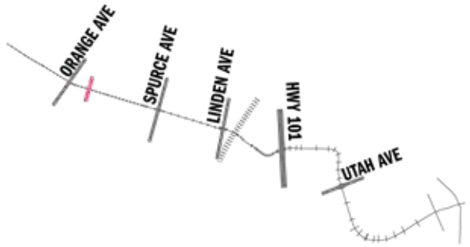
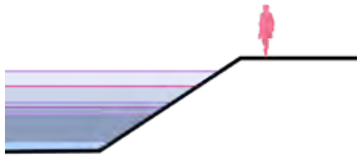


Section

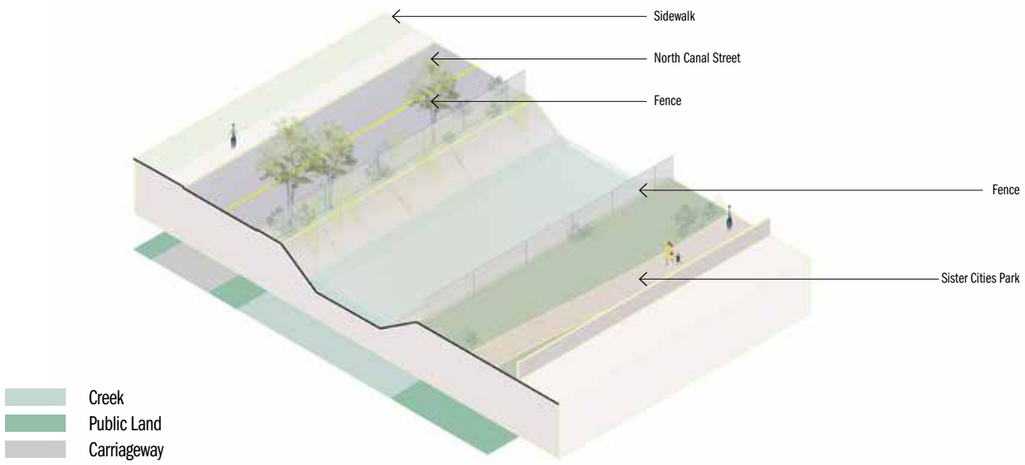
KEY SECTION 03





45 degree sloped concrete channel, bordered by Sister Cities linear park on the south. North Canal Rd to the north is a wide street with a planted buffer and fence along the edge of the creek. There is no pedestrian access along the north edge of the creek.

Edge Condition



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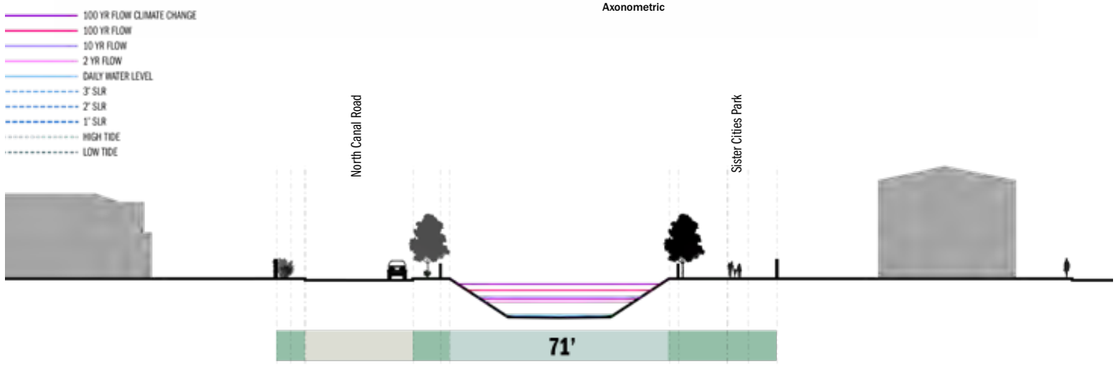
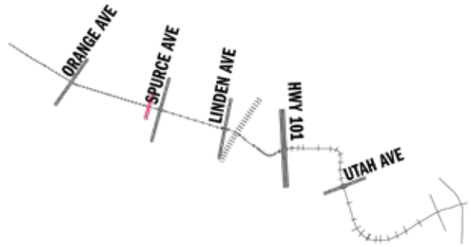
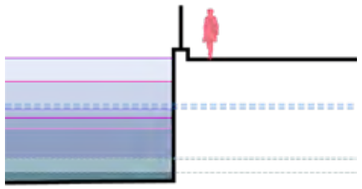


Section

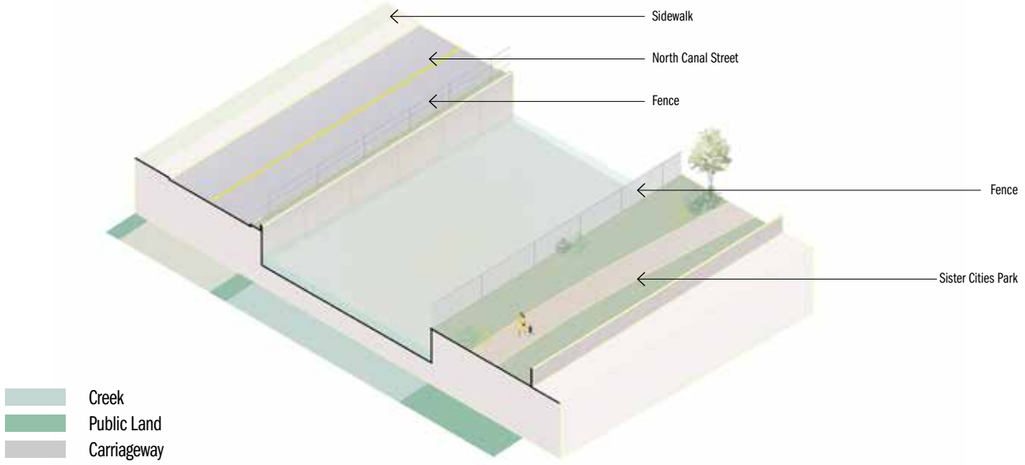
KEY SECTION 04





Similar to section 03 but with sides transitioning to vertical walls and expanded capacity due to the high tides reaching this point in the creek. A narrow buffer run along the north edge of the creek.

Edge Condition



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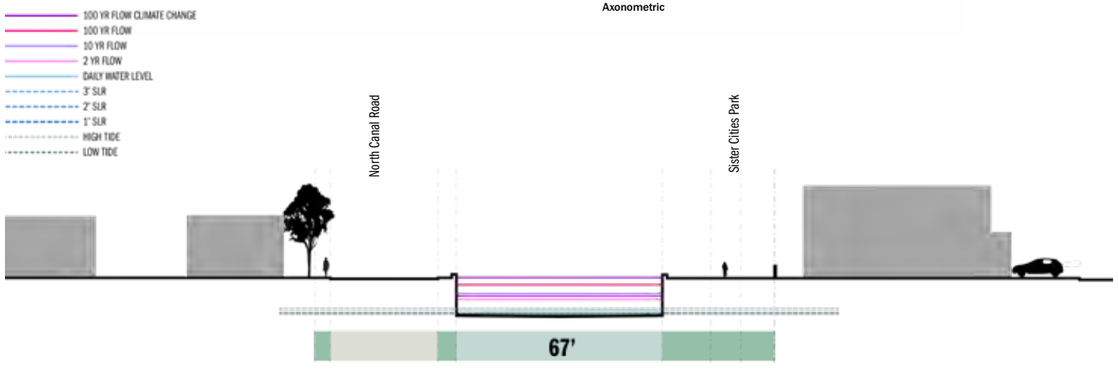
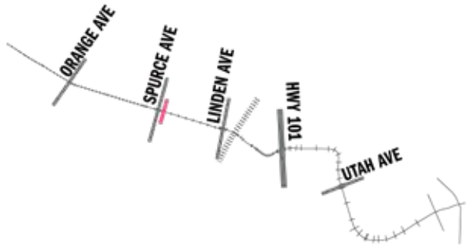
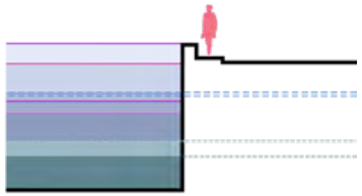


Section

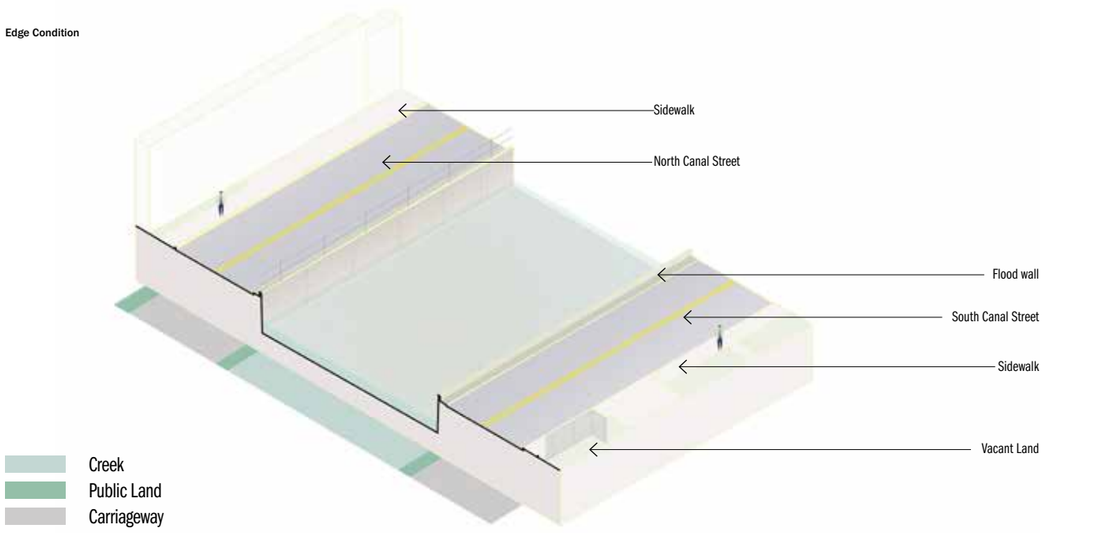
KEY SECTION 05





Wide concrete channel with vertical concrete walls extending above the street level. Duplicate road infrastructure on either side of the creek with no sidewalks that run next to the creek. Industrial properties adjacent.

Edge Condition



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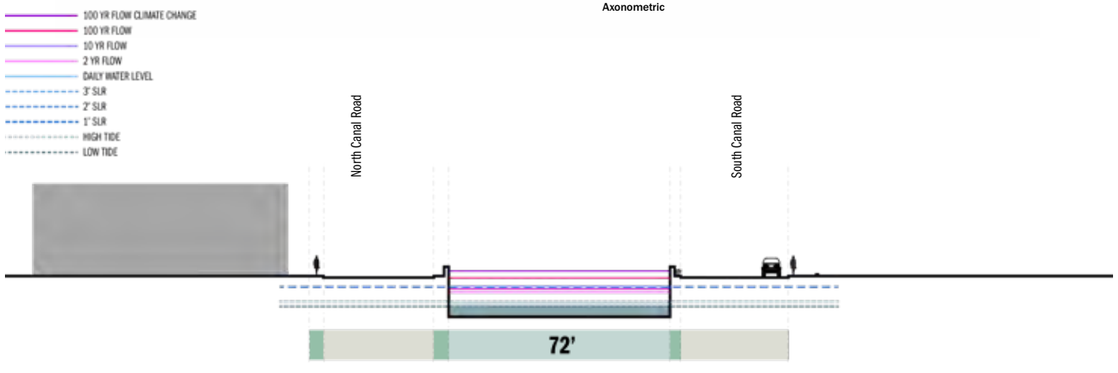
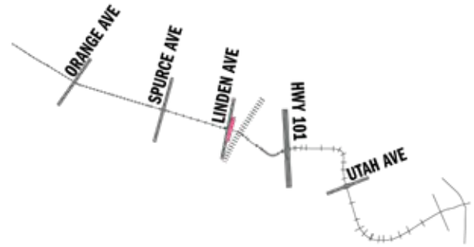
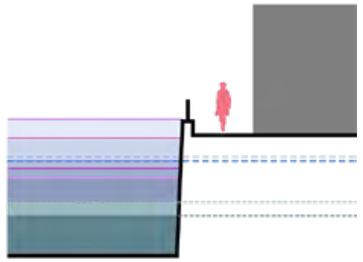


Section

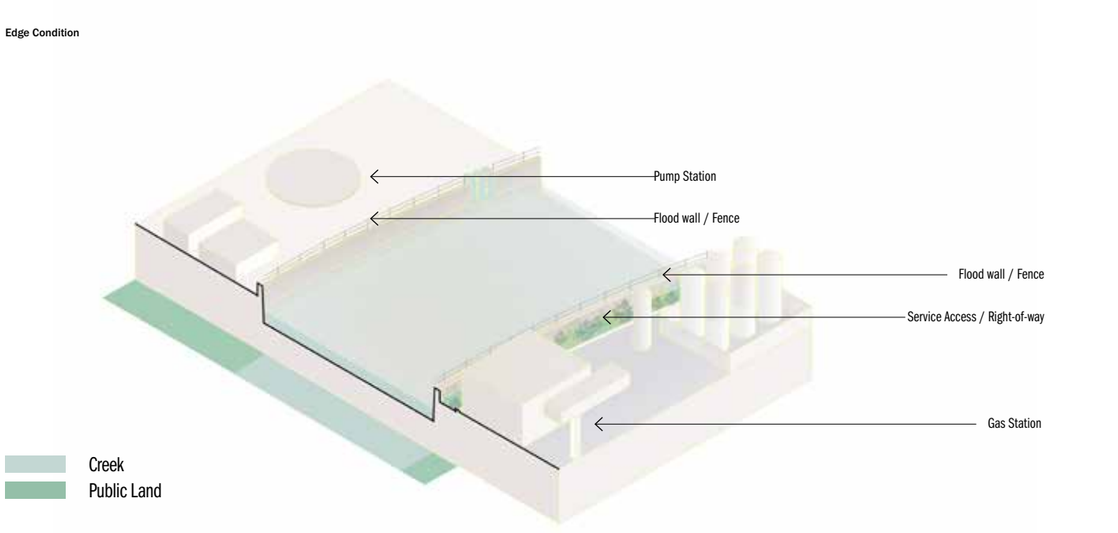
KEY SECTION 06





Creek bends and winds under CalTrain corridor. No public access adjacent to the creek, though both sides include some public land through a pump station/service site (north) and an access right-of-way (south).

Edge Condition



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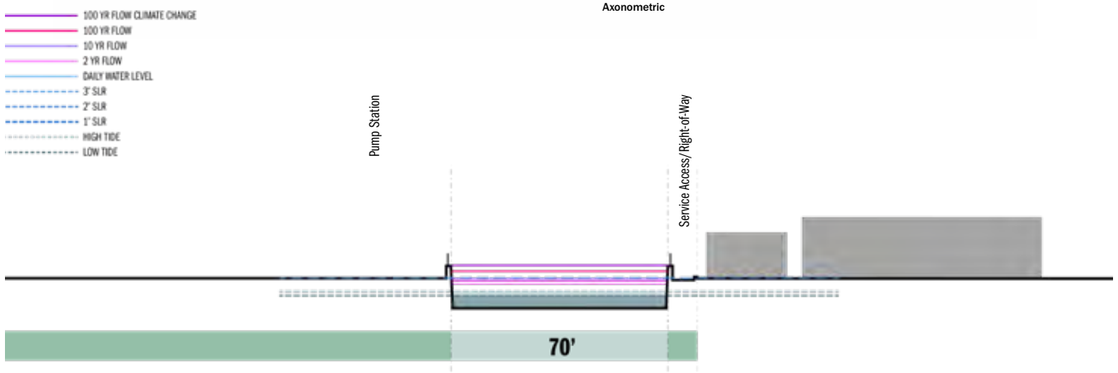

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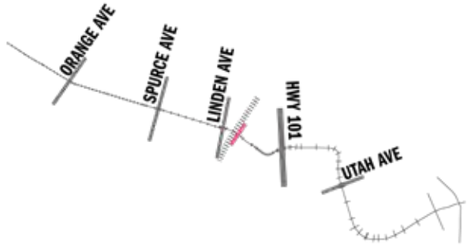
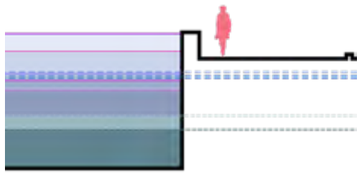
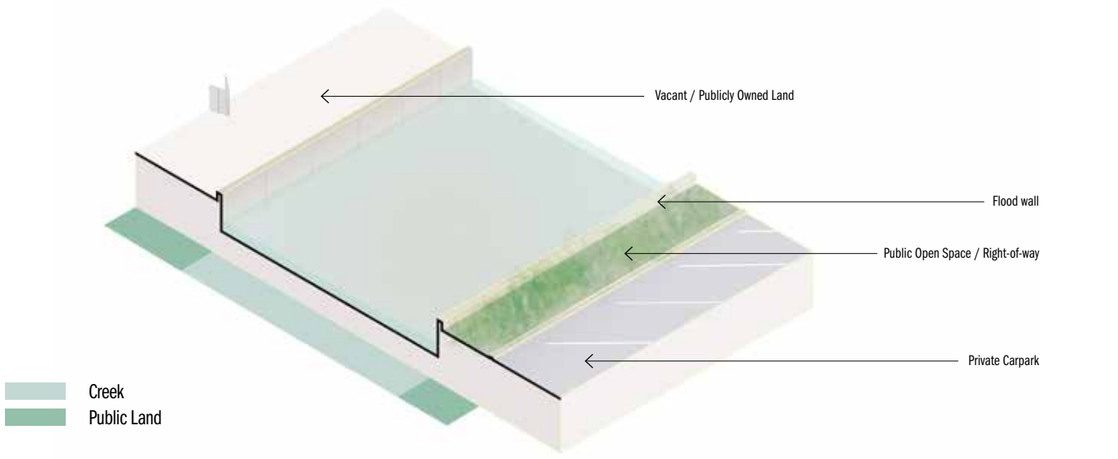
KEY SECTION 07





Deep and wide vertical concrete section with walls extending above banks due to flood levels and sea level rise threats. No adjacent public access. Narrow publicly owned land on both sides with larger area to the north.

Edge Condition



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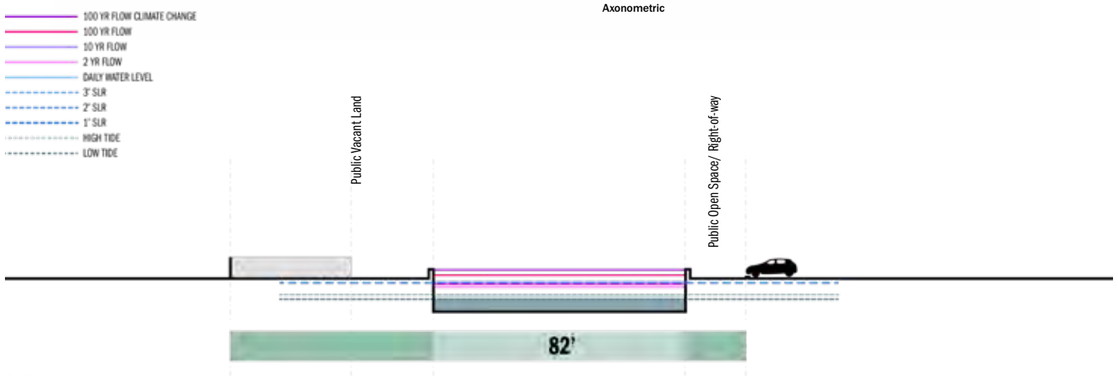

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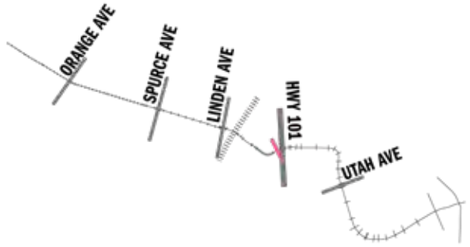
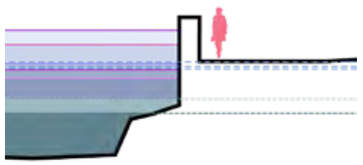
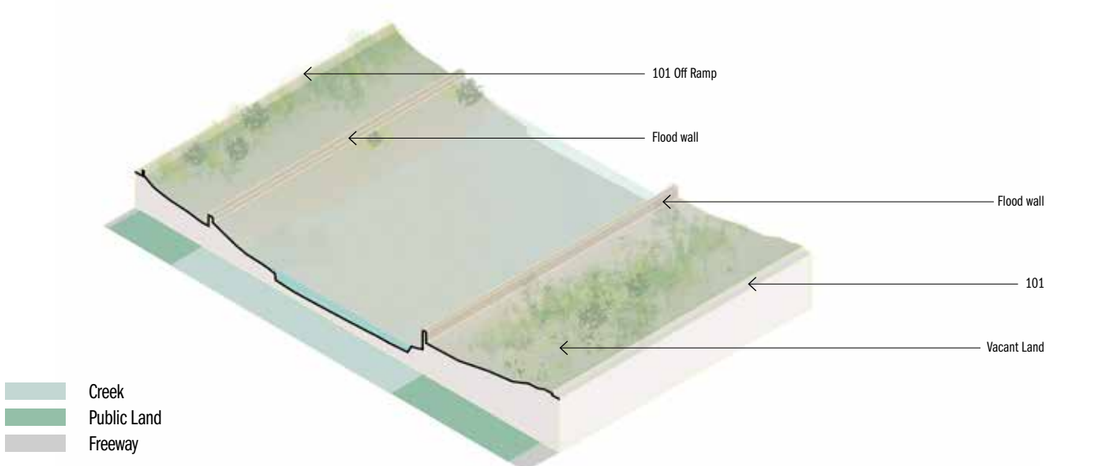
KEY SECTION 08



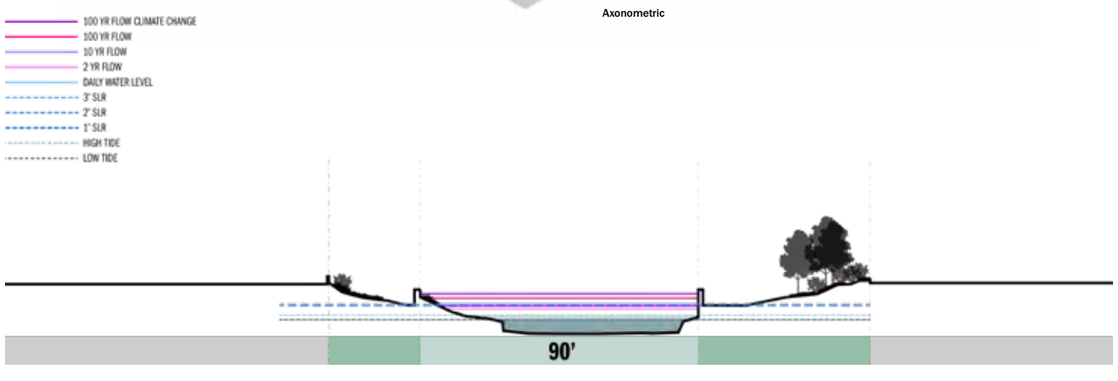


Brackish marsh begins in this low flat section, with flood walls extending above the banks due to flood levels and sea level rise threats. No existing public access but public land adjacent associated with nearby 101 freeway.

Edge Condition

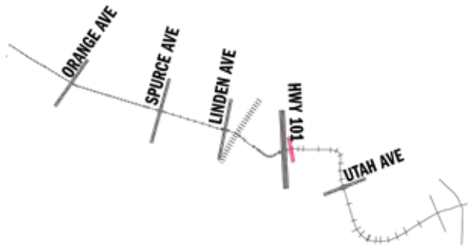


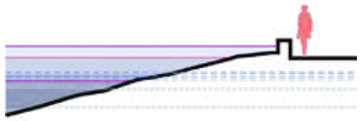
Axonometric



Section

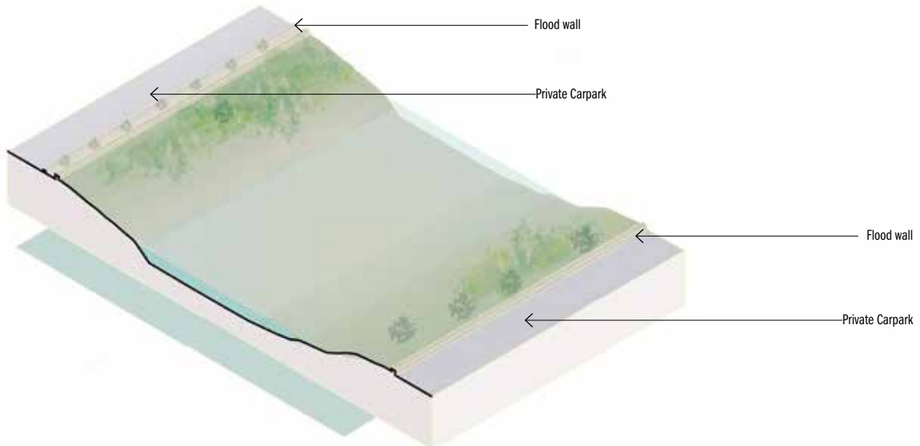
KEY SECTION 09





Flood walls against edges of this low flat marshland section. Bordered by private carparks on both sides, with no public access to creek edge.

Edge Condition



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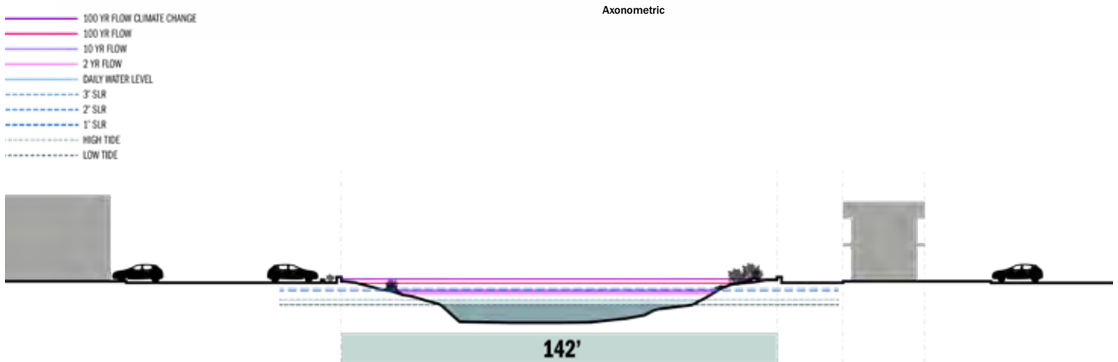

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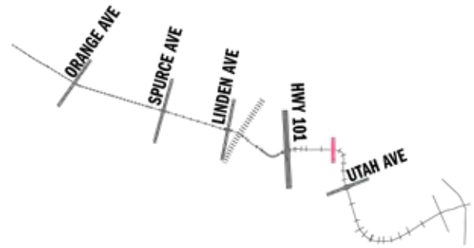
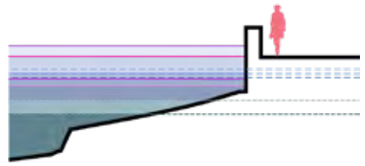
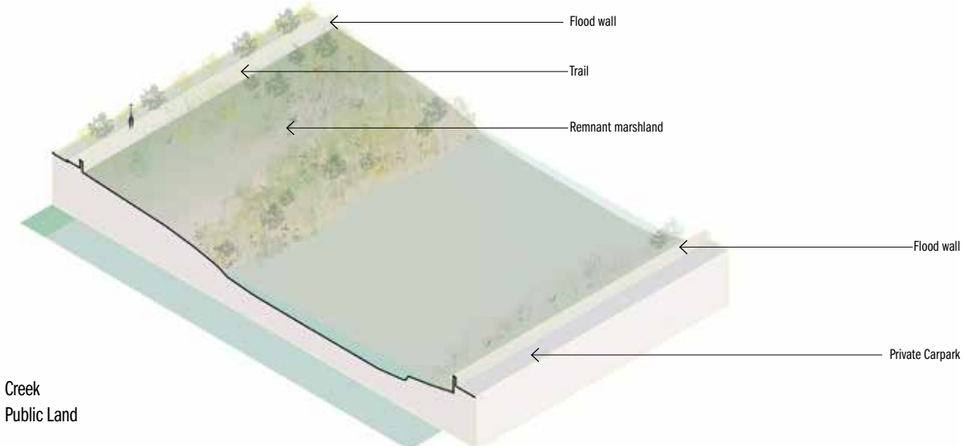
KEY SECTION 10



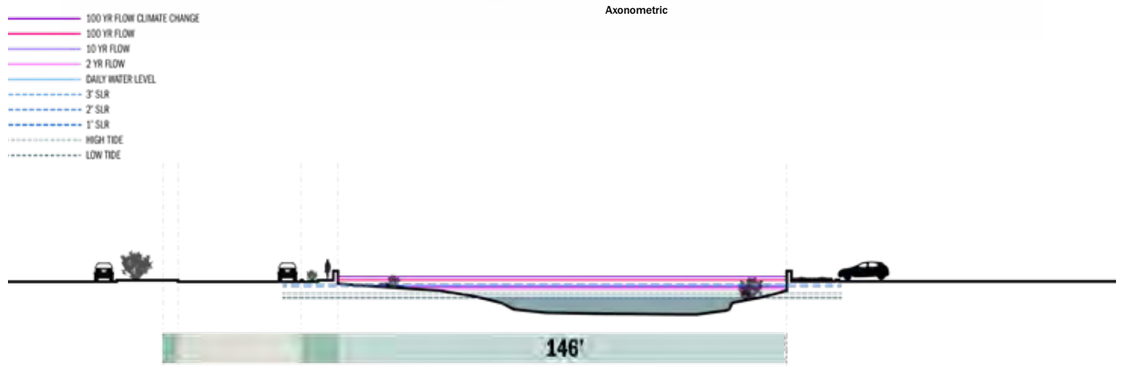


Flood walls against edges of this low flat marshland section. Bordered by a public street to the north with narrow sidewalk access along the creek edge, separated by levee wall. No public access on the south.

Edge Condition

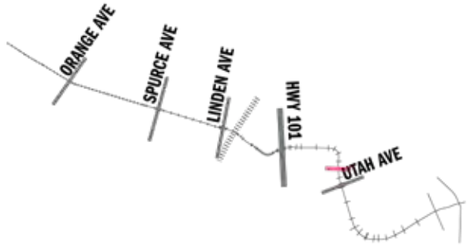


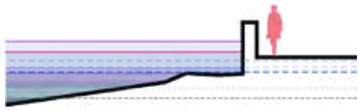
Axonometric



Section

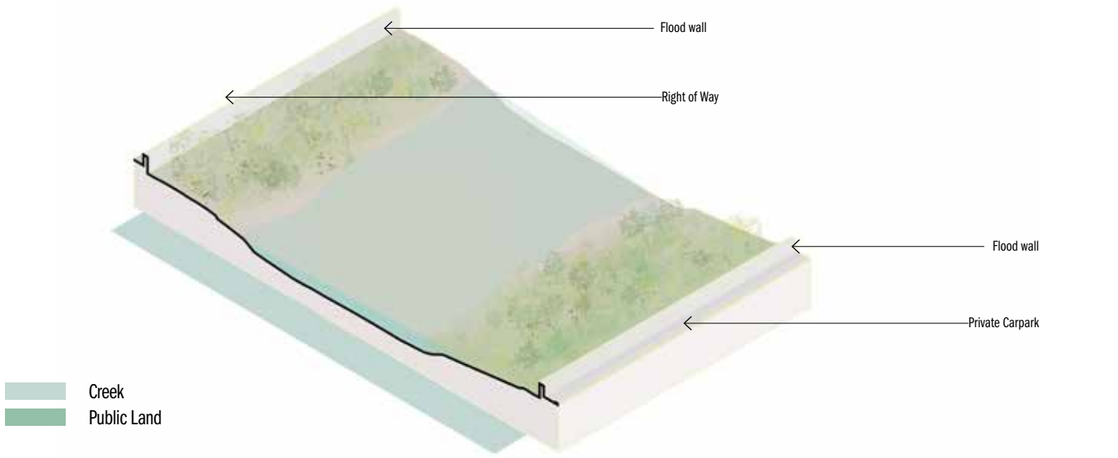
KEY SECTION 11



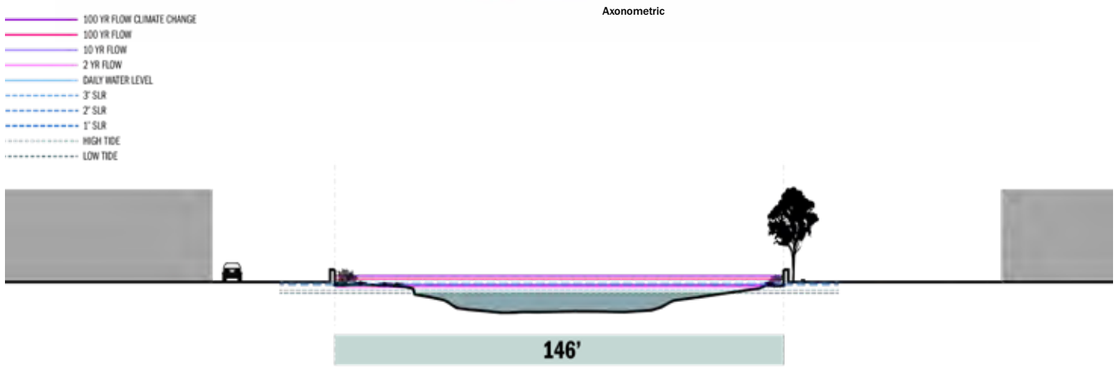


Levee walls are present through this stretch of marshland. The creek contains significant vegetated tidal wetlands and is bordered by private property on both sides of the creek.

Edge Condition



Axonometric



Section

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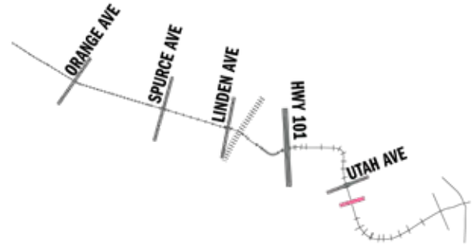
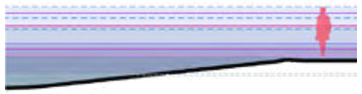
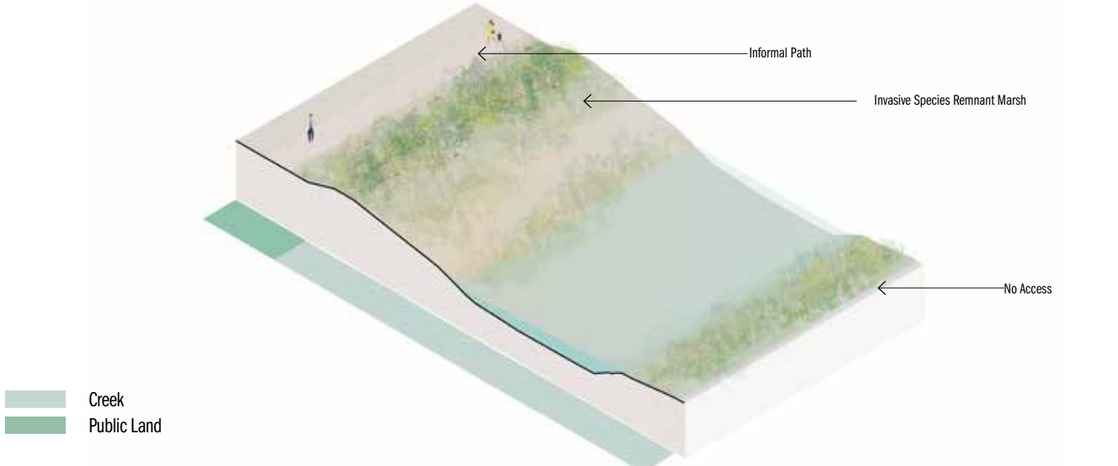




In the area South of Utah Ave, sediment has built up on the eastern side of the creek adjacent to industrial properties and a historic Union Pacific right-of-way. Properties on the western side of the creek have no flood wall between carparks and the creek edge, often flooding with king tide events.

Edge Condition



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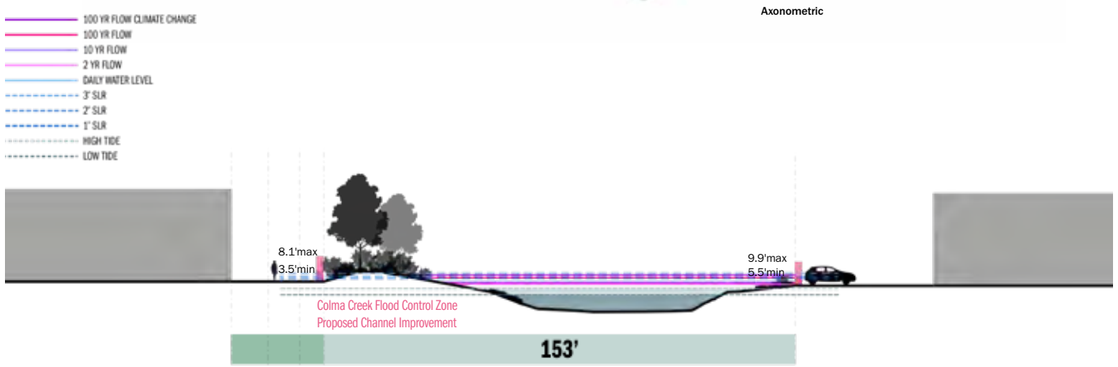
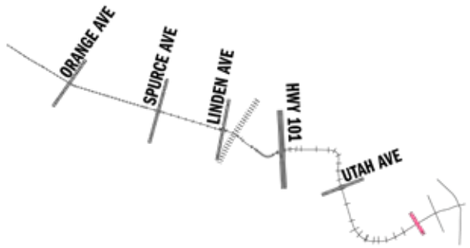
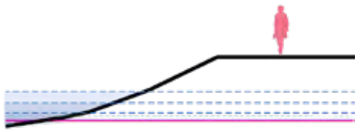


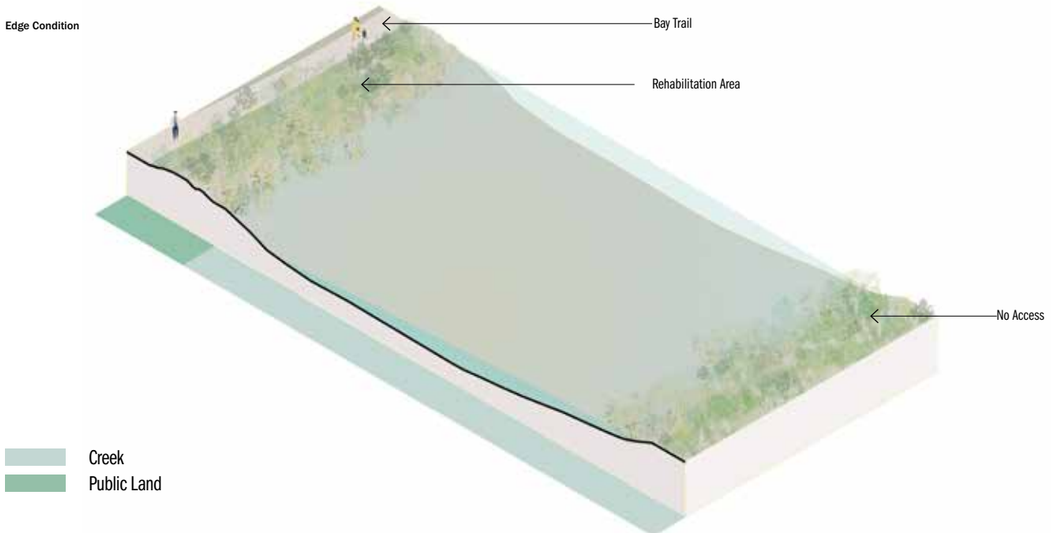
Section

KEY SECTION 13





The creek widens as it approaches the mouth, with extensive tidal marsh on both sides. The Bay Trail is situated to the north within a narrow shoreline park, and San Bruno Water Quality Treatment Plant to the south.



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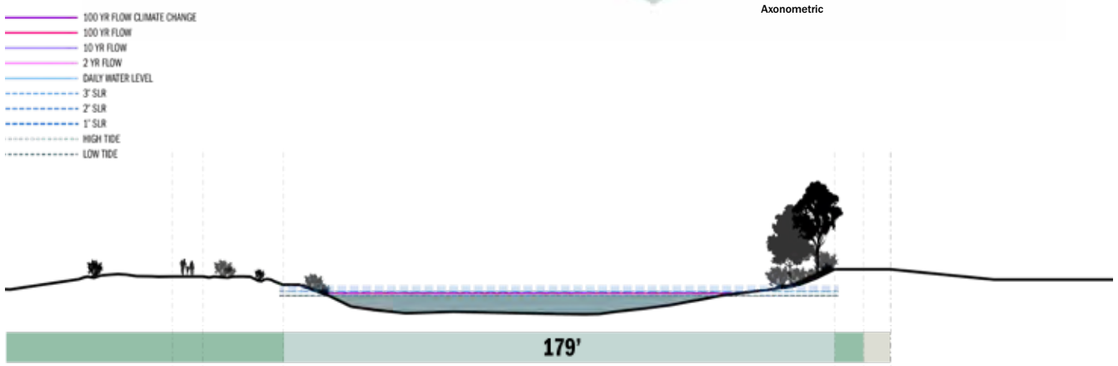
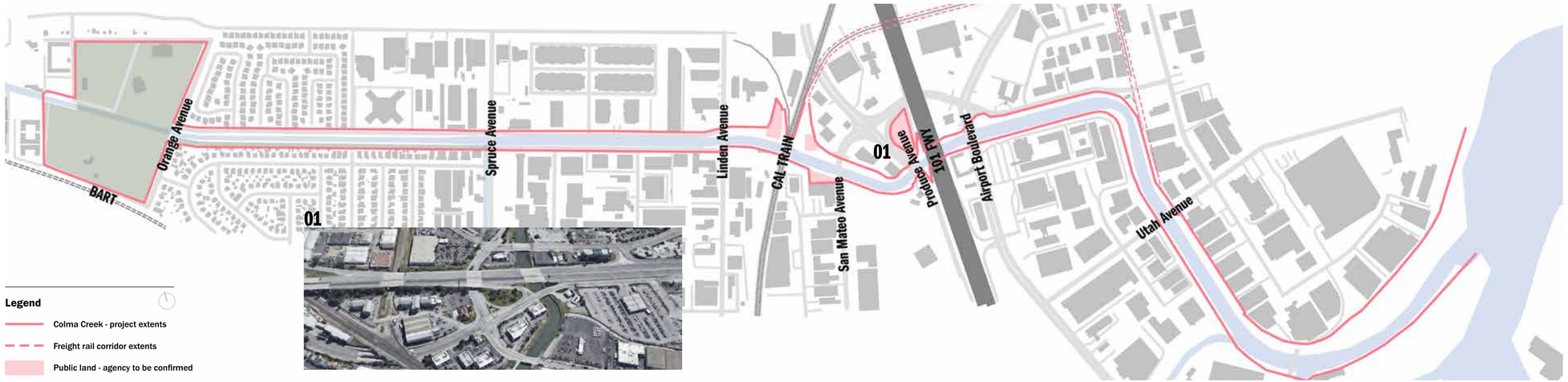


Section

Scope (Creek Corridor Extents)

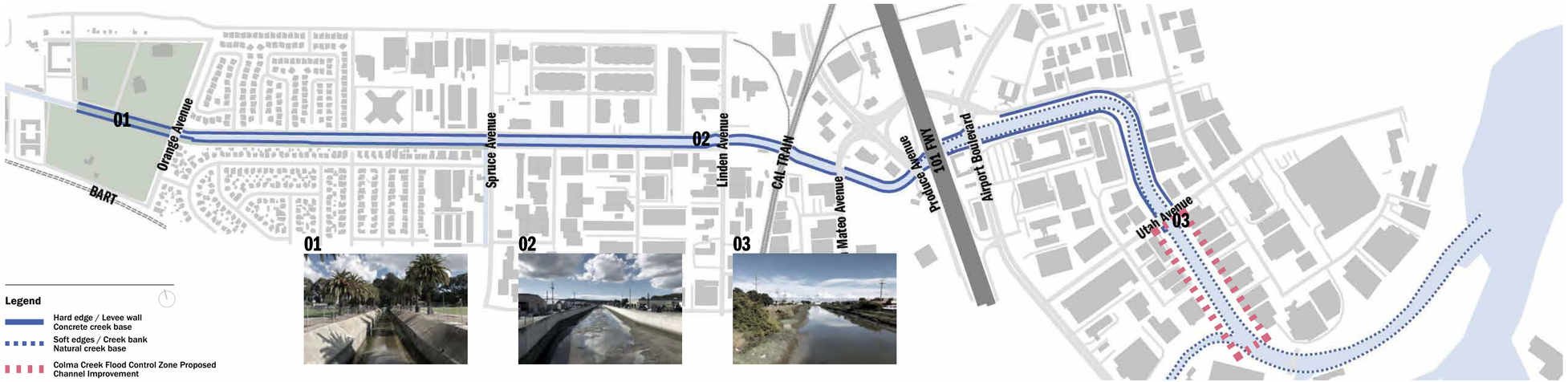
The study area takes in the broader creek corridor as shown, and is drawn to incorporate adjacent public land including roads, interstitial spaces, and public maintenance parcels. The channelized creek is contained within walls for much of its length, to mitigate flooding events to locals.

Consideration of the adjacent land uses influences the scales and opportunities for creek adaptation.



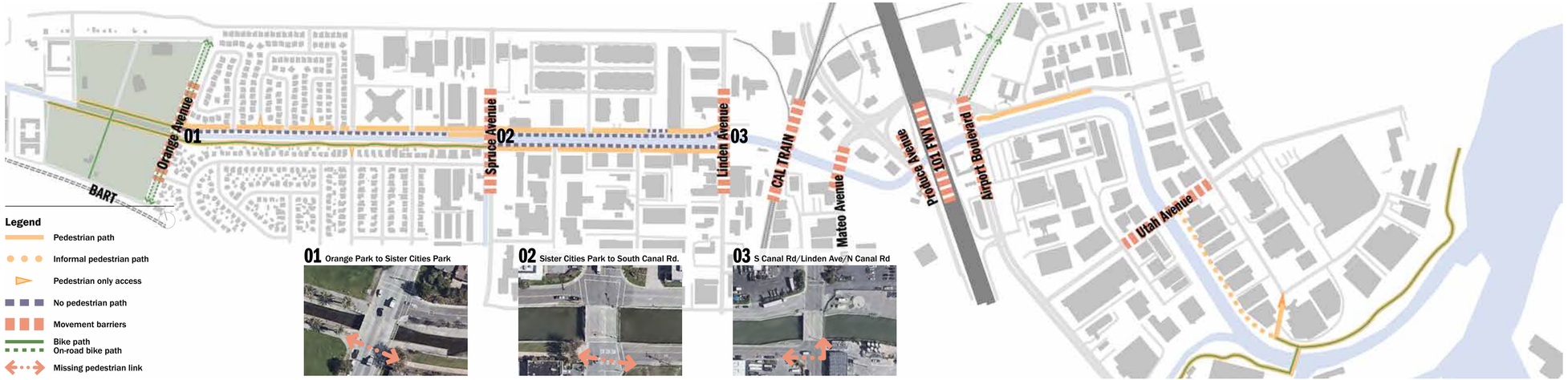
Creek/Channel Edge Conditions

Visual access to the creek is very limited. Particularly through the areas where there is business and residential abutting the creek, significant concrete walls are in place to contain peak water volumes.



Pedestrian Access and Circulation

Pedestrian access to the creek is predominantly limited to Orange Park and Sister Cities Park, where there are opportunities to get close to the creek. There is little opportunity to interact with the creek between Spruce Ave and the Bay where the creek intersects the San Francisco Bay Trail.

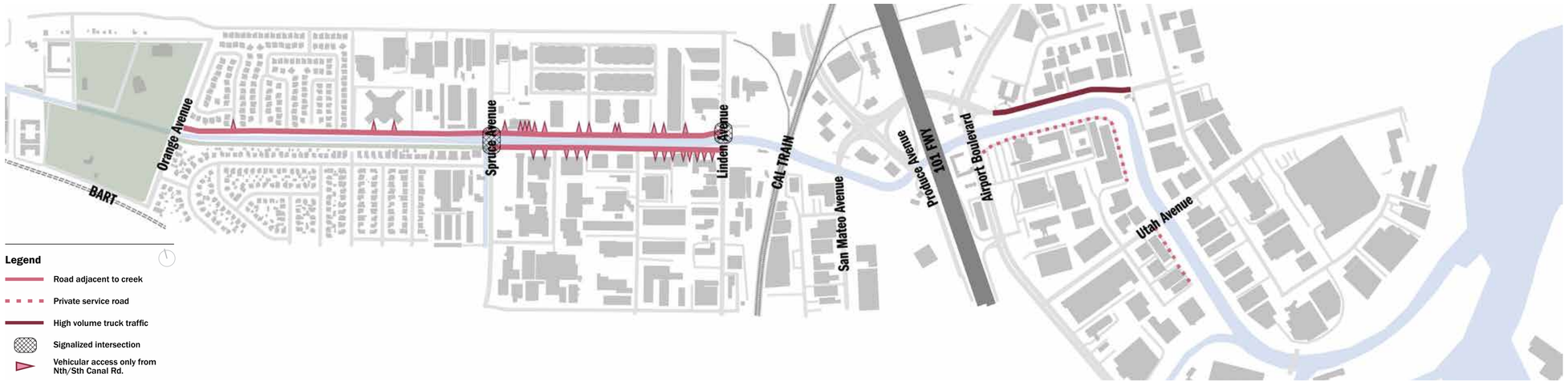


Road Network and Vehicular Access

Whilst there are numerous roads that cross Colma Creek, only North and South Canal Rds run directly alongside the creek - serving to disconnect pedestrians and local community from the creek. North and South Canal Rds also provide the sole access point to several properties/driveways. The low traffic counts along these roads offer opportunity for reconfiguring lanes and uses to provide greater public amenity.

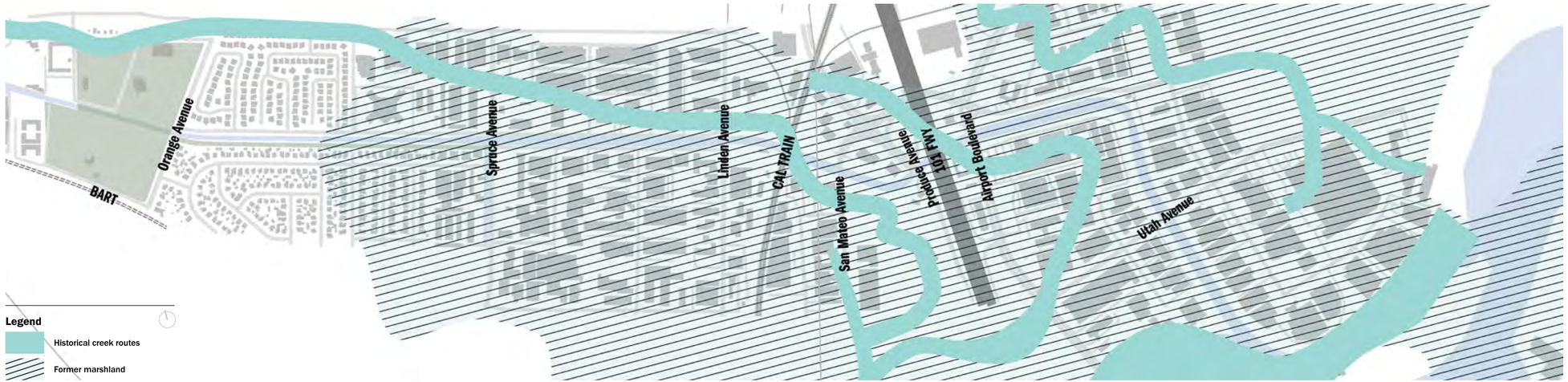
Mitchell Ave is known to sustain significant truck traffic due to its connection to the industrial areas making it unlikely to undergo wholesale change to its function.

Maintenance access to the creek is possible at multiple points, typically aligned to bisecting roads.



Historic Creek Route

Much of South San Francisco abutting Colma Creek is former marshland. Historically, the river meandered from San Bruno mountain down to the Bay. The creek has since been re-routed and channelized and seen significant development though the former marshy areas.

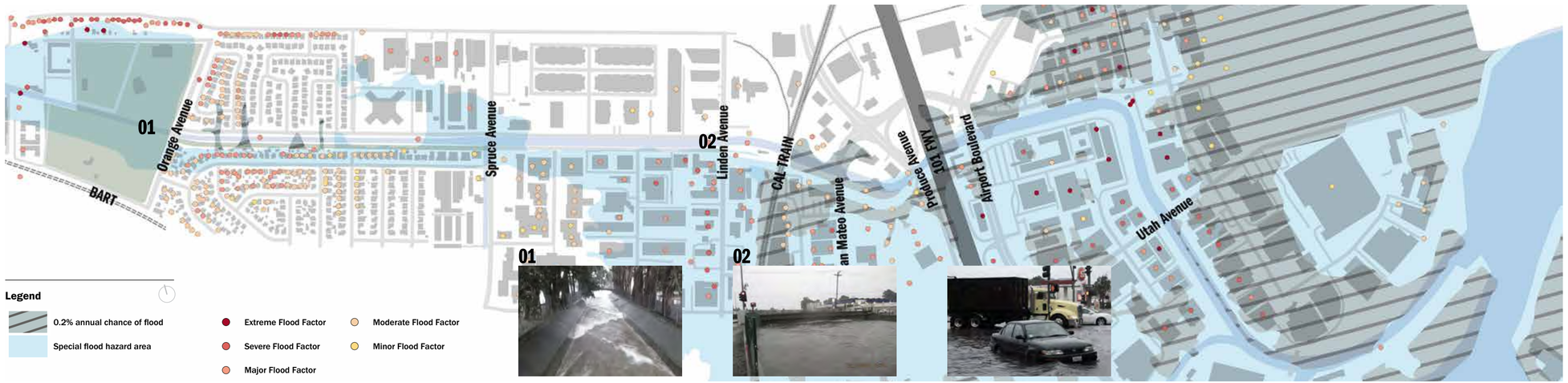


FEMA Flood Zones + Flood Risk

FEMA flood mappings show a prevalence of flood hazard along and around the creek - which has occurred through this area for many years. Flooding is known to impact lower Colma Creek, through the Lindenville Industrial Precinct and much of the property near the bay.

FEMA Flood Zones are likely to be exacerbated by increased risk of sea level rise.

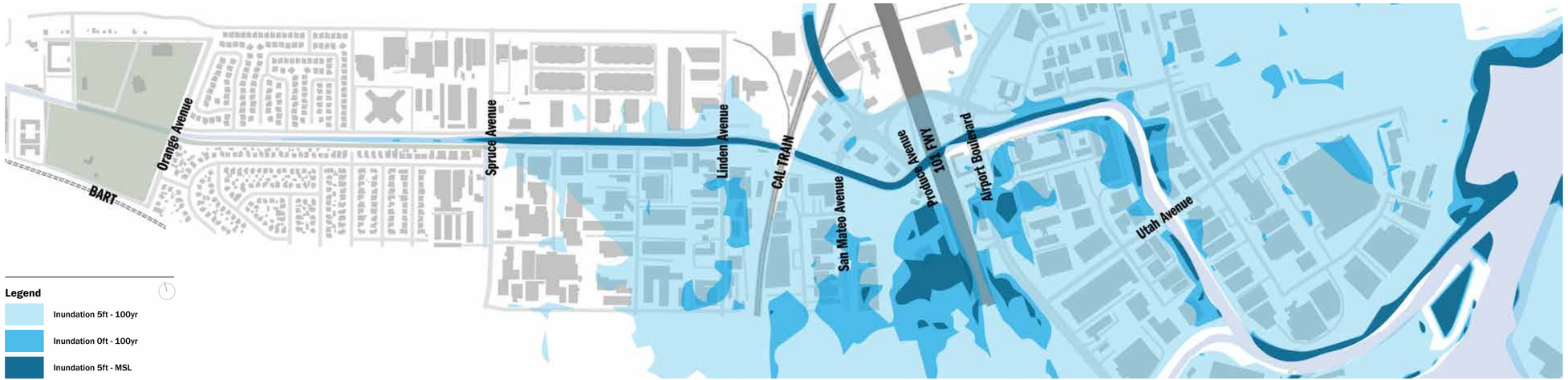
An independent research group, The First Street Foundation, recently released national data for flood risk that they claim captures additional risk not currently accounted for within FEMA's assessment. The maps take into account sea-level rise projections and new rainfall data to highlight properties facing additional risk of various levels that they believe should be captured by FEMA maps.



5' Sea Level Rise + 100 Year Storm

The Colma Creek catchment also faces risk from sea-level rise scenarios. Depending on severity, many of the sites along the former creek marsh, and current creek mouth are likely to be impacted.

This will also exacerbate existing stormwater flood risk along the corridor, particularly when peak water events coincide with high tide. The tide is understood to influence water levels as far up as Spruce Ave. where the creek bed steps up.



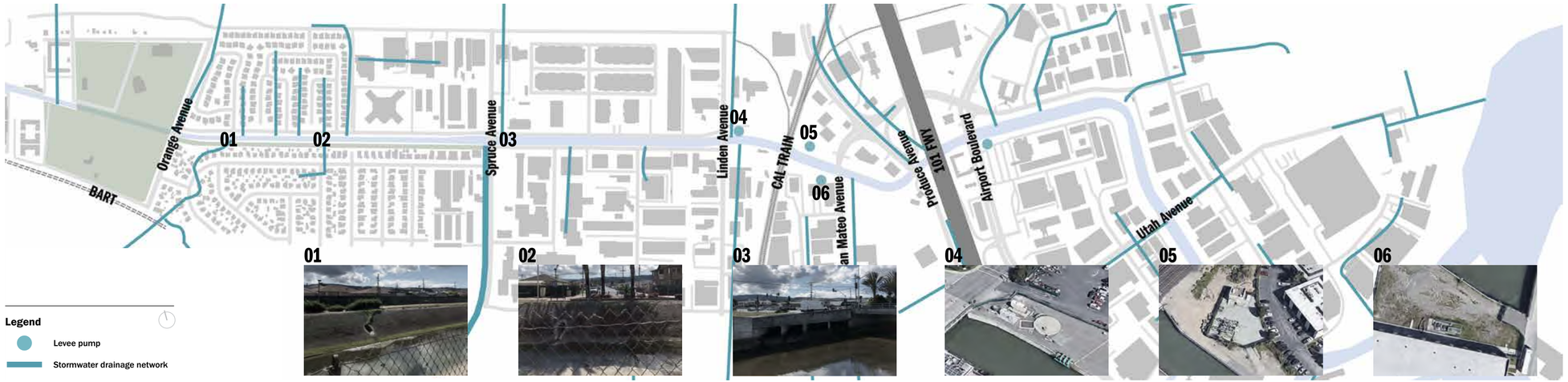
Tree Canopy Cover + Invasive Species

There is little to no tree and canopy cover through the study area and in neighborhood streets surrounding. In fact, less than a third of the street trees in blocks closer to Grand Ave. The preponderance of trees fall in Orange Memorial Park, which is characterized by its dense planting along the creek edge.

Invasive species are also found at points along the creek and into the Bay, with significant instances of Fennel and Invasive Spatina.

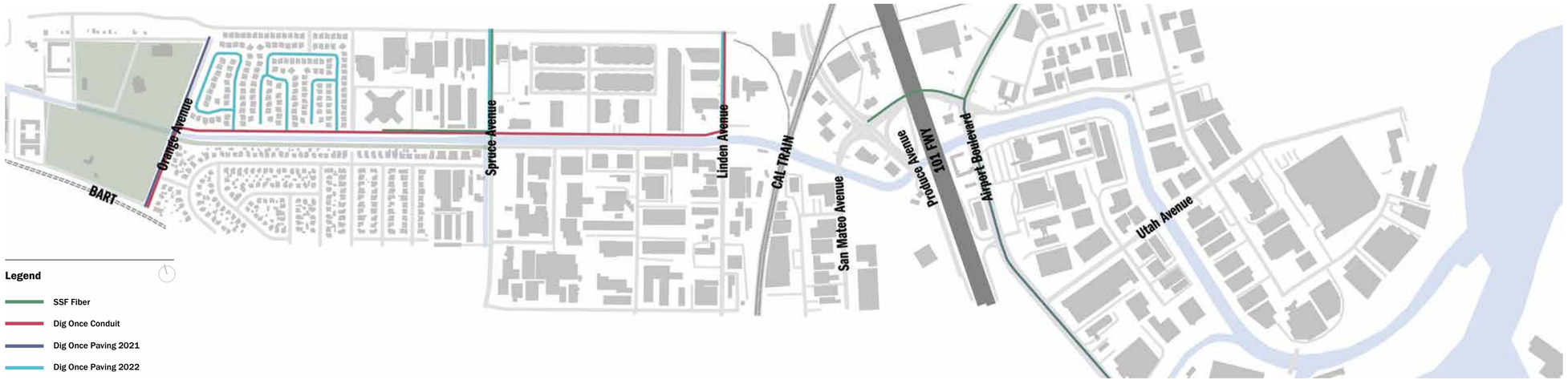
Stormwater Drainage and Creek Pumps

The Colma Creek catchment takes in much of the surrounding neighbourhoods and much of the stormwater infrastructure is conveyed along and under streets, and ultimately arrives in the creek. At locations where the creek water level is often higher than stormwater out fall points, pumps have been places to discharge into the creek.



Utilities

Between Orange Avenue and Linden Ave there are numerous existing services, including fiber, conduits and sewage/stormwater, situated within the road reserve to the north of the creek. This is likely to limit the appetite for significant reshaping of the north side of the creek through this stretch. Utilities are unlikely to impact adaptation opportunities in other locations.



Zoning

Responding to current and future land use adjacent to the creek corridor will be essential to the revitalization of the creek. Opportunities for redefining the creek will emerge from sensibly utilizing public land overlays, and inviting private development to rethink its relationship to the creek.

Land Use

Current land uses are typified by low density residential towards Orange Memorial park and light industrial from the Linden area eastwards to the Bay. A cluster of hotels exists close to Hwy 101 and the exits either side.

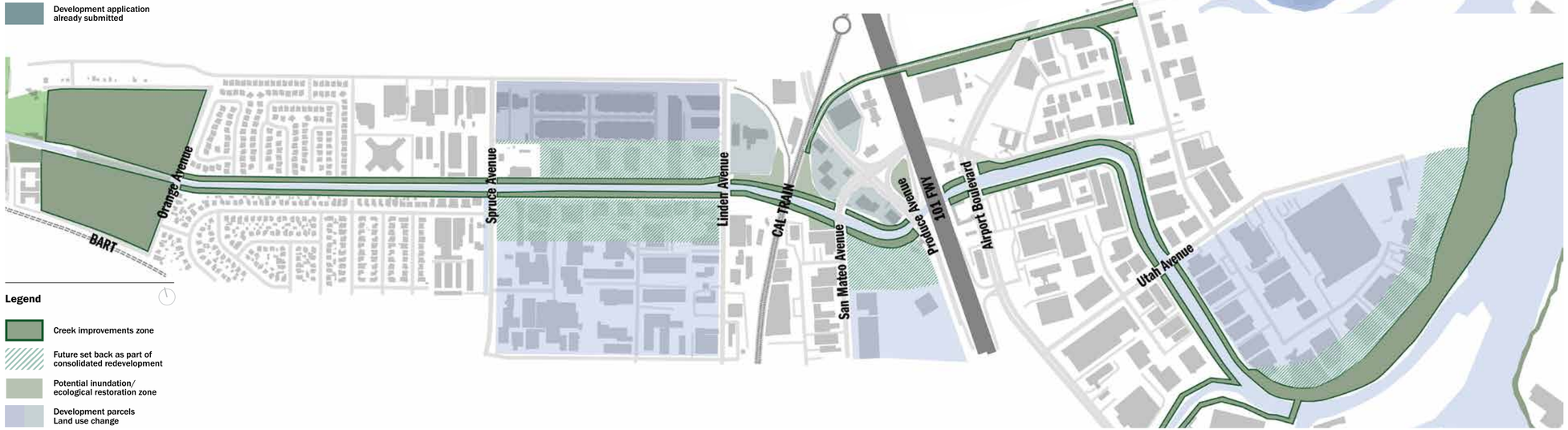
New medium density residential developments are under construction and planned on the west side of 101, potentially extending residential uses from the Park to the Freeway.

Development Parcels + Zoning Changes

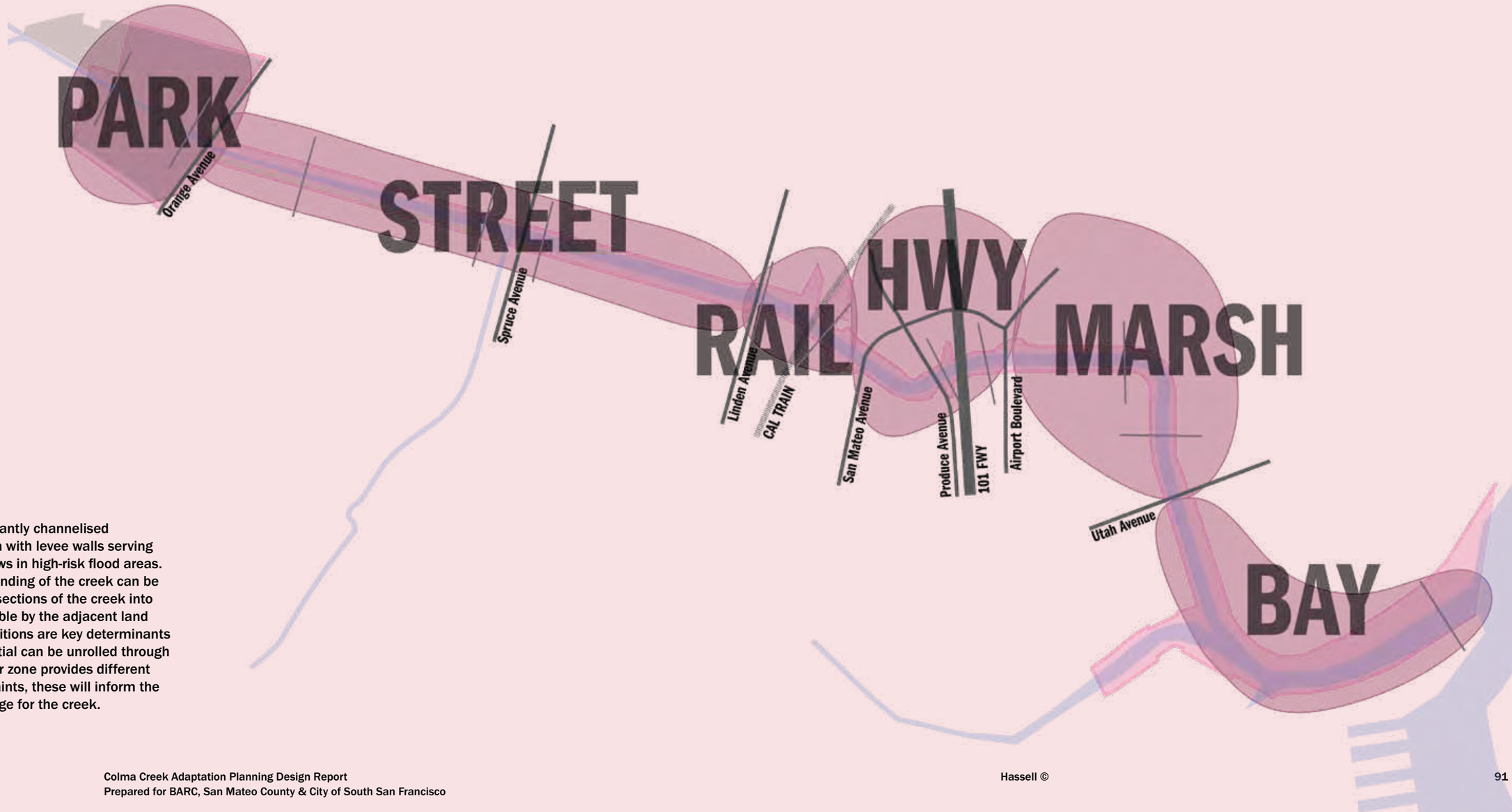
To complement water management and ecological restoration along the creek, adjacent private development can meaningfully contribute. Several key parcels are already under development around the rail and highway and will likely bring residents looking to walk along the creek towards the Park. Flood mitigation strategies as well as improved access to the river corridor could be part of General Plan prescriptions supporting rezoning of other creekside land. Providing improved amenity, additional open space contributions and developing coordinated flood mitigation strategies will benefit residents, business and community.

Opportunities Analysis

Leveraging the significant public land available, along and adjacent to the creek corridor, begins to illustrate the key opportunities for creek improvements. In combination with changes to zoning and land use, a clearer picture emerges of the opportunities to rejuvenate the creek and build a usable public asset for the community.



CHARACTER AREA ANALYSIS



Colma Creek is predominantly channelised throughout the study area with levee walls serving to contain peak water flows in high-risk flood areas. A more detailed understanding of the creek can be gained by distinguishing sections of the creek into character zones, identifiable by the adjacent land use. These adjacent conditions are key determinants in what adaptation potential can be unrolled through each area. Each character zone provides different opportunities and constraints, these will inform the scale and impact of change for the creek.

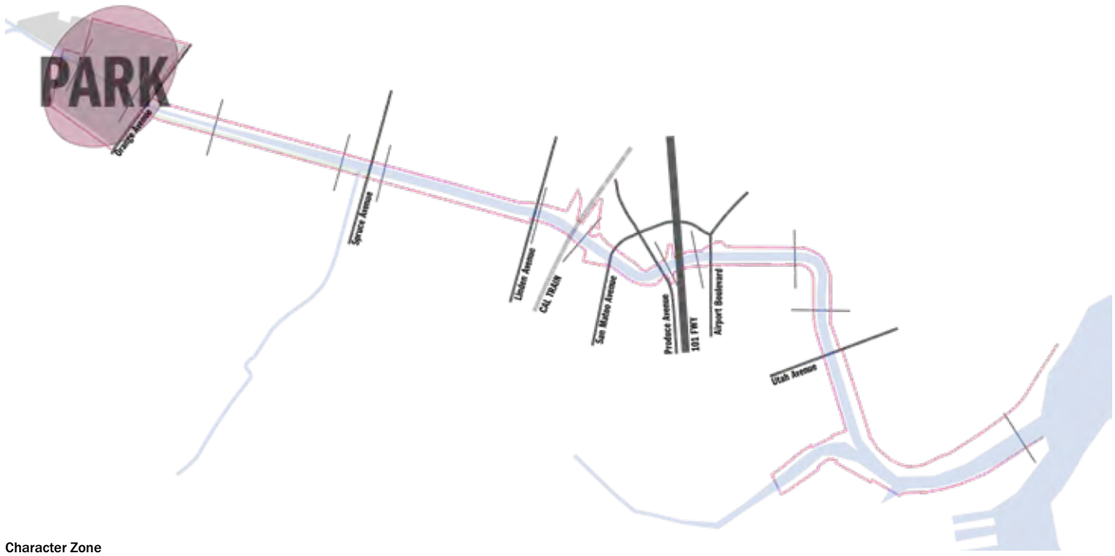
PARK

Defining Characteristics

- → Flood risk is low & forecast sea-level rise risk is low
- → Good public access on both sides
- → Adjacent park land provides flexibility for adaptation, while existing community programming (including active sports) will likely need to be maintained
- → Existing vegetation close to creek is a potential constraint to adaptation
- → Water detention opportunities allow for capture and slow release
- → Water treatment project with subterranean storage planned for park expansion area

Legend

- Trees
- Sport Courts
- Parking
- Recreation Centres
- Open Fields
- Sport Fields
- Colma Creek - project extents



Character Zone

Program Map

Canopy Cover (see Analysis for species overview)

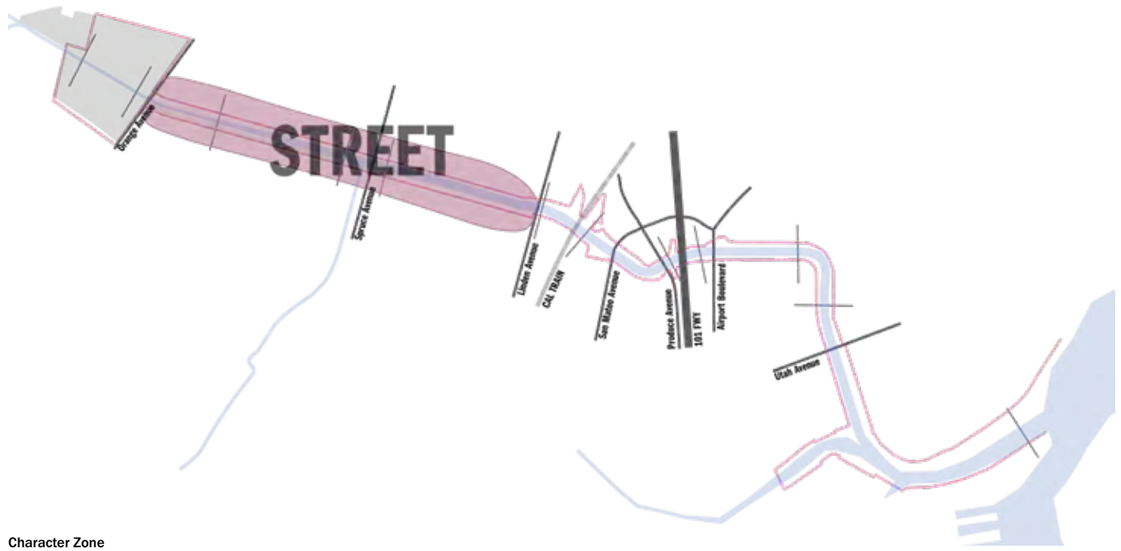
STREET

Defining Characteristics

- Flood risk is moderate and forecast risk of sea-level rise is low (particularly between Spruce & Orange Avenues)
- Public access exists along the north and south of the creek, although only Sister Cities Park offers formalised bike and pedestrian access by the creek
- Adjacent streets and linear park provide flexibility for adaptation
- Major infrastructure under North Canal Rd (fiber and sewage) constrains adaptation options to the north
- Nearby land use transitions from low density residential to light industrial
- Industrial property access points along South Canal Rd require innovative street typology in order to extend Sister Cities Park to Linden Ave.
- The general plan update includes re-zoning scenarios to transform industrial land north and south of the creek into medium density residential
- Fire department located on North Canal Rd at Spruce Ave - access to be maintained

Legend

- Annual chance flood hazard area
- Special flood hazard area
- Flood factor: Extreme/Severe/Major/Moderate/Minor
- Road adjacent to creek
- Private service road
- High volume truck traffic
- Signalized intersection
- Vehicular access only from Nth/Sth Canal Rd.
- SSF Fiber
- Dig Once Conduit
- Dig Once Paving 2021
- Dig Once Paving 2022



Character Zone

FEMA Flood Zones

Vehicle Access

Utilities

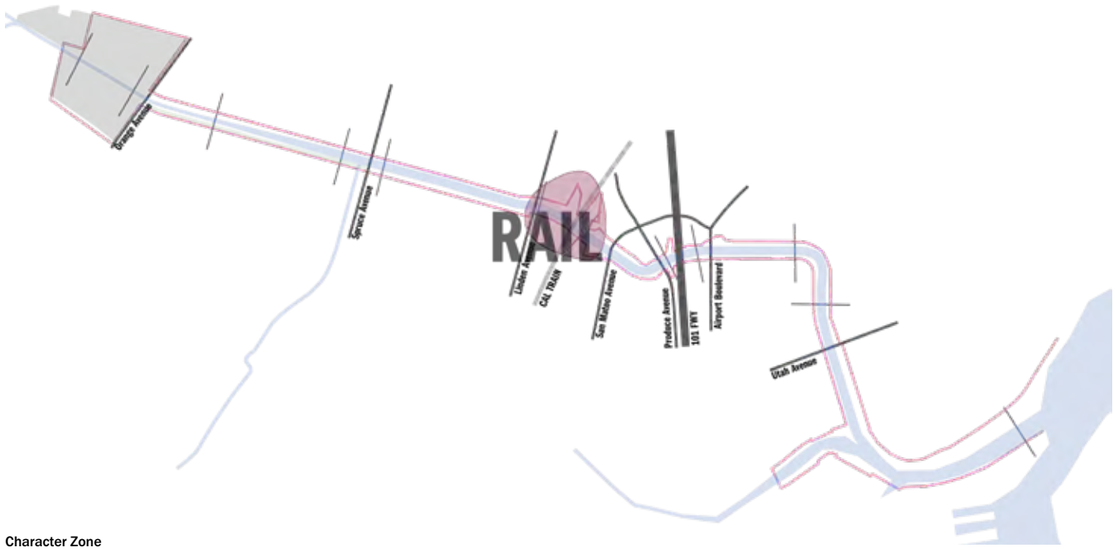
RAIL

Defining Characteristics

- → Flood risk is high and forecast sea-level rise risk is moderate
- → No public access exists next to the creek
- → Clearance under CalTrain bridge is minimal
- → Public land provides potential for adaptation, especially to the north of the creek
- → Development applications have been submitted for 3 sites north of the creek between Linden and San Mateo Avenues.
- → The general plan update includes rezoning scenarios to transform the produce market site into a mixed use neighborhood
- → Freight corridor diverges east just after Colma Creek providing opportunity

Legend

- Annual chance flood hazard area
- Special flood hazard area
- Possible rezoning due to General Plan update
- Likely rezoning due to General Plan update
- Development application already submitted
- Movement barriers
- Pedestrian paths
- Creek improvements zone
- Future no build zone
- Creek improvements zone



Character Zone

Creek Corridor Opportunities

FEMA Flood Zones

Movement Barriers

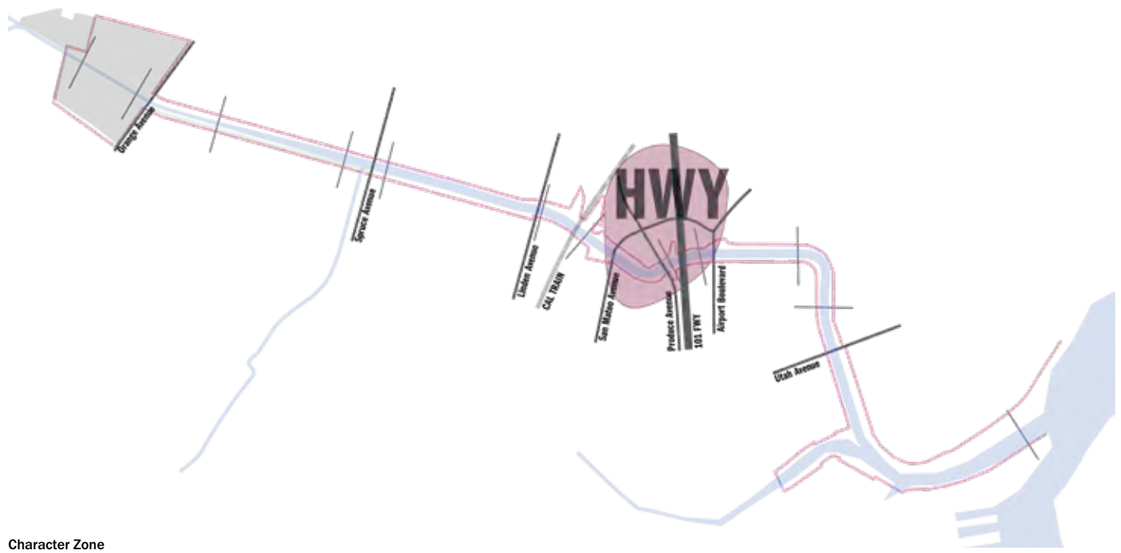
HWY

Defining Characteristics

- → Flood risk is high and forecast sea-level rise risk is moderate
- → No public access exists next to the creek
- → Large number of heavily trafficked roads crossing the creek are barriers for creating continuous safe access path
- → Clearance under bridges is minimal
- → Underutilized public land adjacent to the freeway provides potential for ecological adaptation
- → The general plan update includes re-zoning scenarios to transform the produce market site into a mixed use neighborhood
- → Creek transitions from channel to soft base with levees

Legend

- Annual chance flood hazard area
- Special flood hazard area
- Possible rezoning due to General Plan update
- Development application already submitted
- Movement barriers
- Pedestrian paths



Character Zone

Land Use Change

FEMA Flood Zones

Movement Barriers

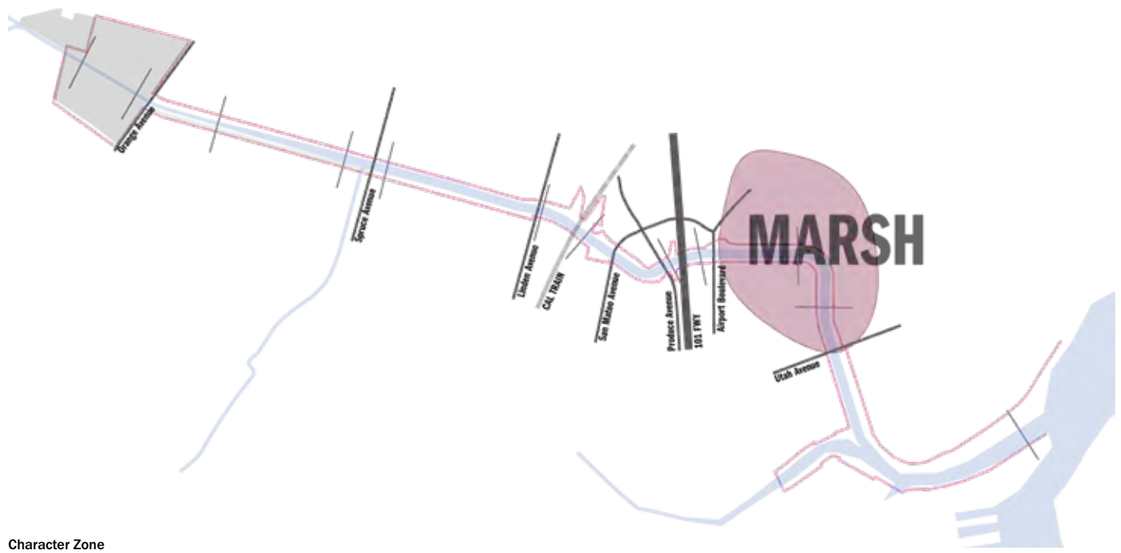
MARSH

Defining Characteristics

- → Flood Risk is high and forecast sea-level rise risk is moderate
- → Public access exists along Mitchell Ave only, with limited pedestrian space
- → Aside from Mitchell Ave, there is a narrow strip of publicly owned land to the east of the creek
- → Flood wall and tidal marsh zone provide some opportunities for adaptation
- → No public access points between Mitchell and Utah Ave on east side, and between S. Airport Blvd and Utah Ave on north and west sides
- → Historical north-south rail freight RoW connects Mitchell Ave to rail corridor

Legend

- Movement barriers
- Pedestrian paths
- Informal pedestrian path
- Bike path / On-road bike path (dashed)
- Private service road
- High volume truck traffic
- Decommissioned rail right of way



Character Zone

Access

Pedestrian Access

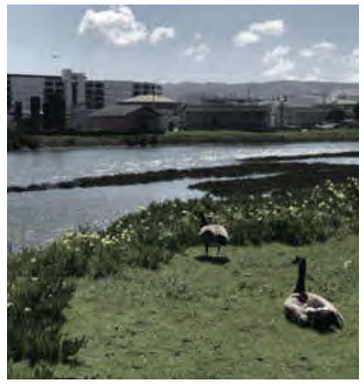
BAY

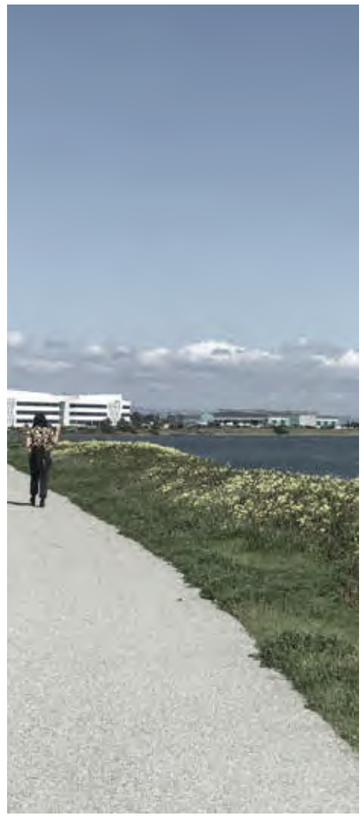
Defining Characteristics

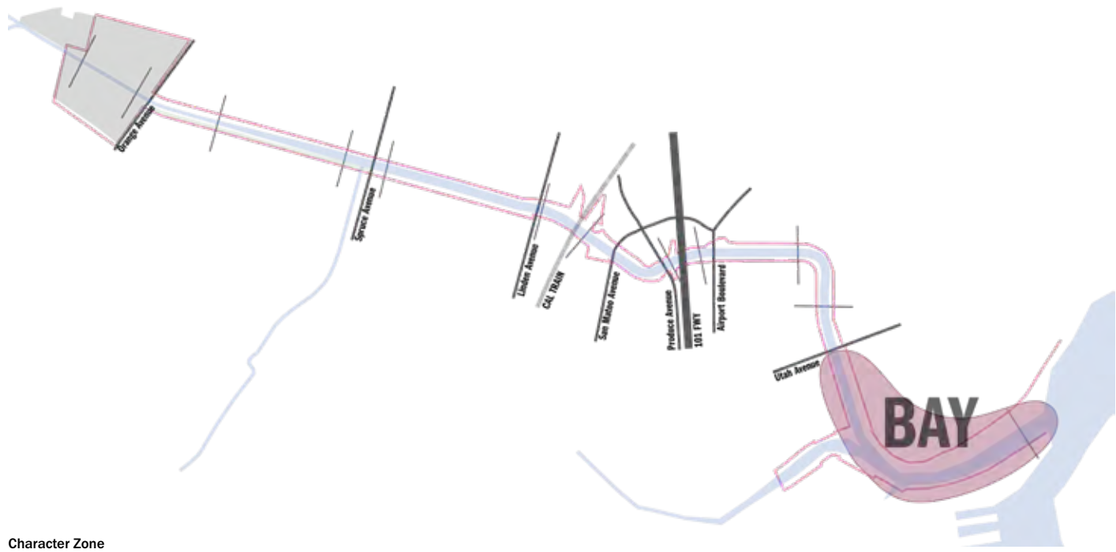
- → Flood Risk is moderate and forecast sea-level rise risk is high
- → Bay Trail access on north side of creek extending around Oyster Point
- → Mudflats provide some opportunity for further strengthening of nature-based resilience measures
- → 100' - 150' public parkland provides some opportunities for adaptation before low density industrial and R&D land uses
- → The general plan update includes rezoning scenarios to upgrade industrial sites to R&D land uses. These sites are at risk from sea level rise

Legend

- Possible rezoning due to General Plan update
- Inundation 5ft - 100yr
- Inundation 0ft - 100yr
- Inundation 5ft - MSL







Character Zone

Land Use Change

FEMA Flood Zones

CREEK LONG SECTION

→ The long section reveals existing tidal influence extending all the way past Spruce Avenue.

→ The 2 year flow level indicates a significant difference in level with he daily tidal volumes, as well as unfortunately no clearance for public access above this level and below existing bridges.

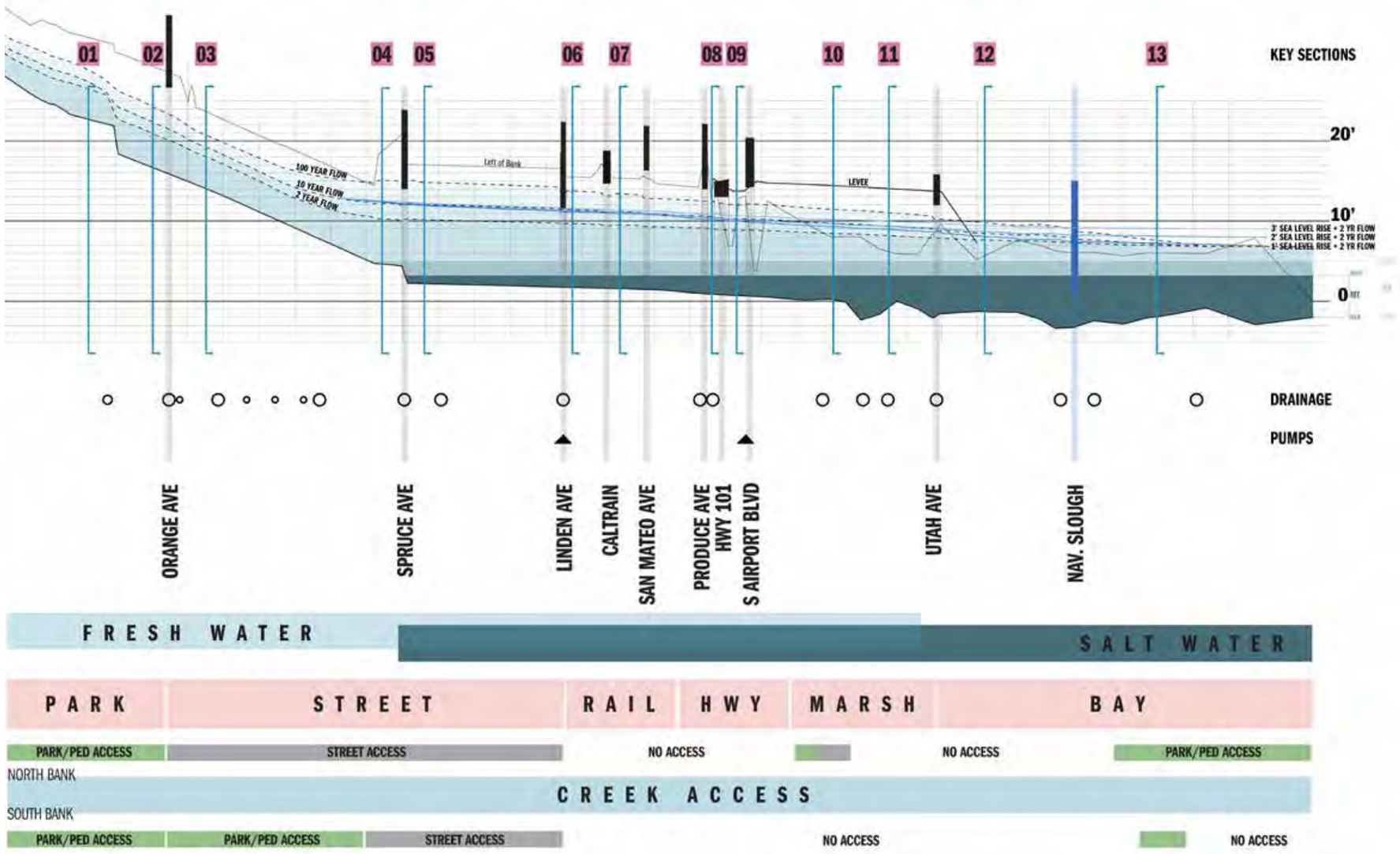
→ The 10 year flow is extremely close to the underside of the Linden Ave bridge, which already significantly constrains the flow of a 100 year event.

→ Variation in the height of banks to the east of 101, along with the dynamic sediment movement causing variation in depths, is a major flood risk.

→ Tidal impact on flood risk shows the scale of vulnerability to sea-level rise, without widened profile of the creek between Spruce Ave and the Bay

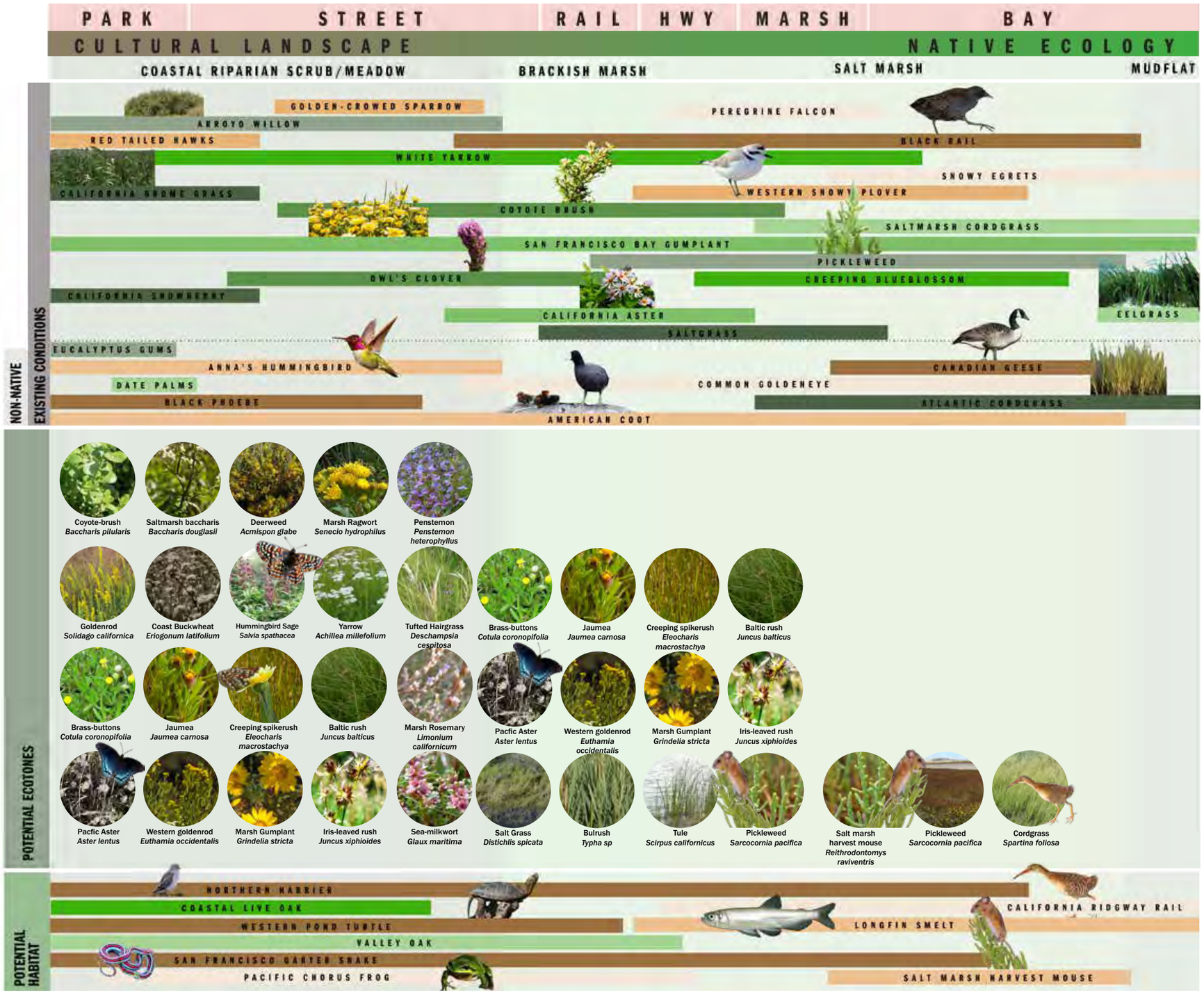
→ The extent of public access varies greatly between the various character areas along the Creek.

→ Opportunities for continual public access from the Park to the Bay exist predominantly on the northern side of the Creek.



CREEK ECOLOGY

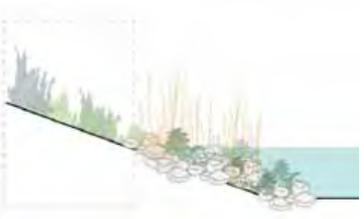
- → Research into historical ecologies of the area reveals potential for restoration of zones transitioning from; a Central Coast Riparian Scrub Zone, to a Coastal Brackish Marsh Zone, to a Tidal Marsh Zone, to the shoreline mudflats.
- → Existing mature Eucalyptus Gums and Date Palms in Orange Memorial Park will likely remain, so a pragmatic restoration strategy is for a transition from this mixed cultural landscape to a fullt restored native landscape downstream
- → A restored creek would provide habitat suitable for a number of threatened native species like the Salt Marsh Harvest Mouse and the California Ridgeway Rail (which already exists within the shoreline areas)
- → Other well-loved local species may be easier to attract and more quickly build populations, like the San Francisco Garter Snake and the Pacific Chorus Frog



CREEK ECOLOGY

SAN FRANCISCO GARTER SNAKE

Thamnophis sirtalis tetrataeni



Ideal habitat

- → Densely vegetated ponds near an open hillsides where it can sun, feed, and find cover in rodent burrows
- → Emergent and creek-bank vegetation - cattails, bulrushes and spike rushes provide protection from predators
- → The zone between creek/pond habitats and grasslands or bank sides is utilized for basking
- → Dense vegetation or water provides escape cover

PACIFIC CHORUS FROG

Pseudacris regilla

Ideal habitat

- → Ponds and other still waters, shallow water for breeding
- → Fallen logs, rocks and tall vegetation, for example grasses, cattails, and shrubs provide protection from predators

WESTERN POND TURTLE

Pseudacris regilla

Ideal habitat

- → Permanent and intermittent waters of creeks, ponds, marshes and drainage ditches
- → Bask on land or near water on logs, branches or boulders
- → Terrestrial habitat is important for nesting and overwintering

LONGFIN SMELT

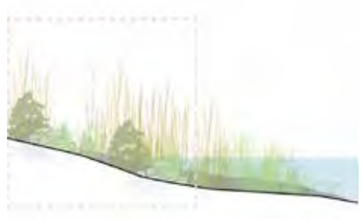
Spirinchus thaleichthys

Ideal habitat

- → A range of low-salinity water and shallow fresh or brackish wetland habitats
- → Sandy or gravel substrate could potentially provide spawning areas

SALT MARSH HARVEST MOUSE

Reithrodontomys raviventris

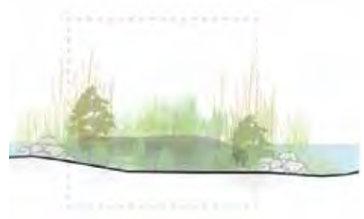


Ideal habitat

- → Habitat can be enhanced for this species by widening the tidal marsh area and planting dense vegetation like pickleweed

CALIFORNIA RIDGWAY'S RAIL

Rallus obsoletus obsoletus



Ideal habitat restoration

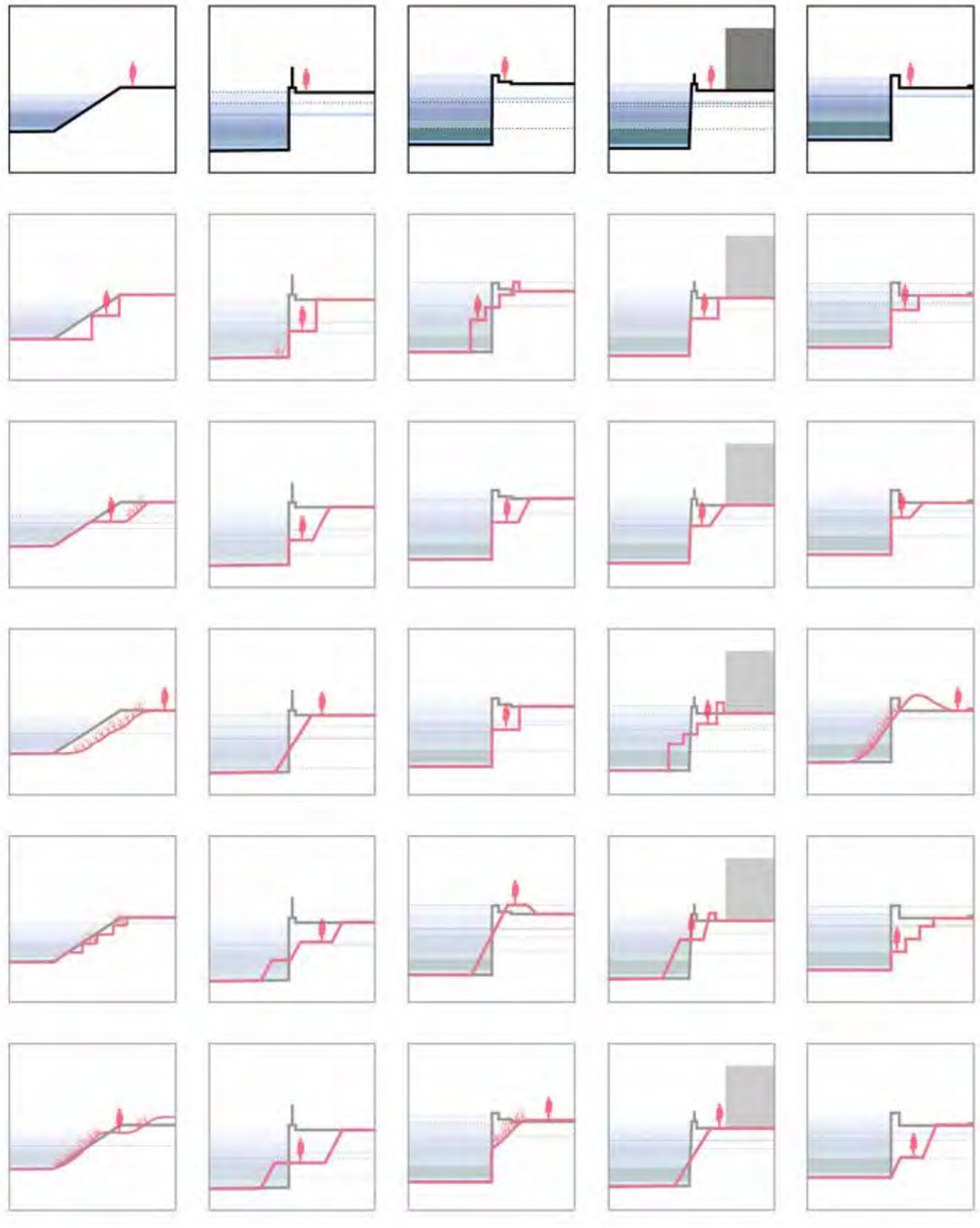
- → Dense marsh vegetation for foraging and protection, in and along creeks and mudflat edges

PARK

Refer pp. 186 - 189

ADAPTATION TOOLKIT

We have extracted a series of existing conditions from Colma Creek based on sectional profiles, and adjacent conditions and land use. These conditions were selected as they have been identified as typical of the region. This has allowed us to explore a broad range of potential adaptations within the creek corridor and adjacencies. Grouped by the context surrounding the creek, diverse design options have been explored with outcomes evaluated against the flood, ecology and access objectives.



The challenges faced by Colma Creek are similar to those faced by many locations and communities around the Bay. The historic pattern of large freeway and rail infrastructure circling the Bay has cut off many smaller communities from the shoreline. Main streets and creeks need to be revived and reconnected to the Bay as both social and ecological corridors enabling climate adaptation.

With the regional grants supporting this planning study comes an opportunity to support regional collaboration on climate adaptation. This project was inspired by the characteristics that Colma Creek and South San Francisco share with other creeks and communities around the region. More than 40 other creeks and communities share the challenges of limited open space and access to the Bay. These locations similarly have creek corridors that could be reconnected as ecological and access corridors supporting adaptation to climate change.

The design process for this project has aimed to differentiate the various character areas of Colma Creek to clearly define the conditions, constraints and opportunities that are shared with sections of these other corridors around the region. The team has explored a wide range of adaptation options and ranked whether they deliver resilient outcomes across 1, 2 or 3 of the objectives (Water, Ecology and Access) to make clear their most suitable application for other communities.

This chapter establishes the options for adaptation when working under varying constraints related to existing creek conditions, levee walls, adjacent public or private land, movement barriers, and sea-level rise risk. The breadth of options are also assessed for likely cost and impact, relative to the identified existing condition.

The Kit of Parts identifies smaller moves and techniques that are then combined into the Toolkit Options. Each section of the Toolkit highlights the best suited adaptation opportunities and an explanation of performance.

The Toolkit has been designed to flexibly translate to similar creeks across the Bay Area. As such, other locations with matching conditions have been identified.

Challenges of limited open space and access to the Bay are shared by

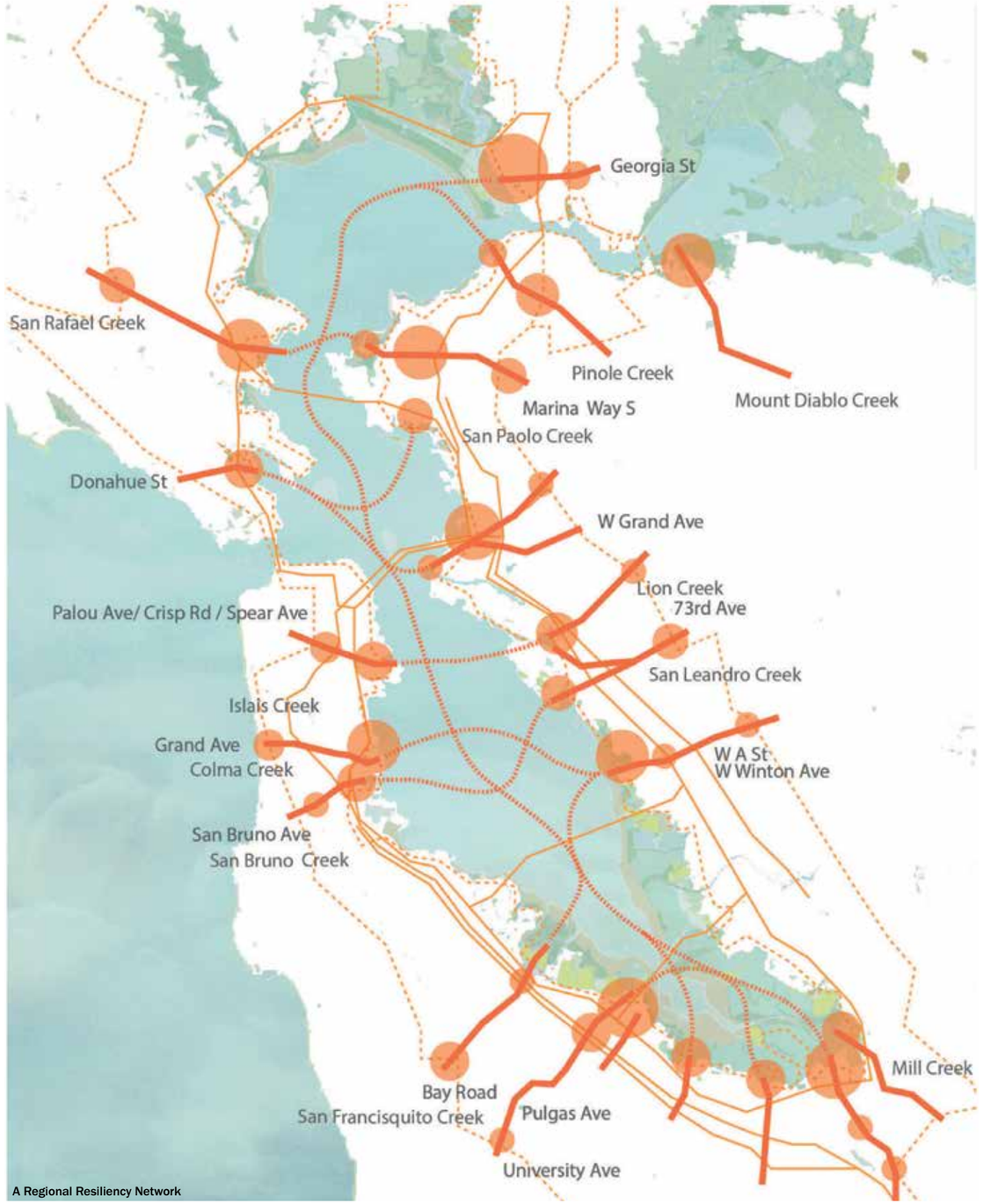
40+

Creeks and communities

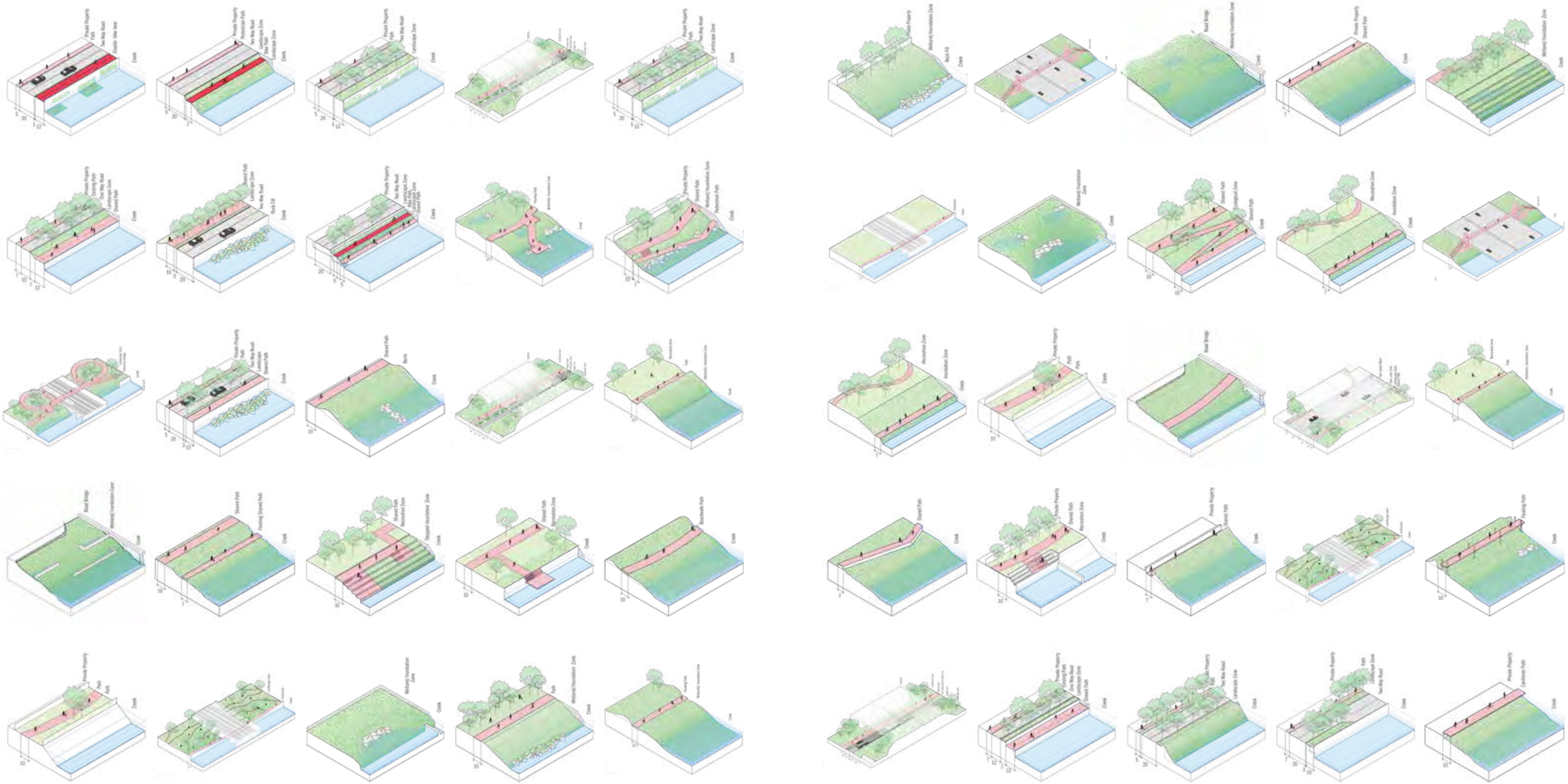
Transport Network

Public Open Spaces

Local Creeks and Main Streets



A Regional Resiliency Network

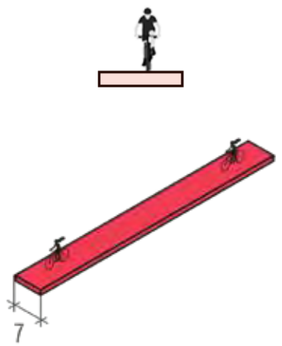


KIT OF PARTS

The Kit of Parts identifies a series of detailed elements that work to improve access, ecology and water. These individual elements are deployed in a range of configurations that make up the options explored in the Adaptation Toolkit. Options within the Adaptation Toolkit are responsive to site conditions and can be supplemented and adapted with other pieces from the Kit of Parts.

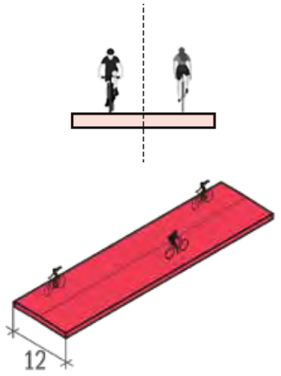
Bike Lane (1-way)

A 7' bike lane allows for one way dedicated bike access



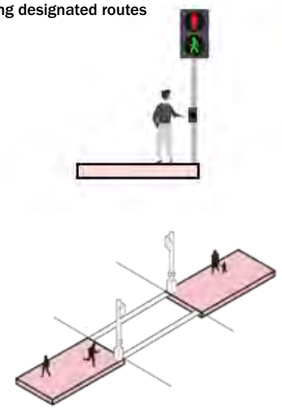
Bike Lane (2-way)

A 12' bike lane allows for two way dedicated bike access



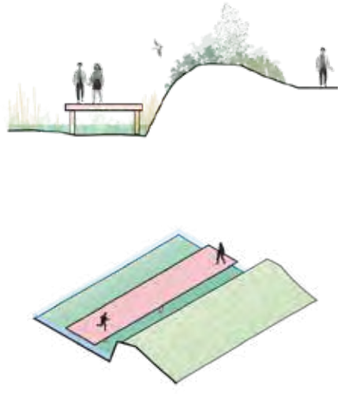
Signalized

Signalized crossings provide priority access for pedestrians and bikes at key intersections along designated routes



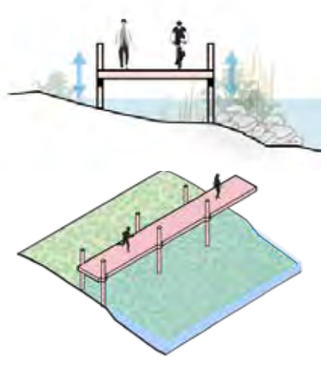
Horizontal Levee

Horizontal levees are self-maintaining and use natural flood protection benefits of coastal tidal marshes to reduce the destructive forces of storms and sea level rise impacts



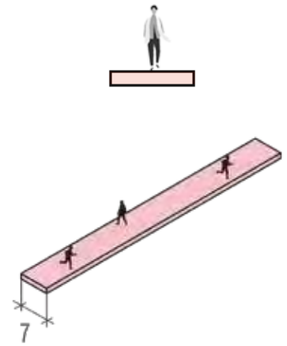
Floating Boardwalk

Dynamic boardwalks respond to changing water levels, allowing continuous access during peak water events



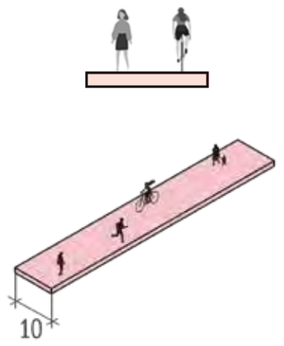
Pedestrian Path

A 7' path at a maximum 5 degree slope provides generous, ADA compliant pedestrian access



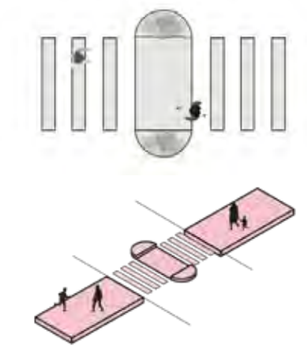
Shared Path

A 10' path provides a consolidated bike and pedestrian path



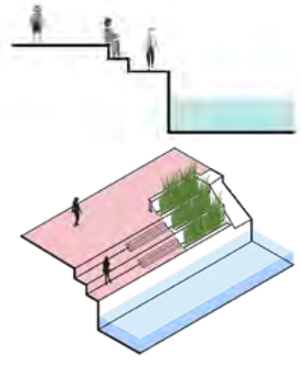
Zebra Crossing

Zebra crossings with pedestrian refuge islands allow for safe, pedestrian and bike priority road crossings



Tiered Seating

Stepped access and seating along the creek edge allows for physical and visual connectivity to the creek, while also expanding the creek cross section

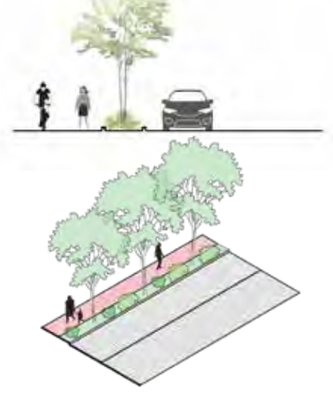


Seating

Seating can provide places to stop and rest along the path

Planted Buffer

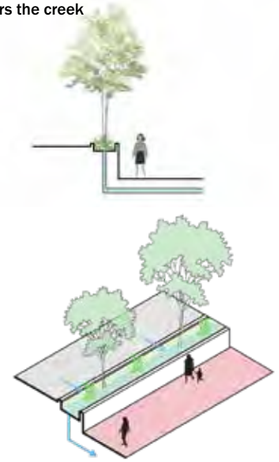
Planting between roads and access paths increases public safety and comfort for pedestrians and cyclists, captures stormwater run-off, and increases biodiversity opportunities



KIT OF PARTS

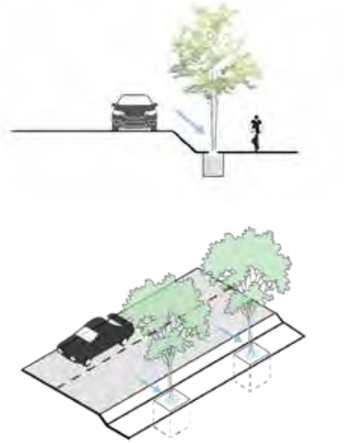
Bioretention Swale

Shallow, vegetated, landscape depressions capture and treat stormwater run-off before it enters the creek



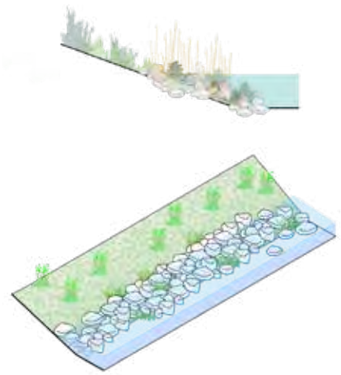
Tree Pit

Water capture tree pits intercept and treat stormwater run-off before it enters the creek and have minimal space requirements



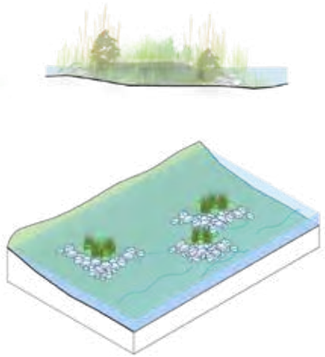
Rocky Embankment

Rocky embankments within the creek corridor improve water quality and provide opportunities for habitat



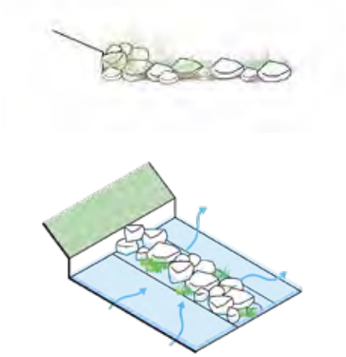
Living Storm Barriers

Raised sections of planting within the mudflats can provide protected habitat for birds while also reducing the impact of waves and storm-surge on the shoreline



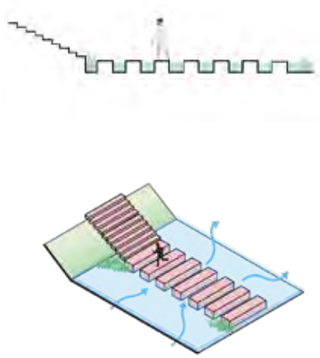
Rocky Weir

Through interrupting the daily water flow, we can provide aquatic habitat, as well as improve water quality. A possible crossing or natural playspace is a bonus



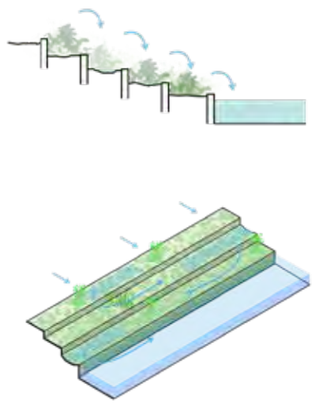
Stepping Stone Weir

Crossing points in the creek can also improve water quality through aeration of daily flow



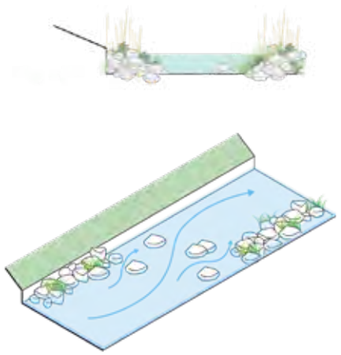
Ecological Terracing

Discharging stormwater between certain plant species with gravity flow, can improve water quality while also creating habitat for creekside species



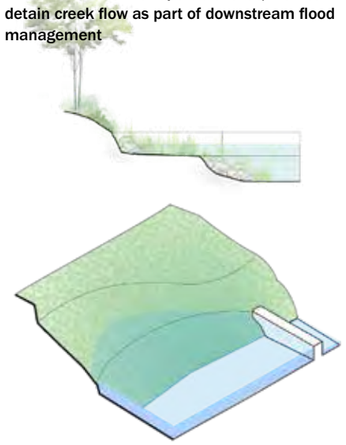
Rocky Edge

Rocky edges within the creek corridor improve water quality and provide opportunities for habitat



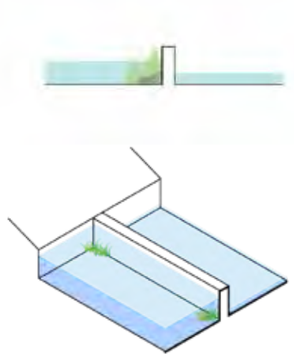
Detention Basin/Levee

Lowered open landscape adjacent to the creek can provide detention for overland flow or when combined with operable levee/weir can detain creek flow as part of downstream flood management



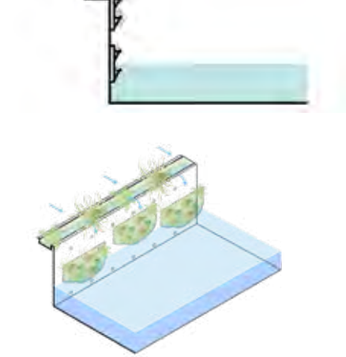
Concrete Weir

Aquatic plants that improve water quality can thrive in 1.5 feet of water. Small weirs can provide these conditions in many areas where the average daily flow is only half a foot



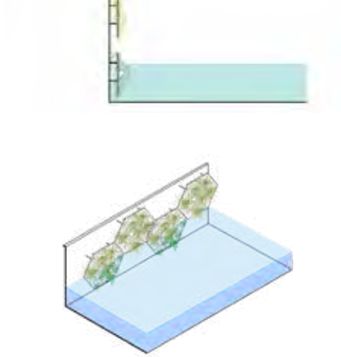
Swale Green Wall

Street runoff can be redirected to irrigate green wall plants, in turn treating runoff



Tidal Green Wall

Water quality can be improved and green habitat created within the tidal zone, replacing bare concrete walls



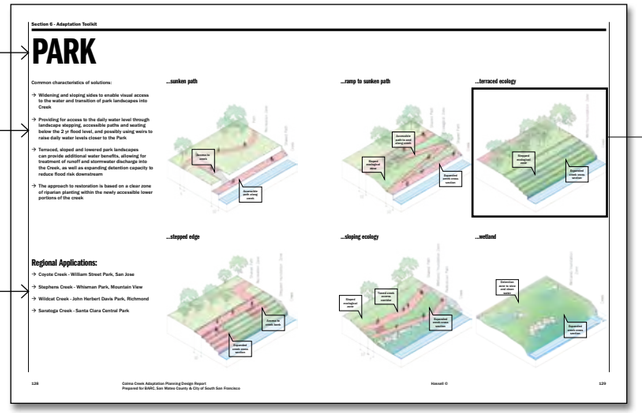
TOOLKIT HOW TO

Preferred Adaptations

Tool Kit Type

Description

Regional Application



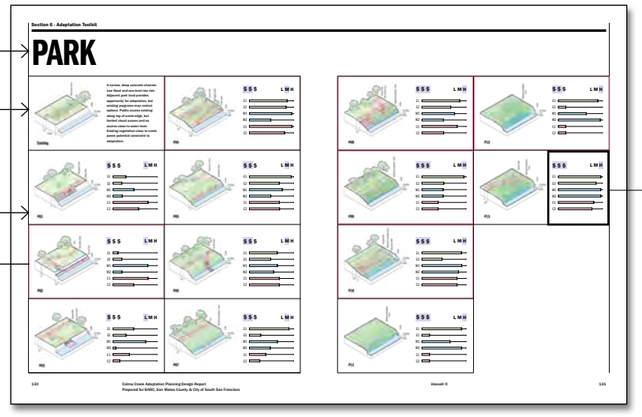
Tool Kit Analysis

Tool Kit Type

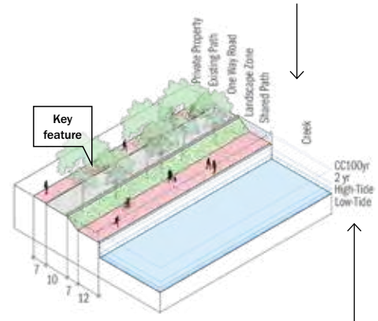
Colma Creek Existing

Tested Options

Preferred Adaptation (previous spread)



Programs



Adaptation Option

Key Water Levels

Legend

- Pedestrian/Shared Path
- Bike Path
- Recreational Open Space
- Terrestrial Ecological Zone
- Riparian Ecological Zone
- Existing Edge
- Climate Change 1 in 100 yr Flood
- 2ft Sea-Level Rise
- 1 in 2 yr Flood
- High-Tide
- Low-Tide/Daily

Water levels taken from the ColmaCrROA model dated August 8 2019

Project Principles Assessment

Cost Impact: $ $ $

Construction Impact: L M H

E1
Ecological Restoration Potential

E2
Access to Ecology

W1
Flood & SLR Mitigation

W2
Water Quality Improvement

C1
Continuous, Comfortable Access Along Creek

C2
Access to the Water

Relevant Principles

Refer page 36-41

PARK

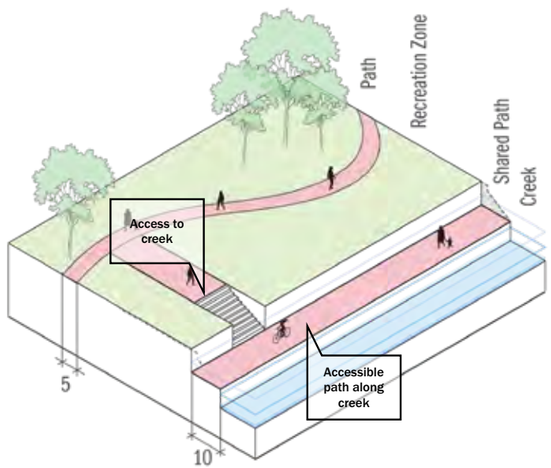
Common characteristics of solutions:

- → Widening and sloping sides to enable visual access to the water and transition of park landscapes into Creek
- → Providing for access to the daily water level through landscape stepping, accessible paths and seating below the 2 yr flood level, and possibly using weirs to raise daily water levels closer to the Park
- → Terraced, sloped and lowered park landscapes can provide additional water benefits, allowing for treatment of runoff and stormwater discharge into the Creek, as well as expanding detention capacity to reduce flood risk downstream
- → The approach to restoration is based on a clear zone of riparian planting within the newly accessible lower portions of the creek

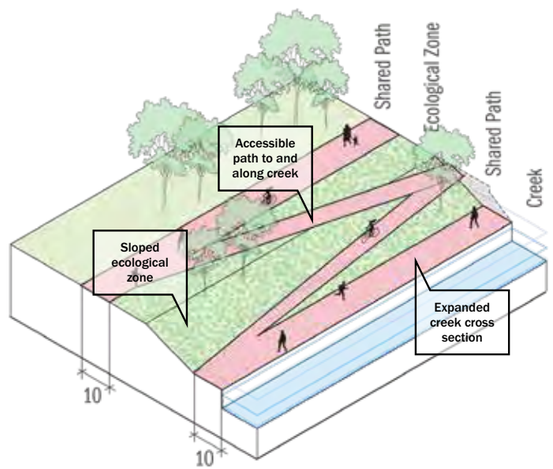
Regional Applications:

- → Coyote Creek - William Street Park, San Jose
- → Stephens Creek - Whisman Park, Mountain View
- → Wildcat Creek - John Herbert Davis Park, Richmond
- → Saratoga Creek - Santa Clara Central Park

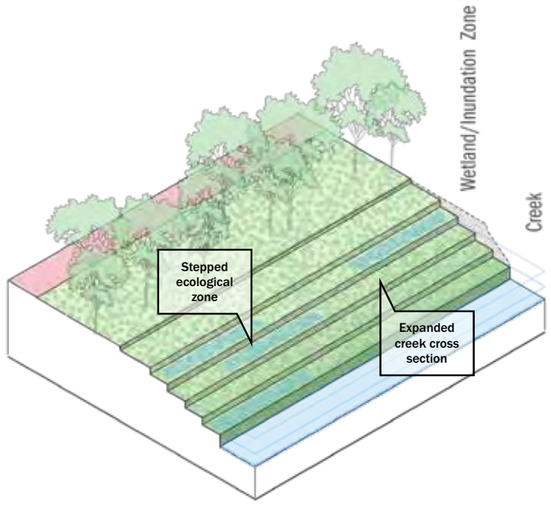
...sunken path



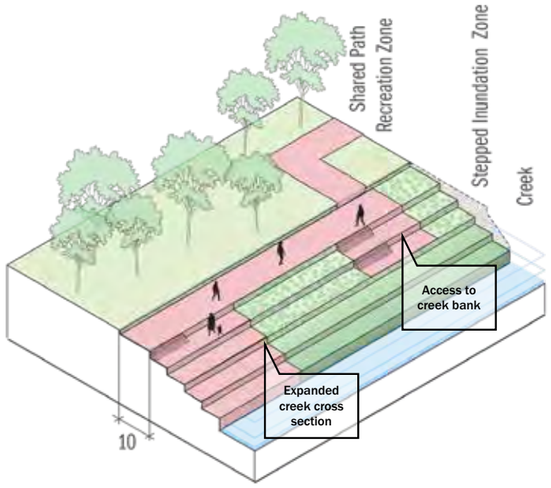
...ramp to sunken path



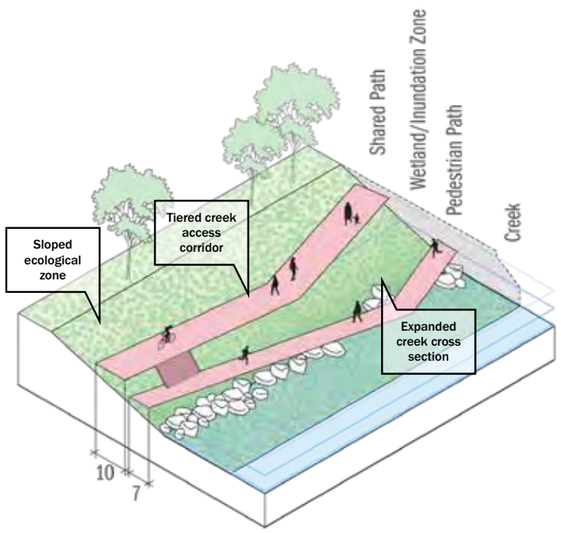
...terraced ecology



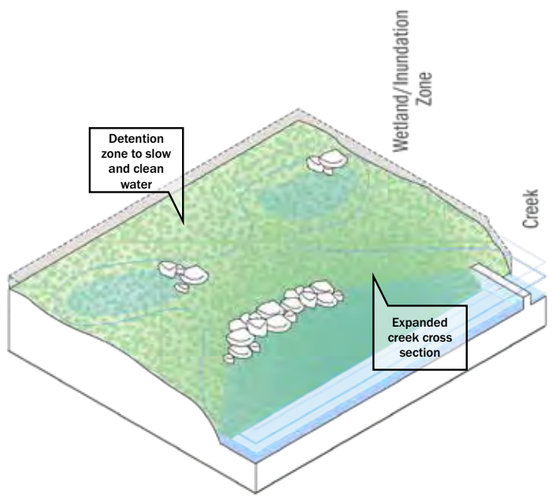
...stepped edge



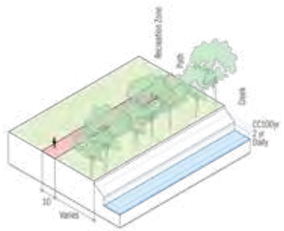
...sloping ecology



...wetland

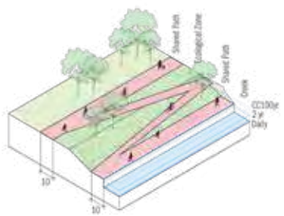


PARK



Existing

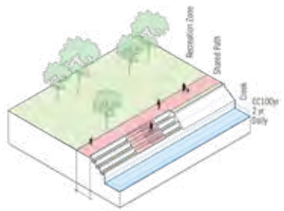
A narrow, deep concrete channel. Low flood and sea-level rise risk. Adjacent park land provides opportunity for adaptation, but existing programs may restrict options. Public access existing along top of creek edge, but limited visual access and no access close to water level. Existing vegetation close to creek poses potential constraint to adaptation.



P04

$ $ $ L M H

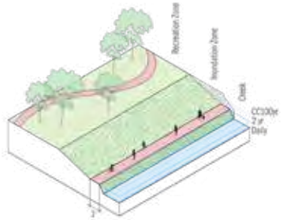
E1
E2
W1
W2
C1
C2



P01

$ $ $ L M H

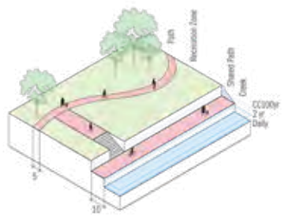
E1
E2
W1
W2
C1
C2



P05

$ $ $ L M H

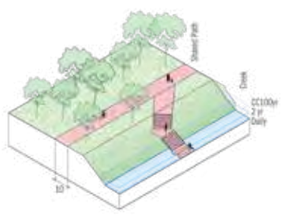
E1
E2
W1
W2
C1
C2



P02

$ $ $ L M H

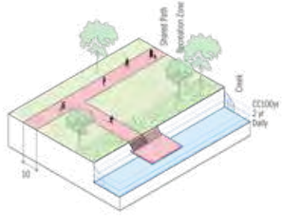
E1
E2
W1
W2
C1
C2



P06

$ $ $ L M H

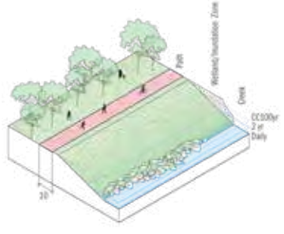
E1
E2
W1
W2
C1
C2



P03

$ $ $ L M H

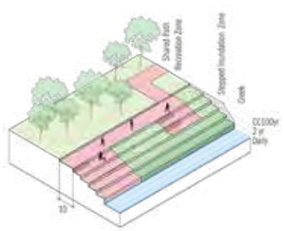
E1
E2
W1
W2
C1
C2



P07

$ $ $ L M H

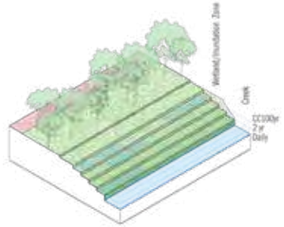
E1
E2
W1
W2
C1
C2



P08

$ $ $ L M H

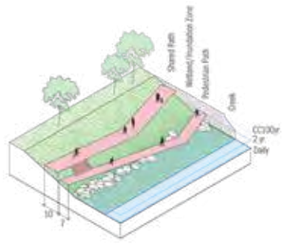
E1
E2
W1
W2
C1
C2



P09

$ $ $ L M H

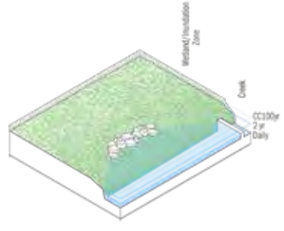
E1
E2
W1
W2
C1
C2



P10

$ $ $ L M H

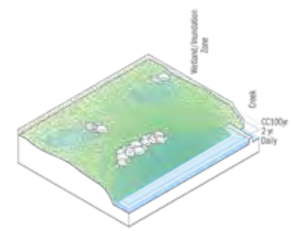
E1
E2
W1
W2
C1
C2



P11

$ $ $ L M H

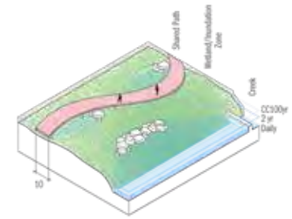
E1
E2
W1
W2
C1
C2



P12

$ $ $ L M H

E1
E2
W1
W2
C1
C2



P13

$ $ $ L M H

E1
E2
W1
W2
C1
C2

STREET

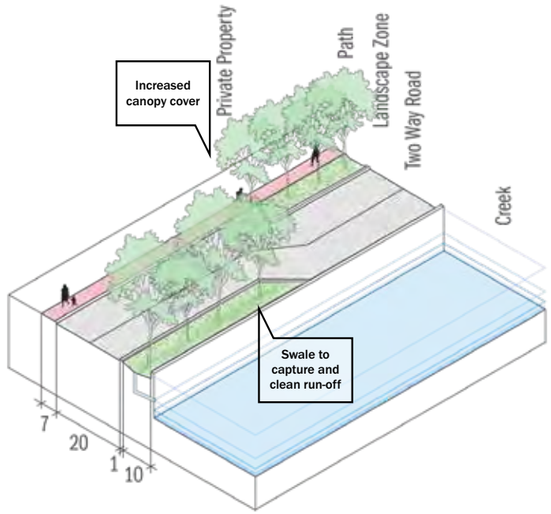
Common characteristics of solutions:

- → Additional width within road reserve used to introduce bike and pedestrian access adjacent to Creek edge, or reduced lane widths to give back part of road reserves to creek for flood & ecology.
- → Stepping and sloping, where possible, to mediate between street and daily water levels. Also useful for treating stormwater discharge.
- → Stepping into the road reserve to increase flood capacity.
- → The introduction of trees for shade and comfort of pedestrians next to Creek.
- → Many locations of this condition have duplicate infrastructure (ie. Roads on both sides of the creek), allowing for the adaptation approach to balance access and ecology on the two sides.

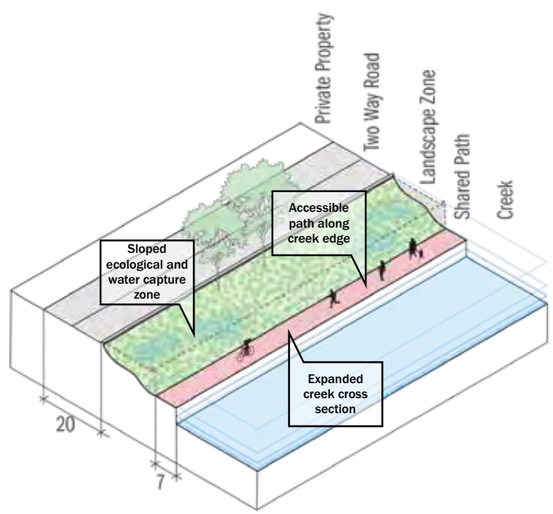
Regional Applications:

- → Alameda Creek - Industrial Parkway, Union City
- → San Leandro Creek - Leet Drive, Oakland
- → Calabazas Creek - Mission College Blvd, Santa Clara
- → Colma Creek - Mission Rd, South San Francisco (Upstream of Study Area)

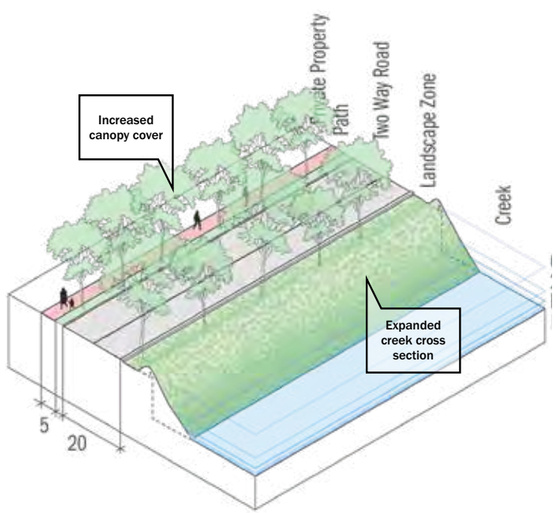
...green street



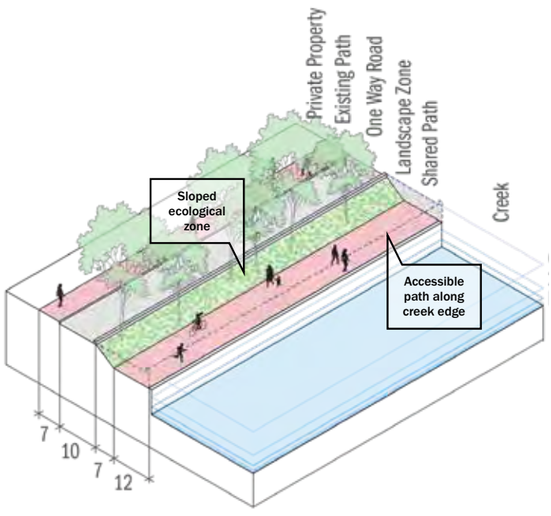
...floodable path



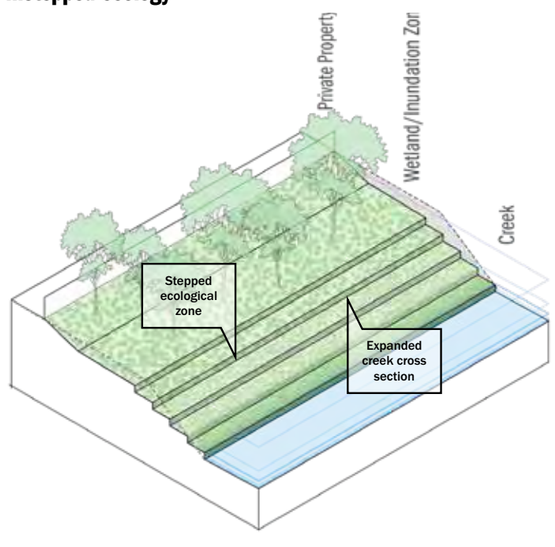
...remove the wall



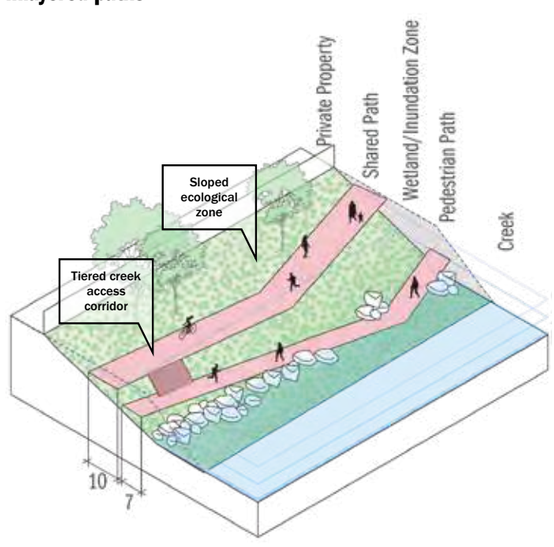
...shared + stepped green street



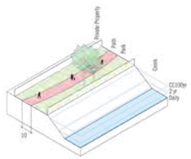
...stepped ecology



...layered paths

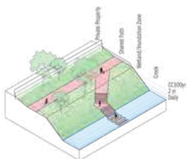


STREET (PARK)



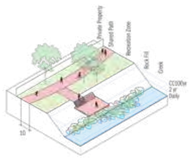
Existing

A wide, deep, 45 degree concrete channel. Moderate flood risk and low sea level rise risk. Adjacent linear park provides opportunity for adaptation. Private property next to linear park restricts adaptation zone. Public access is available through linear park, but there is limited visual access and no physical access to the creek.



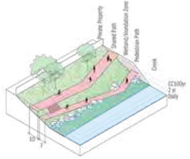
SP04

$ $ $ L M H
E1
E2
W1
W2
C1
C2



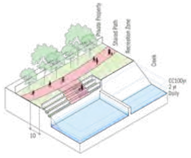
SP01

$ $ $ L M H
E1
E2
W1
W2
C1
C2



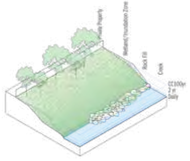
SP05

$ $ $ L M H
E1
E2
W1
W2
C1
C2



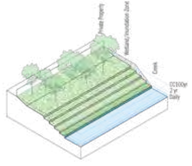
SP02

$ $ $ L M H
E1
E2
W1
W2
C1
C2



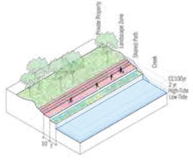
SP06

$ $ $ L M H
E1
E2
W1
W2
C1
C2



SP03

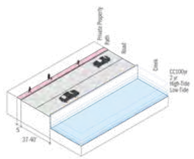
$ $ $ L M H
E1
E2
W1
W2
C1
C2



SP07

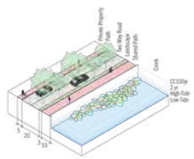
$ $ $ L M H
E1
E2
W1
W2
C1
C2

STREET



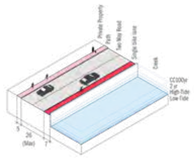
Existing

A wide, deep concrete channel with vertical walls. Moderate flood risk and low sea level rise risk. Adjacent street provides opportunity for adaptation. Private property next to street restricts adaptation zone. No public access is available along creek edge, and there is no visual access from existing sidewalk. Also no physical access to the creek. Infrastructure under road constrain adaptation options.



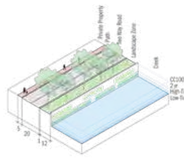
S04

$ $ $ L M H
E1
E2
W1
W2
C1
C2



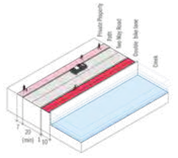
S01

$ $ $ L M H
E1
E2
W1
W2
C1
C2



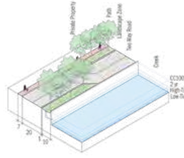
S05

$ $ $ L M H
E1
E2
W1
W2
C1
C2



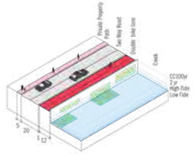
S02

$ $ $ L M H
E1
E2
W1
W2
C1
C2



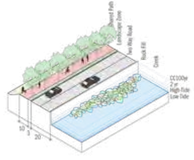
S06

$ $ $ L M H
E1
E2
W1
W2
C1
C2



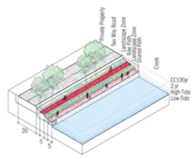
S03

$ $ $ L M H
E1
E2
W1
W2
C1
C2



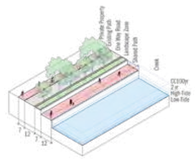
S07

$ $ $ L M H
E1
E2
W1
W2
C1
C2



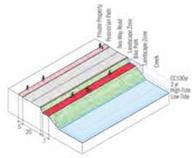
S08

$ $ $ L M H
E1
E2
W1
W2
C1
C2



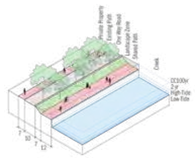
S12

$ $ $ L M H
E1
E2
W1
W2
C1
C2



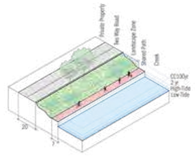
S09

$ $ $ L M H
E1
E2
W1
W2
C1
C2



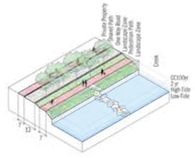
S13

$ $ $ L M H
E1
E2
W1
W2
C1
C2



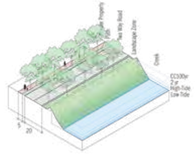
S10

$ $ $ L M H
E1
E2
W1
W2
C1
C2



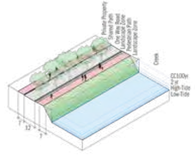
S14

$ $ $ L M H
E1
E2
W1
W2
C1
C2



S11

$ $ $ L M H
E1
E2
W1
W2
C1
C2



S15

$ $ $ L M H
E1
E2
W1
W2
C1
C2

CROSSINGS

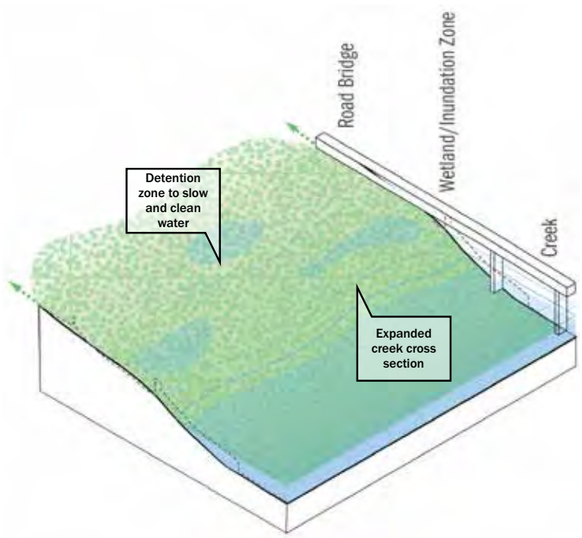
Common characteristics of solutions:

→ Access and water flow are often both restricted at major crossings, so more space for flood waters through either adjacent inundation zones, or widened underpass areas (or both) provide a dual benefit.

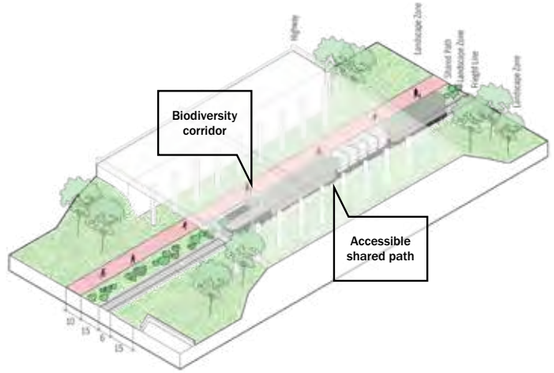
→ Options allowing for the multi-use path to share space with road or rail underpasses can provide more affordable solutions than new bridges or tunnels though the safety and quality of experience need to be considered.

→ When access is moved away from the Creek's edge, lowered and sloped edges for inundation and runoff treatment become possible.

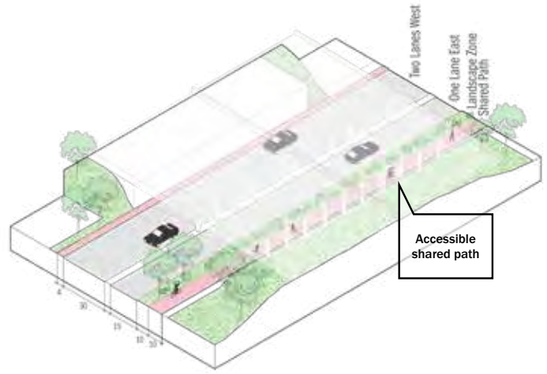
...wetland overflow detention



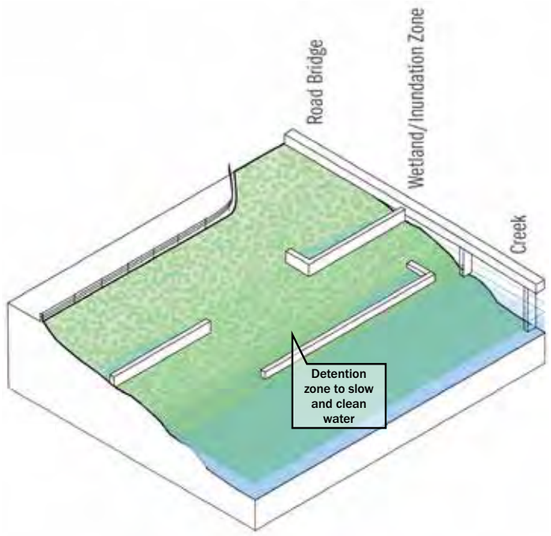
...rails to trails



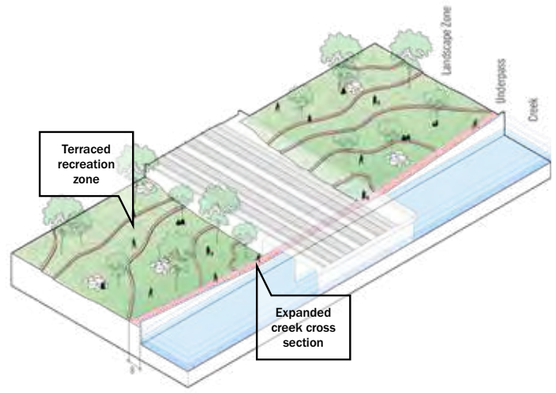
...bikes by the street



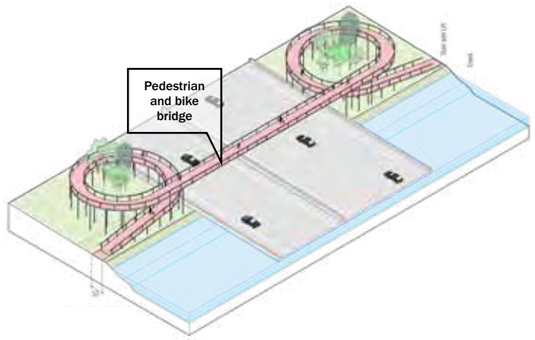
...hold + treat runoff



...floodable terraced park



...bike bridge



Regional Applications:

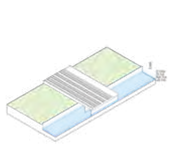
→ San Leandro Creek (i880/BART), San Leandro

→ San Pablo & Wildcat Creeks (Capital Corridor/i80), Richmond

→ San Lorenzo Creek (i880), San Lorenzo

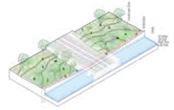
→ Adobe & Barron Creeks (101), Palo Alto

CROSSINGS



Existing

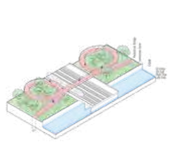
A wide, deep concrete channel with vertical walls. Rail bridge intersects creek and clearance under bridge is minimal. Flood risk is high and sea-level rise risk is moderate. Adjacent public land provides significant opportunity for adaptation. No public access available along creek.



RaC04

$ $ $ L M H

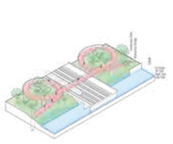
E1
E2
W1
W2
C1
C2



RaC01

$ $ $ L M H

E1
E2
W1
W2
C1
C2



RaC05

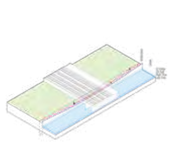
$ $ $ L M H

E1
E2
W1
W2
C1
C2

RaC02

$ $ $ L M H

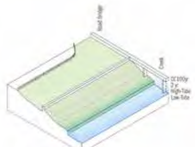
E1
E2
W1
W2
C1
C2



RaC03

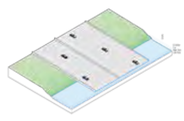
$ $ $ L M H

E1
E2
W1
W2
C1
C2



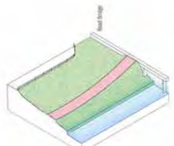
Existing

Low, wide, soft based marsh zone with flood walls. Flood risk is high and sea-level rise risk is moderate. Adjacent public land provides potential for ecological adaptation. This opportunity is somewhat interrupted by heavily trafficked surrounding roads. No public access available along creek.



Existing

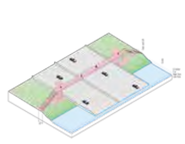
Low, wide, soft based marsh zone. Road bridge intersects creek and clearance under bridge is minimal. Flood risk is high and sea-level rise risk is moderate. Public land adjacent land provides potential for adaptation. No public access available along creek.



C01

$ $ $ L M H

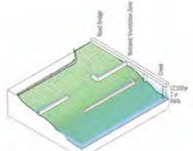
E1
E2
W1
W2
C1
C2



RoC01

$ $ $ L M H

E1
E2
W1
W2
C1
C2



C02

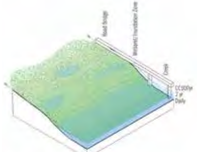
$ $ $ L M H

E1
E2
W1
W2
C1
C2

RoC02

$ $ $ L M H

E1
E2
W1
W2
C1
C2



C03

$ $ $ L M H

E1
E2
W1
W2
C1
C2

Existing

A dual carriageway with highway bridge over. Limited public access is provided by two narrow sidewalks. Physical structure of the bridge limits opportunities for adaptation on one side. On the other side there are opportunities to excavate within current span to provide greater access.

RoR04

$ $ $ L M H

E1
E2
W1
W2
C1
C2

RoR01

$ $ $ L M H

E1
E2
W1
W2
C1
C2

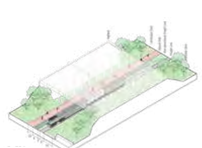
Existing

Semi-active freight line with highway bridge over. No public access. Adjacent public land the potential to decommission one track provides opportunity for adaptation.

RoR02

$ $ $ L M H

E1
E2
W1
W2
C1
C2



RoF01

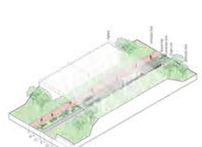
$ $ $ L M H

E1
E2
W1
W2
C1
C2

RoR03

$ $ $ L M H

E1
E2
W1
W2
C1
C2



RoF02

$ $ $ L M H

E1
E2
W1
W2
C1
C2

MARSH

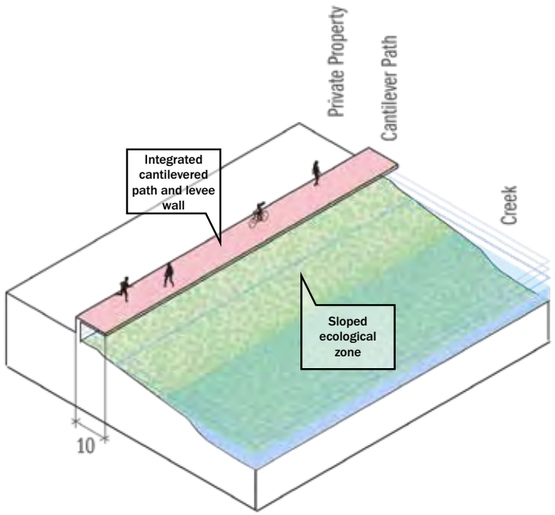
Common characteristics of solutions:

- → The introduction of public access, along with flood and sea-level rise protections can be designed to both allow close access to nature as well as provide for ecological connectivity up and down the tidal marsh.
- → Elevated structures provide marsh connectivity beneath and can adapt to flood scenarios through floating mechanisms.
- → Alternatively built-up sloped barriers can maintain visual access from paths immediately behind levees.
- → This innovative integration of protective structures and pubic access provides for adaptation in areas where often little to no public land exists along the Creek side

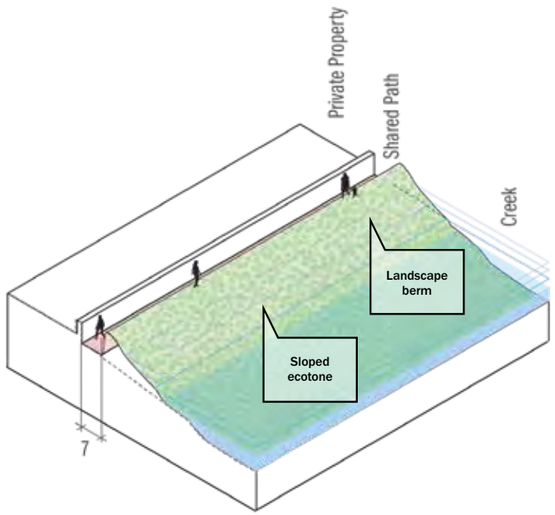
Regional Applications:

- → Belmont Slough, Redwood Shores
- → Alameda Creek, Union City
- → Guadalupe River, Alviso
- → Redwood Creek, Redwood City

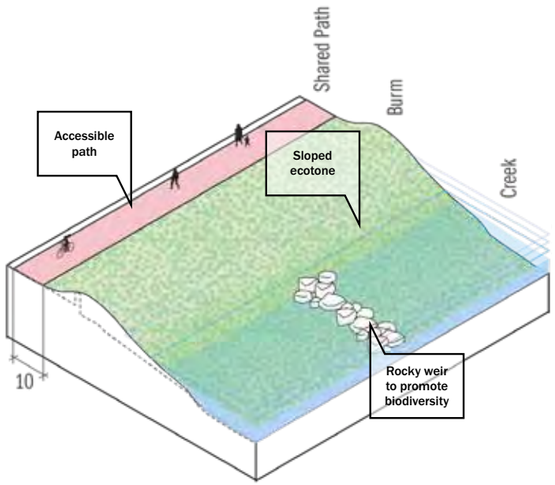
...hanging path



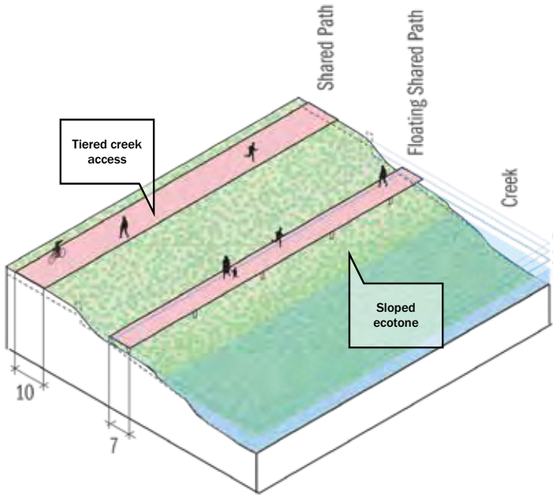
...sunken path



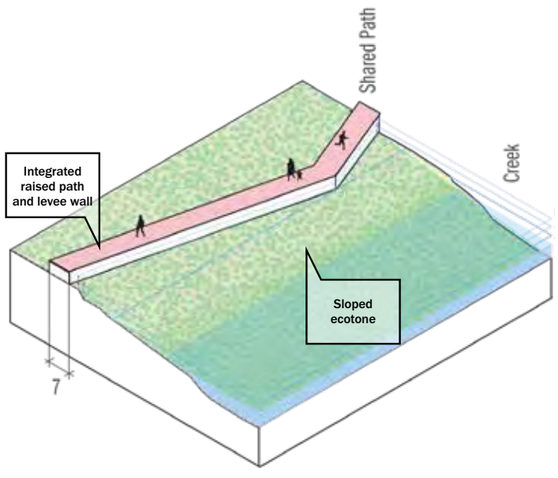
...soft berm



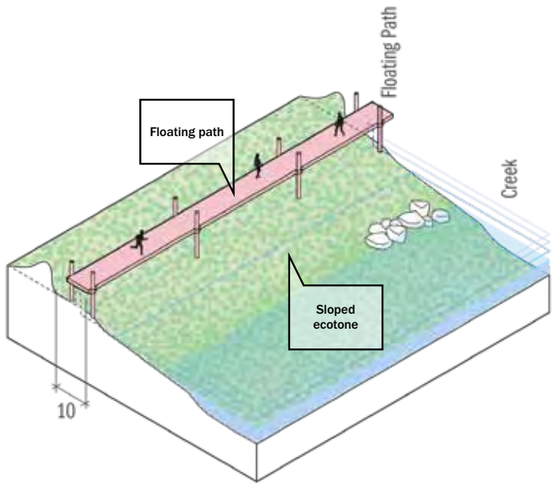
...layered path



...levee path



...floating path



BAY

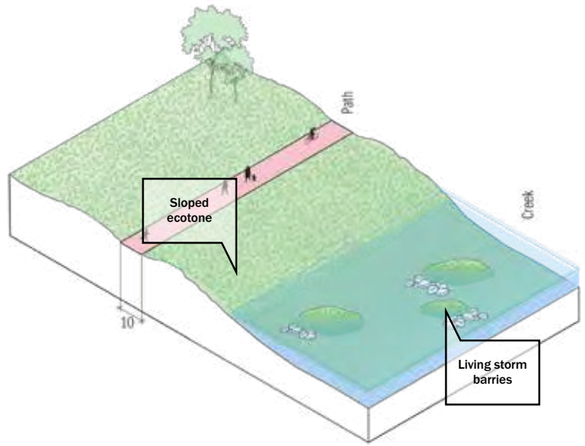
Common characteristics of solutions:

- → Placement and nature of Sea-level rise protection dictates the nature of public access, ecological and recreational space. It also can have impacts on future fluvial flooding and balance if fresh water and salt water inundation
- → The public access path becomes the natural transition between two types of environments.
- → If parkland is dedicated to migrating marshlands, this provides for maximum restoration opportunities, while if dedicated to storm water detention then it could have the greatest possible flood benefits for adjacent parcels
- → Outboard marshland restoration can also provide storm surge protection reducing the size of required levees.

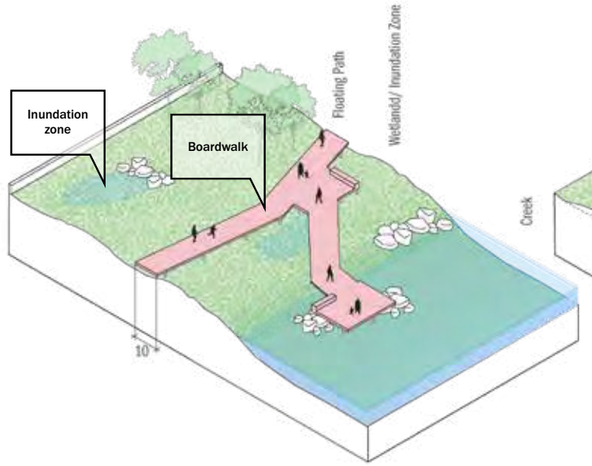
Regional Applications:

- → Coyote Point Recreation Area, San Mateo
- → Steinberg Slough, Redwood Shores
- → India Basin, San Francisco
- → Albany Mudflats State Marine Park, Albany

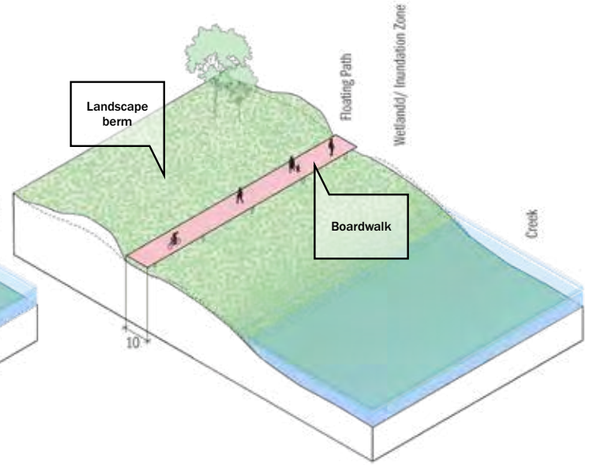
...living storm barriers



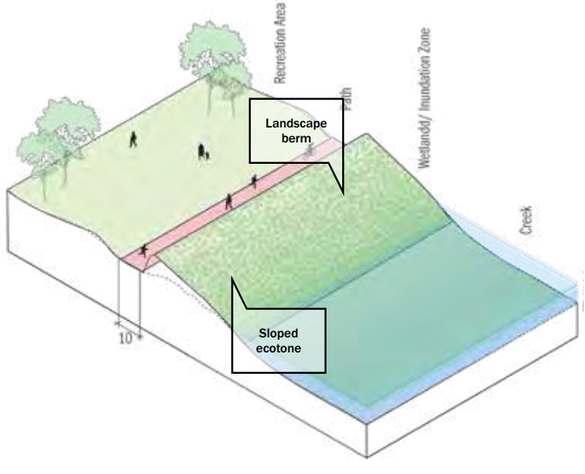
...migrating shoreline



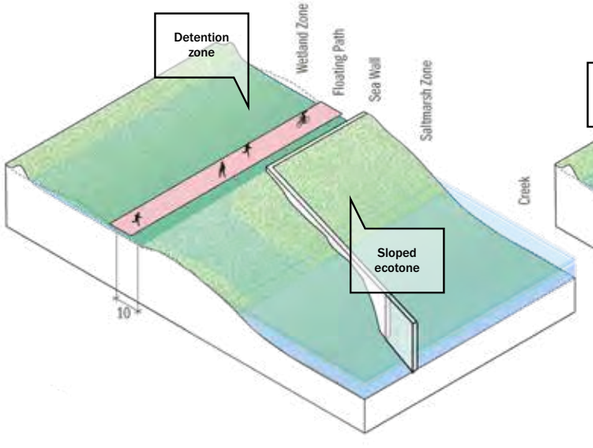
...bermed park



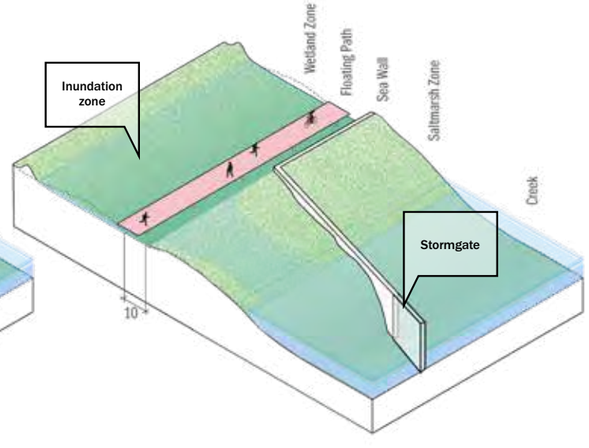
...horizontal levee



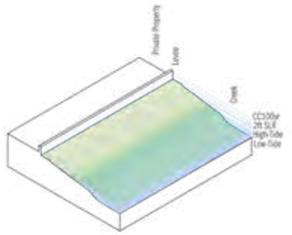
...levee + detention zone



...levee + detention zone+ stormgate



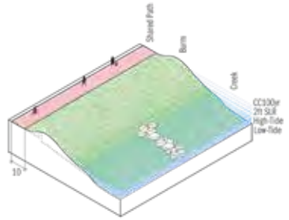
MARSH + BAY



Existing

MARSH

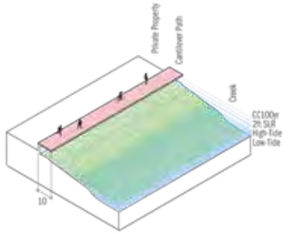
Low, wide marshland section with flood walls. High flood and sea level rise risk. Flood wall, tidal marsh zone and adjacent right of way provide some opportunities for adaptation. Limited public access available along creek.



M04

$ $ $ L M H

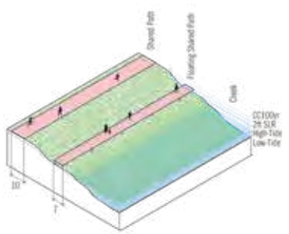
E1
E2
W1
W2
C1
C2



M01

$ $ $ L M H

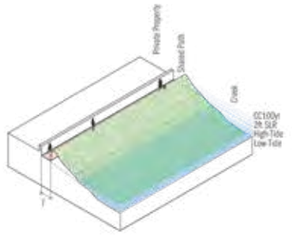
E1
E2
W1
W2
C1
C2



M05

$ $ $ L M H

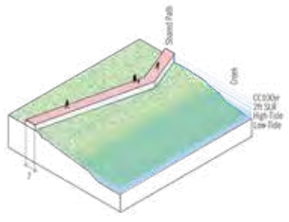
E1
E2
W1
W2
C1
C2



M02

$ $ $ L M H

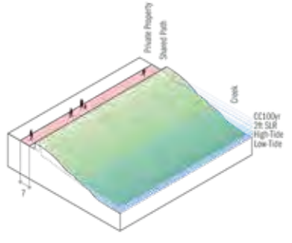
E1
E2
W1
W2
C1
C2



M06

$ $ $ L M H

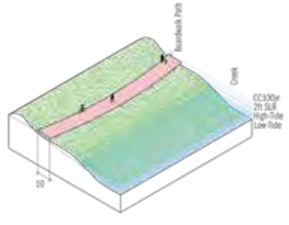
E1
E2
W1
W2
C1
C2



M03

$ $ $ L M H

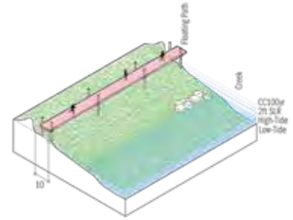
E1
E2
W1
W2
C1
C2



M07

$ $ $ L M H

E1
E2
W1
W2
C1
C2



M08

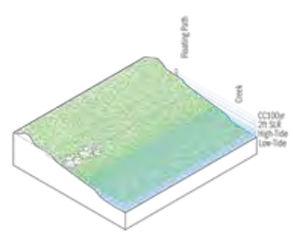
$ $ $ L M H

E1
E2
W1
W2
C1
C2

B02

$ $ $ L M H

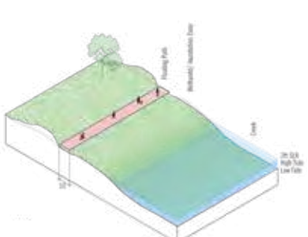
E1
E2
W1
W2
C1
C2



M09

$ $ $ L M H

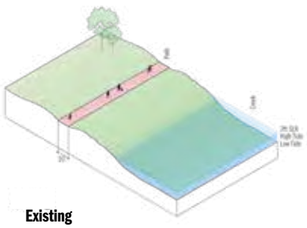
E1
E2
W1
W2
C1
C2



B03

$ $ $ L M H

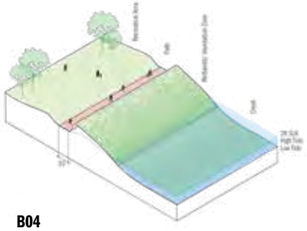
E1
E2
W1
W2
C1
C2



Existing

BAY

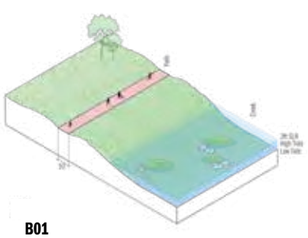
Wide tidal marsh section as creek meets the bay. Moderate flood risk and sea level rise risk. Wide adjacent public parkland provides significant opportunity for adaptation. Bay Trail provides access along creek and bay.



B04

$ $ $ L M H

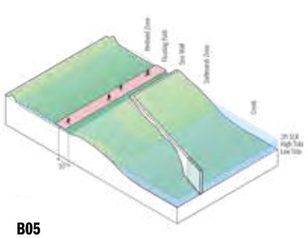
E1
E2
W1
W2
C1
C2



B01

$ $ $ L M H

E1
E2
W1
W2
C1
C2



B05

$ $ $ L M H

E1
E2
W1
W2
C1
C2

BAY

Refer pp. 236 - 239

CREEK ADAPTATION SCENARIOS

Combining the site analysis & adaptation toolkit, the following scenarios establish 3 potential continuous routes from Orange Memorial Park to the Bay, applying adaptation options to each character area of the creek to prioritize multi-benefit outcomes across the 3 project objectives.

SCENARIO 01
BRIDGE TO BRIDGE

16 minutes from Orange to Bay

1.8 miles from Orange to Bay

1.8 miles of creek access

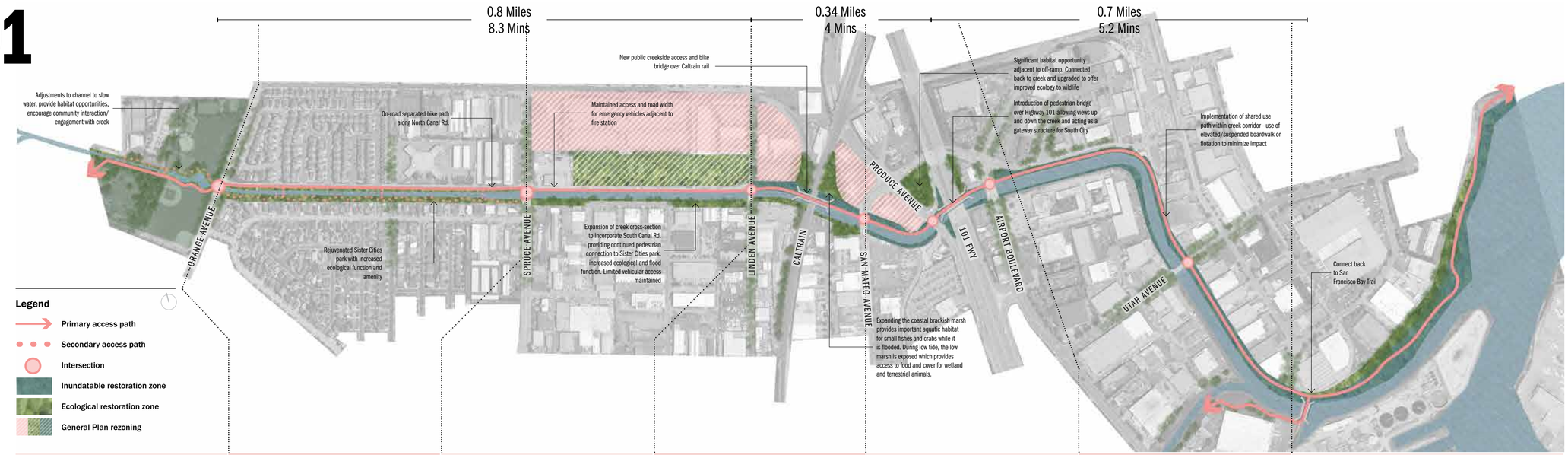
7 intersections

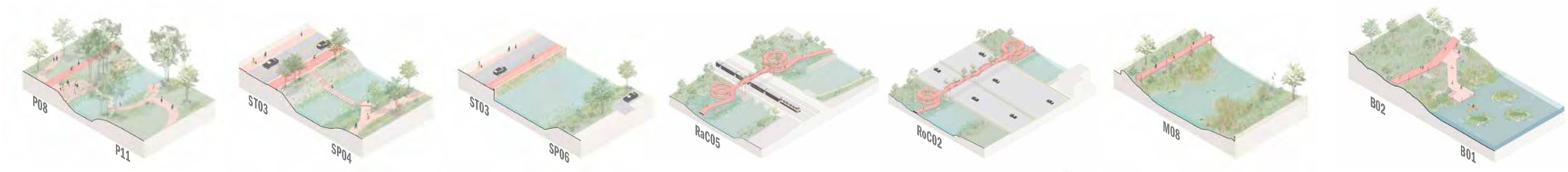
42 acres of improved public amenity

39 acres of connected ecology

Route details:

- Terraced seating and infilled rock edges open up the canal to the park and connect adjacent public activities down to the water's edge
- New bike/ped access on the northern edge of the creek between Orange Park and Linden Ave, within existing carriageway widths. The edge of Sister Cities Park is softened with increased planting and habitat created within the Park.
- An accessible bike bridge enables a continual and legible access alongside the creek on it's north bank.
- Another bike bridge spans Hwy 101 as a landmark structure associated with South City Hwy exits
- A suspended boardwalk connects from Mitchell Avenue to the Bay Trail, with landform adapted to increase flood capacity and extend restoration of marshland into an ecotone.





SCENARIO 01

Park

Key Features

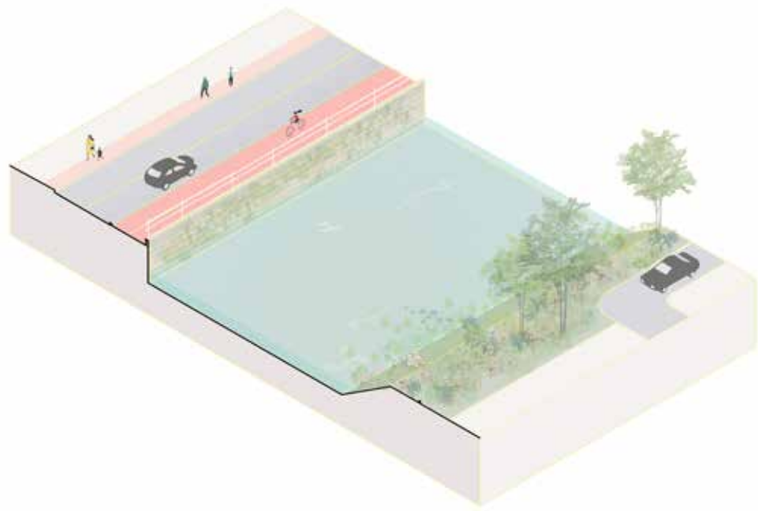
- → Realigned creek route slows water movement and encourages sediment build up for habitat within average daily water levels
- → Slowed water movement enables community creek crossing
- → New habitat created for increased biodiversity & improved water quality
- → Amphitheatre seating invites renewed engagement with creek from adjacent active public recreation areas

Street 01

Key Features

- → Redistributed lanes within existing roadway allows for bike path adjacent to creek
- → New creek crossing opportunities during average daily flow, allowing access to and across the creek
- → Road capacity maintained whilst providing significant public amenity improvements

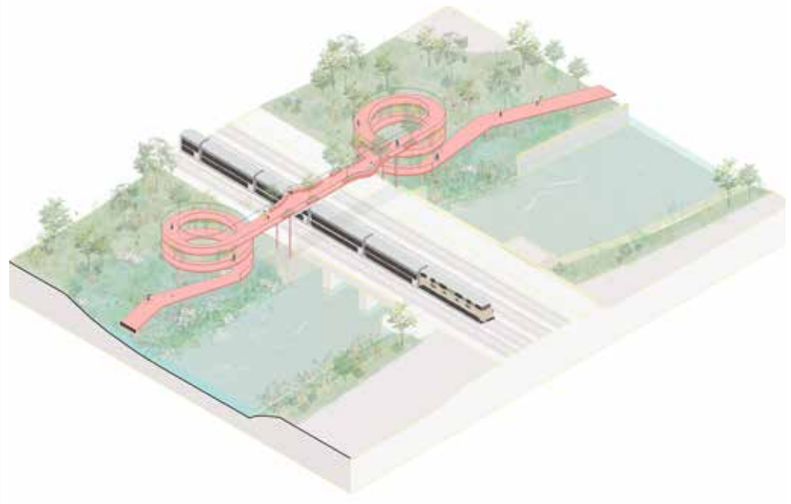
Street 02



Key Features

- → Reconfigured roadway and lanes allows for bike path adjacent to creek, and visual access to water
- → Road capacity maintained with increased cross-sectional capacity for creek
- → Habitat opportunities created in greened creek edges - as well as throughout extended Sister Cities Park
- → Limited vehicular access maintained on South Canal Rd through one-way single lane portion of street

Rail

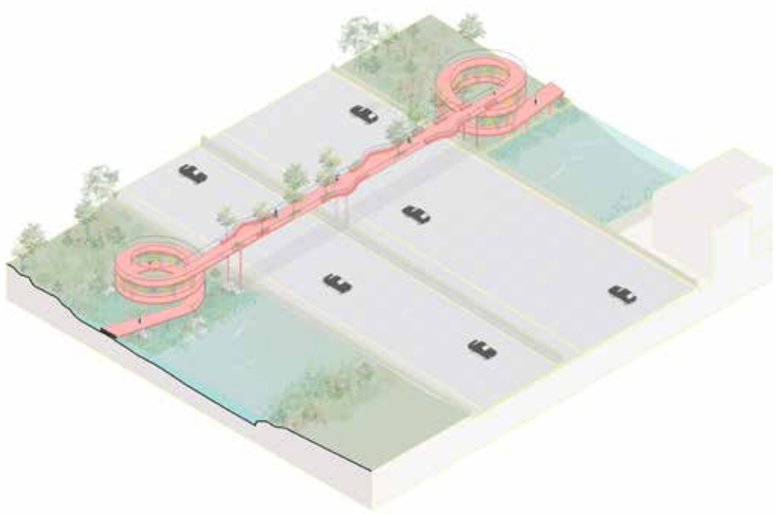


Key Features

- → Bike bridge over rail line (@5deg slope)
- → Adaptation of existing public land within creek corridor to provide shared path access over rail bridge
- → Lowering public land provides expansion of creek flood capacity as well as providing brackish marsh habitat opportunities

SCENARIO 01

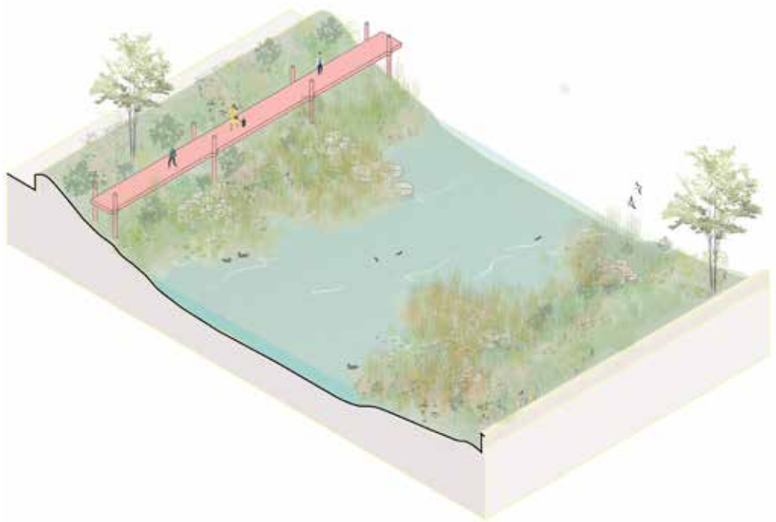
Highway



Key Features

- → Bike/ped bridge over highway
- → Adaptation of existing public land within creek corridor to provide shared path access over bridge
- → Lowering public land provides expansion of creek flood capacity as well as providing brackish marsh habitat opportunities

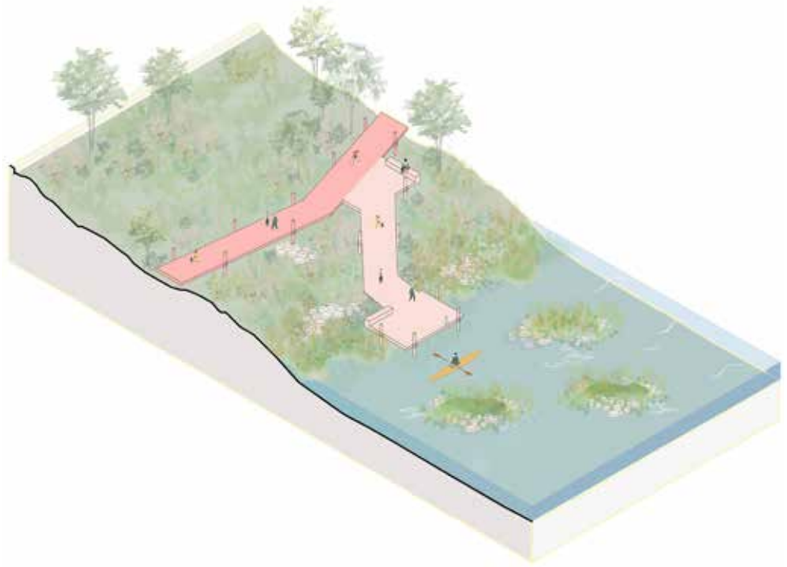
Marsh



Key Features

- → New creekside public access through elevated boardwalk
- → Restored brackish marsh with cut and fill allowing full ecotone transition up to flood protection height
- → Potential for boardwalk to float/ elevate during flood events

Bay



Key Features

- → Boardwalk through expanded inundation zone
- → Habitat designed for inundation and gradual migration with sea-level rise
- → Access to bay edge and kayak launch
- → Living sotrm barriers for wave attenuation and protection from sea level rise

SCENARIO 02

SISTER CITIES TO STREET

17 minutes from Orange to Bay

1.9 miles from Orange to Bay

1.2 miles of creek access

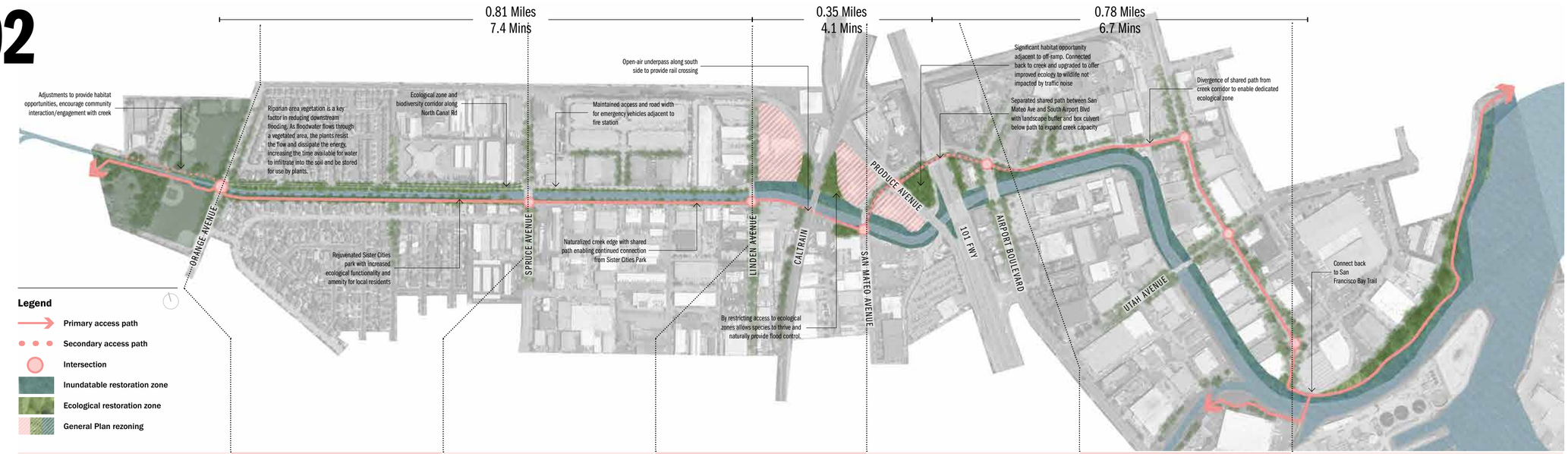
9 intersections

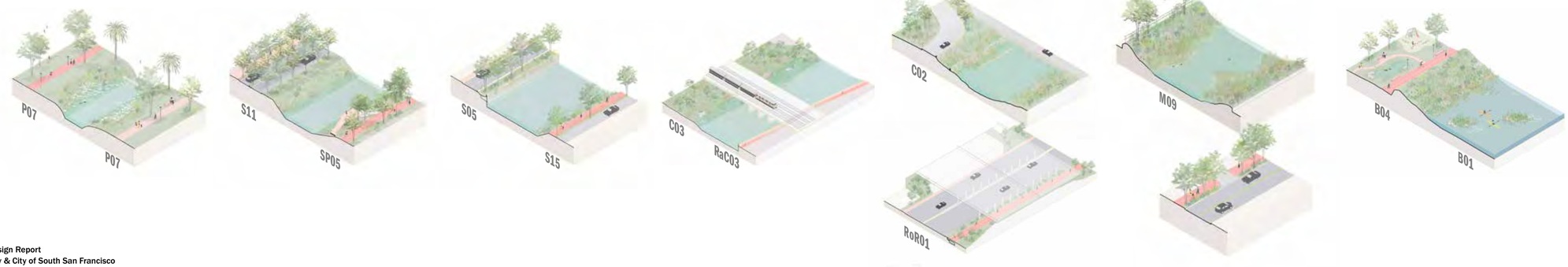
40 acres of improved public amenity

33 acres of connected ecology

Route details:

- Naturalized channel edge and concrete dam within the Park provides for habitat restoration and increased visual access to the canal from adjacent paths. Improvements within the park will slow water and improve water quality, provide greater visual amenity with the creek, and provide habitat and detention opportunities.
- Combining a lowered Sister Cities Park into the creek corridor will integrate ecological value (vegetation and habitat within the creek) and critical increase in cross-sectional capacity. Additional street trees and swales in North Canal offer shade and habitat while a new ped/bike/planting zone along South Canal Rd allows continual active mobility.
- After crossing Linden Ave, a narrow R.O.W is sued along the south side of the creek - crossing beneath Caltrain in a protected underpass.
- At San Mateo Ave, the shared path turns north to cross the river. Rearrangement of lanes along San Mateo Ave, South Airport Blvd under Hwy 101 and through to Mitchell Ave sees the insertion of a separated on-road bi-directional cycleway. Beneath this zone a new culvert expands high flow of the creek across Hwy 101.
- Users then travel along Mitchell Ave to Harbor Way and through the industrial precinct on a new shared path before connecting to the Bay.
- Significant ecological improvements through the marsh section of the creek enable protected habitat restoration.





SCENARIO 02

Park

Key Features

- Softened creek edges and rock edge slows water movement, weir holds a depth suitable aquatic plantlife improving daily water quality
- Slowed water movement enables community creek crossing
- Habitat restoration adding to overall biodiversity within the park
- Softened edges and raised water level provide for better visual connection to the creek from adjacent paths and spaces

Street 01

Key Features

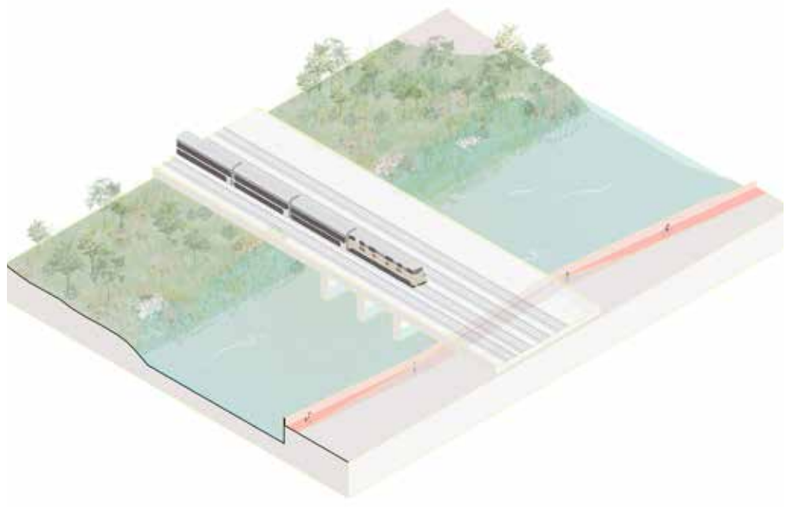
- Reconfigured roadway and lanes allows for more street trees and bioswale, expanding the effective width of ecological corridor across street.
- Softened creek edges slow water movement and provide for aquatic plantlife to improve water quality
- Continuous safe bike/ped shared path through Sister Cities Park
- Lowered Sister Cities Park creates opportunities for closer connection to daily water level as well as expanded flood capacity for the creek

Street 02

Key Features

- Reconfigured North Canal Rd and lanes allows for more street trees and bioswale, expanding the effective width of ecological corridor across street.
- Softened creek edge on South slows water movement and provides for aquatic plantlife to improve water quality. Creek section expanded for increased flood capacity
- Continuous separated bike/ped shared path created along South Canal Rd, for creekside access.
- A single (wide) lane preserved on South Canal Rd for vehicular movement

Rail

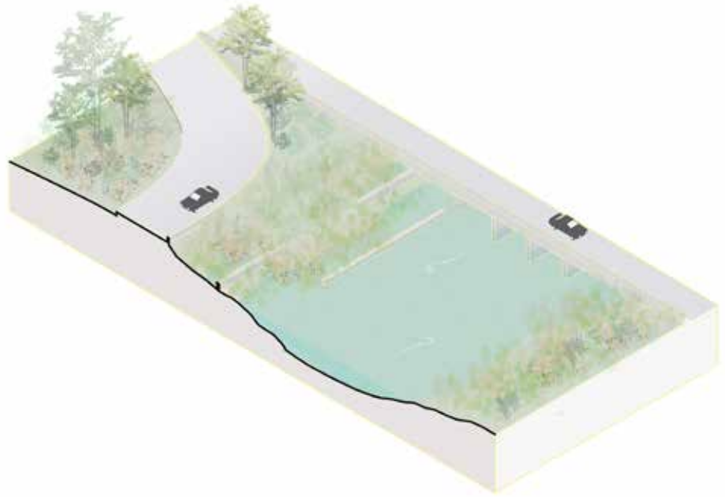


Key Features

- Adapted R.O.W on south side of creek to provide 5 degree ramped underpass for bike/ped
- Lowered public land on north side provides brackish marsh restoration as well as increased flood capacity

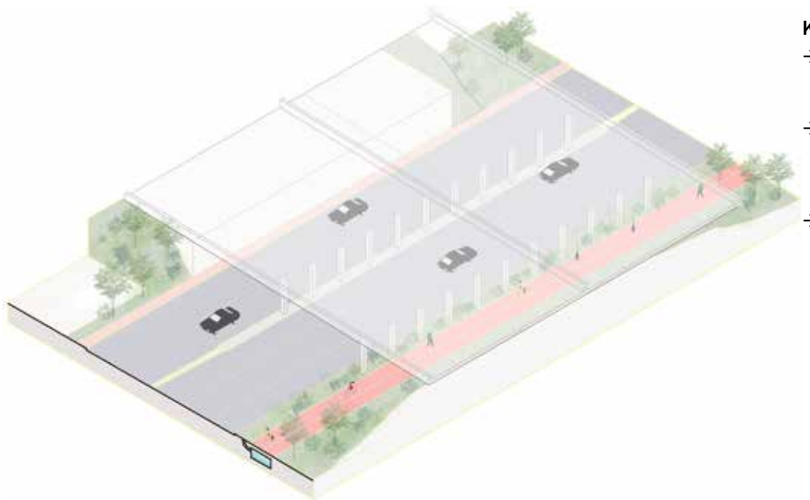
SCENARIO 02

Highway



Key Features

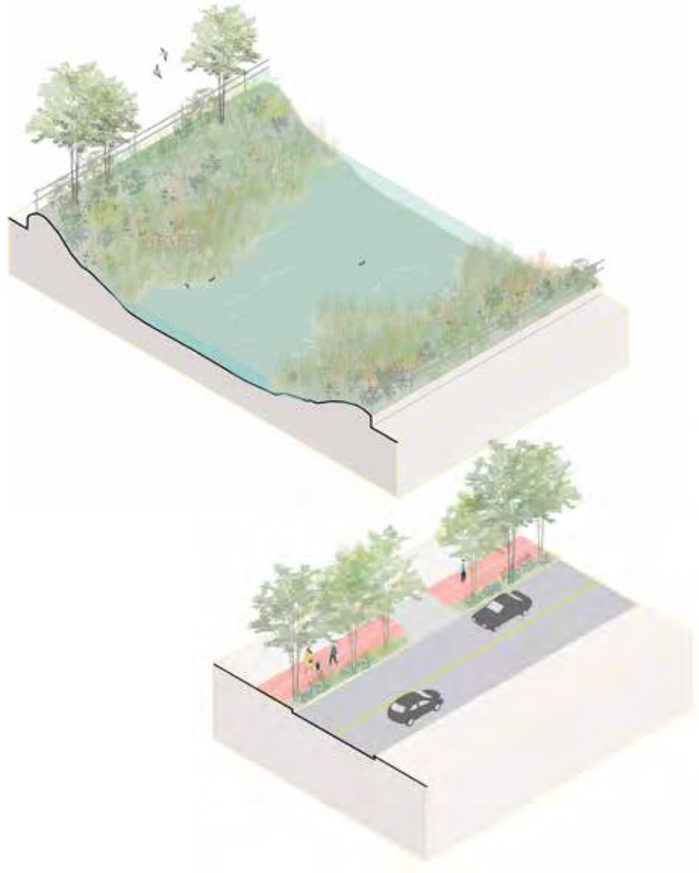
- Expanded tidal marsh zone on both sides of the creek, through relocating tidal wall to outer edge of public land.
- Expanded flood capacity within tidal zone
- Adaptation of vacant land around freeway exit to provide for treatment of runoff



Key Features

- Rearrangement of lanes for insertion of a separated shared path.
- Bridge structure provides for additional excavation on South side for buffer separated bike/ ped
- New box culvert created under cycleway for additional creek flood capacity under 101

Marsh



Key Features

- Restoration of ecotone through the marsh section of the creek creating protected habitat through section without public access.
- Cut and fill to expand flood capacity within creek

Key Features

- New shared bike/ped path within road reserve
- Swale landscape buffer separating from maintained 2-way carriageway

Bay

Key Features

- New horizontal levee provides protection from sea-level rise and flood
- Living storm barriers create protected habitat and reduce impact of waves/storm surge on shoreline
- Potential fresh water detention on park-side

SCENARIO 03

RAILS TO TRAILS

19 minutes from Orange to Bay

2 miles from Orange to Bay

1.4 miles of creek access

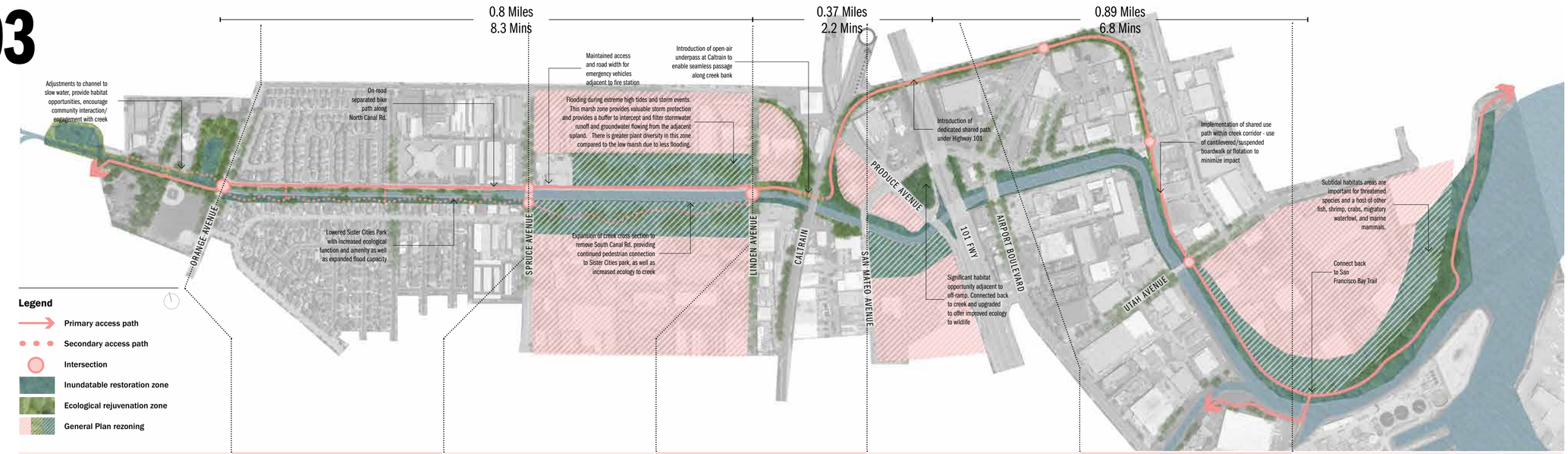
6 intersections

81 acres of improved public amenity

76 acres of connected ecology

Route details:

- Naturalized creek edges and new wetland edge on northern side of the creek. Informal playing fields lowered to provide stormwater detention for overland flow and detention with new operable weir.
- Bike access on the north of the creek between Orange Park and Caltrain, utilising existing road reserve. Sister Cities park is lowered to expand creek cross-section and provide critical habitat opportunities for creek wildlife.
- New public spaces created on both sides of the creek in conjunction with upzoning and redevelopment. Parks set below street level for detention and flood mitigation.
- Vacant and disused public land adjacent to the rail corridor is connected to the creek for expanded water detention and ecology. In conjunction with new Caltrain corridor underpass which overs expanded high flow capacity for the creek
- The Union Pacific freight line is partially transformed into a new linear park, with shared access path, new vegetation and ecology (maintaining rail use on half the corridor until being decommissioned). Returning to the creek down existing Union Pacific RoW.
- Mitchell Ave focuses on expanding creek cross-sectional capacity and adapting the public space to better service creek ecology.
- The access path is then continues over Mitchell Ave within Union Pacific R.O.W adjacent to existing flood wall, to the Bay and Bay Trail.



SCENARIO 03

Park

Key Features

- Naturalized creek edges and new wetland edge on northern side of the creek to provide new habitat, flood capacity and amenity
- Informal playing fields lowered to provide stormwater detention for overland flow and detention with new operable weir.
- Weir creates daily water depths suitable for aquatic plant life to improve water quality.

Street 01

Key Features

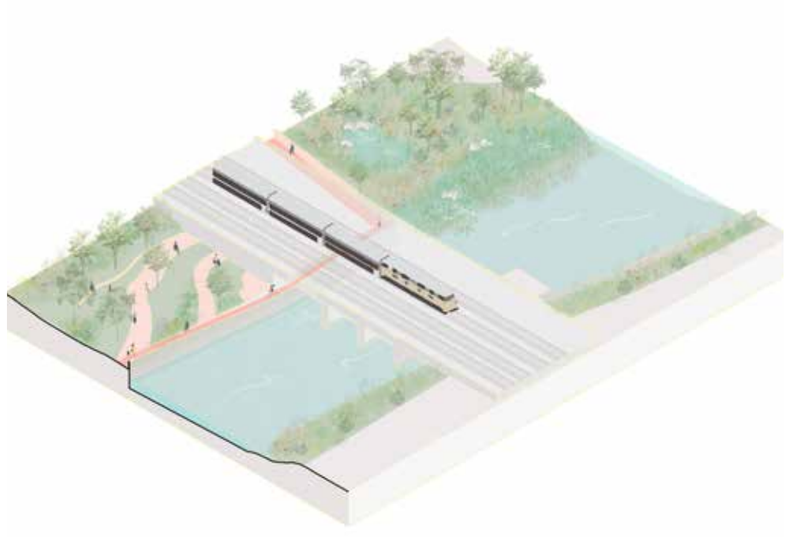
- Reconfigured roadway and lanes allows for separated bike path adjacent to creek
- Naturalized creek edges and new creek crossing opportunities during average daily flow provide for access to the creek as well as new habitat within tidal zones
- Lowered Sister Cities Park increases flood capacity within the creek
- Road capacity maintained whilst providing access immediately adjacent on both sides of the creek

Street 02

Key Features

- Continuous bike/ped paths on north and south of creek
- New tidal habitat created through setting boulders within existing concrete section, meandering flow and improving water quality
- Tidal brackish marsh zones created on south side of the creek, connecting to new detention park

Rail

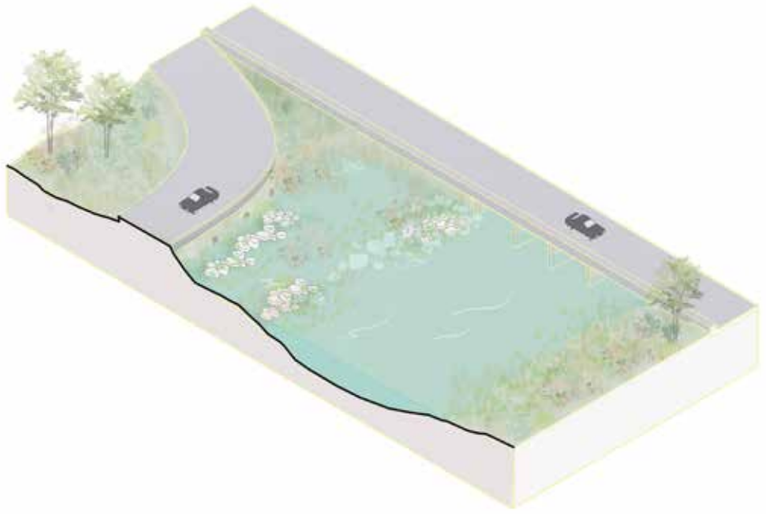


Key Features

- New ramped bike/ped underpass which can provide increased capacity in flood
- Terraced landscape for detention and new tidal marsh habitat on public land north of creek
- Increased amenity for planned medium density residential north of the creek

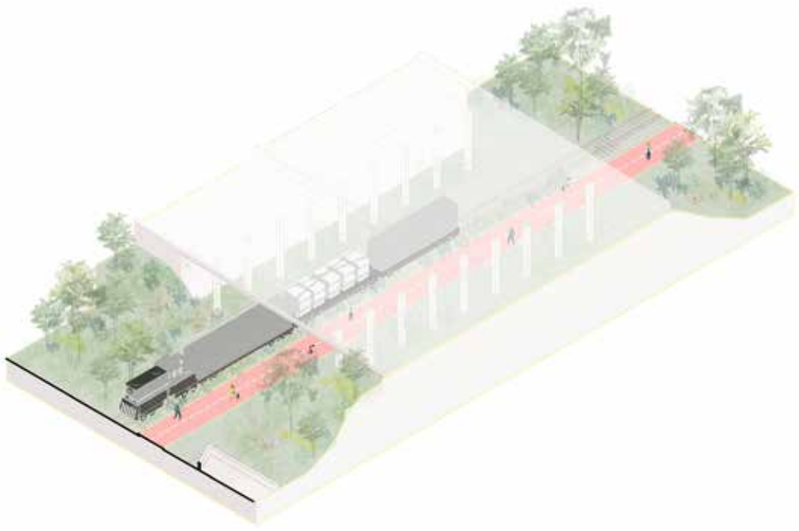
SCENARIO 03

Highway



Key Features

- → Expanded tidal marsh zone on both sides of the creek, with piped connections through to freeway exit island for expanded habitat and detention.
- → Expanded flood capacity within tidal zone
- → Adaptation of vacant land around freeway exit to provide for treatment of runoff



Key Features

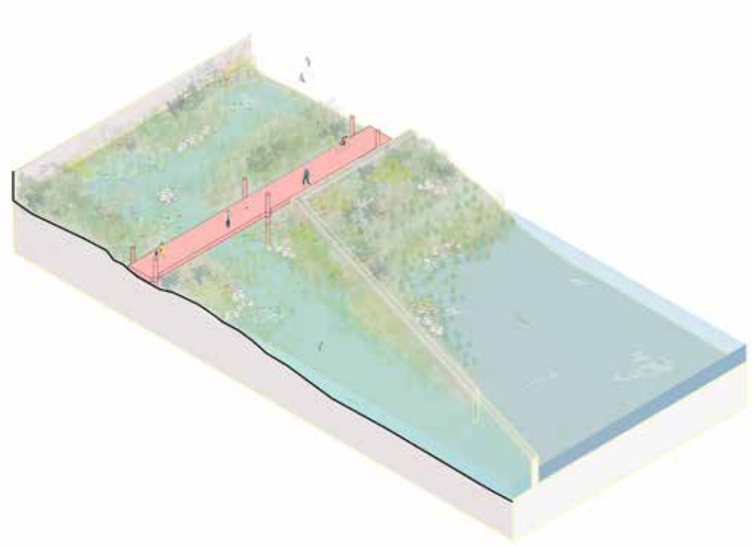
- → Partially adapted freight corridor for shared path connection
- → Planted buffers with maintained freight line (rarely used)
- → New planting and swales within corridor to manage runoff

Marsh

Key Features

- → Shared path located on Union Pacific R.O.W along with new trees for shade
- → Expanded brackish marsh and ecotone through excavated sediment
- → Increased flood capacity within creek

Bay



Key Features

- → Operable storm barrier for protection against king tide during future sea-level rise scenarios
- → Fresh water detention within parkland
- → Salt water marshland at base of horizontal levee which allows for treatment of pumped detained fresh water


XTRA

MARSHY EDGE

Refer pp. 228 - 235

DELIVERY ROADMAP

The segments of the various scenarios are interchangeable for maximum flexibility in the delivery stages of this project. Different cost and regulatory barriers exist to different design moves, as well as different funding opportunities. This chapter lays out this implementation landscape for the pieces of the previous scenarios, as well as focusing in on defining short, medium and long term project opportunities.

SCENARIO ASSESSMENT

	Park	Street 01	Street 02	Rail	Hwy	Marsh	Bay
Existing: Key Opportunities & Challenges	Large adjacent public land	No tidal influence and sloped creek sides	Likely land use change adjacent to the creek with upzoning in General Plan Update	Adjacent publicly owned land and current development applications	Existing underpasses that could be adapted for bike and pedestrian access (Freight Line & South Airport Blvd)	Remnant marsh for restoration. Continuous Union Pacific R.O.W for connection to Bay Trail	The Bay Trail, public parkland and existing Ridgeway Rail population
	Physical and visual access to the water. Concrete channel with poor water quality	Distance from access to the water. Concrete channel with poor water quality	Distance from access to the water. No ped/bike access adjacent to the creek. Vertical concrete walls	No public access to or along creek. Vertical concrete walls	No public access to or along creek. Large number of roads crossing the creek	Non-continuous public access. Invasive species and trash collecting on banks	Sea-level rise risk.
Scenario 1: Delivery Opportunities & Constraints	Full project control of project by Parks & Rec. strong case for benefit of access to water by sports community	Existing road width provides for multi-use path on North Canal Rd, maintaining number of vehicle lanes. Sister Cities park can be lowered for additional flood capacity	Existing road width provides for multi-use path on North Canal Rd, maintaining number of vehicle lanes	Direct and legible connection on North Side of Creek. Publicly owned sites for adaptation	Direct access can be maintained adjacent to creek. Visible ped/bike connection over Hwy 101 provides opportunity for CalTrans investment	Reshaping of banks has potential to reduce flood risk. New public access could directly extend Bay Trail from shoreline to Hwy 101	Adaptation of publicly owned land
	Safety of public access will need to be ensured	Access to the water's edge could likely not be delivered as ADA accessible	Cycleway cannot be separated at firestation for turning radius. Small section of South Canal Rd maintained as one-way street for access to a handful of properties	Expensive and complex structure	Expensive, long-span, and complex structure	Potential complex approvals with BCDC due to movement of fill and boardwalk structure	Potential complex approvals with BCDC related to storm barrier islands fill
Scenario 2: Delivery Opportunities & Constraints	Full project control of project by Parks & Rec. Habitat restoration will provide for grant funding opportunities to deliver amenity	Adequate space within North Canal Rd and Sister Cities Park for new trees around access requirements	Adequate width within both North Canal and South Canal Rds	Publicly owned land on north side of Creek and flood benefits creating grant opportunities	Combined public access and flood mitigation project on South Airport Blvd will access funding opportunities	Increased restoration grant opportunities without direct public access	Adaptation of publicly owned land
	Integration of existing trees/habitat with restoration	Trees on North Canal are constrained by existing services. ADA accessible path in Sister Cities Park cannot be lowered for expanded flood capacity	Existing services within North Canal Rd. Negotiations with property owners on South Canal Rd	Narrow R.O.W on south side of Creek, may be difficult to construct	Challenging intersection with bike/ped conflicting with Hwy 101 access	Limited space on Harbor Way for bike/ped and street trees. Not direct public access to creek	Potential complex approvals with BCDC related to horizontal levee and storm barrier islands fill
Scenario 3: Delivery Opportunities & Constraints	Full project control of project by Parks & Rec. Habitat restoration & flood mitigation impacts will provide for grant funding opportunities	Integrated water quality, restoration, flood mitigation impacts will broaden grant opportunities	Alignment with general plan scenarios for upzoning. Opportunities for development contributions to fund adaptation	Integrated public access, flood mitigation and restoration proposal using only publicly owned land and adjacent to increasing residential population	Singular Union Pacific R.O.W connecting all the way to the Bay Trail	Singular Union Pacific R.O.W connecting all the way to the Bay Trail. Expanded flood capacity and restoration provides access to more grant funding	Adaptation of publicly owned land
	Community fears around floodable parkland	Investment required to change landform on South side	Requires incentives to consolidate lots and careful planning to capture contributions	Expanding Caltrain bridge span without interrupting operations may be complicated	Existing users of freight service East of 101	Adjacent property owners using R.O.W and BCDC approvals for altering sediment in creek	Delivery challenges relate to any interruption of tidal habitat associated with storm barrier
Alignment with future projects & General Plan Update	Current stormwater capture project is likely to start too soon to align any creek access improvements, but our proposals do not conflict with existing plans	Key connection between approved and planned new residential population to the east and Orange Memorial Park to the West. Critical to save pedestrian and bike connections to the park	Rezoning of sites on both sides of the creek opens opportunities required landscape setbacks with detention capacity	Current development applications for three sites on North of Creek between Linden Produce Ave indicates a growing residential population fronting the creek	New Utah Ave exits/access to Hwy 101 provides opportunities for rework of what is recognized as a problem exit	San Mateo County proposal for additional flood protection could be adjusted to align with public access objective on West side of creek. Current City negotiations with Union Pacific could be expanded	Future expansion of Genentech's campus and potential rezoning of shoreline industrial land to R&D is an opportunity to plan and fund shoreline adaptation to SLR
Project Owners	SMC Flood & SLR Resiliency District, SSF Parks & Rec	SMC Flood & SLR Resiliency District, SSF Public Works	SMC Flood & SLR Resiliency District, SSF Public Works	SMC Flood & SLR Resiliency District, SSF WQCP, Union Pacific	SMC Flood & SLR Resiliency District, Caltrans	SMC Flood & SLR Resiliency District,Union Pacific	SMC Flood & SLR Resiliency District, BCDC
Additional Stakeholders	CalWater, CalTrans (funding current water quality project), Community Sports Assoc.	SSF Parks & Rec	BCDC, Adjacent Property Owners, Cal Fish & Wildlife	BCDC, Caltrain, Adjacent property owners & new residents	BCDC, SSF Public Works	BCDC	SSF Parks & Rec, Adjacent Property Owners

GRANT FUNDING

The successful delivery of the project will rely on accessing grant funding from regional, state and federal government agencies. The project objectives align with current best practice in creek restoration as well as the environmental and social impact aligning with the mission of many established grant programs.

Grants related to urban greening, habitat restoration, water quality improvement and increased open space are listed below from organizations such as The Bay Restoration Authority, California State Coastal Conservancy and California Natural Resources Department. Flood mitigation funding is available through the Federal Emergency Management Agency (FEMA). And grants aimed at public access and active mobility are identified from MTC, BART and the Federal Department of Transport.

Significant grant funding is available for flood mitigation through nature-based solutions, especially when these proposals create habitat and/or floodplains that are accessible to fish and bird species. Public access is also a major opportunity to attract outside funding when providing connections that link to broader regional infrastructure like the Bay Trail and CalTrain station.

Restoration/Parks/Water

Measure AA (2016)
http://sfbayrestore.org/restoration-authority-grants

Parks & Water Bond Act – Proposition 68 (2018)
https://www.parks.ca.gov/?page_id=29906

SF Bay Area Climate Ready Grants - Proposition 68 (2018)
https://scc.ca.gov/grants/proposition-68-grants/

Proposition 1 Grants
https://scc.ca.gov/grants/proposition-1-grants/

National Fish Habitat Partnership
https://www.fhwa.dot.gov/specialfunding/stp/

CA Natural Resources – Urban Greening Grant Program
https://resources.ca.gov/grants/urban-greening/

Flood

FEMA flood Mitigation Assistance Grant Program
https://www.fema.gov/flood-mitigation-assistance-grant-program

Access/Transportation

Active Transportation Program
https://mtc.ca.gov/our-work/invest-protect/investment-strategies-commitments/protect-our-climate/active-transportation

Climate Initiatives Program
https://mtc.ca.gov/our-work/fund-invest/investment-strategies-commitments/protect-our-climate/climate-initiatives

Recreational Trails Program
https://www.fhwa.dot.gov/environment/recreational_trails/

Surface Transportation Block Grant
https://www.fhwa.dot.gov/specialfunding/stp/

Congestion Mitigation and Air Quality Improvement Program (CMAQ)
https://www.fhwa.dot.gov/environment/air_quality/cmaq/

Safe Routes to BART (SR2B) – Measure RR
https://www.bart.gov/about/planning/safe-routes

Caltrans Sustainable Communities Grants
https://dot.ca.gov/programs/transportation-planning/regional-planning/sustainable-transportation-planning-grants

Union Pacific Foundation Grants
https://www.up.com/aboutup/community/foundation/local-grants/index.htm

One Bay Area Grant
https://mtc.ca.gov/our-work/fund-invest/investment-strategies-commitments/focused-growth/one-bay-area-grants

Bay Area Water Trail Grant Program
https://scc.ca.gov/webmaster/project_sites/watertrail/water-trail-grant-program.pdf

IMPLEMENTATION ROADMAP

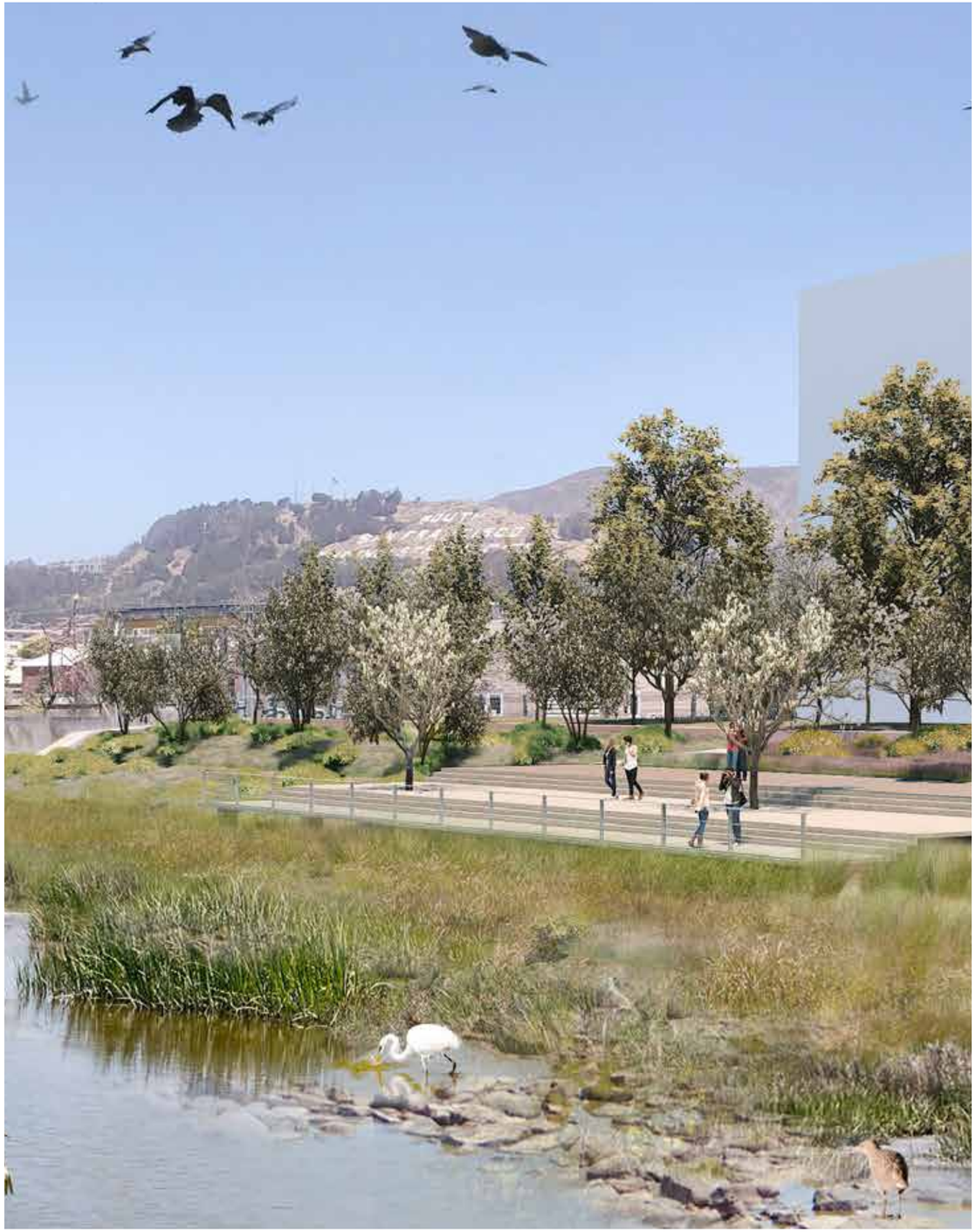
Project description	Potential Project Partners
	Potential Grant Contributors

Design test project (see following chapter)

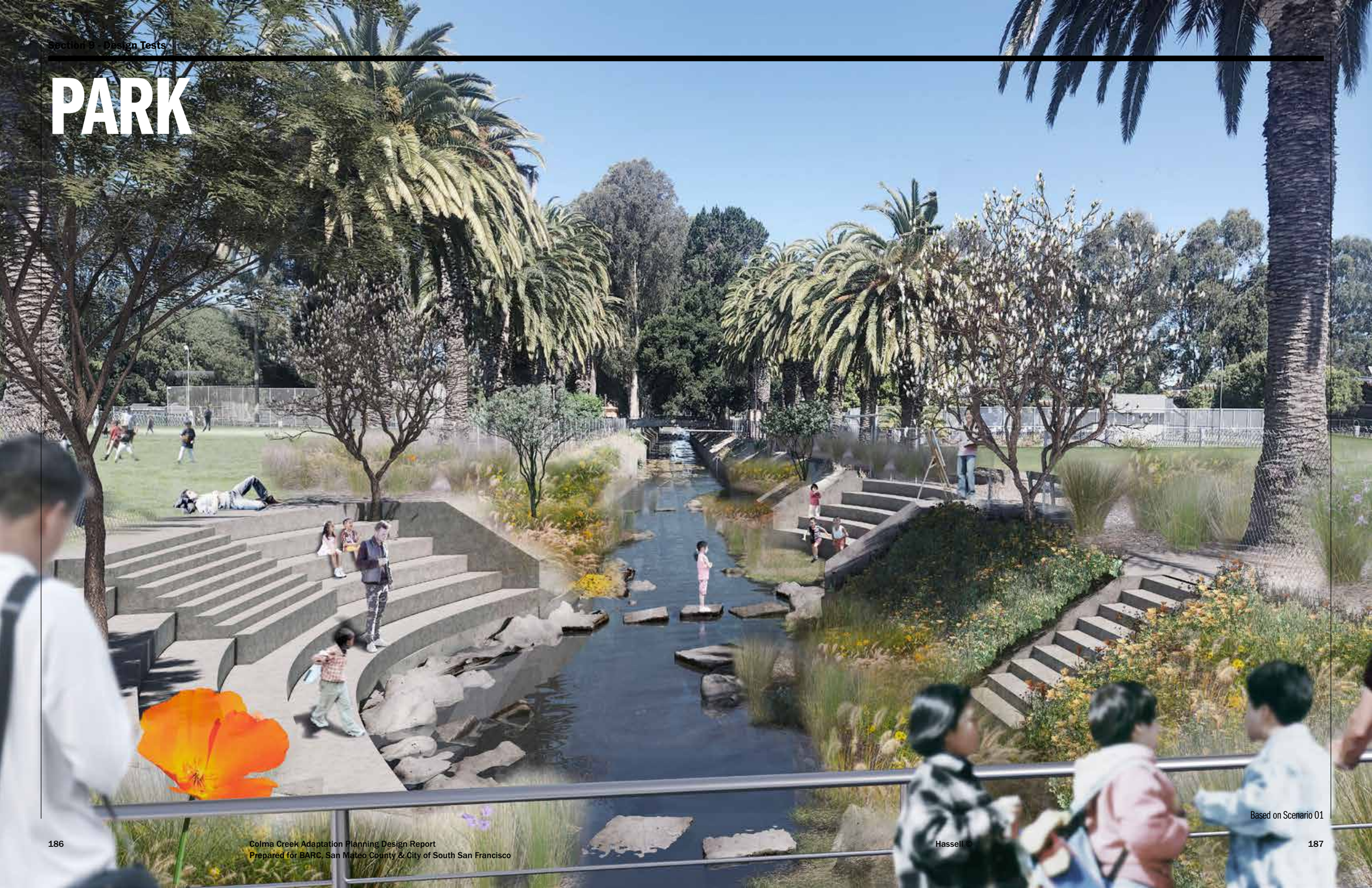
	Short term / Start-up		Medium Cost / Impact		High Cost / Impact	
Park	Water quality improvements through rocky weirs and low-flow interventions	SSF Parks & Rec CalTrans, SCC, SFBRA	Terraced seating, water access as well as rocky weirs for water quality improvements	SSF Parks & Rec SCC, SFBRA	Freshwater wetland, operable weir and above ground detention within park	SSF Parks & Rec Caltrans, SCC, Cal Fish & Wildlife, FEMA
	New pedestrian bridge crossing	SSF Parks & Rec CalTrans	Widened and naturalized creek profile with limited public access to new habitat	Cal Fish & Wildlife, Cal Coastal Conservancy	Subsurface detention tank for flood control	 Caltrans, FEMA
Street 01	Painted bikeway on North Canal Rd, relocated centerline	SSF Public Works MTC, BAAQMD	Demonstration restoration project, slope changes and habitat creation along Sister Cities Park	SSF Parks & Rec, SSF Public Works SCC, SFBRA	Widened and greened creek profile, water access and quality improvements as well as lowered Sister Cities Park	SMC Public Works SCC, SFBRA, FEMA
	Demonstration restoration planting and upper edge changes within Sister Cities Park	SSF Parks & Rec SCC, SFBRA	Rework of North Canal Rd: Street trees, bioswale and separated multiuse path	SSF Public Works MTC		
Street 02	Painted bikeway on North Canal Rd, relocated centerline	SSF Public Works 	Rework of North Canal Rd: Street trees, bioswale and separated multiuse path	SSF Public Works MTC	Partial removal of South Canal Rd and introduction of low-level paths and parkland as continuation of Sister Cities Park	Property owners, SSF Parks & Rec
	Temporary closures of South Canal Rd (e.g Parks Alive Streets Alive Festival)	SSF Public Works, SSF Parks & Rec 	Rework of South Canal Rd with ped/bike lane adjacent to creek with new street trees and bio-swale	SSF Public Works MTC	Removal of South Canal Rd along with redevelopment of sites south of the creek, including new floodplain public park	 SCC, SFBRA, FEMA, Developers
Rail	Public artwork marking distance to the shoreline and highlighting planned public access (potentially on existing gas station silos)	SSF WQCP, Gas Station Owner 			Ped/bike bridge over new tidal marsh parkland	CalTrain Caltrain, MTC
	Temporary public access to creek in partnership with adjacent residential developments	SSF WQCP, SSF Public Works, Adjacent Developers 			Floodable pedestrian/bike underpass and adjacent parkland and tidal marsh zones	CalTrain FEMA, MTC
Hwy	Public artwork marking distance to the shoreline and highlighting planned public access (vertical structure visible from freeway)	 MTC	Partial conversion of Union Pacific freight corridor into trail for bike/ped access under Hwy 101	Union Pacific UP, MTC, CalTrans, BAAQMD	Pedestrian bridge over Hwy 101	Caltrans Caltrans, MTC
	Temporary fencing and access along Union Pacific freight rail line, as trial rails to trails project	Union Pacific, SSF Public Works MTC, BAAQMD	Rework of South Airport Blvd for ped/bike access under Hwy 101, including box culvert beneath bike path for additional flood capacity under 101	SSF Public Works, CalTrans MTC, CalTrans, BAAQMD	Additional brackish marsh restoration and flood capacity on adjacent vacant land through re-work of exit from Hwy 101	CalTrans SCC, SFBRA, CalTrans
Marsh	Gravel public access trail from Mitchell Rd to Utah Ave (Stair over existing wall at Mitchell)	SMC Public Works MTC	Removed terrestrial vegetation and sediment to restore ecotone on east bank and increase flood capacity	 SCC, SFBRA	Ecotone restored along with new floodwall and public access on Union Pacific R.O.W	SMC Public Works SCC, SFBRA, CalTrans, MTC, FEMA
	Community planting days for removal of invasives and restoration of native plants	SMC, San Bruno Mountain Watch MTC	New pubic access path along Union Pacific R.O.W	MTC, Union Pacific MTC, CalTrans, BAAQMD		
Bay	Outdoor classroom pod on shoreline	SMC, San Bruno Mountain Watch MTC	Widened creek mouth and expanded marsh/ ecotone through cut/fill and relocation of Bay Trail	SMC Public Works SCC, SFBRA, FEMA	Widened creek mouth, expanded marshland with access boardwalks and horizontal levee for flood & SLR protection	SMC Public Works SCC, SFBRA, FEMA
	Community planting days for removal of invasives and restoration of native plants	SMC, San Bruno Mountain Watch MTC			Storm gate, horizontal levee and freshwater wetland on landside	USACE FEMA, USACE

DESIGN TESTING

Conceptual designs have been prepared to test the application of the toolkit and scenarios to specific site conditions along the creek. Proposals attempt to illustrate the detailed adaptation of a number of key sites, communicating both technical and immersive aspects of how the toolkit approach lands on these sites.

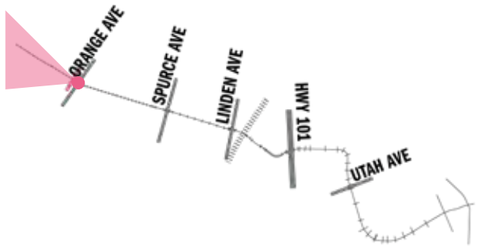


PARK



Based on Scenario 01

PARK



BEFORE

AFTER

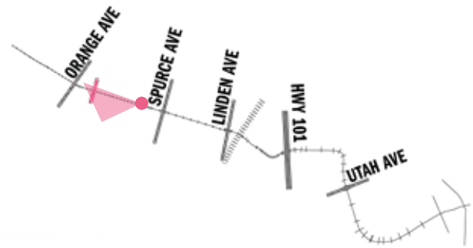
Opening the creek to the park. This proposals brings people right down to the creek edge through stepped seating edges, integrating this key waterway back into Orange Park. Sections of the creek are softened with the new vegetation and rocky edges providing new habitat for fauna and flora. The creek meanders past rocky outcrops and terraced seating, cleaning the water and prodiving diverse opportunities for engagement with the creek.

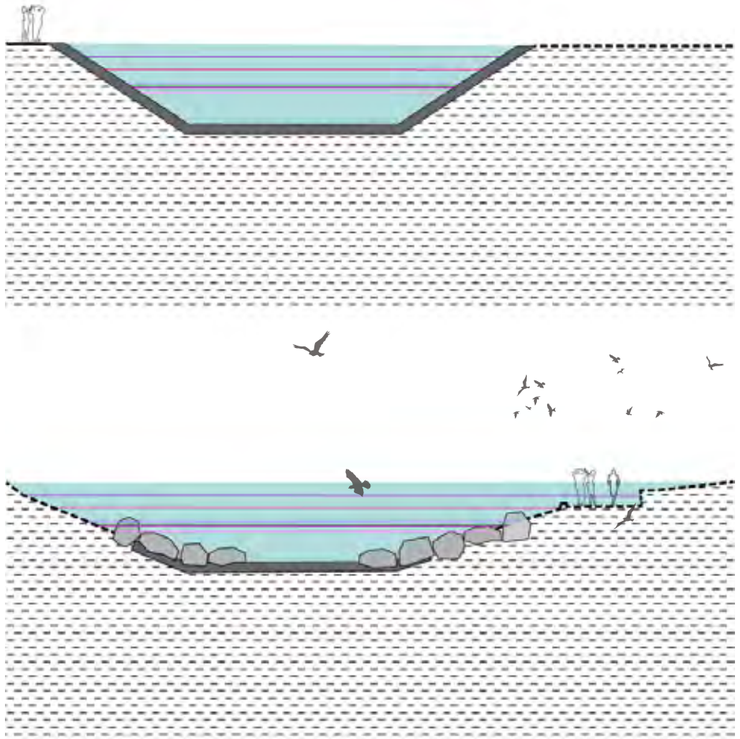
CREEK PARK

The transformation of the existing street, creek and Sisters Cities Park between Orange Avenue and South Spruce Avenue into a linear, floodable parkland.

CHARACTER AREA - STREET 1

KEY SECTION - 03





EXISTING VOLUME

PROPOSED VOLUME

32%
increase in creek capacity/volume

2ac
gray to green transformation

Based on Scenario 01

CREEK PARK

100 Year Flow Climate Change
100 Year Flow
10 Year Flow
2 Year Flow
Daily/Tidal Water Levels

1. Planted embankment - riparian scrub species
2. Viewing platform
3. Rocky edge and freshwater marsh planting
4. Daily water level
5. Street swale - water collection and treatment
6. Street tree planting
7. Shared path
8. Riparian meadow planting
9. Existing concrete base retained

Detail area

North Canal Street

Creek Park

Sister Cities Park

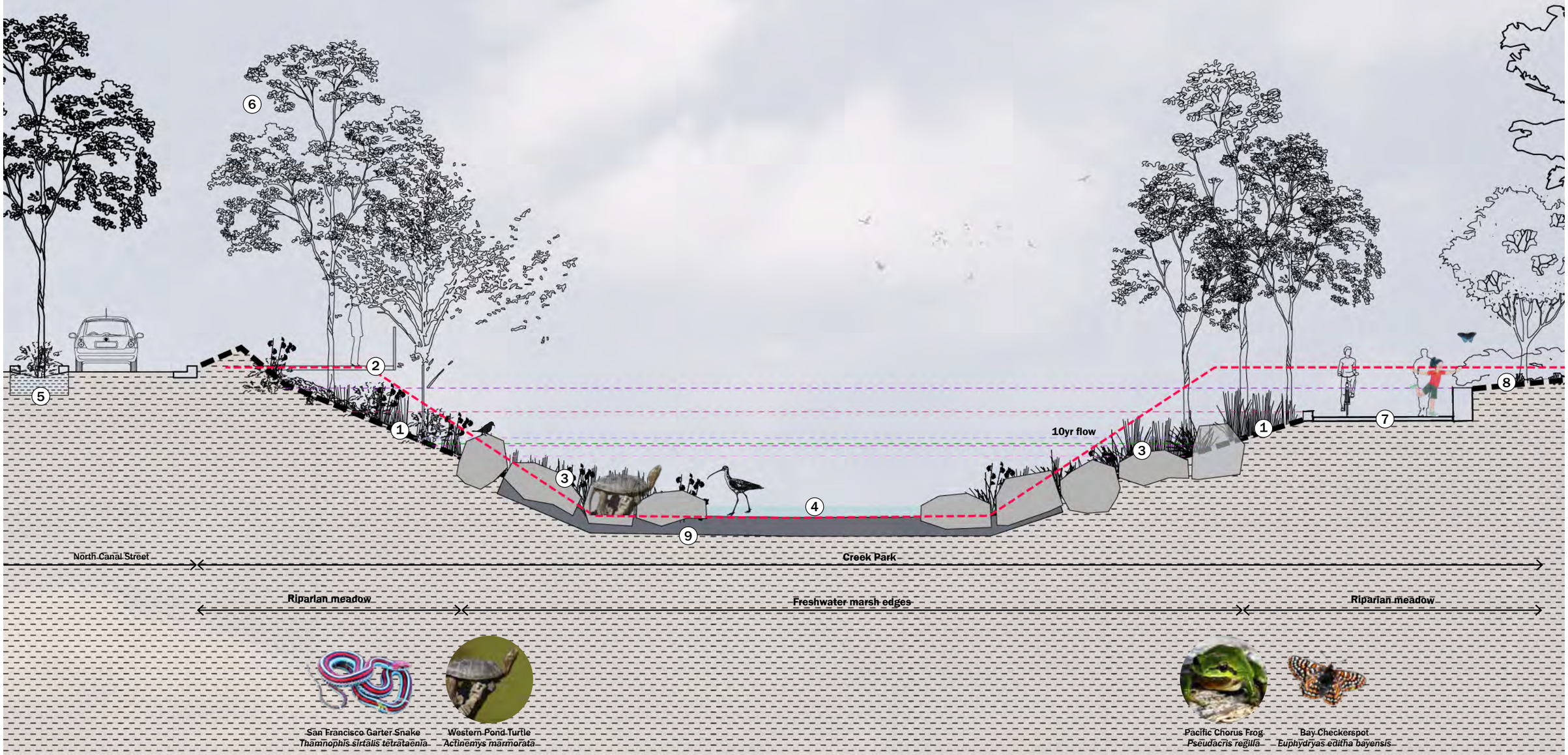
Freshwater Marsh

Shared Path

CREEK PARK

100 Year Flow Climate Change
100 Year Flow
10 Year Flow
2 Year Flow
Daily/Tidal Water Levels

1. Planted embankment - riparian scrub species
2. Viewing platform
3. Rocky edge and freshwater marsh planting
4. Daily water level
5. Street swale - water collection and treatment
6. Street tree planting
7. Shared path
8. Riparian meadow planting
9. Existing concrete base retained



San Francisco Garter Snake
Thamnophis sirtalis tetrataenia

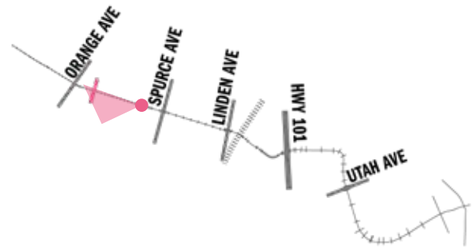
Western Pond Turtle
Actinemys marmorata

Pacific Chorus Frog
Pseudacris regilla

Bay Checkerspot
Euphydryas editha bayensis

CREEK PARK

CREEK PARK



Allowing people to be next to and close to the water... this proposal introduces ped/bike access along the northern edge of the creek, expands the creek capacity with a lowered Sister Cities Park, softens the sides and introduces rocky edges for habitat and access down to the water's edge. More trees line the paths for pedestrian shade and comfort, while native plants and flowers bring back the bird life and butterflies to entertain passers-by. Street and creek become a singular green corridor.

BEFORE

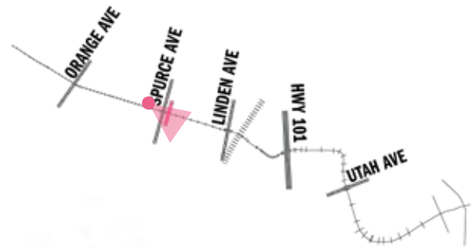
AFTER

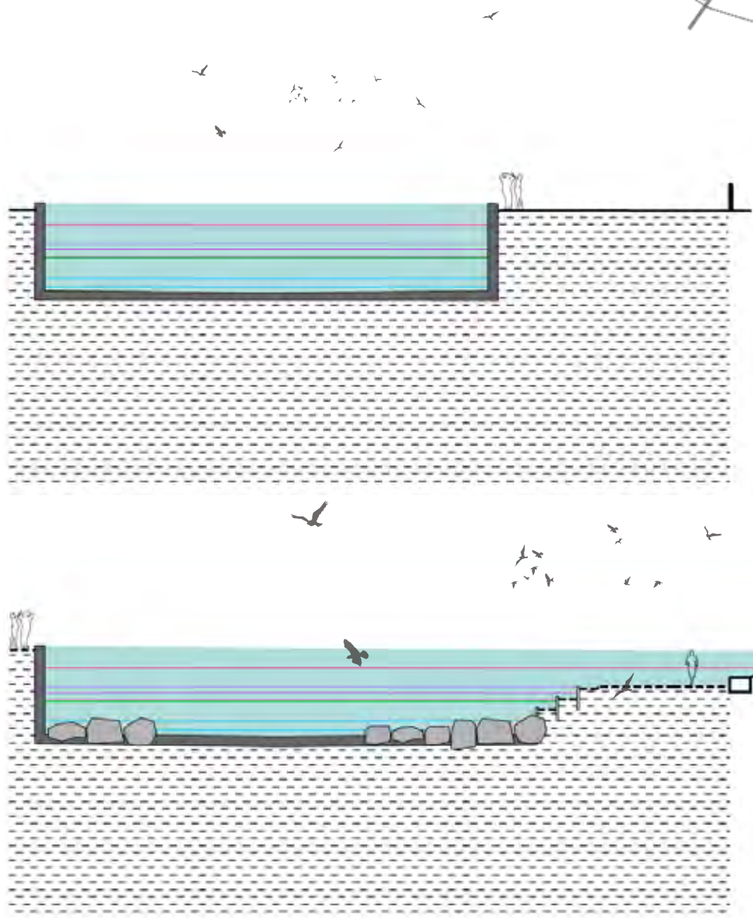
EXPANDED FLOODPLAIN

The transformation of the existing creek and streets - both North Canal and South Canal between South Spruce Avenue and South Linden Avenue into a linear, floodable parkland.

CHARACTER AREA - STREET 2

KEY SECTION - 05





EXISTING VOLUME

PROPOSED VOLUME

32%

increase in creek capacity/volume

1.8ac

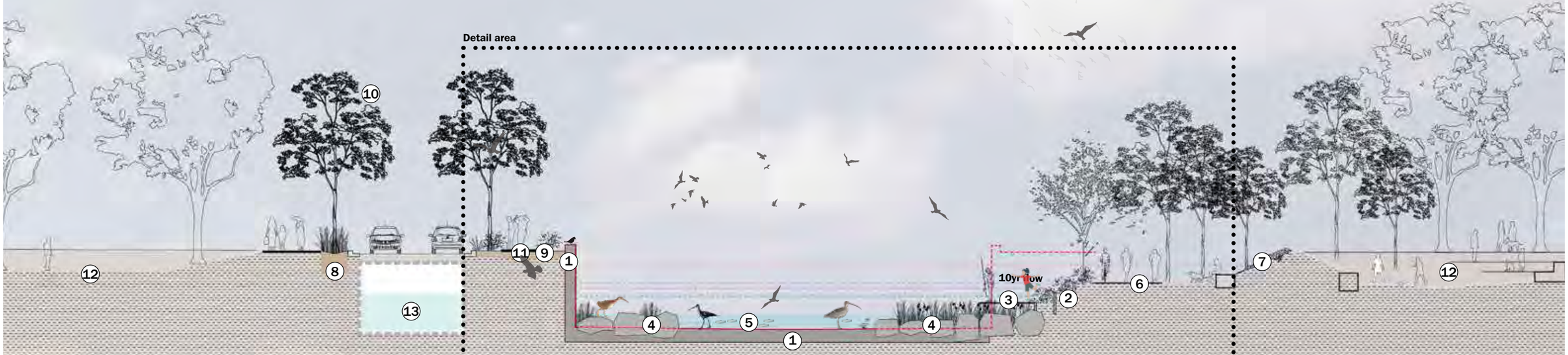
gray to green transformation

Based on Scenario 01

EXPANDED FLOODPLAIN

- 100 Year Flow Climate Change
- 100 Year Flow
- 10 Year Flow
- 2 Year Flow
- Daily/Tidal Water Levels

1. Existing floodwall and channel base (retained)
2. Stepped, retaining wall edge planted with riparian scrub species
3. Viewing platform
4. Rocky edge and brackish marsh planting
5. High Tide zone
6. Shared path
7. Berm edge planted with riparian meadow species
8. Street swale - water collection and treatment
9. Expanded street verge planted with riparian meadow species
10. Street tree planting
11. Creek-edge sidewalk
12. Future 'floodable' park space
13. Possible water detention beneath street



Street Swale

Brackish Marsh

Shared Path and Creek Edge Access

Future 'Floodable' Park Space

EXPANDED FLOODPLAIN

- 100 Year Flow Climate Change
- 100 Year Flow
- 10 Year Flow
- 2 Year Flow
- Daily/Tidal Water Levels

1. Existing floodwall and channel base (retained)
2. Stepped, retaining wall edge planted with riparian scrub species
3. Viewing platform
4. Rocky edge and brackish marsh planting
5. High Tide zone
6. Shared path
7. Berm edge planted with riparian meadow species
8. Street swale - water collection and treatment
9. Expanded street verge planted with riparian meadow species
10. Street tree planting
11. Creek-edge sidewalk

Bay Checkerspot
Euphydryas editha bayensis

Longfin Smelt
Spirinchus thaleichthys

Long Billed Curlew
Numenius americanus

California Ridgway's Raill
Rallus crepitans

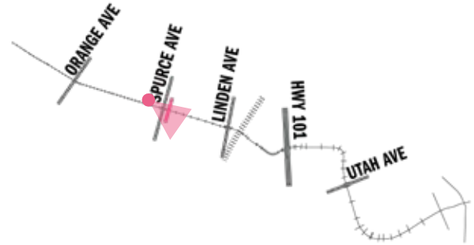
Ridgway's Rail
Rallus obsoletus

Western Pond Turtle
Actinemys marmorata

Pacific Chorus Frog
Pseudacris regilla

EXPANDED FLOODPLAIN

EXPANDED FLOODPLAIN



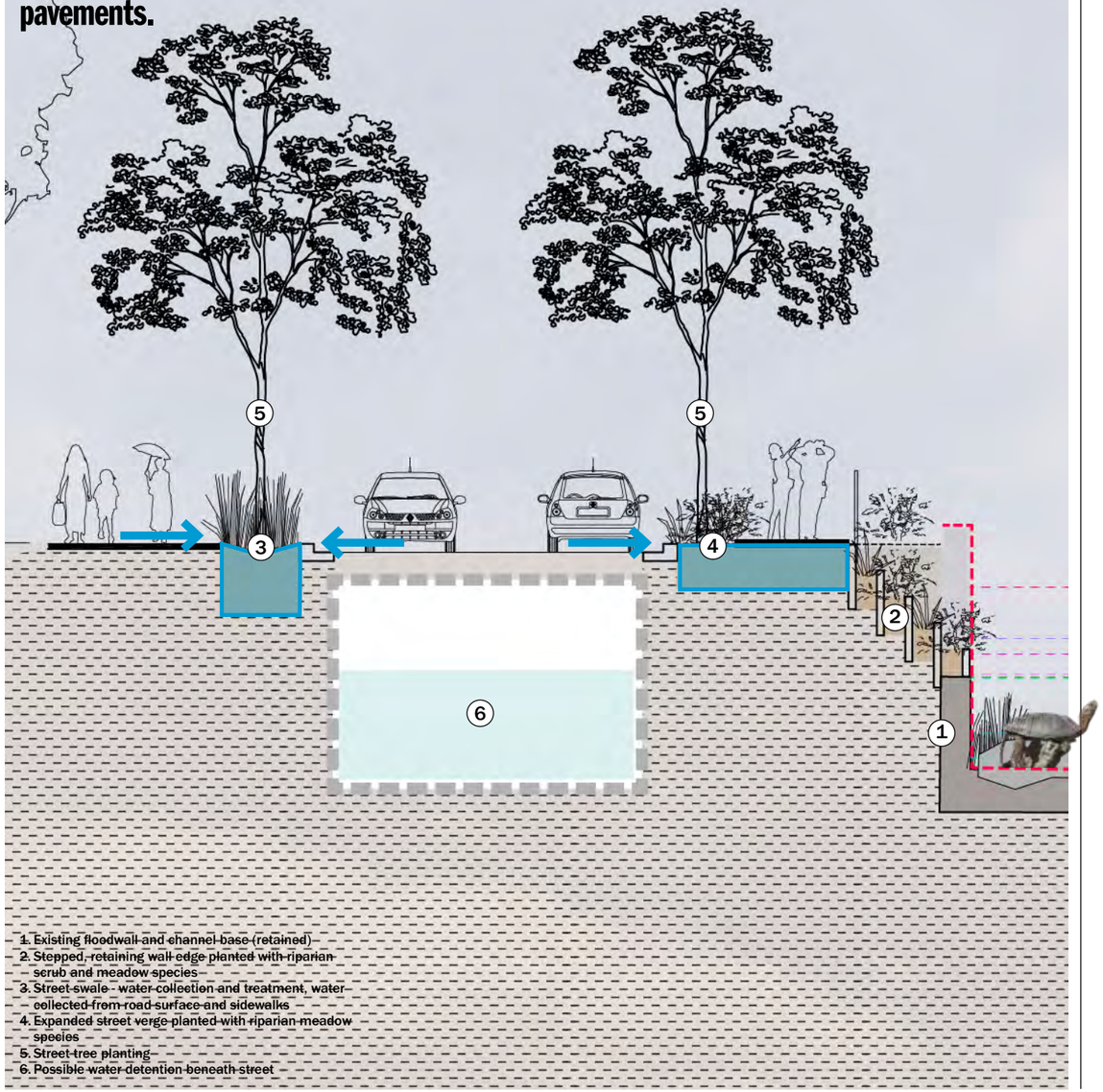
From grey to green, the stark walls make way for stepped terraces of greenery... this proposal brings people back to the edges of the creek and turns the design focus from disaster to daily use. Stepped landscapes no both sides treat runoff while staggered rocky outcrops in the creek meander the daily flow for brackish habitat and quiet local fishing perches. Access paths on both sides accommodate those moving by quickly or those looking to sit for a while and enjoy the sounds of the creeks flow and returning water birds.

BEFORE

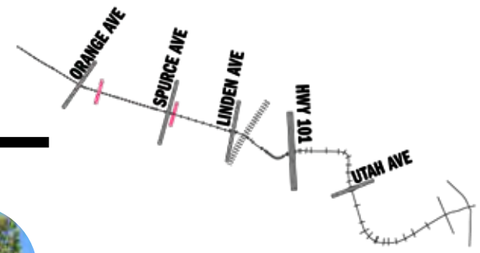
AFTER

GREENER STREETS

Retro-fitting streets with additional tree planting to shade sidewalks and shared paths and installing linear street swales and rain gardens to collect and treat water falling onto road surfaces and pedestrian pavements.



1. Existing floodwall and channel base (retained)
2. Stepped, retaining wall edge planted with riparian scrub and meadow species
3. Street swale - water collection and treatment, water collected from road surface and sidewalks
4. Expanded street verge planted with riparian meadow species
5. Street tree planting
6. Possible water detention beneath street

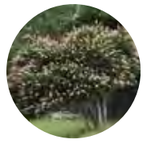


Canopy cover - street tree planting

Big Leaf Maple
Acer macrophyllum

California sycamore
Platanus racemosa

Pacific Dogwood
Cornus nuttallii



California Buckeye
Aesculus californica

Linear street swales, rain gardens and verges

These spaces are planted with an array of native riparian meadow species, showcasing flowering species - Yarrow, Penstemon, Golden Rod and Hummingbird Sage teeming with pollinators.

Coyote-brush
Baccharis pilularis

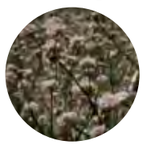
Saltmarsh baccharis
Baccharis douglasii

Deerweed
Acmispon glabe

Marsh Ragwort
Senecio hydrophilus

Penstemon
Penstemon heterophyllus

Goldenrod
Solidago californica



Coast Buckwheat
Eriogonum latifolium

Hummingbird Sage
Salvia spathacea

Yarrow
Achillea millefolium

Tufted Hairgrass
Deschampsia cespitosa

Brass-buttons
Cotula coronopifolia

Jaumea
Jaumea carnosa

Creeping spikerush
Eleocharis macrostachya

Baltic rush
Juncus balticus

Marsh Rosemary
Limonium californicum

Pacfic Aster
Aster lentus

Western goldenrod
Euthamia occidentalis

Marsh Gumplant
Grindelia stricta

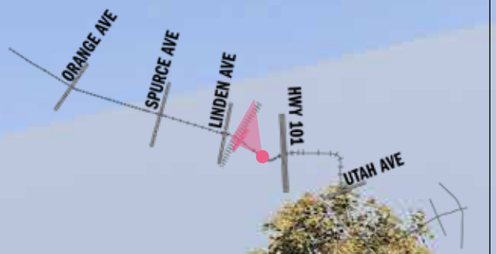
Iris-leaved rush
Juncus xiphioides

Sea-milkwort
Glaux maritima

FLOODABLE TERRACED PARK

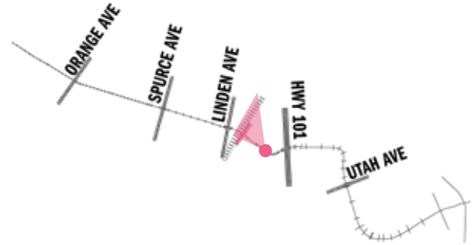
The creation of a new floodable parkland stretching from South Linden Avenue through to the Bayshore Freeway.

CHARACTER AREA - RAIL
KEY SECTION - 07



Based on Scenario 03

FLOODABLE TERRACED PARK



The enclosed experience of a cyclist riding under the Caltrain corridor opens up into an expansive brackish marshland flourishing with fish and birdlife. The stretched ecotone spans from the creek up to the viewing platforms and new residential developments, with diverse species spanning the salt and fresh water divide. This proposal imagines a transformation from fenced lands to a dynamic tidal habitat in one of the most interesting ecological zones of the creek.

BEFORE

AFTER

FLOODABLE TERRACED PARK

1. Expanded tidal mudflat
2. Brackish marsh planting
3. Boardwalk and viewing platform
4. Ephemeral stormwater detention planted with riparian meadow species
5. Meandering pathways
6. Parkland with scattered tree planting
7. Floodable terraces planted with riparian scrub species
8. Shared path
9. Street tree planting
10. Existing flood wall (shown in red)
11. Additional tree planting and swales - water collection and treatment installed within existing carparks adjacent to Colma Creek - where possible
12. Marsh Park

Riparian meadows

Brackish marsh (high marsh)

Brackish marsh (low/middle marsh)

Colma Creek

San Mateo Avenue

Coyote-Brush
Baccharis pilularis

Saltmarsh Baccharis
Baccharis douglasii

Deerweed
Acmispon glabe

Marsh Ragwort
Senecio hydrophilus

Penstemon
Penstemon heterophyllus

Goldenrod
Solidago californica

Coast Buckwheat
Eriogonum latifolium

Hummingbird Sage
Salvia spathacea

Yarrow
Achillea millefolium

Tufted Hairgrass
Deschampsia cespitosa

Pacific Aster
Aster lentus

Western Goldenrod
Euthamia occidentalis

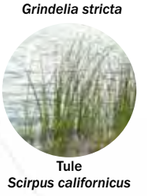
Marsh Gumplant
Grindelia stricta

Brass-Buttons
Cotula coronopifolia

Jaumea
Jaumea carnosa

Salt Grass
Distichlis spicata

Bulrush
Typha sp



Tule
Scirpus californicus

Tule
Scirpus acutus

Pickleweed
Sarcocornia pacifica

Long Billed Curlew
Numenius americanus

California Ridgway's Rail
Rallus crepitans

Ridgway's Rail
Rallus obsoletus

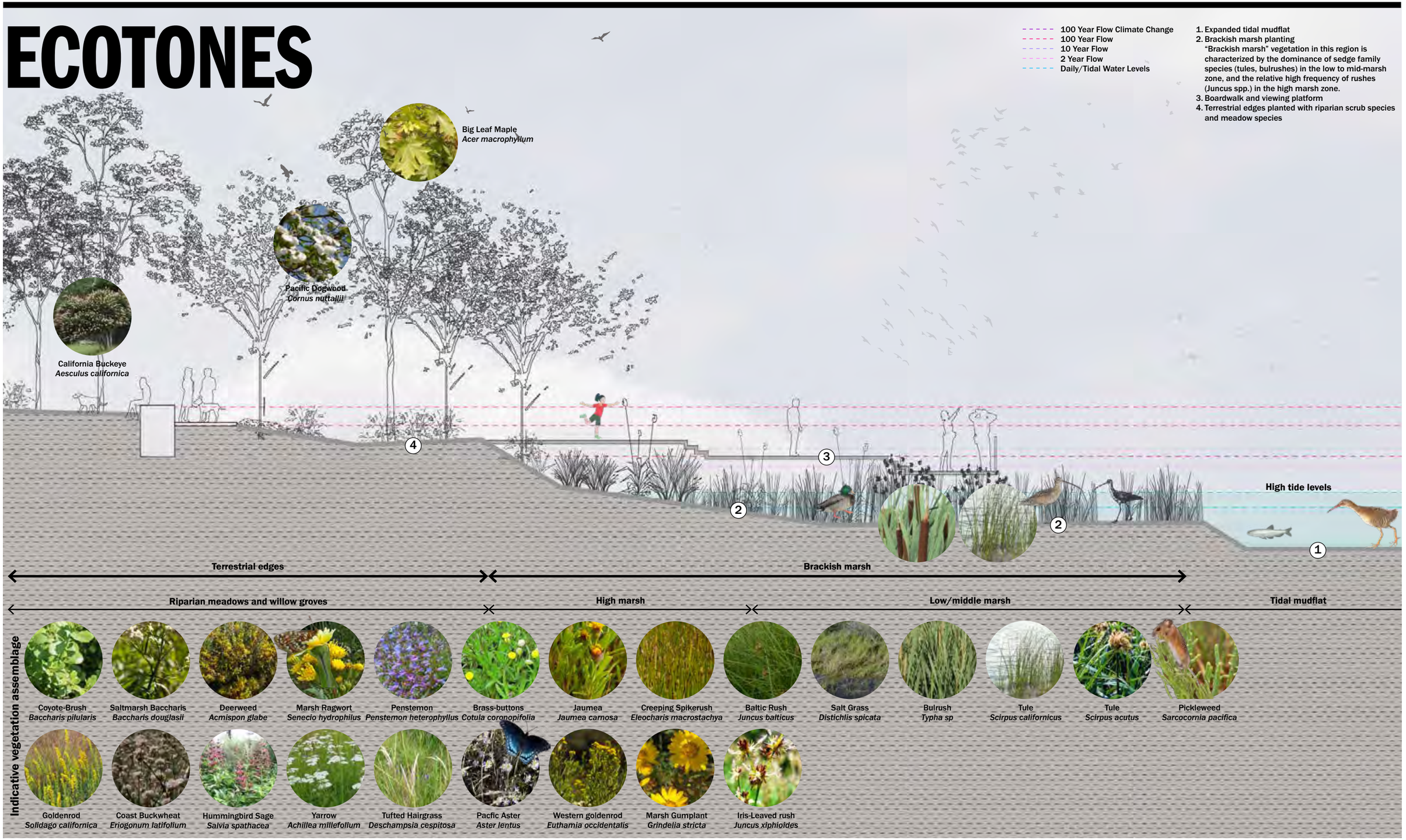
Floodable terraces expand the creek extents

Improved Water Quality

Viewing Platforms

Brackish Marsh Edges

ECOTONES


100 Year Flow Climate Change
100 Year Flow
10 Year Flow
2 Year Flow
Daily/Tidal Water Levels
1. Expanded tidal mudflat
2. Brackish marsh planting
"Brackish marsh" vegetation in this region is characterized by the dominance of sedge family species (tules, bulrushes) in the low to mid-marsh zone, and the relative high frequency of rushes (Juncus spp.) in the high marsh zone.
3. Boardwalk and viewing platform
4. Terrestrial edges planted with riparian scrub species and meadow species
Big Leaf Maple
Acer macrophyllum
Pacific Dogwood
Cornus nuttallii
California Buckeye
Aesculus californica
High tide levels
Terrestrial edges
Brackish marsh
Riparian meadows and willow groves
High marsh
Low/middle marsh
Tidal mudflat
Indicative vegetation assemblage
Coyote-Brush
Baccharis pilularis
Saltmarsh Baccharis
Baccharis douglasii
Deerweed
Acmispon glabe
Marsh Ragwort
Senecio hydrophilus
Penstemon
Penstemon heterophyllus
Brass-buttons
Cotula coronopifolia
Jaumea
Jaumea carnosa
Creeping Spikerush
Eleocharis macrostachya
Baltic Rush
Juncus balticus
Salt Grass
Distichlis spicata
Bulrush
Typha sp
Tule
Scirpus californicus
Tule
Scirpus acutus
Pickleweed
Sarcocornia pacifica
Goldenrod
Solidago californica
Coast Buckwheat
Eriogonum latifolium
Hummingbird Sage
Salvia spathacea
Yarrow
Achillea millefolium
Tufted Hairgrass
Deschampsia cespitosa
Pacfic Aster
Aster lentus
Western goldenrod
Euthamia occidentalis
Marsh Gumplant
Grindelia stricta
Iris-Leaved rush
Juncus xiphioides

SECTION AA

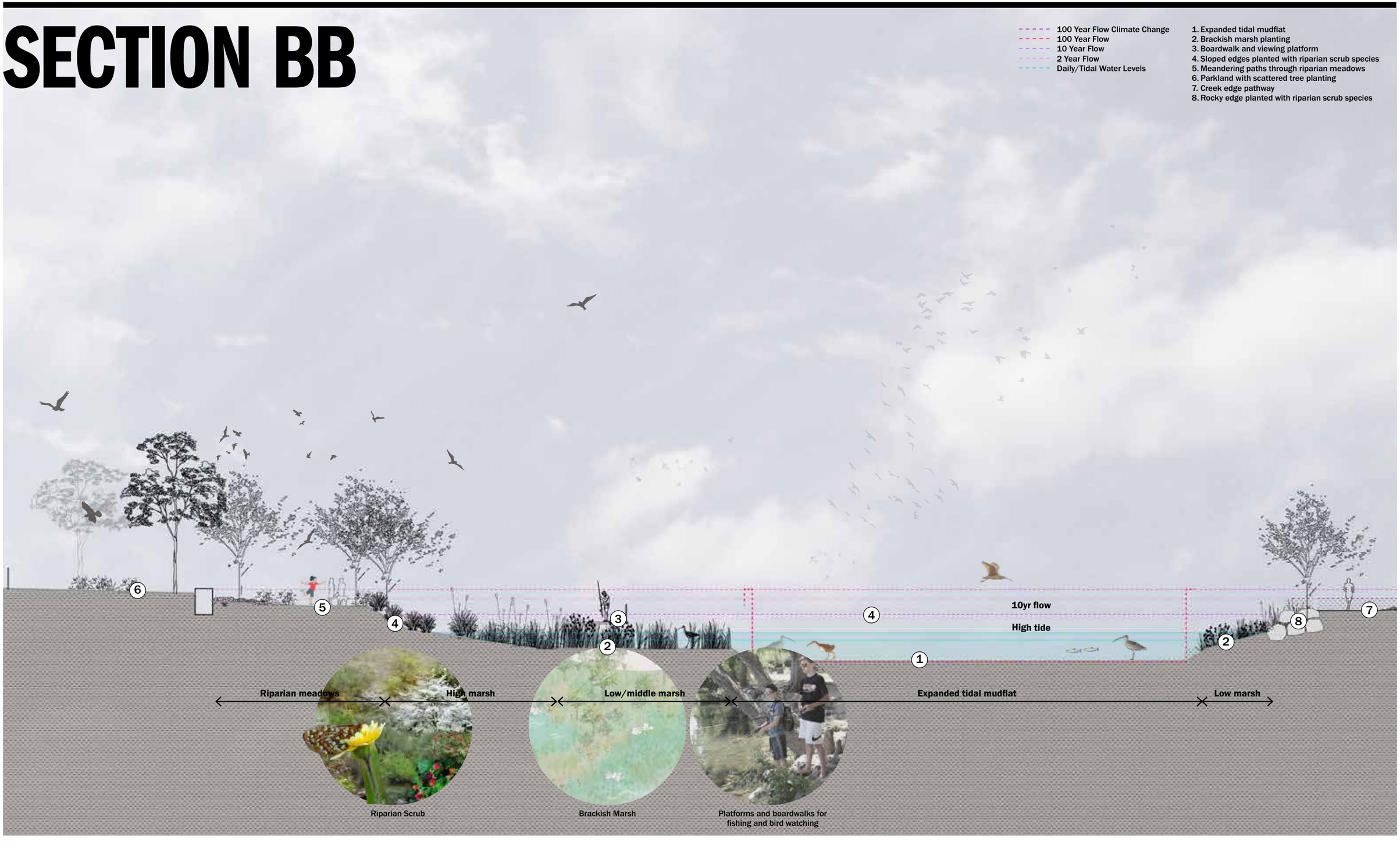
100 Year Flow Climate Change
100 Year Flow
10 Year Flow
2 Year Flow
Daily/Tidal Water Levels

1. Expanded tidal mudflat
2. Brackish marsh planting
3. Boardwalk and viewing platform
4. Ephemeral stormwater detention planted with riparian meadow species
5. Meandering pathway
6. Parkland with scattered tree planting
7. Creek edge boardwalk
8. Stepped, retaining wall edge planted with riparian scrub species
9. Swale - water collection and treatment installed within existing carparks adjacent to Colma Creek

SECTION BB

100 Year Flow Climate Change
100 Year Flow
10 Year Flow
2 Year Flow
Daily/Tidal Water Levels

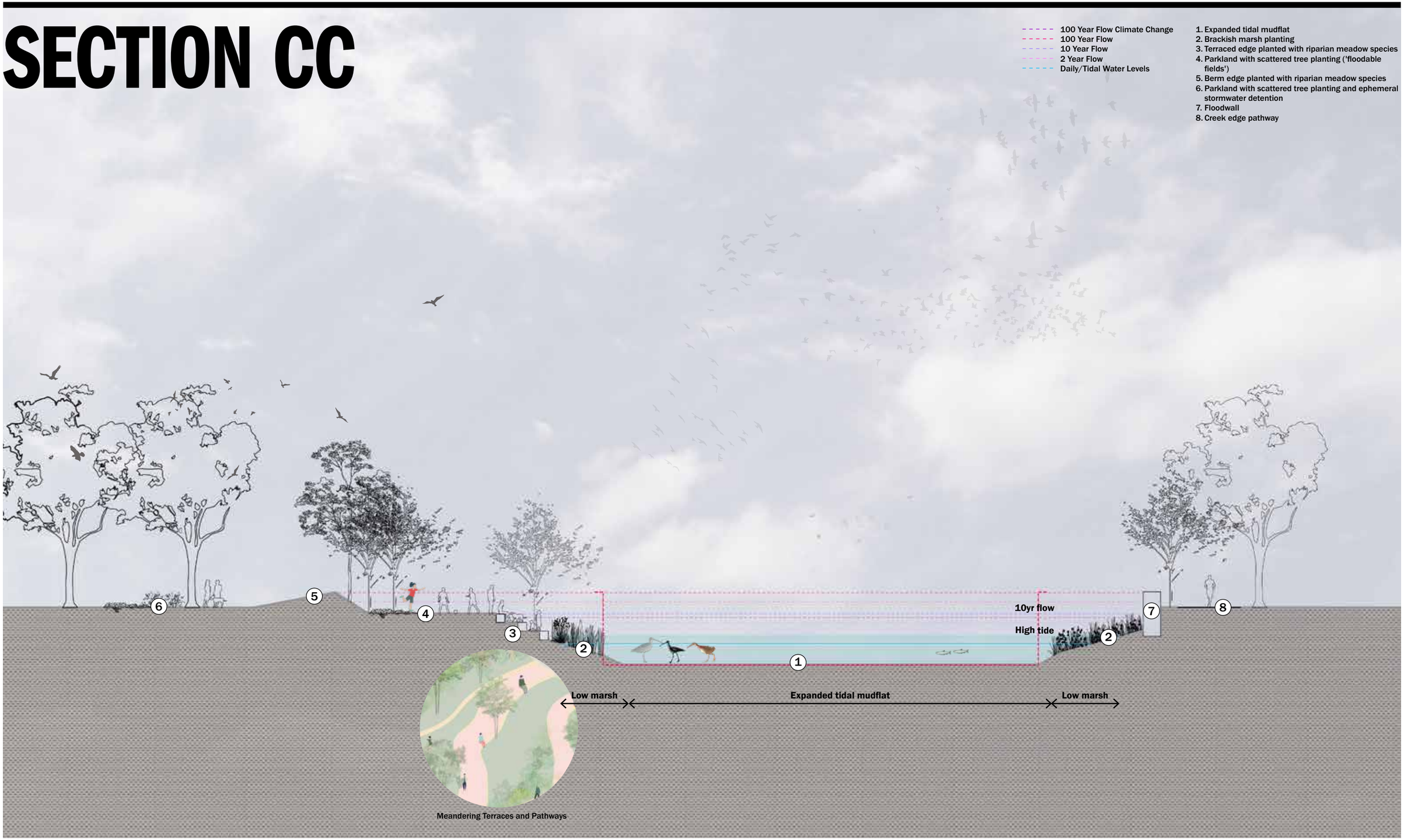
1. Expanded tidal mudflat
2. Brackish marsh planting
3. Boardwalk and viewing platform
4. Sloped edges planted with riparian scrub species
5. Meandering paths through riparian meadows
6. Parkland with scattered tree planting
7. Creek edge pathway
8. Rocky edge planted with riparian scrub species



SECTION CC

100 Year Flow Climate Change
100 Year Flow
10 Year Flow
2 Year Flow
Daily/Tidal Water Levels

1. Expanded tidal mudflat
2. Brackish marsh planting
3. Terraced edge planted with riparian meadow species
4. Parkland with scattered tree planting ('floodable fields')
5. Berm edge planted with riparian meadow species
6. Parkland with scattered tree planting and ephemeral stormwater detention
7. Floodwall
8. Creek edge pathway



Meandering Terraces and Pathways

SECTION DD

100 Year Flow Climate Change
100 Year Flow
10 Year Flow
2 Year Flow
Daily/Tidal Water Levels

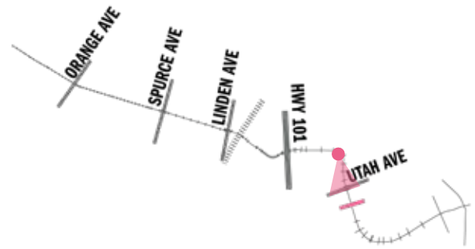
1. Expanded tidal mudflat
2. Brackish marsh planting
3. Terraces and creek edge embankment planted with riparian meadow species
4. Viewing platform
5. Adjacent property
6. Creek edge embankment planted with riparian scrub species
7. Creek edge pathway
8. Berm edge planted with riparian meadow species
9. Future 'floodable' park space and stormwater detention space

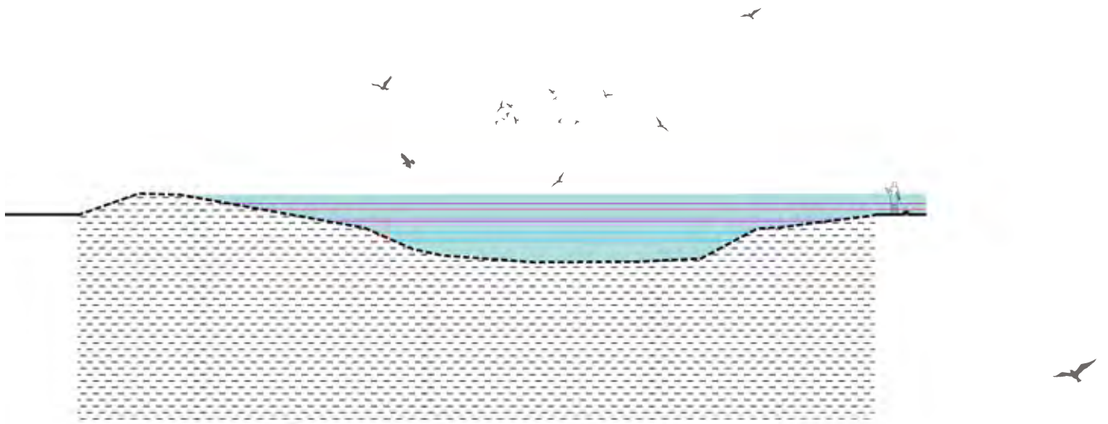
Future 'Floodable' Park Space

A MARSHY EDGE

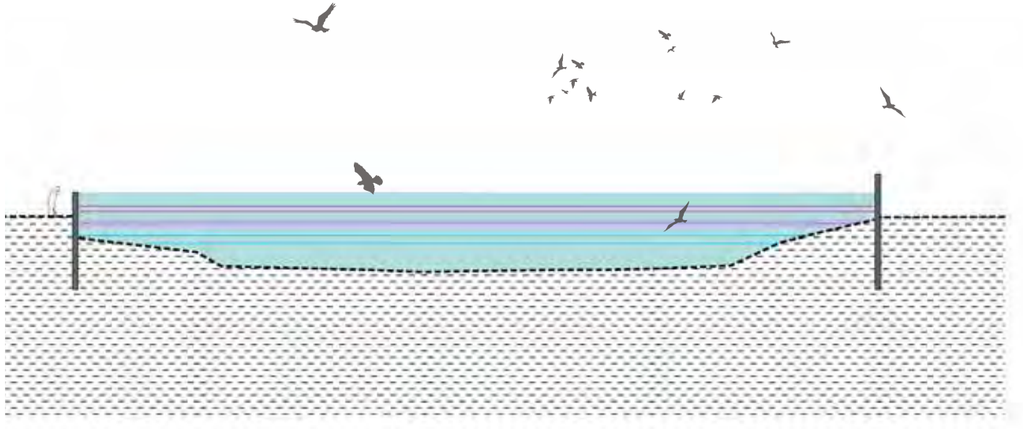
CHARACTER AREA - MARSH

KEY SECTION - 12





EXISTING VOLUME



PROPOSED VOLUME

Based on Scenario 01/03

A MARSHY EDGE

100 Year Flow Climate Change
100 Year Flow
10 Year Flow
2 Year Flow
Daily/Tidal Water Levels

1. Proposed floodwall
2. Viewing platform/walkway with seating edge
3. Salt marsh re-vegetation
   Cordgrass - *Spartina foliosa*
   Pickleweed - *Sarcocornia pacifica*
4. Expanded tidal mudflat zone
5. Carpark swale - stormwater capture and treatment
6. Permeable pavement zone adjacent to creek edge
7. Tree planting
8. Existing groundline

Detail area

Low marsh
Tidal mudflat
Low marsh

Salt marsh

A MARSHY EDGE

100 Year Flow Climate Change
100 Year Flow
10 Year Flow
2 Year Flow
Daily/Tidal Water Levels

1. Proposed floodwall
2. Viewing platform/walkway with seating edge
3. Salt marsh re-vegetation
   Cordgrass - *Spartina foliosa*
   Pickleweed - *Sarcocornia pacifica*
4. Expanded tidal mudflat zone
5. Carpark swale - stormwater capture and treatment
6. Permeable pavement zone adjacent to creek edge
7. Tree planting
8. Existing groundline

Salt Marsh Harvest Mouse
Reithrodontomys raviventris

Pickleweed
Sarcocornia pacifica

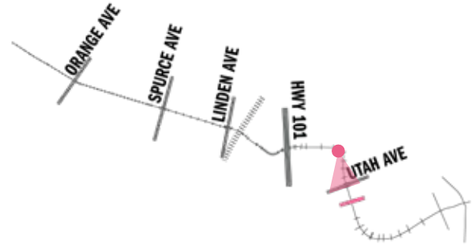
Cordgrass
Spartina foliosa

Long Billed Curlew
Numenius americanus

California Ridgway's Rail
Rallus crepitans

Ridgway's Rail
Rallus obsoletus

A MARSHY EDGE



From fennel to tidal, this design imagines a restored ecotone and expanded tidal and flood zone along this forgotten corridor. New public access threaded between the flood wall and industrial properties, with near views of a restored tidal marshland and ecotone drawing diverse species up from the bay shoreline. The watery edges of the creek protected by the flood wall from nearby pedestrians, able to watch the creek life from the nearby path under the shade of new trees lining the path.

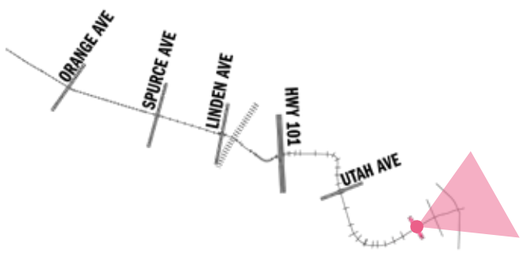
BEFORE

AFTER

BAY

Based on Scenario 03

BAY



BEFORE

AFTER

The river's mouth opened up, and the bay tidal life washed into the park. Through cut and fill, the path is lowered into a widened and restored marsh, widening the discharge into the bay, reducing flood risk and preparing for sea-level rise. The boardwalk wraps the shoreline, punctuated by curated interpretive elements and weathered structures shared by local schools (outdoor classrooms) and local bird enthusiasts (hides). The Ridgeway rails gather on the edges of the mudflats, while the salt marsh harvest mouse darts between pickleweed thickets.

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Document Control

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01	05.28.2020	Richard Mullane	Draft SB1
02	01.06.2020	Richard Mullane	Updated Draft SB1
03	25.06.2020	Richard Mullane	Draft 02
04	08.07.2020	Richard Mullane	Final Report (standard resolution)
05	10.07.2020	Richard Mullane	Final Report (high resolution)