FLOOD PROTECTION PROJECTS & THEIR REGULATORY PROCESS:

CASE STUDY

San Francisquito

San Francisco Bay
Conservation & Development
Commission

A PRODUCT OF FLOOD CONTROL 2.0

Flood Control 2.0 - Flood Protection Project Case Study
San Francisco Bay Conservation and Development Commission
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I. Abstract

San Francisquito Creek, which represents the boundary between Santa Clara and San Mateo Counties along its lower reach, has a history of flooding adjacent residences, public facilities, and businesses. Since the 1950's local agencies have discussed flood protection project ideas and the San Francisquito Creek Watershed Council recommended specific actions in 1997. The flood of record in 1998 that damaged approximately 1,700 properties in Palo Alto, East Palo Alto and Menlo Park and cost approximately $28.8 million in damages, led local agencies to create the San Francisquito Creek Joint Powers Authority (SFCJPA). This regional government agency plans, designs and implements capital projects that are comprehensive in both geography and function because they cross jurisdictional boundaries and they protect vulnerable populations against flooding, including flooding from projected sea level rise, foster and restore healthy ecosystems, and connect communities by enhancing trails. Its watershed-wide, multi-purpose effort is known as the ***San Francisquito Creek Flood Reduction, Ecosystem Restoration, and Recreation Project***. The San Francisco Bay to Highway 101 phase was designated as the first major capital project within that comprehensive planning effort; completion of the overall effort requires that it begin with the downstream reach and work upstream so as not to transfer flood risk from one area to another. The San Francisco Bay to Highway 101 Project (Project) is now under construction and it is the subject of this case study. The project seeks to reduce flood risk, improve habitat and recreation opportunities, and provide necessary hydraulic capacity to allow the implementation of flood protection work upstream. This case study discusses the San Francisco Bay to Highway 101 Reach project details, issues and resolutions faced along the way, and lessons learned for future flood control projects.

II. Site Description and History

San Francisquito Creek is a perennial stream that originates at the confluence of Corte Madera Creek and Bear Creek just downstream of Stanford University's Searsville Dam. Geologically, San Francisquito Creek's watershed and alluvial fan formed an hourglass-shaped area with the upper watershed draining through a narrow passage out of the Santa Cruz Mountains, flanked by bedrock outcroppings below the current Interstate 280 corridor (Figure 1). Over geologic time, the creek followed several courses forming the alluvial fan, but historically the portion of the creek between the Santa Cruz Mountains and current Highway 101 remained fairly stable in its current alignment. The creek once flowed into an extensive tidal marsh that contained many salt pannes and tidal channel networks connected to large sloughs (SFEI 2016). In the 1930s, the lower portion of the creek from Highway 101 to San Francisco Bay was channelized into its current alignment to accommodate adjacent land uses. Currently, the watershed drains a 45-square-mile area extending from Skyline Boulevard to San Francisco Bay. The creek is the boundary between Santa Clara and San Mateo counties and between the City of Palo Alto and its neighboring cities, Menlo Park and East Palo Alto. The creek's 5-square-mile floodplain is primarily located within these cities. The lower portion of the creek, which constitutes the S.F. Bay-Highway 101 Project, is bordered by East Palo Alto homes to the north and west of the creek, and Palo Alto businesses, a school and Post Office to the south, and closer to the Bay, the Faber Tract Marsh lies to the north and the Palo Alto Airport and Palo Alto Municipal Golf Course to the south and east (Figure 2).

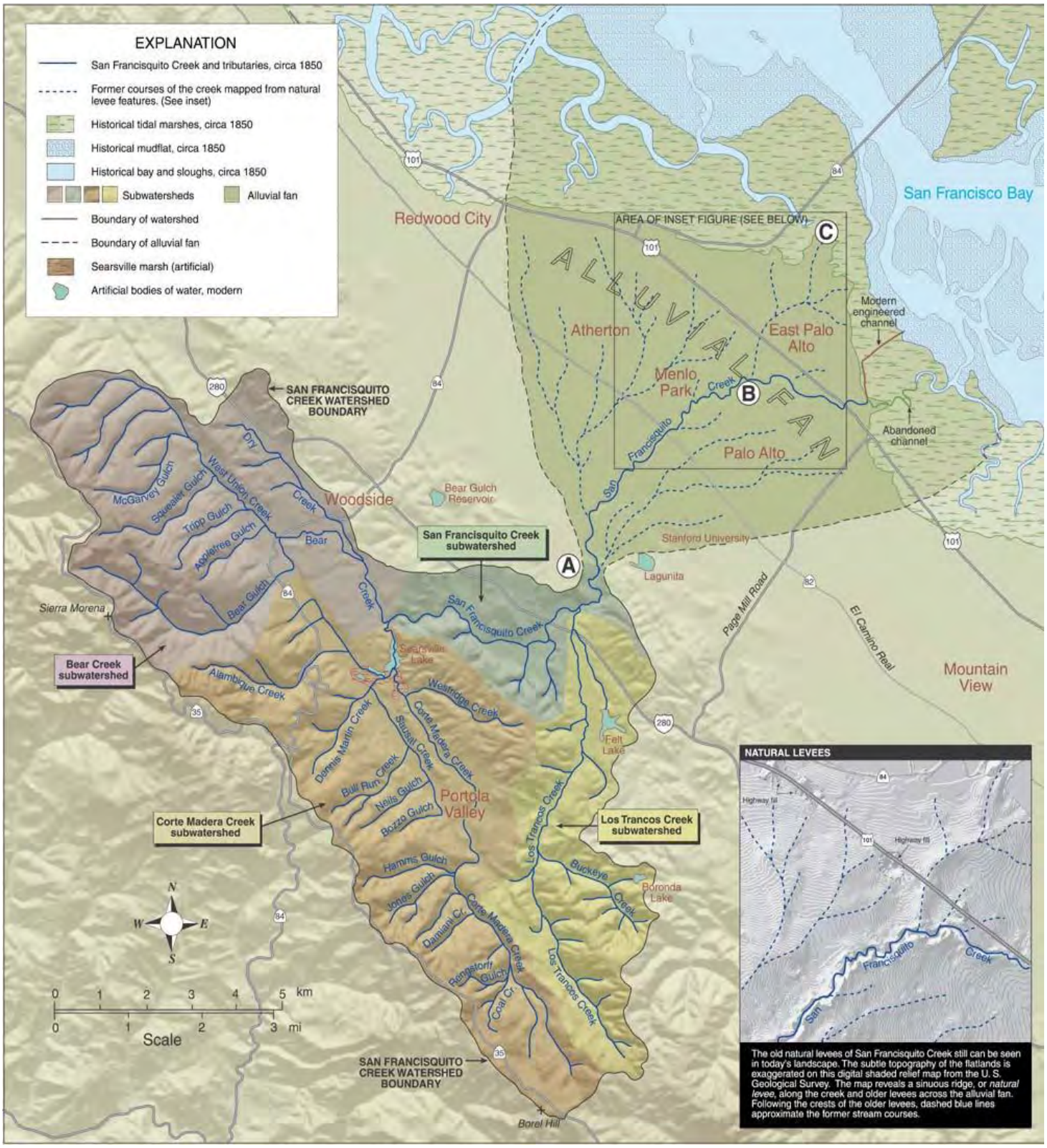

Figure 1. Historic Palo Alto watershed and alluvial fan. (http://museumca.org/creeks/1460-SFrancisquitoWS.html)

Flood History

Beneath the cities of Palo Alto, East Palo Alto, Menlo Park, Atherton, and the Stanford University campus lies the alluvial fan created by the large watershed. Flooding used to occur naturally around the main stem of the creek and neighboring branch creeks prior to European settlement. Due to the demand for space in the Bay Area, human development has encroached upon the narrow San Francisquito Creek channel. Along its developed lower reach, where homes, schools and businesses are located in the historic floodplain, the creek presents a flood risk to the cities of Palo Alto, Menlo Park, and East Palo Alto.

Currently, the natural and regular overbanking of the creek has become a modern urban hazard for many of the adjacent property owners. During high-flow periods, floodwaters overtop the creek banks and flood adjacent homes, community infrastructure, and developments. In February 1998, San Francisquito Creek experienced its worst flooding in recorded history, reaching a maximum instantaneous peak flow of 7,200 cubic feet per second (cfs) upstream of the Project area, which is thought to be an approximately 60-year flood event. A 100-year flood event, according to a new hydraulic model completed in 2016, would have a flow of 7,640 cfs at that location.

Flood Response

The severity and costliness of the 1998 flood led to local planning of a flood control project that would need to be coordinated and beneficial across several jurisdictional boundaries. This type of project requires a significant amount of collaboration and cooperation and thus prompted the formation of the San Francisquito Creek Joint Powers Authority (SFCJPA). Since its creation, the SFCJPA has led the development of a regional comprehensive plan to provide flood protection, ecosystem restoration, and recreational opportunities along San Francisquito Creek, and the coastal areas of the SFCJPA member agencies. Within the context of that overall plan, the SFCJPA is planning, designing, and constructing four capital projects that will alleviate 8,400 properties that are subject to flooding from the Creek's 100-year floodplains along the Creek and the Bay shoreline of Palo Alto, East Palo Alto, and Menlo Park.

Over the past six years, the SFCJPA has secured funding commitments from local, state, federal and private sources totaling over $75 million for projects that are part of the SFCJPA's comprehensive plans. This includes funds from the Santa Clara Valley Water District's Clean, Safe Creek and Natural Flood Protection parcel tax measure that was approved by the voters of Santa Clara County in November 2000 for planning and designing a flood control channel. Additional project funding for construction was approved by the voters in 2012. Voter support for project funding was likely influenced by the 1998 San Francisquito Creek flood event. The passage of these measures funded nine flood protection projects, including $10.6 million in planning and design funding for the San Francisquito Creek - San Francisco Bay to Highway 101 project (SFC Project – SFB to 101). The SFB to 101 project was estimated to cost approximately $21.6 million and be completed within a two-year time frame once all permits were secured.

III. Planning and Project Development Details

The SFC Project – SFB to 101 is the first major capital project launched by the SFCJPA. As the downstream phase of the San Francisquito Creek Comprehensive project, the SFB to 101 project objectives were to reduce local flood risk, improve habitat, and provide necessary in-stream capacity for the future upstream project phases.

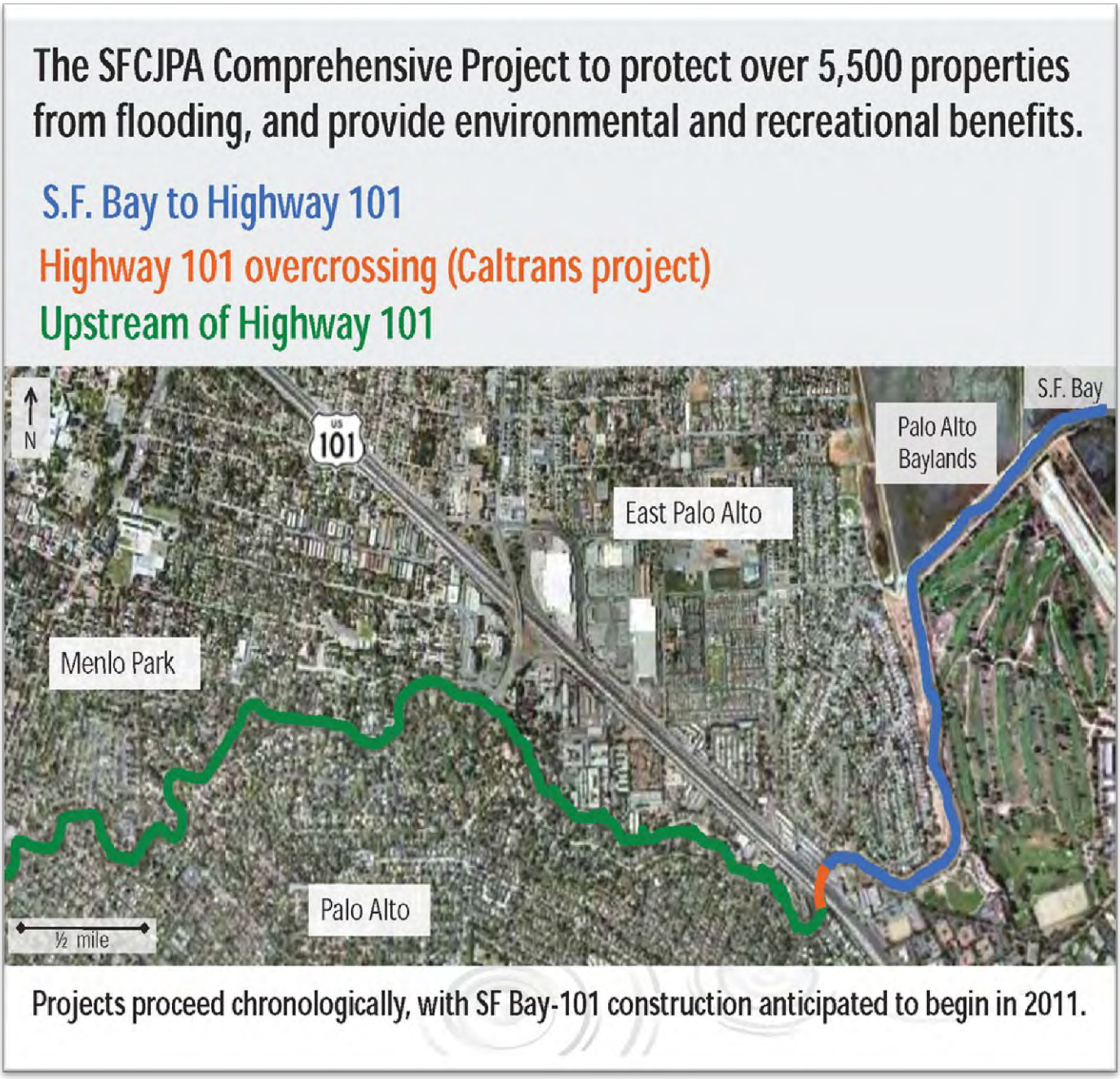

Figure 2. The multiple phases of the San Francisquito Creek SFCJPA Comprehensive Project. The subject of this case study is the lower reach known as the SFB to Highway 101 Project indicated in blue.

Multi-Benefit Project Objectives

- Protect properties and infrastructure from creek flows resulting from 100-year fluvial flood flows coinciding with a 100-year tide event (projected with 2067 Sea Level Rise);
- Accommodate future flood protection measures that might be constructed upstream (e.g., removal of the Searsville dam, or other measures to enhance flood control capacity upstream);
- Enhance habitat along the project reach, particularly habitat for threatened and endangered species;
- Restore the marsh plain along the channel edges;
- Enhanced recreational uses and public access along the creek;
- Minimize operational and maintenance requirements;
- Improve water conveyance and improve flood protection for residents along San Francisquito Creek.
- Reduced need for future maintenance because the channel geometry will move suspended sediments to the Outer Faber Tract Marsh and San Francisco Bay.

Using funds from the local parcel tax approved in 2000, the SFCJPA started the planning and design of the SFC Project – SFB to 101 project (Figure **3**). One of the most difficult challenges faced in designing the project were the adjacent land uses along the length of the creek that constrained it. The upper reaches are also heavily constrained by urban development, and homes within East Palo Alto are built right up to the creek and levee edge in the lower reach. The land associated with the municipal golf course (Palo Alto Golf Course) adjacent to the lower reach, owned by the City of Palo Alto. The creek was also highly constricted between the Palo Alto Airport of Santa Clara County runway and a levee that borders the Faber Tract Marsh. Per the Federal Aviation Agency (FAA) regulations, the runway could not be shortened or moved. To the north of the creek, Faber Tract Marsh (Palo Alto Baylands in Figure 1), is home to a healthy breeding populations of the endangered Ridgway's rail and potential habitat for the endangered salt marsh harvest mouse. The SFCJPA determined that there wasn't much that could be done to completely eliminate the constriction point at the mouth of the Creek. The SFCJPA also concluded that the levee between the channel and the adjacent Faber Tract marsh could be lowered to just above marsh plain elevation to enhance habitat value by reconnecting the creek with the adjacent baylands and assist with floodwater conveyance for flood protection upstream.

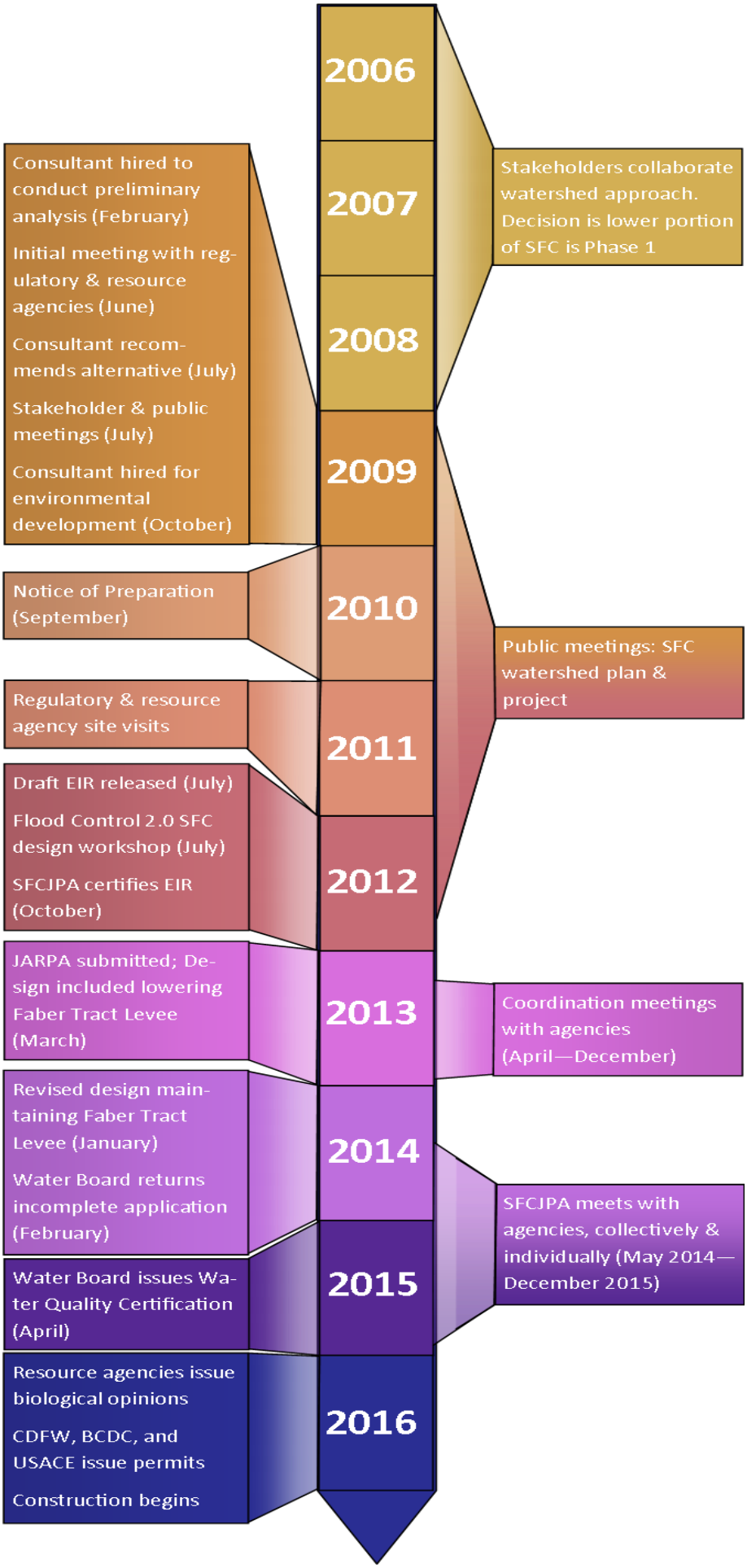

Figure 3. Project Timeline

After much discussion, a section of the City of Palo Alto's Palo Alto Municipal Golf Course was relinquished to the project so that the southern levee could be relocated to the southeast (on former Golf Course land), thereby widening of the channel, allowing the creation of a marsh plain terrace, and increasing the flow capacity of the creek. This opportunity was possible because the City of Palo Alto was a project proponent and member of the SFCJPA.

The SFCJPA– SFB to Highway 101 Project was designed to improve habitat for species living in and adjacent to the creek, it also allowed for alignment in some cases, to enable the maintenance, replacement, or improvement of utilities and infrastructure (e.g. the Caltrans reconstruction of the Highway 101 Bridge). This project was also design to accommodate the boring of a fourth water conveyance tunnel for the Creek under Highway 101 to improve and restore flows and the replacement and relocation of a 1959 PG&E gas pipeline and other utilities in the project area.

Flood Control 2.0 (FC 2.0) Project Involvement

The San Francisquito flood control project was the first flood control channel in the region to be incorporated into Flood Control 2.0 (FC 2.0). Although this project was at the 90% design stage when FC 2.0 began, the SFCJPA and FC 2.0 sought to identify potential design elements that could expand upon the multiple benefits of effective flood conveyance, restored fish habitat and migratory routes, and downstream wetland restoration. It also attempted to create design features that would minimize channel maintenance, reduce costs of the project and biological in-stream impacts on species of special concern (SFEI 2012). Regional experts were brought together with the SFCJPA in a workshop to examine the existing design and offer advice for improving the multiple benefits of the project.

At the FC 2.0 Workshop, held on July 23, 2012, the 90% project design was presented along with research background about the historical ecology of San Francisquito Creek. This brainstorming session provided design suggestions that could expand upon the project's multiple benefits and fit within the dense urbanized area surrounding the San Francisquito Creek. Two main design elements were identified.

Flood Control 2.0 Suggestions

A) Creation of Ecotone and Upland Connectivity.

Changing the grade/slope of the outboard south levee to a more gentle grade. Planting native plants along the slope could provide upland transition areas and also serve as high fluvial flow refugia areas for species present in the channel and adjacent wetlands. Planting native plants on the inboard slopes of the levee would improve the project if allowed by USACE regulations.

B) Create Connectivity between the Faber Tract marsh and San Francisquito Creek.

The experts agreed that the connection of San Francisquito Creek with the Faber Tract marsh would enhance the creek design and mimic the historic conditions of the area. Reconnecting the Creek with the marsh could benefit the species living in the area and also provide additional floodwater and sediment conveyance for flood control management. They also suggested that the proposed 90% design, which included degrading the existing Faber Tract levee to just above marsh plain elevation had the potential to harm species present in the marsh and limit the deposition of sediments in the back of the marsh. The experts suggested alternate design connections between the fluvial-tidal environments that were more likely to provide multiple benefits for the project. These alternative design elements included:

- Modification of the northern levee to provide for greater exchange of water, sediment, and biota between the flood channel and the adjacent marsh. This alternative would mimic the historic nature of the fluvial-tidal interface.
- Placing notches at channel invert elevation in the northern levee along Faber Tract to provide continual connection between the creek and the marsh. This alternative would effectively create islands of high tide refugia for marsh wildlife during high fluvial flow and function with the tidal marsh channels to provide heterogeneity in the environment in both the subtidal and supratidal portions of the environment along the levee.
- Carve entry channels at channel invert elevation from the main flood control channel into the marsh. These channels would maintain the connection with the creek and also allow

water to remain in the channels to support fish populations and prevent stranding from occurring in Faber Tract.

- Use culverts or flap-gates to control the exchange of water and sediments between the channel and Faber Tract.
- Use root wads and other natural materials as bank stabilization along the channel rather than using riprap.

The SFCJPA left the workshop with suggestions for design elements that could increase the multiple benefits of the project. However SFCJPA's analysis suggested that increasing the connectivity between the Creek and Faber Tract marsh at the channel invert elevation, would result in channel downcutting and removal of large portions of established high marsh in the Faber Tract. This was recognized as an unacceptable alternative by the United States Fish and Wildlife Service (USFWS) and the California Department of Fish and Wildlife (CDFW), who managed the listed species within Faber Tract. The SFCJPA asserted that the proposed 90% design, including degrading the levee to marsh plain elevation, would provide for frequent exchange of water, nutrients and sediment between the fluvial and tidal environments without the removal of significant portions of mature high marsh. The SFCJPA maintained the original project design as proposed and used it in the permit applications to all agencies. In March 2013, the JPA submitted the proposed project to the regulatory and resource agencies.

IV. Main Project Issues

Although the planning and design phases of the SFB to Highway 101 project went relatively quickly, the project took longer than anticipated in the permitting process as the SFCJPA worked with the permitting agencies to provide more information about the project and adjust/include specific project elements to address their concerns. The project construction was originally scheduled and anticipated for completion by the end of 2015; however, the permitting for the final project was not completed until February of 2016. The issues listed below represent different agencies' concerns with the initial 90% Design as submitted in the March 2013 application package and some issues brought up with the revised project design that was submitted to the permitting agencies in January 2014. All these issues were addressed and resolved in the final permitted project design.

Application Completeness

The SFCJPA had certified its final Environmental Impact Report/Environmental Impact Statement (EIS/EIR) in October of 2012 (Figure **3**). The permit applications, which included degrading the levee between Faber Tract Marsh and the San Francisquito Creek to just above marsh plain elevation, were submitted to the San Francisco Bay Regional Water Quality Control Board (Water Board), the San Francisco Bay Conservation & Development Commission (BCDC), California Department of Fish and Wildlife (CDFW), and the United States Army Corps of Engineers (USACE).

The Biological Assessment was submitted to the resource agencies (including the United States Fish and Wildlife Service (USFWS), CDFW, and NOAA National Marine Fisheries Service (NMFS)) for consideration.

Upon review of the Joint Aquatic Resources Project Application (JARPA) permit application, several of the agencies had initial concerns regarding particular project elements, most of which pertained to impacts to the Faber Tract Marsh (discussed below). The Water Board, who has the greatest jurisdiction over this project, had concerns about potential flooding in portions of East Palo Alto resulting from different constructed levee heights on either side of the creek, and concerns about floodwater elevations upstream. BCDC had additional concerns, and along with the Water Board, requested that additional information be provided. The SFCJPA provided supplemental information and the updated project design on January 28, 2014, but the Water Board found that within the legally allotted permit timeline of one year, the information provided was not sufficient for the staff to issue a water quality certification and adhere to the Clean Water Act (CWA). Under the CWA, the Water Board has a one-year statutory deadline from when an application was received to act on the permit application. During the initial one-year period, there were several meetings and discussions regarding the project but resolution was not reached. On February 27, 2014 after a meeting with the other regulatory and resource agencies, the Water Board issued a letter, denying the project without prejudice, but agreed to coordinate with the SFCJPA to work through permitting the project and requested the submittal of additional information with the new permit application.

Similarly, BCDC reviewed the application and determined it was incomplete, pending some project details and the Water Quality Certification, CDFW's incidental take permit and streambed alteration permit, and the biological opinions from NMFS and USFWS. However, BCDC does not have the same statutory requirements related to incomplete applications as the Water Board does. The SFCJPA's BCDC application remained unfiled and incomplete until January 2016 when all required documentation was submitted.

The USACE permit application also remained incomplete while USACE awaited the results of endangered species consultations with USFWS and NMFS, the issuance of the water quality certification by the Water Board, and BCDC's Coastal Zone Management Program certification. USACE waited to see if any project elements were modified in response to the concerns of the Water Board, BCDC or the federal resource agencies. USACE held the application as incomplete until final project details were worked out and permitted by the state and federal agencies.

During the three-year permitting period (2013-2016), the regulatory and resource agencies had discussions with the SFCJPA and amongst themselves regarding issues and ways to reach resolution. Because of concerns over consistency with laws and policies, the agencies requested further changes to the project before completing their analysis. The SFCJPA raised concerns over not having access to private agency discussion and that meeting notes or summaries were not developed and made public. They remain concerned over this issue today.

Lack of Full Project Understanding

Although substantial information about the project details, design, and planning process were provided in the application packages and supplemental information, in some instances the agencies needed to be provided with further details to fully understand the project background and project details to analyze the project for compliance with their agency mandates.

Least Environmentally Damaging Practicable Alternative (LEDPA)

The SFCJPA sent out a draft EIS/EIR for comments in 2012, and received comments from a number of agencies at that time. The agencies brought up significant issues with the proposed project's fundamental design, with the USFWS voicing concern over the Ridgway's rail presence in Faber Tract Marsh, but did not suggest alternatives to address the concerns. Early on in the application review process, the Water Board identified a potential alternative design that was considered in the EIS/EIR (Alternative 3). The Water Board thought this alternative may have fewer impacts to wetlands and waters of the State than the proposed project (Water Board Letter, March 2013). The Water Board requested more information and justification on the alternatives analysis and the rational for selecting the proposed project as the LEDPA. After the SFCJPA responded In October 2013, the Water Board requested further justification for the chosen LEDPA project, and further details regarding design alternatives that had been dismissed, as well as considerations for design modifications that may further avoid impact to waters of the State, sensitive habitats, and listed species. BCDC and USFWS also initially thought that the project impacts to Faber Tract could be avoided through the implementation of "Alternative 3 – Golf Course Bypass Design," a project alternative that had been rejected in the EIS/EIR development process which included a bypass channel through the golf course. However due to property ownership, FAA rules and regulations and a higher project cost ultimately ruled this alternative out as a feasible alternative.

Additionally, in early 2014, the Water Board provided "future application guidance" to the SFCJPA that suggested modifying the proposed project design by moving the setback south levee alignment into the airport and further into the golf course as a project alternative to decrease impacts to the Faber Tract Marsh (Water Board Letter, February 2014).

To further resolve the LEDPA issue, and to better understand the potential effects of the project, BCDC, the Water Board, and the USFWS required additional modeling of the proposed project and alternatives analysis. As requested the SFCJPA commissioned additional modeling studies to demonstrate that the January 2014 proposed project alternative achieved the desired flood control benefits and minimized environmental impacts. These models also showed that an alternative design with a further set back of the south levee into the golf course did not achieve more flood control benefits beyond those benefits identified for the proposed project. The results of the modeling studies allowed the SFCJPA to negotiate with the regulatory agencies on some of the design elements and justify how the January 2014 project would reduce impacts to protected species within the project area and the adjacent Faber Tract Marsh.

Revised Project

In the Water Board's February 27, 2014 response letter, staff stated that the newly submitted project design proposal (dated January 28, 2014) containing a restored levee with Faber Tract marsh, "reflected a single purpose design of conveying flood flows quickly to the Bay..." The staff requested more information to explain how the project incorporated multi-objective elements to convey flood flows, but also protect water quality, and endangered species and their habitat. The classification of the design as a single purpose project may have reflected a lack of understanding of how the project fit into the larger San Francisquito Creek Flood Reduction, Ecosystem Restoration, and Recreation Project; connections not made in the

application or information provided to the staff; or the desire to include more watershed attributes in a constrained area with a limited understanding of project constraints.

The SFCJPA response clearly described the project's multiple benefits of increased public safety, erosion reduction, improved water quality and habitat restoration and that the project represented the LEDPA. The SFCJPA described habitat creation and restoration that would be included in the project and described the physical constraints that limited the use of detention basins and other project elements along the lower reach of the creek. The SFCJPA also acknowledged that the use of upstream detention basins in the floodplain is part of their broader 100-year flood protection planning effort, but that it was important to move forward with the construction on the lower reach, SFB to Highway 101 project, to address immediate flood protection needs.

Equity Concerns

The area adjacent to the creek in the City of East Palo is a low-income community in a low-lying area that experiences frequent flooding. The agencies (primarily the Water Board and BCDC) expressed concern that the levee bordering the San Francisquito Golf Course was designed to be higher than the levee bordering the City of East Palo Alto, thereby placing the community of East Palo Alto at greater flood risk than the golf course and properties in City of Palo Alto. The SFCJPA provided the geotechnical studies and the explanation that the levee to be built on the City of Palo Alto side of the creek would be built in a new location on un-compacted Bay mud and therefore would need to be built higher to allow it to settle over time. The City of East Palo Alto levee would be constructed on soils already compacted by the existing levee, and therefore would settle less over time. The SFCJPA further explained that in the first year of settlement the tops of the two levees would be expected to be at the same elevation. Once the agencies understood this, they agreed with the SFCJPA's assessment and the proposed designs for the levees.

Stakeholder Engagement

During the project planning (from 2009 to 2012), the SFCJPA met with adjacent property owners, held public meetings at the golf course, and met with airport staff and Searsville Dam advocates. Additionally, representatives from the Community for Green Foothills (CGF) also spoke at one of the SFCJPA board meetings. The SFCJPA also made efforts to solicit early input from the regulatory agencies before project design began, but the initial meeting was poorly attended by the regulatory agencies. The SFCJPA was notified that because of limited staff resources, regulatory agencies were not able to commit to multiple meetings on project planning until it is apparent that the project would actually materialize. The SFCJPA was told to re-engage the agencies when the project was at a sufficient level of development to apply for regulatory permits. The SFCJPA then submitted applications to all the agencies in March 2013 when the project was at the 90% Design phase.

As part of the Water Board's investigation into the originally selected project design, the Water Board requested additional stakeholder meetings with stakeholders that may have additional information regarding the project alternatives (Water Board, October 2013). The Water Board suggested inclusion of Beyond Searsville Dam, Palo Alto Golf Course, Palo Alto Airport and the Community for Green Foothills – stakeholders who were adjacent property owners or had knowledge of the watershed level planning. In 2013, the Water Board staff did not appear to be

aware of the public outreach and stakeholder involvement in the project planning process. At that time, the Water Board likely thought these stakeholders may provide thoughts on potential designs or project components, such as retention basins, that were already planned or could be used upstream to assist in flood control downstream.

Resource Impacts

A) Faber Tract Marsh

The portions of the project that raised the most concerns from the resource and regulatory agencies during the permitting process were the potential impacts to Faber Tract Marsh from degrading the levee between the creek and the marsh. Of primary concern to the USFWS and CDFW were impacts to healthy populations of the California Ridgway's rail and the salt marsh harvest mouse found in the Faber Tract Marsh. Identifying significant project impacts associated with the initial project proposal, USFWS found that more frequent inundation of Faber Tract marsh had the potential to increase mortality as a result of increased marsh flooding, and increased predation that may be associated with a loss of upland refugia. The proposed degradation of the degrading of Faber Tract Marsh levee to just above marsh plain elevation would immediately decrease the quantity of available upland refugia and be compounded by the existing poor vegetative cover in the upland areas surrounding the marsh, resulting in a likely increase in predation.

The potential increased frequency of fluvial flooding in the marsh represented a tradeoff between improved water quality and impacts to listed species. By returning the creek to its historic marsh connection, water quality would be improved, but the concerns raised by USFWS and CDFW regarding impacts to listed species influenced the thinking of other agencies. Allowing the creek to be reconnected to the marsh in ways described in the FC 2.0 Workshop would likely allow sediment deposition and potential long-term sustainability of the marsh. However, improved long-term viability of the marsh or other habitat presents a difficult choice when there are short-term negative impacts to special-status species that have limited populations and cannot emigrate from surrounding areas easily. This issue of short-term negative impacts to healthy marsh habitat containing listed species vs. long-term habitat viability contributed to the need for all the agencies to engage in further discussions and suggest modifications to the project design, which delayed the permitting process. USFWS requested consideration of design alternatives that would avoid increases in the velocity, quantity, or frequency of flood flows in Faber Tract Marsh relative to the existing conditions prior to an upstream Caltrans freeway improvement project. The SFCJPA fully agreed to modify the project design to address the USFWS' concerns as discussed in the resolution section below.

B) Water Quality

The Water Board found that the initial project design would increase flows into the Faber Tract Marsh and was also likely to increase loads of urban runoff pollutants and trash into sensitive marsh habitat. The Water Board requested the inclusion of flood control features, such as detention basins, that could provide flood control while also decreasing the flow of pollutants into Faber Tract Marsh. Additionally, the Water Board suggested the inclusion of Low Impact Development (LID) elements into the project (Water Board, February 2014) to decrease the flow through the creek and into Faber Tract Marsh. However, the SFCJPA provided further information (SFCJPA Comment Letter) that LID would not likely reduce the flow rate during

large flood events enough to provide additional flood protection beyond the proposed project design.

The Water Board also had concerns that construction of the Caltrans 101 Bridge project, which introduced a fourth bore at the Caltrans 101 Bridge located over San Francisquito Creek, had already altered creek flows, even though the fourth bore was not yet opened and will not be opened until 2018. The SFCJPA provided further details regarding the flows that would be anticipated as a result of the project and showed the January 2014 revised design, which did not lower the levee with Faber Tract Marsh, would not adversely impact the water quality in the creek and would not adversely impact Faber Tract Marsh.

C) Bay Fill

The revised design included placing fill in the form of high tide refugia mounds and other features within Faber Track Marsh as mitigation for loss of habitat. BCDC had concerns regarding the placement of fill into the healthy marsh habitat in the creek and in Faber Tract Marsh. In receiving the revised design, The Bay Plan requires that any fill placed in the Bay must be the minimum necessary to achieve the purpose of the fill. BCDC identified several project elements (fill for the levees, and eventually for high-tide refuge islands, etc.) that would qualify as Bay fill, and requested the SFCJPA's justification and a discussion of their alternatives to show the fill was the minimum amount necessary and minimized the environmental impacts. In the final project design, BCDC understood that the purpose of the fill was linked to protecting listed species through creation of high tide refugia and was able to balance the seemingly opposing policies.

V. Resolutions

While some of the original design elements proposed were intended as hydrodynamically restorative features, to return the San Francisquito Creek and its banks to its more natural state and connect the creek to the adjacent baylands, some elements presented challenges for the permitting agencies that are required to protect Bay resources. Ultimately, the SFCJPA worked with staff from the agencies to identify minor alterations to the project design that would address the agency concerns and meet the laws, policies, and regulations of the resource and regulatory agencies. To address concerns about particular project elements, the following project adjustments were made to the originally (March 2013) proposed design and incorporated into the final project design.

- **Adjustments to the Faber Tract Levee.** To prevent the larger flood flows during storm events from the widening of the channel entering into Faber Tract Marsh, the SFCJPA decided to leave in the levee between Faber Tract Marsh and the Creek areas and place fill to build the levee up to original design elevation. This limits floodwaters from entering the marsh at a rate greater than current conditions. Additionally, a floodwall was placed at the turn in the Creek near the marsh to further protect the marsh from increased flows that may have otherwise resulted in the Faber Tract Marsh levee failure.
- **Increased Vegetation on Upland Refugia.** Upland vegetative cover would be provided by planting native plants along existing levees/berms surrounding the Faber Tract Marsh to enhance upland refugia. This will reduce the probability of predation during high tides or when the marsh is flooded. A ten-year monitoring plan was approved to assess the success

of the revegetation efforts. Monitoring of greater frequency will occur within the first five years of project completion and then taper off until 10-years have passed and the project has met success criteria.

- **Inclusion of High Tide Refuge Islands.** To compensate for the removal of portions of the Outer Faber Tract levee that provided high tide refugia for marsh species in Outer Faber Marsh, the SFCJPA will create five refugia islands. The constructed islands increases Bay fill, but the SFCJPA provided additional details to justify these habitat features and that the amount of fill proposed is the minimum necessary to build the islands.
- **Maximizing Biotechnical Stabilization along the Creek.** Following the widening of the Creek channel, biotechnical stabilization strategies will be used in lieu of hard engineering strategies (e.g. riprap) along much of the flood control channel edges, where appropriate. The SFCJPA plans to use vegetation to control erosion and provide habitat in areas where erosional forces are low. However, some areas of the project require riprap or other erosion control methods due to the anticipated higher flows and critical shear stress occurring in these portions of the creek.
- **Future Upstream Planning.** The Water Board suggested the inclusion and consideration of pump stations or other infrastructure to reduce runoff and pollutant loads (e.g., through first flush flow diversion to publicly owned treatment works) into the creek during future planning for the upstream phases of the San Francisquito Creek. Although the SFCJPA did not have a comprehensive watershed scale plan prior to obtaining the permits for the lower portion of the San Francisquito Creek, the SFCJPA agreed to coordinate this project design with Low Impact Development projects that are being implemented or are planned upstream.
- **Hydrodynamic Modeling and Future Sea Level Rise.** The initial hydrodynamic modeling performed by the SFCJPA utilized a 100-year flood occurring with a 100-year tide on top of 36 inches of sea level rise as a criterion to help guide the appropriate flood control design for the creek. The SFCJPA provided additional model interpretation and extensive additional modeling to support the permit applications and satisfy the requests of the Water Board. The SFCJPA provided inundation modeling results and a narrative discussion of their potential future adaptation strategies to protect communities and properties from future sea level rise by building up the levees along the creek, but did not submit a full vulnerability assessment or an adaptation plan for the project.
- **Mitigation for Impacts.** Although the project included the creation of approximately 15 acres of tidal marsh habitats, some construction methods and project features utilized in the final permitted project will impact protected resources and the impacts could not be fully minimized. The regulatory and resource agencies required mitigation for these impacts. More specifically, temporary impacts to tidal marsh habitats were required at a mitigation ratio of 1:1 and permanent impacts required a 2:1 mitigation ratio. The SFCJPA exceeded these requirements by including the restoration and creation of tidal marsh habitat and upland refugia. The resource and regulatory agencies approved the final Mitigation and Monitoring plan in September of 2016.

Final San Francisquito Creek Project – SFB to 101

The permitting process for the SFC Project – SFB to Highway 101 began with the submittal of a JARPA and the 90% design plans to the regulatory agencies and lasted approximately three years as the SFCJPA worked with all the agencies to modify some of the project elements to meet all the laws, policies, and regulations of each agency. The project received all the required permits/approvals in early 2016 and began work in August of 2016. The final permitted project (Figure 4) included the following project activities:

- Degrading only a small portion of an unmaintained levee to allow flood flows from the Creek channel into a portion of the Outer Faber Tract Marsh;
- Excavating sediment deposits within the channel to create a low-flow channel and marsh plain terrace along the edge of the creek channel to marsh plain elevation;
- Realigning portions of the southern levee to widen the channel to increase channel capacity and conveyance to lower the flood elevation, as well as increasing levee height and stability;
- Widening the channel and construct floodwalls in the upper reach of the project area to increase capacity and maintain consistency with Caltrans' U.S. 101/East Bayshore Road Bridge project over San Francisquito Creek (Caltrans facility);
- Restoring sections of an unmaintained levee running along the southern edge of Faber Tract Marsh to protect the marsh from increased water conveyance resulting from the project;
- Creating 15 acres of habitat (such as in-channel marsh habitat, in-channel velocity refuge structures, high tide refugia islands, and planting native plants on the levee berms surrounding Faber Tract Marsh) for protected species occurring in and around the project area;
- Creating a new overflow terrace at marsh plain elevation adjacent to the low-flow channel; and
- Extending Friendship Bridge and build a new public access boardwalk across the overflow terrace.

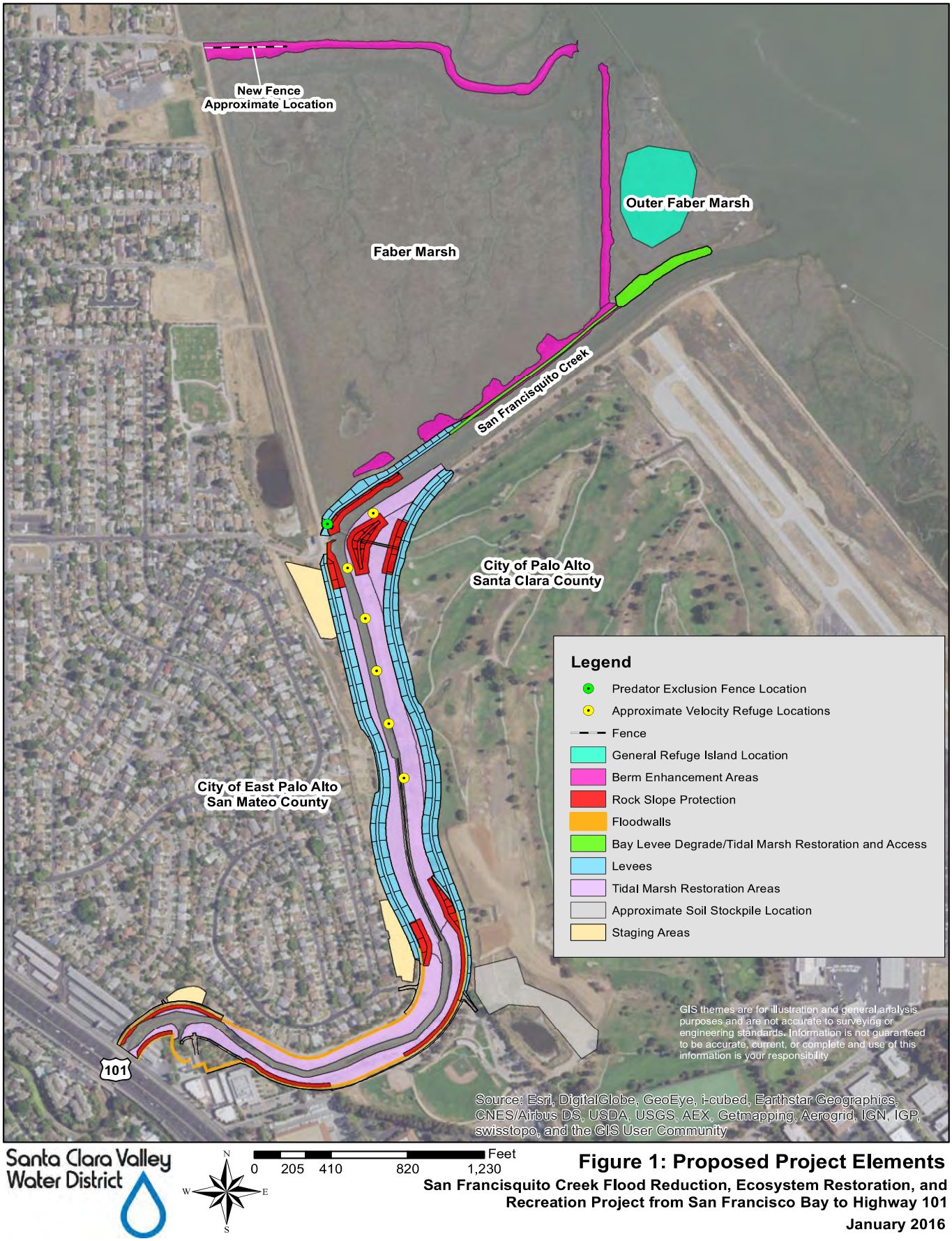

Figure 4: Proposed Project Elements

VI. Lessons Learned

- **Engage Early.** Discussions with the resource agencies and other permitting agencies should begin early in the design process to identify specific issues as quickly as possible and work collaboratively to incorporate design features and construction methods that minimize the impacts of the project on protected resources. In early engagement, it is important to have staff from both the regulatory and resource agencies, specifically those that administer the Endangered Species Acts, participating. Agency staff assisting the applicants in this way provides for a better project and more efficient permit process as the project proceeds. Agency staff should make an effort to be involved in the early planning process and attend project meetings when invited and offer feedback/advice related to their agencies' policies.
- **Plan Per Historical Context.** Historical context was the essence of the SFCP-101 to SFB design, and given the constraints presented, the design that best returned the area to historic conditions, given the developed state of the region, was the design that was initially chosen. Due to protections afforded listed species and their critical habitat, regulatory agencies imposed changes that altered the design further. Similar projects should also consider historic ecology and geomorphology in the design alternatives analysis with the individual constraints of the watershed, and the remaining high value habitat. These suggested design elements might reduce the potential harmful impacts of the project to habitat and protected species in the area and harness natural characteristics of the stream. Providing potential design solutions that the resource agencies would be able to find consistent with their laws and policies will likely speed up and streamline the permitting process.
- **Surrounding Land Use.** In many instances, Bay Area streams/channels occur in highly urbanized areas where there may not be much room to accommodate design elements that require more space. Often the properties adjacent to the channel are not owned by the flood control district, which can make it difficult to incorporate large-scale flood control features into the project. Given these realities, flood control managers and resource/regulatory agency staff should work together to identify the LEDPA project within a watershed context and provide a detailed justification regarding constraints.
- **Agency Participation in the EIR process.** The permitting process would likely be more efficient if the expectations from the agencies were clearly laid out early in the planning process and if the stance on the project was conveyed early in the EIR process and remained consistent throughout the permitting process.
    - **Meetings**. It is important to hold collaborative meetings to keep all agencies informed of changes to the project over time, however these meetings should follow discussions between project proponents and individual regulatory agencies so that each gains an understanding of the perspective of the other.
    - **Hire a Mediator/Facilitator.** If discussions surrounding the project come to a stalemate or are at a point where they are unproductive and issues are not being resolved in a timely manner, the agencies and applicants participating might consider seeking the assistance of a mediator or facilitator to run the meetings and discussions regarding particular project elements. This may guide the resolution of issues related to a particular project and ease the permitting process.

VII. Conclusion

After many years of scoping, planning, stakeholder engagement, design, alternatives analysis, and regulatory permitting, the construction on the SFC Flood Control Project – SFB to 101 broke ground in August 2016. The project is projected to take 2-3 years to construct. It includes the relocation of utilities present in the area, channel excavation, levee construction and deconstruction, construction of low-flow terraces, floodwalls, high-tide refugia, and enhancement of tidal habitats and upland refugia within the channel and in/around the adjacent Faber Tract Marsh area. This capital project is projected to cost about $41.5 million for all construction and mitigation costs.

VIII. Who We Are

This case study was developed through Flood Control 2.0: Rebuilding Habitat and Shoreline Resilience through a New Generation of Flood Control Channel Design and Management, an EPA-funded project of the San Francisco Bay Conservation and Development Commission (BCDC), the San Francisco Estuary Partnership (SFEP), the San Francisco Bay Joint Venture (SFBJV), and the San Francisco Estuary Institute (SFEI). This case study was only possible with the cooperation of the Contra Costa County Flood Control and Water Conservation District. The four agencies mentioned above are working together to provide information resources and technical assistance to support flood control agencies in the design and evaluation of flood control projects for improved control function, sediment transmission, and Bay connectivity.

The primary author for this report is Anniken Lydon, Coastal Program Analyst, with assistance from Brenda Goeden and Alex Braud of the Sediment Management Team at the San Francisco Bay Conservation and Development Commission. We would like to thank Len Materman, Executive Director of the San Francisquito Creek Joint Powers Authority and Kevin Murray, Senior Project Manager at the San Francisquito Creek Joint Powers Authority for their participation, contributions and feedback during this case study analysis.

For more information, please see the San Francisquito Creek Project website http://sfcjpa.org. See also the dedicated Flood Control 2.0 website http://floodcontrol.sfei.org for more information related to innovative flood control projects around the region and useful tools/guidance for developing a multi-benefit flood control project.

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