SAN FRANCISQUITO CREEK
JOINT POWERS AUTHORITY

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Climate Change Impact Assessment
Reach 2 (Urban Reach) Project

This assessment evaluates how conditions may change in the future because of climate change. To do so, we describe potential changes to physical processes based on modeling, then assess how the area may be impacted by these changes.

The goal of this evaluation is to infer how vulnerable the project and mitigation measures are to impacts from climate change, and thus identify location, design, and management strategies to avoid and minimize those impacts.

This evaluation follows the following steps, in accordance with the State Water Board's April 2020 *Implementation Guidance for the State Wetland Definition and Procedures for Discharges of Dredged or Fill Material to Waters of the State*:

Step 1. Identify Reasonably Foreseeable Impacts
Step 2. Assess Overall Impact Risk Level
Step 3. Identify Avoidance and Minimization Measures
   A. Identify project design measures that will avoid and/or minimize impacts from climate change
   B. Identify monitoring and/or performance measures that will avoid and/or minimize impacts from climate change

This evaluation is consistent with the SF Water Board's Proposed Basin Plan Amendment on Climate Change and Aquatic Habitat Protection, Management, and Restoration, which is being considered for adoption July 13, 2022 (https://www.waterboards.ca.gov/sanfranciscobay/water_issues/programs/climate_change/.

MODELING FUTURE CONDITIONS

The Environmental Impact Report for the Reach 2 project considered 1.5 feet of sea level rise using a basin wide model that was informed by hydraulic and chemical data collected in 2017 in San Francisquito Creek, and presented in the July 2018 Final San Mateo County Groundwater Assessment. The climate change scenario included predicted increased precipitation from climate change, but modeled results did not indicate a significant change in the amount of inflow to San Francisquito Creek. Seawater intrusion was also evaluated as this was observed to have occurred in the past along with local land subsidence as a result of past over-pumping of groundwater. The evaluation concluded that climate change effects were less than potential over-pumping effects.

This evaluation began in March 2017 when the SFCJPA developed a scope of work (SOW) for San Mateo County's (SMC) Office of Sustainability's Groundwater Assessment to collect surface water data in San Francisquito Creek to determine if any significant changes had occurred since it was last monitored by the USGS in 1996-1997. This work, which was developed, funded, and implemented by SFCJPA, was included in SMC's July 2018 Final

San Mateo Plain Groundwater Basin Assessment (SMC 2018). This document as well as the SFCJPA's Environmental Impact Report (EIR) describe the results of the climate change scenarios, as well as potential increased groundwater use that could adversely affect baseflow (and potentially fish) in San Francisquito Creek as the more significant effect (SFCJPA 2019).

In summary, the results of the climate change scenario that considered 1.5 feet of sea level rise did not identify any significant changes to San Francisquito Creek groundwater and surface water. As such, this evaluation may already meet the Water Board suggestion of evaluating climate change projections of at least 20 years, as 1.5 feet of sea level rise would be an approximate 50-year estimate.

The Ocean Protection Council's (OPC 2020) updated projections that are being used for planning in California indicate that seas could rise by 3 to 10 feet by 2100, depending on how well greenhouse gas emissions are reduced and how quickly ice is lost from the Antarctic ice sheet (Source: https://ourcoastourfuture.org/science-and-modeling/).

As a result of the more recent higher sea level rise and increased temperature projections and overall uncertainty of human action, the SFCJPA has incorporated an evaluation of significantly more severe scenarios and storm events.

UPDATED CLIMATE CHANGE MODELING 2021

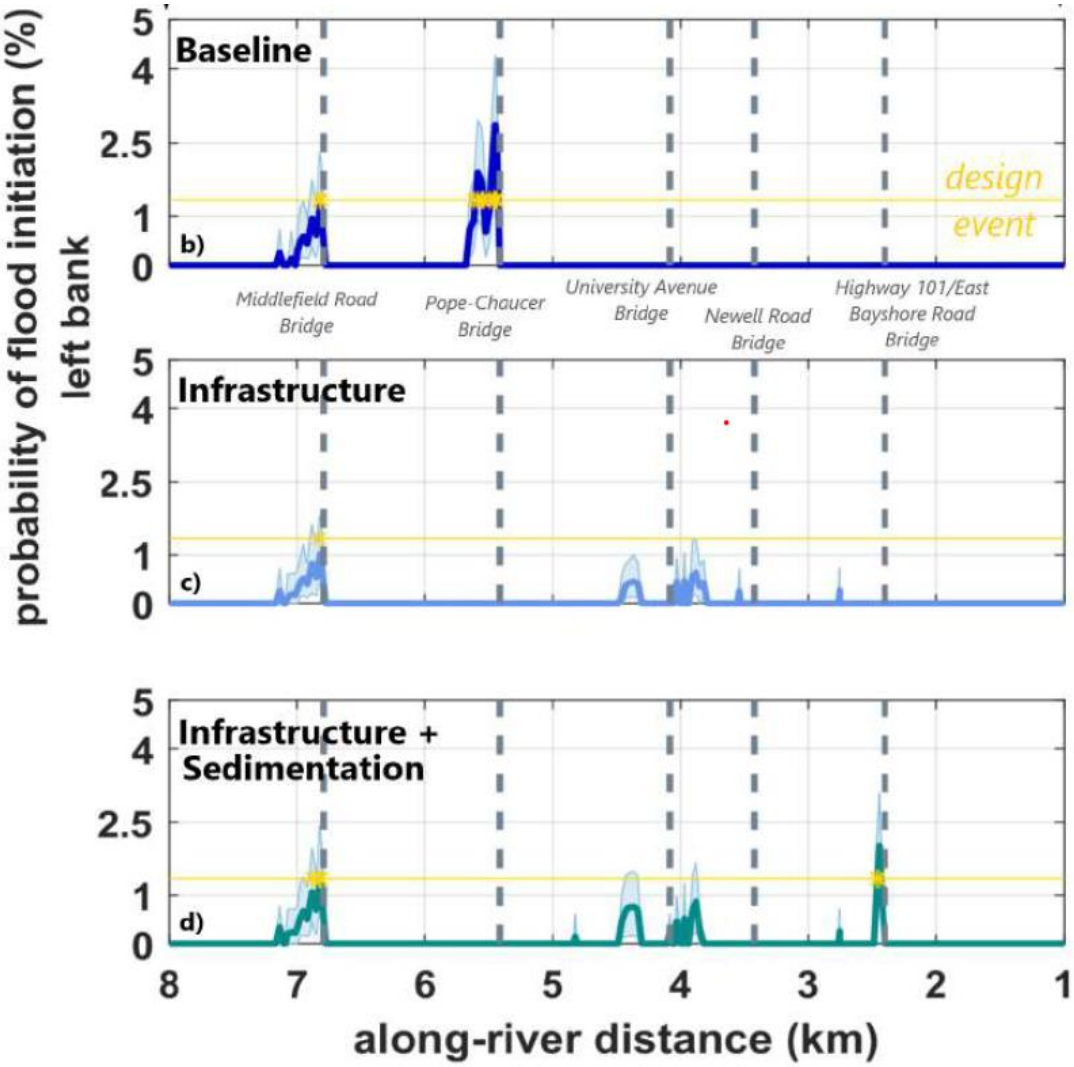
The SFCJPA collaborated on a study with Stanford University on hydraulic modeling of San Francisquito Creek (https://agu.confex.com/agu/fm20/meetingapp.cgi/Paper/734076). The study used the existing watershed level HEC-RAS and sediment transport models and modified them to three separate probabilistic predictions of flows under the following three transects:

1) upstream of the Middlefield Road Bridge,
2) between the Middlefield Road Bridge and the Pope-Chaucer Bridge, and
3) downstream of the Pope-Chaucer Bridge.

Thirty centimeters of sea level rise were included, and a 50% increase in precipitation was simulated by increases in river discharge. The study used the output from HEC-RAS at transects within the above three locations to evaluate outflow over modeled hydraulic structures (levees, floodwalls) to predict flooding. The probabilistic modeling was completed for four potential future climate conditions- present-day, increased discharge, increased sea level, increased discharge and sea level, and across each of the three creek conditions: Baseline, Infrastructure, and Infrastructure + Sedimentation.

Results indicate that the probability of a 1% (100-year) flood becomes approximately two and one half times (2.5x) more frequent. Very high flood events, a 500-year flood (0.4%) may occur almost three times more frequently in the future. The simulations also predict that in the future, there is an increased probability of breakout at the University Avenue Bridge. The sedimentation simulations indicate increased probability of sediment

accumulation near Highway 101 that if not managed as planned, could cause flooding, as shown in Figure 1 that shows the increasing probabilities along San Francisquito Creek.



Source: K. A. Serafin, J. Koseff, J.W Baker, and J. Suckale, 2022. *Flood risk transfer as a consequence of climate change and infrastructure modifications along the San Francisquito Creek, California,* draft manuscript submitted to **Water Resources Research,** in press.

The Reach 2 project design was modified based on the above modeled breakout locations when considering sea level rise, increased creek discharge from a 500-year event, infrastructure, and sedimentation conditions. The modeling predicts higher water levels and potential breakouts downstream of the Pope Chaucer Bridge at two locations in East Palo Alto. One location is where the proposed project will replace the existing temporary floodwall with a permanent, engineered floodwall at the Woodland Avenue Wall near University Avenue. The design engineer has increased the height of the wall by one foot to accommodate potential increased water surface in future years. Similarly, at the second predicted breakout point, a low spot in the top of bank near University Avenue will be raised

with a small top of bank structure of up to 2 feet in height to accommodate the predicted future conditions.

The enhanced probabilistic modeling for future scenarios indicates that for the creek and the plants and animals that inhabit it, that high intensity storms will be more frequent. Although lower flows were not simulated, these are likely to be less frequent since rainfall would occur less frequently but at higher intensities. This is not a healthy scenario for steelhead, who rely on lower flows to span and migrate. The features proposed for the project include refugia that may sustain in-migrating adults and out-migrating smolt. NOAA Fisheries recognizes climate change as a key threat to this species, and actions to enhance habitat and buffer areas in gravel-bottomed, fast-flowing, well-oxygenated rivers and streams are considered useful (https://www.fisheries.noaa.gov/species/steelhead-trout).Table 1 presents an assessment of factors that could be affected by climate change, using our most sensitive and water dependent species, steelhead trout (*oncorhynchus mykiss*).

Table 1. Risk Evaluation for San Francisquito Creek Reach 2 Project

Factor	Description of Risk or Impact Level	Score
Aquatic resource type: steelhead *Oncorhynchus mykiss*	Protected species observed in watershed	3
Size	Project is small compared to overall watershed. Impacts are estimated to total less than 5 acres of the 28,800 acres in the watershed. Work will occur in an area of the creek that is highly urbanized and constrained by development.	2
Position in watershed	Projects located in middle of the watershed are considered to be more resilient	2
Soil type/permeability	Soil relatively more permeable in this reach	2
Land use intensity	This reach is fully developed and surrounded by housing.	3
Degree of hydrological connectivity	Creek and groundwater are hydraulically connected. In this reach, the creek generally recharges groundwater due to higher permeability sediments. This condition varies throughout the watershed, with the creek in the upper watershed overlying bedrock that allows small pools to form.	2
Mitigation project design	Design has refugia for out migration resting stops, but the creek is dry in the Reach 2 project area most of the year- steelhead would need to stay in small pools in the upper watershed to survive.	2
Precipitation Impact	Likely to change at the site in the long term, modeling indicates increased frequency of high flood events	3

Factor	Description of Risk or Impact Level	Score
Sea Level Impacts	Tidal effects modeled to be minimal for San Francisquito Creek	1
Temperature Impacts	Temperatures may increase 3-5°F by mid-century and 6-9°F by end of century	2
Regional factors	Potential for fires in heavily wooded upper watershed and surrounding areas that could affect creek and associated riparian habitat	2
Total		**24**

Note: Scores greater than twenty should identify how avoidance and minimization measures related to the climate change risk factors are incorporated into proposed project.

Avoidance and Minimization Measures:

The project has incorporated avoidance and mitigation measures. The project has avoided impacts to the creek by minimizing footprint as much as possible. Fish friendly features are part of project design. Tree loss will be minimized by replacement of canopy, and creation of new canopy in areas of Menlo Park and East Palo Alto that have less canopy.

Trees

In most areas by the creek where trees will be removed, there is already dense canopy as well as space limitations for replanting. The SFCJPA's goal is to not only replace canopy, but to also create canopy in areas where it is documented to be less dense (https://www.communitycommons.org/entities/e428ca57-e89d-4653-af0a-54beffcfd4f0). Trees will be planted outside of the Project footprint based on canopy numbers and goals of each member entity. Palo Alto has approximately 25% tree canopy coverage according to the Healthy Places Index (HPI). In East Palo Alto, HPI indicates canopy coverage of 6% to 12%. Some of this disparity is related to fewer trees naturally occurring in the shoreline areas. In Menlo Park, tree canopy ranges from 15-31% according to the HPI. However, when evaluated at a neighborhood scale, the Belle Haven neighborhood of Menlo Park has an estimated 7% coverage.

The SFCJPA will work with the Cities and local non-profit groups to plant trees in residential areas of Belle Haven and Haven areas of Menlo Park and East Palo Alto residential areas. In consultation with the cities, arborists, local non-profits and residents, the SFCJPA will plant native and low water demand species that are adaptable to changing salinity conditions.

Fish

The project has incorporated as many fish friendly features as possible, given the simultaneous objectives for floodwater conveyance and minimizing creek impact. The replacement of the Pope Chaucer Bridge will reestablish a natural creek bottom for this species, as the current bridge is a concrete culvert. Up to 10 boulder and willow clusters are planned to be planted and maintained, in accordance with CDFW recommendations. In addition, the project has a ½ acre restoration area in the Reller parcel along the creek that is located upstream of widening Site 1, where invasive species will be removed and increasing high quality riparian habitat and shade for fish. We are creating new waters of the State in the widening areas, creating more creek habitat for aquatic species.

Replacing canopy and planting of new trees at a ratio greater than the trees removed will provide additional shade, which will help to mitigate future temperature increases, as well as increase carbon sequestration over the life of the project, which will have a small, but beneficial mitigating effect against the rate of climate change. Invasive species management is also an important factor in Watershed management.

Flow

What we are now learning is that installation of fish friendly features is less important than flows that are appropriate for salmonids at each life stage (Tuolumne River Trust, 2022). SMC's 2018 groundwater assessment concluded flows in San Francisquito Creek are affected by groundwater pumping. As an avoidance measure, flow monitoring should be conducted to maintain balance for sustainable surface flows for fish.

Flow in San Francisquito Creek is highly dependent on precipitation, and the current flow and sediment transport models have defined average water years; this may change in the future because of climate change effects. Flow monitoring will be needed to assess adequate flows but also to inform the models as a tool to predict and adaptively manage the watershed.

Temperature

Temperature changes are expected to increase 3-5°F by 2050 and 6-9°F by 2100. These increases may force changes in plant communities, potentially impacting some tree and other riparian species. Additionally, because evapotranspiration moisture losses will further reduce streamflow throughout the watershed, this could be inferred to further contribute to reduced creek flows in the urban reach.

Fire

For the regional fire threat, Stanford University and local land stewards at Midpeninsula Open Space District, have created plans to address increased threat of wildfires. We have also been collaborating with the Menlo Park Fire District to identify areas along the creek that are potential fire hazards.

Monitoring and/or Performance Measures

The Operation and Maintenance Plan includes adaptive management of the area, and this plan will be updated to incorporate the Reach 2 project area. Triggers for sediment removal at West Bayshore Bridge/Highway 101 area are already included in the plan. The long-term applicability of these triggers will be evaluated as the climate changes. Responses to sediment accretions and erosion within the watershed will be adapted as necessary.

Based on the potential impacts to fish, flows, temperature and canopy, the Adaptive Management Plan will be updated to include flow, temperature canopy and invasive species monitoring. Planting palettes will be evaluated for long term viability with climate stressors.

Consistency with Proposed Basin Plan Amendment on Climate Change and Aquatic Habitat Protection, Management, and Restoration

Guidance for climate change and aquatic Habitat Protection, Management and Restoration specifies the following:

When permitting dredge or fill activities in waters of the state, including wetlands, the Water Board must consider how numerous factors, including but not limited to climate change, influence the direct, indirect, and cumulative impacts of dredge or fill activities on ecosystem functions. The following questions may be relevant and can help the Water Board consider the reasonably foreseeable influence of climate change and related factors in project permitting and assess if the project's adverse impacts to waters of the state have been appropriately avoided, minimized, and compensated where required.

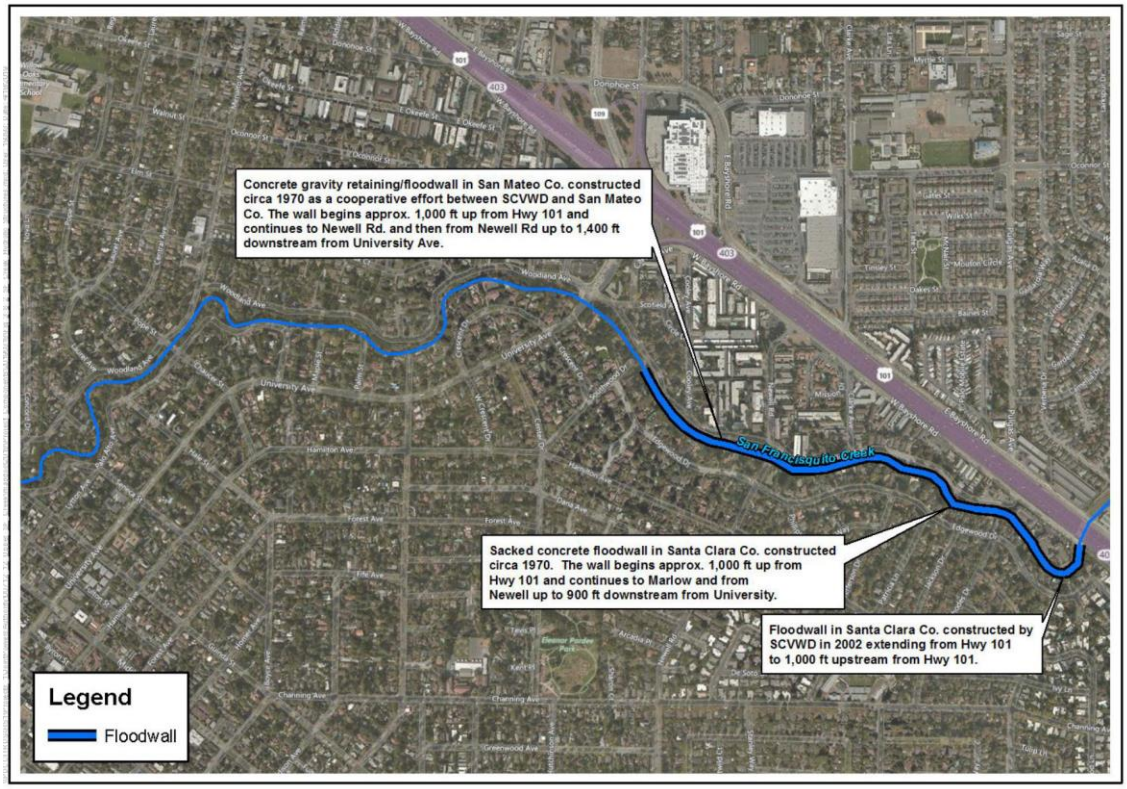
Below are questions and answers for the San Francisquito Creek Urban Reach 2 Project:

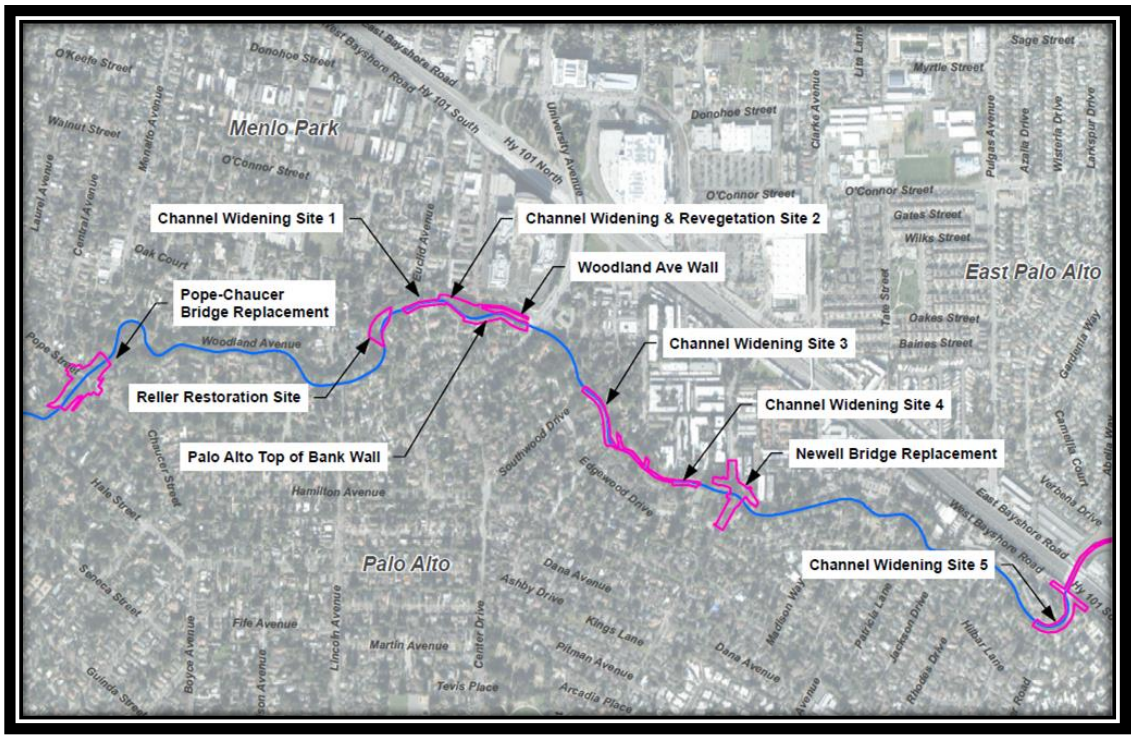
1. Is the proposed project design, as well as assessment of its near-term and long-term impacts at site- and landscape-scales, based on the best available science describing climate change and its influence on the environment? *Yes, the design relies on state of the art hydraulic and sediment models for the entire watershed. In addition, the models were modified as described herein to assess climate change impacts.*
2. Is the proposed project designed as part of a phased adaptation strategy that anticipates potential future projects and accommodates these projects in a manner that protects future beneficial uses of the site and its landscape? *Yes, the project is part of a Comprehensive plan of actions for the Watershed that protects beneficial uses of the creek and riparian corridor.*
3. Is the proposed project designed within a landscape-scale, cross-jurisdictional framework, such as an operational landscape unit? *Yes, the design is watershed scale. San Francisquito Creek operates across jurisdictional boundaries and collaborates not only within the watershed but also adjoining areas to ensure consistency on landscape scale.*
4. Does the proposed project utilize practicable natural and/or nature-based design features, or a combination of traditional and nature-based features? *Yes, the project uses nature-based designs where possible and traditional design where nature based design can not be implemented.*
5. For a proposed dredge or fill activity, what are the near- and long-term direct, indirect, and cumulative impacts to the acreage, functions, and values of waters of the state when considering the reasonably foreseeable conditions from climate change? *Reasonably foreseeable effects have been identified and mitigation measures proposed to address. No action on the affected landscape will likely result in more frequent and intense flooding. No conversion of water of state will occur.*

Conclusions

The Reach 2 Project is vulnerable to the effects of climate change. The project has updated engineering designs to protect vulnerable populations in East Palo Alto. The proposed project has incorporated appropriate avoidance and mitigation measures, and through long term operation and maintenance, will monitor and adjust these measures to maximize habitat for the benefit of aquatic species and the associated riparian corridor.

Current and proposed hydraulic Structures in San Francisquito Creek
(Figure below is Figure 3.8.1 of the FEIR.)





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Regional Water Quality Control Board, San Francisco Bay Region. 2022 *Proposed Basin Plan Amendment on Climate Change and Aquatic Habitat Protection, Management, and Restoration* https://www.waterboards.ca.gov/sanfranciscobay/water_issues/programs/climate_change/ pending July 13 hearing.