Public Comment
2016 Bay-Delta Plan Amendment & SED
Deadline: 3/17/17 12:00 noon

CITY AND COUNTY OF SAN FRANCISCO

OFFICE OF THE CITY ATTORNEY

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March 16, 2017

RECEIVED
3-17-17
SWRCB Clerk

Via Hand Delivery

Jeanine Townsend
Clerk to the Board
State Water Resources Control Board
1001 "I" Street, 24th Floor
Sacramento, CA 95814-0100

Re: **Comments by the City and County of San Francisco to the State Water Resources Control Board's Draft Substitute Environmental Document in Support of Potential Changes to the Bay-Delta Plan.**

Dear Ms. Townsend:

The San Francisco City Attorney's Office submits the enclosed comments on the State Water Resources Control Board's proposed amendment of the Bay-Delta Water Quality Control Plan ("Bay-Delta Plan") and the Draft Substitute Environmental Document on behalf of the San Francisco Public Utilities Commission ("SFPUC" or "San Francisco").

Our submission consists of a cover letter from Harlan L. Kelly, Jr., General Manager, SFPUC and the following two attachments to the SFPUC Cover Letter:

(1) Legal Comments by the City and County of San Francisco to the Draft Substitute Environmental Document in Support of Potential Changes to the Bay-Delta Plan ("Legal Comments"). San Francisco's Legal Comments include exhibits and appendices that are provided on the attached CD, along with electronic copies of our complete submission.

(2) SFPUC Alternative to promote the expansion of fall-run Chinook salmon and Oncorhynchus mykiss populations in the lower Tuolumne River while maintaining water supply reliability.

Very truly yours,

DENNIS J. HERRERA
City Attorney

/s/

Jonathan P. Knapp
Deputy City Attorney

Enclosures

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March 16, 2017

Re: Comment Letter – Bay Delta Plan Revised SED

Dear Ms. Townsend:

The SFPUC appreciates the opportunity to comment on the revised Substitute Environmental Document (SED) prepared for analyzing the potential changes to the water quality control plan for the San Francisco Bay-Sacramento/San Joaquin Delta Estuary (Bay-Delta Plan), and in particular, the proposed revised San Joaquin River (SJR) flow objectives which apply to the Tuolumne River. The SFPUC is a department of the City and County of San Francisco responsible for managing and operating the City's water, clean water and power utilities. We have numerous concerns about the proposal as described below, but at the same time we are submitting a proposal to promote the expansion and maintenance of fisheries on the Tuolumne River. We believe this proposal has significant merit.

The SFPUC believes the State Water Board's revised SED analysis prepared in compliance with the California Environmental Quality Act is deficient. The City and County of San Francisco's City Attorney Office have prepared comments detailing these deficiencies. They are included as an attachment to this letter (Attachment 1). As identified in these comments, contrary to the State Board's analysis, a 40% unimpaired flow proposal would mean a significant impact on San Francisco's water supply, and alternatives to make up that supply are enormously expensive and have potential significant impacts that make their implementability uncertain.

We have serious doubts about the Tuolumne River ecosystem benefits of the State Water Board's proposal. Over 200 studies have been performed on the Tuolumne River since the early 1990s and the SFPUC and Turlock and Modesto Irrigation Districts have spent $25 million on studies on the Tuolumne River fishery in the last 5 years. The State Board neglected to use these site-specific available data. All of these studies provide significant information about the state of the fishery on the Tuolumne River and what should be done to improve the fishery. These studies are included in detail in the comments of the Modesto and Turlock Irrigation Districts. We are incorporating their comments by reference, specifically the following technical comments, attachments and appendices:

SED Technical Comments

1.0 Summary of Findings Related to SWB's Revised Draft Substitute Environmental Document

2.0 Comments on the SED's Description of the Tuolumne River Basin

3.0 Comments on Hydrology, Unimpaired Flow, and Related Adverse Impacts on Fry and Juvenile Fall-Run Chinook Salmon

4.0 Comments on the SED's Assessment of Temperature Benefits

5.0 Comments on the SED's Assessment of Floodplain Benefits

6.0 Comments of the SED's SalSim Model and Analyses

7.0 Comments of the SED's Adaptive Implementation Plan

9.0 The Missing Science and How It Would Change the SED

10.0 Other Material Errors or Misrepresentations Contained within the Draft SED

11.0 References

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Appendix A	Evaluation of the SED's Floodplain Benefits and Hatchery Impacts
Appendix B	Detailed Comments on SalSim Model
Appendix D	Response to the Resource Agencies' Presentations at the January 3, 2017 Public Hearing
Appendix E	Final Swim Tunnel Study Report
Appendix F	Final Tuolumne River Floodplain Hydraulic and Habitat Assessment Study Report
Appendix G	Final License Application (FLA), Don Pedro Project
Appendix H	Final Otolith Study Report, e-filed with FERC post-FLA filing

Most importantly, we have a better proposal for Tuolumne River ecosystem improvements that have significant technical support. This proposal meets the fishery protection goals on the Tuolumne River without the significant impacts to San Francisco that would result from the State Board's proposal. Attached to this letter is a description of the SFPUC's alternative (Attachment 2).

Finally, we cannot support a proposal that hurts our water supply while benefitting other users. Increased flow releases from the San Joaquin tributaries will increase Delta inflow. Increased Delta inflow could be used as the basis for increased diversions from the South Delta by the State Water Project and the Central Valley Project. Benefits for the Projects at the expense of San Francisco's water supply are not acceptable.

In closing, negotiated settlements among water users, NGOs and the State and Federal agencies are a better solution than the State Water Board's regulatory proposal if they can be developed and implemented. They need to be jointly developed for the San Joaquin River, the Sacramento River and the Delta. The State-sponsored settlement discussions are off to a slow, but promising, start. There is much work to be done in building trust among the parties. However, we do not believe the State Water Board's regulatory proposal provides a framework that is sufficiently flexible or robust to support settlements. Please feel free to contact Michael Carlin at (415) 934-5787 or Steve Ritchie at (415) 934-5736 with any concerns or requests for additional information.

Sincerely,

Harlan L. Kelly, Jr.
General Manager

Attachments

cc: SFPUC Commissioners
Michael P. Carlin, Deputy General Manager
Steven R. Ritchie, Assistant General Manager, Water
Nicole Sandkulla, BAWSCA CEO and Executive Director

ATTACHMENT 1:

COMMENTS BY THE CITY AND COUNTY OF SAN FRANCISCO TO THE DRAFT SUBSTITUTE ENVIRONMENTAL DOCUMENT IN SUPPORT OF POTENTIAL CHANGES TO THE BAY-DELTA PLAN

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BEFORE THE CALIFORNIA

STATE WATER RESOURCES CONTROL BOARD

DRAFT SUBSTITUTE ENVIRONMENTAL DOCUMENT IN SUPPORT OF POTENTIAL CHANGES TO THE WATER QUALITY CONTROL PLAN FOR THE SAN FRANCISCO BAY-SACRAMENTO/SAN JOAQUIN DELTA ESTUARY; SAN JOAQUIN RIVER FLOWS AND SOUTHERN DELTA WATER QUALITY	COMMENTS BY THE CITY AND COUNTY OF SAN FRANCISCO TO THE DRAFT SUBSTITUTE ENVIRONMENTAL DOCUMENT IN SUPPORT OF POTENTIAL CHANGES TO THE BAY-DELTA PLAN

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INTRODUCTION

On September 15, 2016, the State Water Resources Control Board ("State Water Board") issued the Draft Substitute Environmental Document ("SED") for proposed amendments to the water quality control plan for the San Francisco Bay-Sacramento/San Joaquin Delta Estuary ("Bay-Delta Plan"). The amendments propose new unimpaired flow objectives for the Lower San Joaquin River ("LSJR"), and a new flow compliance location on the Tuolumne River ("Plan Amendment"). The San Francisco City Attorney's Office submits these comments on the Plan Amendment and the SED on behalf of the San Francisco Public Utilities Commission ("SFPUC" or "San Francisco"), the city department with jurisdiction over San Francisco's water, wastewater, and energy facilities. San Francisco submits these comments in accordance with Title 23, California Code of Regulations sections 3779(b) of the State Water Board's regulations.

BACKGROUND

I. San Francisco's Water Supply Operations.

A. The Hetch Hetchy Regional Water System.

The SFPUC operates the Hetch Hetchy Water and Power System ("HHWPS"), which is comprised of numerous facilities that provide water directly to San Francisco's residents and 26 wholesale customers in San Mateo, Santa Clara and Alameda counties from the Tuolumne River.[1] Collectively, these wholesale customers receive over 66 percent of the water delivered by the RWS. Of these wholesale customers, which are represented in matters related to the Hetch Hetchy Regional Water System ("RWS") by the Bay Area Water Supply and Conservation Agency ("BAWSCA"),[2] 13 rely on the SFPUC for 95 percent or more of their total supply, and 8 rely on the SFPUC for 100 percent of their total supply. The RWS is the third largest supplier of water for domestic and municipal purposes in California, providing water service to 2.6 million people in Tuolumne,

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[1] The RWS also provides water on a wholesale basis to Cordilleras Mutual Water Company ("MWC") and Groveland Community Service District ("CSD") in Tuolumne County, as well as retail customers in the Town of Sunol and Lawrence Livermore National Laboratory in Alameda County. Cordilleras MWC relies entirely on the SFPUC for its supply, and Groveland CSD relies on the SFPUC for the majority of its supply.

[2] Annual Survey, April 2016, Fiscal Year 2014-15, Bay Area Water Supply & Conservation Agency, *available at* http://bawsca.org/uploads/userfiles/files/BAWSCA_AnnualSurvey_FY2014-15.pdf (referred to below as "BAWSCA 2015 Annual Survey"), at ES-1. San Francisco incorporates the BAWSCA 2015 Annual Survey herein by reference.

Alameda, Santa Clara, San Mateo, and San Francisco counties. Water diverted from the Tuolumne River watershed makes up approximately 85 percent of the water used to supply the RWS, and the remaining 15 percent is diverted from the combined Alameda and Peninsula watersheds (referred to collectively as the "local" watersheds).

The RWS begins with Hetch Hetchy Reservoir and O'Shaughnessy Dam, located in Yosemite National Park on the main stem of the Tuolumne River. Hetch Hetchy Reservoir collects drainage primarily in the form of snowmelt from the surrounding 459 square miles of the Tuolumne River watershed. Two additional reservoirs in the Hetch Hetchy Region – Lake Eleanor and Lake Lloyd (also called Cherry Reservoir) – collect water from the watersheds northwest of Hetch Hetchy Reservoir on tributaries to the Tuolumne River.

Under normal operating conditions, Hetch Hetchy is the only reservoir that directly supplies Tuolumne River water to the RWS. San Francisco delivers water from Hetch Hetchy Reservoir to customers without filtration because the high quality of this water supply warrants a filtration exemption from the United States Environmental Protection Agency ("U.S. EPA") and the State Water Board's Division of Drinking Water ("DDW"). Hetch Hetchy Reservoir can store up to 360,400 acre-feet ("AF") of water. San Francisco primarily uses Lake Eleanor and Lake Lloyd to satisfy downstream senior water rights of the Modesto Irrigation District ("MID") and Turlock Irrigation District ("TID," collectively referred to as the "Districts") and to produce hydroelectric power.

The Districts are co-licensees of the Don Pedro Hydroelectric Project located on the Tuolumne River, approximately 39 miles downstream from Hetch Hetchy Reservoir. Don Pedro Reservoir – formed by Don Pedro Dam – can store 2,030,000 AF of water. The Districts also own the La Grange Hydroelectric Project, which consists of a dam and reservoir located on the Tuolumne River downstream of Don Pedro Dam.

In the 1913 Raker Act (38 Stat. 242), Congress granted San Francisco rights-of-way across federal lands for the Hetch Hetchy Project, and required San Francisco to bypass certain flows to the Districts in recognition of their senior water rights – 2,350 cubic feet per second ("cfs") or natural flow, whichever is less, year-round, and 4,000 cfs from April 15 to June 13, as measured at La Grange Dam. (Raker Act, §§ 9(b))-(c).) San Francisco also bypasses an additional 66 cfs of flow in recognition of other pre-1914 water rights held by MID. These bypasses are collectively referred to here as the Districts' "water entitlements." Thus, the Raker Act only allows San Francisco to divert water from the Tuolumne River during high flow periods, and requires that San Francisco bypass all flow to the Districts during dry periods when flows do not exceed quantities specified in the Raker Act.[3]

B. San Francisco's Water Bank in Don Pedro Reservoir.

The 1966 Fourth Agreement between San Francisco and the Districts ("Fourth Agreement") involved the construction and operation of the Don Pedro Reservoir, and established a physical solution that maximizes the beneficial use of water from the Tuolumne River while accommodating the Districts' senior water rights. "The phrase 'physical solution' describes an agreed upon or judicially imposed resolution of conflicting claims in a manner that advances the constitutional rule of reasonable and beneficial use of the state's water supply." (*City of Santa Maria v. Adam* (2012) 211 Cal. App. 4th 266, 287, *as modified on denial of reh'g* (Dec. 21, 2012), *review denied* (Feb. 13, 2013), *cert. denied*, 134 S. Ct. 98 (U.S. 2013). The physical solution embodied in the Fourth Agreement ensures that San Francisco's diversions under its pre-1914 appropriative water rights will not harm the Districts' senior pre-1914 appropriative water rights by creating a water bank in Don Pedro Reservoir that allows San Francisco to "pre-pay" water released from upstream to satisfy the Districts' senior water rights.

Consistent with the requirements of the Raker Act and the Fourth Agreement, operation of the Don Pedro Reservoir "water bank" includes up to 570,000 AF of storage that San Francisco can use to manage its operation of the HHWPS more efficiently. The SFPUC has the right to a maximum water bank credit of 570,000 AF at any time, and has the right to an additional credit in the water bank of up

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[3] *See* Comment Letter – Bay Delta Plan SED, City and County of San Francisco, March 29, 2013, *available at* http://www.waterboards.ca.gov/waterrights/water_issues/programs/hearings/baydelta_pdsed/docs/comments032913/dennis_herrera.pdf (referred to below as "2013 CCSF Comment Letter"), at 26 (unnumbered), Chart entitled "Daily Allocation of Tuolumne River Runoff" [depicting the amount of runoff that San Francisco was entitled to divert during the period from 1986-1993].) San Francisco's ability to divert water from the Tuolumne River was similarly restricted during the recent drought, *e.g.*, in 2014 the City was only able to divert 22,000 AF. *See* Declaration of Steven R. Ritchie in Support of Comments by the City and County of San Francisco to the Draft Substitute Environmental Document in Support of Potential Changes to the Bay-Delta Plan ("Ritchie Decl."), attached hereto as Appendix 1, at ¶ 4.

to 170,000 AF when storage in Don Pedro Reservoir physically encroaches into space reserved for flood control.[4] The United States Army Corps of Engineers flood control manual requires the Districts to maintain 340,000 AF of available flood control capacity in Don Pedro Reservoir from October 7th to April 27th of the following year, unless additional space and time are required by snowmelt parameters. The SFPUC does not include the 170,000 AF in its operational planning for the RWS because the additional credit occurs infrequently, is intermittent, and the SFPUC cannot carry it forward past October 6th of each year.

San Francisco and the Districts incorporated the Raker Act's flow bypass requirements into the terms of the Fourth Agreement. In return for San Francisco paying over half of the capital costs for the new Don Pedro Dam, the Districts agreed not to require San Francisco to bypass flow to meet the Districts' water entitlements whenever San Francisco has a positive balance in the water bank account. If San Francisco's balance in the water bank account goes to zero, the Fourth Agreement requires San Francisco to release or bypass sufficient water to satisfy the Districts' water entitlements at La Grange Dam. When releases from San Francisco's three reservoirs on the Tuolumne River and its tributaries exceed the Districts' water entitlements or the natural river flow, whichever is less, the excess water can be credited to San Francisco's water bank account, allowing the SFPUC to more flexibly store water in Hetch Hetchy Reservoir for delivery to its customers at other times of the year or over the course of successive dry years using carryover storage.[5]

Article 8 of the Fourth Agreement provides "[t]hat at any time Districts demonstrate that their water entitlements, as they are presently recognized by the parties, are being adversely affected by making water releases that are made to comply with Federal Power Commission license requirements, and that the Federal Power Commission has not relieved them of such burdens, City and Districts agree that there will be a re-allocation of storage credits so as to apportion such burdens on the following basis: 51.7121% to City and 48.2879% to Districts." The SED explains that "[b]y 2022, the State Water Board will fully implement the February through June LSJR flow objectives through

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[4] *See* Fourth Agreement, Article 5.

[5] *See* 2015 Urban Water Management Plan for the City and County of San Francisco, San Francisco Public Utilities Commission, June 2016 (referred to below as "SFPUC 2015 UWMP"), *available at* http://www.sfwater.org/modules/showdocument.aspx?documentid=9301, at Appendix L, at 6.

water right actions or water quality actions, *such as Federal Energy Regulatory Commission (FERC) hydropower licensing processes*." (SED, at K-28 [emphasis added].) Pursuant to Article 8 of the Fourth Agreement, revised water release requirements for the Don Pedro Hydroelectric Project ordered by FERC could result in San Francisco being responsible to bypass approximately 51.7 percent of the required flows.[6]

C. San Francisco's Current Contractual Obligations Regarding Instream Flow Release Requirements at Don Pedro Dam.

In 1994 FERC initiated mediation among 12 parties, including San Francisco and the Districts, on flow schedules and other matters related to instream flow releases from Don Pedro Dam in support of fisheries in the lower Tuolumne River.[7] In February 1996, the Districts filed an uncontested settlement agreement with FERC that included minimum flow schedules that were greater than the previous flow schedules (1996 Settlement Agreement).[8] In July 1996, FERC amended the Don Pedro Hydroelectric Project license to incorporate the flow schedules in the 1996 Settlement Agreement.[9] Prior to execution of the 1996 Settlement Agreement, on April 21, 1995, San Francisco and the Districts entered into an agreement that required San Francisco to make annual payments to the Districts in return for the Districts meeting all the minimum flow requirements provided for in the

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[6] The analysis in these comments assumes a 51.7 percent flow contribution by San Francisco. As a water supply provider to approximately 2.6 million people throughout the Bay Area, San Francisco must utilize worst-case scenarios for water supply planning purposes. In presenting the potential water supply, environmental, and socioeconomic effects from certain interpretations of the Raker Act and the Fourth Agreement San Francisco does not waive arguments it may have about how the Raker Act or Fourth Agreement should or will be interpreted in future proceedings before the State Water Board, FERC, courts of competent jurisdiction, or in any other context.

[7] Water System Improvement Program Programmatic Environmental Impact Report ("WSIP PEIR" or "PEIR"), *available at* http://sf-planning.org/sfpuc-negative-declarations-eirs, at 2-42. San Francisco incorporates the WSIP PEIR by reference herein.

[8] *Id.*

[9] *Id.*; see also *Turlock Irrigation Dist. & Modesto Irrigation Dist., Order Amending License and Dismissing Rehearing Requests* (July 31, 1996) 76 FERC ¶ 61117 ("1996 FERC Decision"), at 61614; Submission by Turlock Irrigation District and Modesto Irrigation District of Settlement Agreement and Request for License Amendments Pursuant to Settlement Agreement, February 5, 1996 ("1996 Settlement Agreement"), attached hereto as Exhibit 1. It is not clear from the SED whether, or why, the fishery and water quality standards analyzed in the SED were not comprehensively addressed in the 1996 Settlement Agreement and the proceedings leading up to it, or how the new information developed since 1996 would inform the dramatically different flow schedule called for in the SED.

1996 Settlement Agreement ("1995 Side Agreement").[10] The 1996 Settlement Agreement extends through the remainder of the FERC license and any annual licenses issued for the project.[11]

D. Water System Improvement Program.

The Water System Improvement Program ("WSIP") is a $4.8 billion, multi-year, capital program to upgrade the RWS and is approximately 90 percent complete.[12] The SFPUC undertook the WSIP to ensure that the RWS would be able to meet the Level of Service ("LOS") goals for water quality, seismic reliability, delivery reliability, and water supply. (*Id.*) The WSIP identifies a number of projects that San Francisco could potentially rely on to achieve the stated Water Supply LOS goal of meeting customer water needs in non-drought and drought periods throughout the RWS service territory. (*Id.*)

As required under CEQA, the San Francisco Planning Department prepared a Programmatic Environmental Impact Report ("WSIP PEIR" or "PEIR") for the WSIP, that analyzed facility projects at a program level and implementation of a water supply option at a project level. (*Id.*) The PEIR evaluated the potential environmental impacts of the proposed WSIP projects and identified potential mitigations for those impacts. (*Id.*) As recognized in the SED, the WSIP PEIR rejected the concept of San Francisco relying on a new in-Delta diversion as infeasible.[13] The San Francisco Planning Commission certified the PEIR on October 30, 2008. (*Id.*)

On the same day, the SFPUC adopted the Phased WSIP Variant option in Resolution No. 08-200. (*Id.*) The Phased WSIP Variant approved by the SFPUC included a 2 mgd water transfer from the Districts as a potential water supply source for meeting current demands in the RWS service territory during dry years.[14]

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[10] WSIP PEIR, *supra* note 7, at 2-42.

[11] *Id.* at 2-42—2-43.

[12] SFPUC 2015 UWMP, *supra* note 5, at 6-2.

[13] WSIP PEIR, *supra* note 7, at 9-126 (stating that "since this alternative would have uncertain water supply reliability and an unknown ability to reduce impacts on Tuolumne River resources, as well as significant additional environmental impacts, it was eliminated from further consideration."). *See also* SED, at 16-68 (where the State Water Board acknowledges the "SFPUC concluded that the in-Delta diversion option was infeasible, in part, because it would not achieve consistent year-round diversions due to uncertainties regarding the availability of water supplies and pumping capacities.").

[14] Public Utilities Commission, City and County of San Francisco, Resolution 08-0202 (adopting WSIP CEQA findings), *see* Attachment A, Water System Improvement Program, California Environmental Quality Act

The Phased WSIP Variant establishes a mid-term planning milestone in 2018, when the SFPUC will reevaluate water demands through 2030 in the context of then-current information, analysis, and available water resources. (*Id*.) The SFPUC has historically made annual average deliveries ranging from 285 million gallons per day ("mgd") in 1987 to 265 mgd in 2005 from the RWS. (*Id*.) The Phased WSIP Variant would meet the projected 2018 purchase requests of 285 mgd from the RWS by capping purchases at 265 mgd, the Interim Supply Limitation ("ISL") established by the SFPUC to limit water sales from the RWS through December 31, 2018. (*Id*. at 4-9, 6-2.) The remaining 20 mgd would be met through increased water efficiency and conservation, water recycling and local groundwater use: 10 mgd by the SFPUC's wholesale customers in Alameda, Santa Clara, and San Mateo Counties, and 10 mgd within San Francisco. (*Id*. at 1-1, 6-2.) By December 31, 2018, the SFPUC will reevaluate water system demands and supply options and conduct additional studies and environmental reviews necessary to address water supply needs after 2018. (*Id*. at 6-2.) As part of this process, the SFPUC will consider whether the Bay Area Regional Desalination Project ("BARDP") could serve as a future "source of supplemental water supply during droughts."[15]

E. The SFPUC's Contractual Obligations to its Wholesale Customers.

The 1984 Settlement Agreement and Master Water Sales Contract (collectively referred to as the "1984 Agreement") established the "Supply Assurance" of 184 million gallons per day ("mgd") to

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Findings, Findings of Fact, Evaluation of Mitigation Measures and Alternatives, and Statement of Overriding Considerations (referred to below as "WSIP CEQA Findings"), attached hereto as Exhibit 2, at 4 (explaining that the Phased WSIP Variant includes a "[d]ry year transfer from MID and/or TID of about 2 mgd," among other key program elements); *see also* SFPUC 2015 UWMP, *supra* note 5, at 7-6 (explaining that "[t]he proposed WSIP evaluated in the PEIR included a drought year water transfer with MID and/or TID of 25 mgd on an average annual basis during the design drought to meet drought year water delivery under the scenario in which demand was expected to be 300 mgd. The Phased WSIP that the SFPUC approved, however, only included a 2 mgd dry year transfer as that was the dry year need associated with meeting a demand of 265 mgd.").

[15] WSIP CEQA Findings, *supra* note 14, at 60 (emphasis added) ("After balancing competing policy considerations and the extent to which the Regional Desalination for Drought Alternative would add a great deal of complexity and uncertainty to the satisfaction of the SFPUC's long-term water supply objective, the Commission presently rejects the Regional Desalination for Drought Alternative as infeasible within the meaning of CEQA. In doing so, however, the SFPUC is by no means closing the door permanently on eventual participation in a regional desalination facility. *As part of its assessment in 2018 as to whether to increase Tuolumne River diversions to meet anticipated 2030 demand in its service area, the SFPUC will assess any progress the region has made towards putting in place, on a timely basis and under acceptable environmental conditions, a facility for desalinating seawater as a source of supplemental water supply during droughts.* Any such facility is simply too ill-defined and uncertain at present to be adopted at this time.").

the SFPUC's wholesale customers. (SFPUC 2015 UWMP, at 4-8.) Following the expiration of the 1984 Agreement on June 30, 2009, in July 2009, the SFPUC entered into the WSA, a 25-year agreement that describes the current contractual relationship between the SFPUC and its wholesale customers. (*Id.*) The 184 mgd Supply Assurance is a perpetual obligation carried forward in the WSA that survived expiration of the 1984 Agreement. (*Id.*) The Supply Assurance includes the demands of the City of Hayward and 23 additional wholesale customers (representing 24 of the 26 wholesale customers). (*Id.* at 4-9.) The cities of Santa Clara and San Jose do not have an allocated share of the Supply Assurance due to their temporary, interruptible status under the 1984 Agreement and the WSA. (*Id.*)

The WSA describes the temporary limitation on water sales through 2018 established by the Phased WSIP Variant, as noted. (*Id.*) As set forth in the WSA, the distribution of the Interim Supply Limitation ("ISL") is allocated as follows between wholesale customers and retail customers: the wholesale supply allocation is 184 mgd, and the retail supply allocation is 81 mgd. (*Id.*) If the SFPUC projects that the ISL will not be met by June 30, 2018 because of wholesale customers' projected use exceeding 184 mgd, the SFPUC may issue a conditional 5-year notice of interruption or reduction in supply of water to Santa Clara and San Jose. (*Id.*)

F. 2015 Urban Water Management Plan.

The SFPUC prepared the 2015 Urban Water Management Plan ("SFPUC 2015 UWMP") for San Francisco in accordance with the requirements of the 1983 California Urban Water Management Act ("Act"), Water Code sections 10610 through 10656. (*Id.* at 2-1.) The purpose of the Act is to assure that water suppliers plan for long-term reliability, conservation, and efficient use of California's water supplies to meet existing and future demands. (*Id.*) The Act requires that planning projections extend at least 20 years beyond the year of the UWMP, *e.g.*, through 2035 for the 2015 UWMP cycle. (*Id.*) The planning horizon for the SFPUC 2015 UWMP is 25 years, through 2040. (*Id.*) The SFPUC adopted the 2015 UWMP on June 14, 2016. (SFPUC 2015 UWMP, Appendix P.)

G. 2040 WaterMAP.

To establish a water supply planning framework for the planning period of 2019 through 2040, the SFPUC developed the *Draft May 2016 2040 WaterMAP: A Water Management Action Plan for the SFPUC* ("WaterMAP"). (SFPUC 2015 UWMP, at 4-11.) The WaterMAP identifies a shortfall in supplies of 19.5 million gallons per day ("mgd") over the 2040 planning horizon. As required by the terms of the WSA, the WaterMAP addresses the following water supply decisions associated with the shortfall: (1) whether to provide permanent individual supply guarantees totaling 14.5 mgd to the cities of Santa Clara and San Jose; (2) whether to expand the 184 mgd wholesale Supply Assurance by adding 1.5 mgd to East Palo Alto's existing individual supply guarantee and the increment of supply made available to Santa Clara and San Jose; and (3) the recovery of net losses in yield of 3.5 mgd resulting from instream flow requirements prescribed in permits authorizing construction of local watershed WSIP projects. Significantly, the WaterMAP states that the RWS will experience a 5.3 mgd deficit by 2040 during drought years, assuming the SFPUC maintains a consistent level of 10 percent rationing in all years.[16]

H. San Francisco's Contribution to the Sacramento-San Joaquin Delta.

As explained in the WSIP, "[t]he Sacramento-San Joaquin Delta is a 600-square-mile area of channels and islands at the confluence of the Sacramento and San Joaquin Rivers." (WSIP, at 5.3.1-16.) Freshwater from a 41,300-square-mile watershed drains into the Delta from the Sacramento and San Joaquin Rivers and several smaller rivers. (*Id.*) "Some of the freshwater is diverted from the Delta channels for municipal and agricultural purposes. The remainder flows through the Delta to the San Francisco Bay Estuary." (*Id.*) Although on average about 21 million AF of natural flow reaches the Delta annually, actual inflow varies widely from year to year and within the year. (*Id.*) For example, in 1977, a year of extraordinary drought, Delta inflow totaled 5.9 million AF. By contrast, in 1983, an exceptionally wet year, Delta inflow was about 70 million AF. (*Id.*) "On a seasonal basis, average monthly flow into the Delta varies by more than a factor of 10 between the highest month in

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[16] Draft May 2016 2040 WaterMAP: A Water Management Action Plan for the SFPUC, *available at* http://sfwater.org/Modules/ShowDocument.aspx?documentid=9750 ("WaterMAP"), at 24. San Francisco incorporates the WaterMAP herein by reference.

the winter or spring and the lowest month in the fall." (*Id*. (citation omitted).) The California Department of Water Resources ("DWR") estimates that over the historical hydrological record of water years 1922- 2014, on average, the natural flow into the Delta has equaled 21,533,000 AF, and the unimpaired flow has equaled 29,003,000 AF.[17]

Significantly, "[t]he Sacramento River, which enters the Delta from the north, contributes an average of 77 percent of the inflow to the Delta. The San Joaquin River, which enters the Delta from the south, contributes about 15 percent of the inflow. The remainder is contributed by the Mokelumne, Consumnes, and Calaveras Rivers, which enter the Delta from the east." (WSIP, at 5.3.1-16 (citation omitted).) The percentage of average reduction in unimpaired flow into the Delta that is attributable to San Francisco's use of water from the Tuolumne River (which, in turn, reduces flow into the San Joaquin River) may be determined by dividing San Francisco's average annual water supply exported from the Tuolumne River, as described in the WSIP, *i.e.*, 218 million gallons per day ("mgd"), or 244,000 AF/year, (WSIP, at 5.3.1-5), by the total average unimpaired inflow into the Delta, as computed by DWR, of 29,003,000 AF.[18] Thus, San Francisco's exports from the Tuolumne River account for approximately 0.8 percent of total unimpaired Delta inflow per year. (244,000 AF/29,003,000 AF = 0.8 percent unimpaired flow.)[19]

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[17] Estimates of Natural and Unimpaired Flows for the Central Valley of California: Water Years 1922-2014, March 2016 (DRAFT), Department of Water Resources, Bay-Delta Office, *available at* https://msb.water.ca.gov/documents/86728/a702a57f-ae7a-41a3-8bff-722e144059d6, at 5-4; *id*. at ES-1, ES-2 (explaining that "[i]n this report, the term 'unimpaired' flow is used to describe a theoretically available water supply assuming existing river channel conditions in the absence of (1) storage regulation for water supply and hydropower purposes and (2) stream diversions for agricultural and municipal uses. Unimpaired flow estimates are theoretical in that such conditions have not occurred historically. In pristine watersheds that have undergone little land use change, unimpaired flow estimates provide a fixed frame of reference to develop relationships between precipitation, runoff, and water supply based on long-term hydrologic records. For many years these relationships were based on the assumption of stationarity, *i.e.* that the past is a good indicator of the future. However, global warming now requires hydrologists and water resources managers to analyze non-stationary processes, requiring more sophisticated tools and techniques to quantify future water supplies."); *id*. at ES-1 (emphasis added) (distinguishing between "unimpaired flows" and "natural flow" and concluding, "[i]n sum, the findings of this report *show that unimpaired flow estimates are poor surrogates for natural flow conditions*.").

[18] Ritchie Decl., *supra* note 3, at ¶ 5.

[19] *Id*. (wherein Mr. Ritchie further explains that "[i]n fact, in recent years, San Francisco has exported less water from the Tuolumne River than the WSIP average, *i.e.*, San Francisco delivered 205 mgd from the Tuolumne River to the Bay Area, or 230,000 AF/year, in fiscal year ("FY") 2012-2013, and delivered 150 mgd from the Tuolumne River, or 168,000 AF/year, in FY 2015-2016.").

I. Lower San Joaquin River Alternatives Proposed in Plan Amendment

The Plan Amendment proposes new February–June Lower San Joaquin River ("LSJR") flow objectives "for the protection of fish and wildlife beneficial uses and an associated program of implementation." (SED, at 3-1.) The SED evaluates four alternatives for LSJR flow requirements during the February–June time frame, including LSJR Alternative 1 (No Project Alternative) and three other LSJR alternatives (LSJR Alternatives 2, 3, and 4). (*Id*. at 3-8.) The proposed objectives would require flows below New Melones Dam on the Stanislaus River, below Don Pedro Dam on the Tuolumne River, and below New Exchequer Dam on the Merced River. (*Id*.) The objectives would also require flows on the "mainstem of the LSJR between its confluence with the Merced River and downstream to Vernalis," *i.e*., a minimum base flow of between 800-1,200 cubic feet per second ("cfs") at Vernalis at all times of the year. (*Id*. at 3-8, 3-9) There is both a narrative and a numeric component to the objectives. (*Id*. at 3-8) Specifically, the SED explains that "[a] percent of unimpaired flow between a lower and upper limit from each of the Merced, Tuolumne, and Stanislaus Rivers shall be maintained from February through June." (*Id*. [internal quotation omitted].) The SED defines "[u]nimpaired flow" as "the flow that would accumulate in surface waters in response to rainfall and snowmelt, and flow downstream if there were no reservoirs or diversions to change the quantity, timing, and magnitude of flows." (*Id*. at 3-5.) Each LSJR Alternative evaluates a different range of flows: "LSJR Alternative 2 evaluates a range between 20 and 30 percent, with 20 percent as the starting percentage of unimpaired flow in the program of implementation;" "LSJR Alternative 3 evaluates a range between 30 and 50 percent, with 40 percent as the starting percentage of unimpaired flow in the program of implementation;" and "LSJR Alternative 4 evaluates a range between 50 and 60 percent, with 60 percent as the starting percentage of unimpaired flow in the program of implementation." (*Id*. at 3-9.)

LEGAL STANDARD

I. California Environmental Quality Act and Certified Regulatory Programs.

A. California Environmental Quality Act.

The California Environmental Quality Act, Pub. Res. Code, § 21000 *et seq*. ("CEQA"), requires a governmental agency to prepare an Environmental Impact Report ("EIR") whenever it considers approval of a proposed project that may have a significant effect on the environment. (*California Sportfishing Protection Alliance v. State Water Resources Control Bd*) (2008) 160 Cal.App.4th 1625, 1642). "The EIR has been aptly described as the 'heart of CEQA.' Its purpose is to inform the public and its responsible officials of the environmental consequences of their decisions before they are made. Thus, the EIR 'protects not only the environment but also informed self-government.'" (*Napa Citizens for Honest Government v. Napa County Bd. of Supervisors* (2001) 91 Cal.App.4th 342, 355, *as modified* (Aug. 7, 2001), *as modified on denial of reh'g* (Sept. 4, 2001) (citation omitted).) "An accurate, stable and finite project description is the [s]ine qua non of an informative and legally sufficient EIR." (*County of Inyo v. City of Los Angeles* (1977) 71 Cal.App.3d 185, 193.) "[O]nly through an accurate view of the project may the public and interested parties and public agencies balance the proposed project's benefits against its environmental cost, consider appropriate mitigation measures, assess the advantages of terminating the proposal and properly weigh other alternatives." (*City of Santee v. County of San Diego* (1989) 214 Cal.App.3d 1438, 1454, *reh'g denied and opinion modified* (Nov. 21, 1989).)

If there is no substantial evidence a project may have a significant effect on the environment or the initial study identifies potential significant effects, but provides for mitigation measures that make such effects insignificant, "a public agency must adopt a negative declaration to such effect and, as a result, no EIR is required." (*California Sportfishing Protection Alliance*, 160 Cal.App.4th at 1642 (internal quotations omitted).)

Judicial review of decisions involving application of the California Environmental Quality Act, Pub. Res. Code, § 21000 *et seq*. ("CEQA") to quasi-legislative acts extends only to whether there was a prejudicial abuse of discretion: "an agency may abuse its discretion under CEQA either by failing to proceed in the manner CEQA provides or by reaching factual conclusions unsupported by substantial evidence." (*Save Tara v. City of West Hollywood* (2008) 45 Cal.4th 116, 131, *as modified* (Dec. 10, 2008) (*citing* Pub. Res. Code, § 21168.5.) The adoption of water quality objectives is a quasi-legislative act. (*United States v. State Water Resources Control Bd*. (1986) 182 Cal.App.3d 82, 170 (citations omitted); *California Sportfishing Protection Alliance*, 160 Cal.App.4th at 1639).

"[T]he ultimate decision of whether to approve a project, be that decision right or wrong, is a nullity if based upon an EIR that does not provide the decision-makers, and the public, with the information about the project that is required by CEQA. The error is prejudicial if the failure to include relevant information precludes informed decisionmaking and informed public participation, thereby thwarting the statutory goals of the EIR process." (*Napa Citizens for Honest Government*, 91 Cal.App.4th at 355–356 (citation omitted) (internal quotation omitted); see also *California Oak Foundation v. City of Santa Clarita* (2005) 133 Cal.App.4th 1219, 1237 (citing *Concerned Citizens of Costa Mesa, Inc. v. 32nd Dist. Agricultural Assn.* (1986) 42 Cal.3d 929, 935 (concluding that the statutory purpose of the EIR process was not satisfied "in the absence of a forthright discussion [in an EIR] of a significant factor that could affect water supplies.").) Similarly, CEQA's purpose to facilitate informed decisionmaking and public participation is contravened when important information is "scattered here and there in EIR appendices," or significant analyses are "buried in an appendix." (*California Oak Foundation*, 133 Cal.App.4th at 1239 (citing *Santa Clarita Organization for Planning the Environment v. County of Los Angeles* (2003) 106 Cal.App.4th 715, 723) [explaining that "information 'scattered here and there in EIR appendices,' or a report 'buried in an appendix,' is not a substitute for 'a good faith reasoned analysis in response [to public comments on an EIR].'"].)

For purposes of CEQA, "[s]ubstantial evidence shall include facts, reasonable assumptions predicated upon facts, and expert opinion supported by facts." (Cal. Code Regs., tit. 14, § 15384(b).) "Argument, speculation, unsubstantiated opinion or narrative, evidence which is clearly erroneous or inaccurate, or evidence of social or economic impacts which do not contribute to or are not caused by physical impacts on the environment does not constitute substantial evidence." (Cal. Code Regs., tit. 14, § 15384(a).)

B. Certified Regulatory Programs.

"In lieu of the requirement for preparing an EIR or negative declaration, CEQA provides a mechanism for the exemption of certain regulatory programs which themselves require a plan or other written documentation containing environmental information." (*City of Sacramento v. State Water Resources Control Bd*. (1992) 2 Cal.App.4th 960, 973–74, *as modified* (Feb. 14, 1992) (*citing* Pub. Res. Code, § 21080.5(a); *Wildlife Alive v. Chickering* (1976) 18 Cal.3d 190, 196.)   The State Water

Board's water quality control planning program is a certified regulatory program and thus a substitute environmental document, or "SED," may be prepared in lieu of an EIR. (SED, at 1-3 (*citing* Pub. Res. Code, § 21080.5(c) ; Cal. Code Regs., tit. 14, § 15251(g)).) In preparing the SED, the State Water Board must support its conclusion with substantial evidence in the administrative record. (Cal. Code Regs., tit. 23, § 3777(a)) ["Any water quality control plan . . . proposed for board approval or adoption must include or be accompanied by Substitute Environmental Documentation (SED) and supported by substantial evidence in the administrative record."].)

Among other things, a draft SED must include "identification of any significant or potentially significant adverse environmental impacts of the proposed project;" "analysis of reasonable alternatives to the project and mitigation measures to avoid or reduce any significant or potentially significant adverse environmental impacts;" and "environmental analysis of the reasonably foreseeable methods of compliance." (Cal. Code Regs., tit. 23, § 3777(b)(2-4))); Cal. Code Regs., tit. 14, § 15187(b))-(c)).) The environmental analysis of the reasonably foreseeable methods of compliance "shall take into account a reasonable range of environmental, economic, and technical factors, population and geographic areas, and specific sites" at a program level. (Cal. Code Regs., tit. 23, § 3777(c).)

The State Water Board must also comply with the requirements of Public Resources Code Section 21159), which provides an agency "shall perform, at the time of the adoption of a rule or regulation requiring . . . a performance standard . . . an environmental analysis of the reasonably foreseeable methods of compliance." (Pub. Res. Code, § 21159(a).) The required environmental analysis must include: "[a]n analysis of the reasonably foreseeable environmental impacts of the methods of compliance;" "[a]n analysis of reasonably foreseeable feasible mitigation measures;" and, "[a]n analysis of reasonably foreseeable alternative means of compliance with the rule or regulation." (Pub. Res. Code, § 21159(a)(1-3)).) Similar to the requirements prescribed by California Code of Regulations, Title 23, Section 3777 identified above, the environmental analysis of the reasonably foreseeable methods of compliance required by the statute must "take into account a reasonable range of environmental, economic, and technical factors, population and geographic areas, and specific sites" at a program level. (Pub. Res. Code, § 21159(c-d))).)

II. Porter-Cologne Act.

"In addition to CEQA's requirements, the State Water Board's amendments to the 2006 Bay-Delta Plan must be prepared in accordance with applicable water quality planning provisions of the Porter-Cologne Act, Water Code Section[s] 13000 et seq., and other applicable laws." (SED, at ES-63; see also *California Ass'n of Sanitation Agencies v. State Water Resources Control Bd* (2012) 208 Cal.App.4th 1438, 1460, n.19, *as modified on denial of reh'g* (Sept. 27, 2012) [formulation of water quality control plans triggers the need to comply with section 13241].) "The Regional Water Boards have primary responsibility for the formulation and adoption of water quality control plans for their respective regions, subject to State Water Board and [U.S. Environmental Protection Agency] approval. The State Water Board may also adopt water quality control plans, which will supersede regional water quality control plans for the same waters to the extent of any conflict." (SED, at 9-34).

"The Porter-Cologne Act requires the establishment of water quality objectives to ensure the reasonable protection of beneficial uses," (*United States v. State Water Resources Control Bd.* (1982) 182 Cal.App.3d 82, 148), a category that includes "domestic, *municipal*, agricultural and industrial supply," (Wat. Code, § 13050(f) (emphasis added).) Water Code Section 13241 "identifies certain factors that must be evaluated when establishing water quality objectives." (SED, at ES-63; see also *City of Arcadia v. State Water Resources Control Bd.* (2010) 191 Cal.App.4th 156, 177, *as modified on denial of reh'g* (Jan. 20, 2011) (*citing* Wat. Code, § 13241) [same].) "These factors include: (1) past, present, and probable future beneficial uses of water; (2) environmental characteristics of the hydrographic unit under consideration, including the quality of water available thereto; (3) water quality conditions that could reasonably be achieved through the coordinated control of all factors that affect water quality in the area; (4) *economic considerations*; (5) the need for developing housing within the region; and (6) the need to develop and use recycled water." (*Id.* at ES-63—ES-64 (emphasis added); Wat. Code, § 13241.) Thus, Water Code section 13241 requires the State Water Board to "consider the cost of compliance" when establishing water quality objectives,[20] (*City of*

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[20] *See also* Memo titled *Guidance on Consideration of Economics in the Adoption of Water Quality Objectives*, William R. Attwater, Chief Counsel, State Water Resources Control Board, January 4, 1994 (referred to below as "Attwater Memo"), attached hereto as Exhibit 3, at 4 (explaining that "[t]he Porter-Cologne Act does impose an affirmative duty on the Boards to consider economics when adopting water quality objectives. The Boards

Burbank v. State Water Resources Control Bd., (Cal. 2005) 35 Cal. 4th 613, 625), and imposes "obligations that can be enforced by a writ of mandate," (*City of Arcadia*, 191 Cal. App. 4th at 176).

Adoption of water quality objectives is a quasi-legislative act that "is subject to review by traditional mandamus under Code of Civil Procedure section 1085." (*United States v. State Water Resources Control Bd*., 182 Cal.App.3d at 150, 170) (citations omitted).) Review under Code of Civil Procedure Section 1085 "is limited to an inquiry into whether the action was arbitrary, capricious or entirely lacking in evidentiary support," and the "petitioner has the burden of proof to show that the decision is unreasonable or invalid as a matter of law." (*City of Arcadia v. State Water Resources Control Bd.* (2006) 135 Cal.App.4th 1392, 1409 (internal quotation omitted).) "When making that inquiry, the court must ensure that an agency has adequately considered all relevant factors, and has demonstrated a rational connection between those factors, the choice made, and the purposes of the enabling statute." (*Hi-Desert Medical Center v. Douglas* (2015) 239 Cal.App.4th 717, 730, *as modified* (Sept. 15, 2015), *reh'g denied* (Sept. 15, 2015), *review denied* (Nov. 18, 2015) (citing *O.W.L. Foundation v. City of Rohnert Park* (2008) 168 Cal.App.4th 568, 585–586) (internal quotation omitted).)

ARGUMENT

I. The SED Must Analyze the Environmental and Economic Impacts of the Most Reasonably Foreseeable Method of Compliance by San Francisco: Reductions in Deliveries throughout the RWS service territory for the current and projected population through 2040.

As San Francisco has previously explained to the State Water Board, reduction in water deliveries throughout the RWS service territory is San Francisco's most reasonably foreseeable method of compliance with the implementation of a new unimpaired flow objective on the Tuolumne River.[21] The SED concedes that estimated "regional impacts" would be substantially greater if

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probably cannot fulfill this duty simply by responding to economic information supplied by the regulated community. Rather, the Boards should assess the costs of adoption of a proposed water quality objective.").

[21] 2013 CCSF Comment Letter, *supra* note 3, at 6-7 (citation omitted) [wherein San Francisco explains that if it were required, pursuant to the Fourth Agreement, to bypass flow to meet a 35-percent unimpaired flow objective on the Tuolumne River, "[a]ssuming current demands and a recurrence of the 1987-1992 drought, the SFPUC's annual diversions from the Tuolumne River could be reduced by 111,7000 AF for each of the six years of the drought. This additional reduction in supply – when added to reductions in deliveries of up to 20% already imposed by the SFPUC to ensure delivery of water to customers throughout the 1987-1992 drought – results in a single year of reduction in deliveries of 42%, and five years of reduction in deliveries of 52%."].) *See also* Letter to Mark Gowdy, Division of Water Rights, State Water Resources Control Board, from Jonathan

implementation of a new unimpaired flow objective on the Tuolumne River resulted in reduced deliveries throughout the RWS service territory than if, as the draft assumes, San Francisco could simply purchase the requisite volume of replacement water supply from the Districts. (SED, at 20-40 (emphasis added ["It is assumed that SFPUC would purchase and transfer additional water supplies from the Tuolumne River Watershed to offset water shortages during drought periods. *This would result in substantially lower estimates of regional impacts than if it is assumed that SFPUC would cut back its water deliveries* (i.e., impose shortages) to its retail and wholesale customers, particularly in assessing impacts for commercial and industrial water users. *See Sunding 2014 for an assessment of how assumed water shortages, as opposed to the water replacement approach used in this analysis, within the Hetch Hetchy Regional Water System Service Area could impact SFPUC.*"].)[22] However, despite the State Water Board's own recognition that reduced deliveries would result in substantially greater impacts throughout the Bay Area, the draft analysis fails to identify reduction in water deliveries throughout the RWS service territory as a reasonably foreseeable method of compliance by San Francisco, let alone analyze the environmental and economic impacts associated with such shortages.[23] This glaring omission contravenes the State Water Board's statutory obligation to "carefully evaluate the recommendations of concerned . . . local agencies" "[d]uring the process of

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Knapp, Deputy City Attorney, San Francisco City Attorney's Office, July 29, 2014, attached hereto as Exhibit 4 (referred to below as "San Francisco Letter"), at 2 ("The Phase 1 SED must analyze the impacts of reduction in deliveries throughout the RWS service territory that may result from implementation of the proposed Tuolumne River flow alternatives because reduction in deliveries in the only method of compliance that is within the SFPUC's control, and thus, it is the reasonably foreseeable consequence of the State Water Board's contemplated action."].)

[22] Given that, San Francisco has previously informed the State Water Board that its reasonably foreseeable method of compliance would be reductions in deliveries throughout the RWS service territory, which is the only option entirely within San Francisco's control, the State Water Board cannot claim that reduction in deliveries is an "as-yet unknown method of compliance." (SED, at 13-58 (emphasis) ["Service providers may choose any method of compliance described in Chapter 16, or a combination of methods, or they may identify another as-yet unknown method of compliance to comply with requirements from the revised objectives."].)

[23] *See* Bay-Delta Phase 1 Staff Technical Workshop of December 12, 2016, Transcript of Video Recording, attached hereto as Exhibit 5 (referred to below as "December 12th Workshop Transcript"), at 211:23-25—212:1-3 (wherein Les Grober, Assistant Deputy Director of Division of Water Rights, acknowledges that the Draft 2016 fails to "consider the effects of additional water supply rationing by the [SFPUC] system in response to contributions to the instream flows," but refuses to explain the basis for the omission).

formulating or revising state policy for water quality control,"[24] and violates the substantive standards of CEQA, the requirements of the certified regulatory program associated with the State Water Board's water quality control program, and the Porter-Cologne Act.

A. The SFPUC currently faces water supply shortages in sequential-year droughts and hardened water supply demands throughout the RWS service territory, as compared to prior drought periods.

Without consideration of the potential implementation of a new unimpaired flow objective on the Tuolumne River, the SFPUC already faces water supply shortages that require customer rationing during sequential-year droughts. "The SFPUC currently operates under a plan that anticipates multiple stages of response to water supply shortages, ranging from use of dry year water supplies (when available) and voluntary customer water reductions to enforced rationing." (SFPUC 2015 UWMP, at 7-3.) Water demand in a single dry year would initially be satisfied with water deliveries from storage and use of available dry year supplies. (*Id*.) As total system storage declines, however, it would be necessary for the SFPUC to impose mandatory rationing. (*Id*.) Although implementation of the WSIP will improve the SFPUC's water supply reliability,[25] particularly in the earlier years of a sequential-year drought, "in extended drought periods, the SFPUC will continue to experience multiple years of 10 to 20% rationing."[26] (SFPUC 2015 UWMP, at 7-3.) In fact, the 2040 WaterMAP

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[24] Wat. Code, § 13144 (emphasis added) ("During the process of formulating or revising state policy for water quality control the state board shall consult with and carefully evaluate the recommendations of concerned federal, state, and local agencies.").

[25] *See* WSIP PEIR, at 3-37 ("In drought years, the SFPUC would implement a multistep drought response program. Under this program, the initial response to a drought would be to initiate the extraction component of the [groundwater conjunctive-use program in the Westside Groundwater Basin in northern San Mateo County] and to continue to fully deliver customer purchase requests during the initial response stage. If drought conditions were to persist, the groundwater extraction would be augmented with the [proposed 2 mgd water transfer with the Districts], which might be sufficient to defer any additional response actions. If necessary, in combination with the supplemental water supplies and within the WSIP goals for drought periods, the SFPUC would then implement up to 20 percent systemwide rationing.").

[26] "The SFPUC uses a hypothetical drought that is more severe than what the RWS has historically experienced. This drought sequence is referred to as the 'design drought' and serves as the basis for planning and modeling of future scenarios. The design drought consists of the 1987-92 drought, followed by an additional 2.5 years of dry conditions from the hydrologic record which include the 1976-77 drought. While the current drought (2012 through 2015, and potentially ongoing) consists of some of the driest years on record for the SFPUC's watersheds, the design drought still represents a more severe drought in duration and overall water supply deficit." (2015 SFPUC UWMP, at 7-2.) Although the SFPUC relies on the design drought as part of its water supply planning methodology, the water supply shortages depicted in these comments are based on simulations of the historical hydrology from 1921 through 2011. *See* Declaration of Matt Moses in Support of Comments by the City and County of San Francisco to the Draft Substitute Environmental Document in Support of Potential Changes to the Bay-Delta Plan ("Moses Decl."), attached hereto as Appendix 2, *see* Attachment 1 to

predicts a 5.3 mgd deficit in 2040 in drought years with 10 percent rationing in all years. (WaterMAP, at 24.) This is an approximately 2 percent forecasted shortfall. (*Id*.) Were San Francisco required to bypass flows in compliance with an unimpaired flow objective on the Tuolumne River, such water supply reductions would exponentially increase the water supply shortages already experienced by the RWS service territory during protracted droughts.

In addition, because water use within San Francisco, *i.e*., in-City retail service, continues to be among the lowest in the State and below historic consumption levels, (SFPUC 2015 UWMP, at 4-2), San Francisco's current demand "is likely hardened" as compared to historic levels, *e.g*., the level of demand in 1987 at the beginning of the 1987-1992 drought period, (SFPUC 2015 UWMP, Appendix K, at 3). (*See also* SFPUC 2015 UWMP, Appendix L, at 5 ["[t]he SFPUC retail customers are facing a hardened demand as a result of long-term conservation programs and installation of water-conserving devices during the 1987-92 drought."]; SFPUC 2015 UWMP, Appendix K, at 3 [explaining that the conservation measures implemented by San Francisco's retail and wholesale customers during the 1987-1992 drought "have led to permanent per capita water usage savings."].) Both per capita usage, *i.e*., gallons of water consumed per person per day ("GPCD"), and total consumption have declined since the mid-1970s. (SFPUC 2015 UWMP, at 4-2.) "Many factors have contributed to this reduction in water use, including significant changes to the mix of industrial and commercial businesses and their associated water demand, and the general characteristics of water use by San Franciscans. In particular, the severe droughts of 1976-77 and 1987-92, changes in plumbing codes, and conservation programs (either voluntarily embraced by residents and businesses or mandated by the City), have affected water demands." (*Id*.) In FY 2015-2016, per capita water use by in-City retail customers within the residential sector is 44 GPCD, and per capital water use by all sectors is 77 GPCD. (*Id*.) This reduction in water use makes it more difficult to achieve a significant, *i.e*., 25 percent or greater, reduction in water use as compared to the water savings that were attained

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the Moses Decl., *SFPUC Analysis of Proposed Changes to Tuolumne River Flow Criteria*, March 14, 2017 (referred to below as "SFPUC Analysis of Changes to Flow Criteria"), at 3 (explaining that "[w]hile the design drought sequence does not occur in the historical hydrology, the rationing and storage threshold values that are adjusted to allow a system configuration to maintain water delivery through the design drought sequence can be used to evaluate the system performance in the historical record.").

during the 1987-1992 drought, as explained in more detail below. (SFPUC 2015 UWMP, Appendix K, at 4; *see also* SFPUC 2015 UWMP, Appendix L, at 5 ["[t]his hardened demand means that reducing demand during future droughts will be challenging."].)

Similarly, "[a]verage residential per capita consumption (excluding Stanford) in the BAWSCA service area was 64.7 [GPCD] in FY 2014-15," and the average gross per capita consumption in FY 2014-15 was 105.7 GPCD.[27] By comparison, at the peak in FY 1986-87, gross per capita consumption in the areas served by the SFPUC's wholesale customers was 186.5 GPCD.[28]

The low residential use by retail and wholesale customers in the RWS service territory is far below statewide average residential use for November 2016 of 76.6 GPCD.[29] Obtaining further reductions in demand by RWS customers will present new and distinct challenges.

B. Implementation of LSJR Alternatives 3 or 4 would exponentially increase existing water shortages in the RWS service territory during sequential-year droughts.

Although the SED recognizes that if San Francisco were obligated to contribute 51.7 percent of the instream flow required by a new unimpaired flow objective on the Tuolumne River (above the current minimum instream flow requirements prescribed by the Districts' FERC license for the Don Pedro Hydroelectric Project), it could face significant water supply reductions, the draft underestimates the deficit that San Francisco would experience. The SED estimates that, assuming a reoccurrence of 1987-1992 hydrology, the largest potential water supply reduction San Francisco could experience if the State Water Board implemented a 40 percent unimpaired flow objective on the Tuolumne River (LSJR Alternative 3) would be 119,000 AF/year for each year of a 6-year drought. (SED, Appendix L, at L-21, Table L.4-2.) However, the water supply reduction that San Francisco would actually suffer in this scenario is even more severe. Under a 40 percent unimpaired flow

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[27] BAWSCA 2015 Annual Survey, *supra* note 2, at ES-9 (explaining that due to "its unique service area, residential per capita consumption for Stanford is excluded.").

[28] *Id.*

[29] Fact Sheet, November 2016 Statewide Conservation Date, *available at* http://www.waterboards.ca.gov/water_issues/programs/conservation_portal/docs/2017jan/fs010417_nov_conservation.pdf, attached hereto as Exhibit 6, at 5 (unnumbered).

objective, San Francisco's water supply would be reduced by 129,884 AF/year for each of the 6 years, resulting in a loss of an additional 10,884 AF/year, or 65,304 AF in total for the 6-year period.[30]

Using the same assumptions, the SED also estimates that if the State Water Board implemented a 60 percent unimpaired flow objective on the Tuolumne River the greatest potential reduction in water supply that San Francisco could experience would be 208,000 AF/year for each of the 6 years, or 1,248,000 AF in total for the 6-year drought period. By comparison, the maximum capacity of the SFPUC's storage facilities on the Tuolumne River, *i.e.*, Hetch Hetchy Reservoir (360,400 AF), Lake Eleanor (27,100 AF), Cherry Reservoir (273,300 AF), including consideration of the operational flexibility provided by the SFPUC's water bank in Don Pedro Reservoir (570,000 AF), is 1,230,800 AF. As explained, San Francisco relies upon its carryover storage as its primary source of water supply for delivery to the RWS service territory during sequential-year droughts. *The required flow volume would consume all of the water available from the SFPUC's Tuolumne River storage facilities.* This scenario is utterly detached from the reality of the SFPUC's operations on the Tuolumne River. Thus, San Francisco has not separately analyzed whether the SED's estimate of San Francisco's water supply reductions under a 60 percent unimpaired flow objective would, in fact, be even more severe.

C. It is reasonable to assume that San Francisco would require increased levels of rationing if LSJR Alternatives 3 or 4 were implemented and a sequential-year drought occurred based on San Francisco's drought planning policies, and the history of its actions during past droughts.

1. San Francisco imposed water rationing of up to 45 percent during the 1987-1992 drought.

"The 1987-92 [six-year] drought provides an example of how the near-term drought management process works in times when the operational capabilities of Hetch Hetchy and other water supplies available to the SFPUC are taxed to a point that forces drastic actions to avoid running out of water." (SFPUC 2015 UWMP, Appendix K, at 1.) The sequential-year drought "forced San Francisco to adopt a mandatory rationing program, enforced by stiff excess use charges and the threat of shut-off for continued violations of water use prohibitions." (*Id.*) The rationing program was in

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[30] *See* SFPUC Analysis of Changes to Flow Criteria, *supra* note 26, at 16, Table 9.

effect from May 1988 through May 1989, and was then reinstituted in May 1990 and continued until March 1993. (*Id.*) On April 28, 1988, the SFPUC passed a "Water Shortage Emergency Resolution," Resolution No. 88-0155, that declared these rationing periods and the existence of a water shortage emergency pursuant to Water Code Sections 350, *et seq.* (*Id*. at 1, 6.) The resolution also provided authorization for the SFPUC's General Manager to interrupt water service to San Jose and Santa Clara. (*Id*. at 6.)

"The SFPUC's water rationing program was one of the toughest in the state and the most stringent imposed by any urban water supply agency. Although the specifics of the program varied over time, the basic outline of the mandatory rationing program was to achieve a 25 percent reduction to 1987 (pre-drought) consumption (system-wide), with water allocations set on an account-by-account basis." (*Id*. at 1.)

In early 1991, the Hetch Hetchy Reservoir became so depleted (less than 25,000 AF of storage in a reservoir with over 360,000 AF of capacity) that minimum instream flow releases and anticipated demands required the SFPUC to initiate programs to achieve a 45 percent reduction in system-wide water deliveries. (SFPUC 2015 UWMP, at 8-1.). The 45 percent reduction was to be achieved through a 33 percent reduction in indoor water use and a 90 percent reduction in outdoor water use. (SFPUC 2015 UWMP, Appendix K, at 4.) "Public and commercial response to 45 percent rationing was overwhelmingly negative. . . . Simply put, rationing had been taken to a level that was considered intolerable to citizens and had become economically disastrous." (*Id*. at 5; *see also* Affidavit of Anson B. Moran ("Moran Affidavit"), FERC Project No. 2299, January 26, 1994, attached hereto as Exhibit 7, at ¶ 8 [explaining that the 45 percent level of rationing initiated in 1991 "was found to be intolerable and not achievable."].)

The SFPUC's mandatory rationing program ultimately reduced demand by approximately 30 percent as compared to pre-drought deliveries.[31] (Moran Affidavit, at ¶ 9.) As explained in more

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[31] Although the initial system-wide goal of reducing water use by 25 percent – as compared to pre-drought conditions, *i.e*., calendar year 1987 water deliveries – was achieved during the 1987-1992 drought, as noted, the ability of SFPUC's retail customers to achieve a 25 percent reduction in the future "is highly unlikely due to the 'hardening' of water demands that occurred during and subsequent to the drought." (SFPUC 2015 UWMP, *supra* note 5, Appendix K, at 3.) "Thus, it would be more difficult to achieve a 25-percent reduction in water

detail below in Section II(A)(1)(a)(i) *infra*, San Francisco also purchased water from other entities. (*Id*.) "These actions along with a fortuitous storm during the spring of 1991 allowed the City to regain control of its system and efforts moved forward to better plan for the reliability of the City's water deliveries." (*Id*.)

2. During the recent drought, the SFPUC took progressively more aggressive steps to reduce water use.

During the recent drought the SFPUC took progressively more aggressive steps to reduce water use, including: mandatory reduction of all water use by San Francisco city departments; mandatory reduction of outdoor irrigation by customers; a call for voluntary reduction of indoor use by customers; and, other water use restrictions. On January 31, 2014, the SFPUC asked for voluntary 10 percent system-wide rationing. (SFPUC 2015 UWMP, Appendix F, at 2.) On February 10, 2014, the Mayor directed City departments to reduce water consumption by 10 percent. (*Id*. [*citing* Executive Directive 14-01].) On August 12, 2014, in response to State Water Board emergency regulations, the SFPUC imposed a mandatory 10 percent reduction on outdoor irrigation. (*Id*. [*citing* Resolution 14-0121].) On August 26, 2014, SFPUC adopted regulations and restrictions for administering water use allocations and excess use charges on irrigation customers. (*Id*. [*citing* Resolution 14-0140].) On April 28, 2015, the SFPUC imposed additional water use restrictions consistent with State Water Board emergency regulations. (*Id*. [*citing* Resolution 15-0119].) On June 23, 2015, the SFPUC amended rules and regulations for interruptible water service. (*Id*. [*citing* Resolution 15-0149].)

The SFPUC was not compelled to declare a water shortage emergency pursuant to Water Code Section 350 during the recent drought, and, subsequently, to impose mandatory system-wide rationing and shortage allocations, because its customers exceeded the 10 percent voluntary system-wide reduction in conjunction with the Statewide mandatory reductions assigned by the State Water Board. (SFPUC 2015 UWMP, at 8-2.)

It appears that the current drought is now over. However, in future droughts, if the SFPUC determined that mandatory system-wide rationing needed to be imposed, then it would issue a

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use since the 1987-1992 drought, and, specifically, would require additional measures beyond those implemented during the 1987-1992 drought to achieve a comparable level of water use reduction." (*Id*. at 4.)

declaration of a water shortage emergency under Water Code Sections 350 "and implement rationing in accordance with the WSA and Water Shortage Allocation Plan (WSAP)." (SFPUC 2015 UWMP, at 8-2.)

3. Implementation of LSJR Alternatives 3 or 4 would require San Francisco to impose unsustainable levels of mandatory rationing during sequential-year droughts.[32]

If the State Water Board implemented LSJR Alternatives 3 or 4 and San Francisco were obligated to bypass 51.7 percent of the required flow on the Tuolumne River, San Francisco would experience severe water shortages during sequential-year droughts that would, in turn, require the SFPUC to significantly reduce deliveries to the RWS service territory. For example, assuming 1987-1992 hydrology and maximum SFPUC contract deliveries of 265 mgd, the additional reduction in water supply San Francisco would experience under a 40 percent unimpaired flow objective on the Tuolumne River, *i.e.*, 129,884 AF/year for each of the 6 years, would result in a 40 percent reduction in deliveries for the first year of the drought, and a 54 percent reduction in deliveries in each of the subsequent 5 years.[33] Further, using the same assumptions and level of demand, under a 50 percent unimpaired flow objective the SFPUC would need to reduce deliveries to the RWS service territory by a staggering 69 percent in each of the 6 years of the drought.[34]

When lower annual system deliveries are used, the results are similarly jarring. For example, using the same underlying assumptions, as described above, and annual deliveries of 223 mgd, which is equivalent to FY 2012-2013 pre-drought demand, if a 40 percent unimpaired flow objective were implemented on the Tuolumne River the SFPUC would be compelled to reduce deliveries to the RWS

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[32] Although the SED contemplates flow shifting, carryover storage requirements, and other possible adaptive management adjustments of the unimpaired flow standard, the draft does not describe the application of these elements in sufficient detail for San Francisco to include in its modeling analysis of potential water supply shortages to the RWS service territory. Further, the effect of any potential carryover storage requirement associated with Don Pedro Reservoir on the SFPUC's operations is unclear. These additional adjustments of the unimpaired flow standard may have the effect of further reducing the amount of water that the SFPUC is able to divert from the Tuolumne River, and thereby increasing water supply shortages experienced by the RWS service territory. *See* SFPUC Analysis of Changes to Flow Criteria, *supra* note 26, at 2, 7.

[33] *Id*. at 16, Table 9 (showing SFPUC's average annual contribution from compliance with a 40 unimpaired flow objective on the Tuolumne River, assuming 1987-1992 hydrology and using a simulated demand of 264 mgd, as 129,884 AF/year); *id*. at 10, Table 2 (showing correlative reductions in water deliveries across the RWS service territory).

[34] *Id*. at 10, Table 2.

service territory by 39 percent during the first 3 years of the drought, and then tighten its belt further, by imposing 49 percent reductions in deliveries for the next 3 years.[35] Using the same assumptions and level of demand, implementation of a 50 percent unimpaired flow objective on the Tuolumne River would require the SFPUC to reduce its deliveries by an unattainable 62 percent in each of the 6 years of the drought.[36]

Even using the level of reduced deliveries achieved by the SFPUC and its customers throughout the RWS service territory during the recent drought in FY 2015-2016 of 175 mgd – that represents a reduction in San Francisco's pre-drought deliveries of 223 mgd by over 20 percent – high levels of rationing are still required. Using the same set of assumptions, if the State Water Board implemented a 40 percent unimpaired flow objective on the Tuolumne River, the SFPUC would need to reduce deliveries by a further 20 percent during the first 3 years of the drought, and then impose 32 percent reductions in the next 3 years.[37] In this scenario, the State Water Board's implementation of a 50 percent unimpaired flow objective would require the SFPUC to reduce its deliveries by 39 percent in the first 3 years of the drought, and by 62 percent in the next 3 years.[38]

4. Implementation of LSJR Alternatives 3 or 4 may jeopardize current deliveries from the RWS to San Jose and Santa Clara and constrain the SFPUC's ability to provide these cities with permanent supply guarantees.

It is reasonable to assume that if LSJR Alternatives 3 or 4 were implemented, and San Francisco was responsible for bypassing 51.7 percent of the required flow on the Tuolumne River, that the SFPUC would be compelled to deny the request by San Jose and Santa Clara for permanent individual supply guarantees, and, during sequential-year droughts, might also need to interrupt water service to both cities. As explained, the cities of San Jose and Santa Clara do not have an allocated share of the Supply Assurance due to their temporary, interruptible status under the 1984 Agreement and the WSA. (SFPUC 2015 UWMP, at 4-9.) This is not an abstract consideration: in 1988, in the early stages of the 1987-1992 drought, the SFPUC passed a "Water Shortage Emergency Resolution,"

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[35] *Id*. at 11, Table 3.

[36] *Id*.

[37] *Id*. at 12, Table 4.

[38] *Id*.

that, among other things, authorized the SFPUC's General Manager to interrupt water service to San Jose and Santa Clara. (SFPUC 2015 UWMP, Appendix K, at 6.) Further, the severe water supply reductions to the RWS that could result from implementation of LSJR Alternatives 3 or 4 would necessarily have to be taken into consideration by the SFPUC before reaching a decision regarding whether the SFPUC should provide permanent individual supply guarantees totaling 14.5 mgd to the cities of San Jose and Santa Clara.

D. It is reasonable to assume that San Francisco's wholesale customers would require increased levels of rationing if LSJR Alternatives 3 or 4 were implemented and a sequential-year drought occurred based on these customers' drought planning policies.

It is reasonable to assume that San Francisco's wholesale customers would require increased levels of rationing if LSJR Alternatives 3 or 4 were implemented and a sequential-year drought occurred based on these customers' drought planning policies. For example, the Water Shortage Contingency Plan for the Westborough Water District ("WWD") states that in response to a water supply reduction of up to 20 percent, the district will implement a water budget program to ensure "[w]ater use shall not exceed water allocations established by WWD for each customer."[39] Similarly, the Water Shortage Contingency Plan for the San Jose Municipal Water System provides that the City will implement an "[e]enforceable mandatory water budget program" if water deliveries from its wholesale supplier, *i.e.*, the SFPUC, are reduced by more than 50 percent.[40] Further, as explained in the Water Shortage Contingency Plan for the Alameda County Water District ("ACWD"), the District is authorized to adopt a base consumption allowance for each class of customers and establish use charges in response to water supply reductions of 20 to 30-percent.[41]

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[39] 2015 Urban Water Management Plan for the Westborough Water District, Public Review Draft, May 2016, *available at* http://www.westboroughwater.com/Documents/Public%20Draft%20WWD%20UWMP_2016-05-23.pdf (referred to below as WWD UWMP"), at 63 (explaining that in response to a "Stage 3" reduction in water supply WWD will ensure that "[w]ater use shall not exceed water allocations established by WWD for each customer"; *id*. at 59, Table 7-2 – Stages of Water Shortage Contingency Plan (DWR Table 8-1) (defining "Stage 3" as up to a 20 percent water supply reduction).

[40] 2015 Urban Water Management Plan for the San Jose Municipal Water System, June 2016, *available at* https://www.sanjoseca.gov/DocumentCenter/View/57483, at 8-5.

[41] Alameda County Water District, Urban Water Management Plan 2015-2020, *available at* http://www.acwd.org/DocumentCenter/View/1264 (referred to below as "ACWD UWMP"), at 10-8, Table 10-3c (explaining that in response to a "Stage 3" reduction in water supply, defined as a reduction of 20 to 30 percent, the District will "[i]mplement all actions in Stage 1 and 2 plus some or all of the following, as

E. Increased rationing by San Francisco throughout the RWS service territory would result in severe economic impacts to San Francisco and its retail and wholesale customers throughout the Bay Area that the State Water Board must analyze.

Pursuant to the certified regulatory program for the State Water Board's water quality control planning program and Water Code Section 13241(d), the State Water Board is required to analyze the economic impacts of reasonably foreseeable methods of compliance with the proposed unimpaired flow objective on the Tuolumne River, including, as explained above, San Francisco's reduction of water deliveries to the RWS service territory. (Cal. Code Regs., tit. 23, § 3777(c)); Cal. Code Regs., tit. 14, § 15187(d)); Pub. Res. Code § 21159(c); Wat. Code, § 13241(d); Attwater Memo, *supra* note 21, at 4).[42] However, the SED completely fails to analyze the economic impacts that would result from reduced water deliveries throughout the RWS service territory.

1. San Francisco's 2014 Draft Socioeconomic Study is <u>not</u> incorporated by reference in the SED.

As a preliminary matter, to the extent that the State Water Board may believe that two passing references to the analysis of economic impacts of water supply shortages in the RWS service territory presented in *Socioeconomic Impacts of Water Shortages within the Hetch Hetchy Regional Water System Service Area*, Draft Report, March 13, 2014 ("2014 Draft Socioeconomic Study") serve to incorporate that analysis, and thus satisfy the agency's obligation to consider the economic impacts of reductions in deliveries throughout the RWS service territory, the State Water Board is mistaken. (See SED, at L-26) (emphasis added) ["It is reasonable to assume that SFPUC would purchase and transfer additional water supplies from the Tuolumne River Watershed to its service area to offset water shortages during drought periods. Such purchases would be expected to result in substantially lower estimates of regional impacts than if SFPUC would cut back its water deliveries (i.e., impose

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necessary to meet the District's reduction target . . . Adopt Base Consumption Allowance for each customer class and establish use charges. . . .").

[42] *See* David Sunding, David Zilberman, Consideration of Economics Under California's Porter-Cologne Act (2007) 13 Hastings W.-N.W. J. Envtl. L. & Pol'y 73, at *76 (emphasis added) ("A requirement to 'consider economics' is not the same as a directive to adopt only those regulations that pass a cost-benefit test. Agencies can use the results of economic analysis, but not be bound by 'bottom-line' numbers. Most economists would hesitate to argue that quantified costs and benefits tell the whole story, or that precise measurements of either are possible. *But when economic analysis reveals low or non-existent benefits and high costs, something is likely amiss. It would seem that the California legislature sought to avoid such a socially undesirable outcome by mandating a consideration of economics when making water quality regulation*.")

shortages) to its retail and wholesale customers, particularly for impacts related to commercial and industrial water users. *See Sunding 2014 for an assessment of impacts on SFPUC due to assumed imposition of water shortages, as opposed to the water replacement approach used in this analysis, within the Hetch Hetchy Regional Water System Service Area*."]; *id*. at 20-40 [same].) These passing references simply represent the acknowledgement of an alternative view; these statements do not even purport to incorporate the referenced analysis into the SED, nor does the draft rely on the 2014 Draft Socioeconomic Study as a basis for the analysis of potential economic impacts to San Francisco.[43]

Further, even if the 2014 Draft Socioeconomic Study had been properly incorporated by reference into the SED, the failure to respond – in any substantive way – to the 2014 Draft Socioeconomic Study would, nevertheless, render the analysis inadequate. (See e.g., *Santa Clarita Organization for Planning the Environment v. County of Los Angeles* (2003) 106 Cal.App.4th 715, 723 (citing *Cleary v. County of Stanislaus* (1981) 118 Cal.App.3d 348, 357 (emphasis added) [explaining that "[i]t is not enough for the EIR simply to contain information submitted by the public and experts. Problems raised by the public and responsible experts *require a good faith reasoned analysis in response*. *The requirement of a detailed analysis in response ensures that stubborn problems or serious criticism are not 'swept under the rug.'*"].)

2. Increased rationing by San Francisco and throughout the RWS service territory would result in severe economic impacts to San Francisco and its retail and wholesale customers throughout the Bay Area.

In general, assuming a pre-drought level of water supply demand, within the RWS service territory, the first 20 to 30-percent of water supply reductions can be borne by the residential sector and dedicated irrigation alone. These economic losses are experienced as welfare losses by the consumer, and manifest as consumers not being able to receive the water supply reliability that they have paid for through their water rates. Over time, these welfare losses result in dissatisfaction by

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[43] Cal. Code Regs., tit. 14, § 15150(f) (emphasis added) (noting that "[i]ncorporation by reference is most appropriate for including long, descriptive, or technical materials that provide general background *but do not contribute directly to the analysis of the problem at hand*."). By contrast, the 2014 Draft Socioeconomic Study presents an alternative view of how water supply reductions would impact the RWS service territory, *i.e*., by resulting in reduced deliveries, that unquestionably "contribute[s] directly to the analysis of the problem at hand," and thus, this reasonably foreseeable method of compliance, and the consequent environmental and economic impacts, should have been substantively addressed in the SED.

customers with their respective local water providers and City Councils because they are paying for something – water supply reliability – that they are not receiving. Further, the reduced utility revenues result in increased utility rates or deferred capital projects, which may also result in the consumers receiving a reduced level of service.[44] Reduced utility revenues may also result in depleted utility financial reserves, *e.g.*, depletion of utility balancing accounts, which would likely necessitate future rate increases. Additionally, as indicated in the Moody Rating Report for the new SFPUC Water Bond, "[s]ustained deterioration of stored water supply" could negatively affect bond ratings, which would increase the cost of financing for capital projects, and, consequently, require further rate increases to cover higher interest rate payments.[45]

Significantly, as described in more detail below, once water supply reductions in the RWS service territory reach a level that can no longer be borne by the residential sector alone a "tipping point" occurs. "Tipping point" is defined by the Merriam-Webster Dictionary as "the critical point in a situation, process, or system beyond which a significant and often unstoppable effect or change takes place." The threshold at which water supply reductions can no longer be solely absorbed by the residential sector – a point that will necessarily vary depending on the alternative water supplies available to each agency in the RWS service territory – represents a critical juncture. Further water supply reductions past this tipping point require water rationing by the commercial and industrial ("C&I") sectors that, in turn, manifest in the form of reduced economic output and job losses.

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[44] See *e.g.*, Budget Workshop Presentation, Board Meeting, Alameda County Water District, May 26, 2016, attached hereto as Exhibit 8, at 14-25 (explaining that during the recent drought Alameda County Water District ("ACWD") implemented a plan to cut and/or defer spending on ACWD's Capital Improvement Program, that included, depending on the level of water shortage, reduction in spending on water line replacements and deferral of spending on seismic improvements to Alameda and Decosto Reservoirs.) *See also* "Millbrae Residents Learn About Risks of 60 Year Water System," Public, January 30, 2017, *available at* http://www.publicnow.com/view/9CC49AE443AED66936959C0EF03AA66E807B1EC2, attached hereto as Exhibit 9 (presenting an example of risks borne by deferring permanent main replacements: "Millbrae's water system was primarily built in the 1950's and 1960's. Deficiencies in the system became apparent in 2013 when seven water mains broke at the same time, causing thousands of Millbrae residents to temporarily go without water until public works crews were able to repair the broken pipes.").

[45] Moody's Investor Service, Credit Opinion, September 27, 2016, San Francisco Public Utilities Commission, Water Enterprise, *New Issue – Moody's assigns Aa3 to San Francisco Public Utilities Commission (CA) Water Revenue Bonds Rating Report for SFPUC Bond*, available at https://www.moodys.com/research/Moodys-assigns-Aa3-to-San-Francisco-Public-Utilities-Commission-CA--PR_903622289, attached hereto as Exhibit 10, at 2 (emphasis added) (identifying the factors that could lead to a downgrade in the SFPUC's bond rating as "[m]aterial weakening of debt service coverage," "[s]ignificant diminishment of liquidity," or "*[s]ustained deterioration of stored water supply*.").

As explained in Section I(C)(3) *supra*, if the State Water Board implemented a 30, 40, or 50-percent unimpaired flow objective on the Tuolumne River, and San Francisco was responsible for bypassing 51.7-percent of the requisite flow, San Francisco would experience severe water shortages during sequential-year droughts that would require the SFPUC to significantly reduce deliveries to the RWS service territory. The magnitude of these water supply reductions would be too severe for the residential sector to bear alone, and thus, the commercial and industrial sectors would be directly affected. The resulting loss in jobs and economic output across the Bay Area would be staggering. For example, assuming maximum contract deliveries of 265 mgd, and a reoccurrence of 1987-1992 hydrology, implementation of a 30 percent unimpaired flow objective on the Tuolumne River would, in the final year of the drought, result in a total loss of 105,498 jobs throughout the RWS service territory, and a total loss in economic output of nearly $37 billion.[46] Using the same assumptions, implementation of a 40 percent unimpaired flow objective would result in a total loss of 120,063 jobs, and total loss in economic output of over $43 billion.[47] Under the same scenario, implementation of a 50 percent unimpaired flow objective would result in a total loss of 191,419 jobs, and total loss of economic output of over $69 billion.[48]

Total job losses and economic output during the 6-year drought period are extremely dire. For example, again using the assumptions referenced above, and maximum contract deliveries of 265 mgd, implementation of a 40 percent unimpaired flow objective on the Tuolumne River would result a total

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[46] *Bay Area Socioeconomic Impacts Resulting from Instream Flow Requirements for the Tuolumne River*, The Brattle Group, prepared by David Sunding, Ph.D., March 15, 2017, attached hereto as Appendix 3 (referred to below as "2017 Socioeconomic Impacts Analysis"), at 11, Table 11 (total job losses of CCSF of 33,237 + total job losses of BAWSCA member agencies, or "wholesale customers," of 72,261 = 105,498 total projected jobs lost throughout RWS service territory); *id*. at 10, Table 9 (total economic output losses for CCSF of $8.248 billion + total economic losses of wholesale customers of $28.654 billion = $36.902 billion).

[47] *Id*. at 11, Table 11 (total job losses of CCSF of 33,237 + total job losses of wholesale customers of 86,826 = 120,063 total projected jobs lost throughout the RWS service territory); *id*. at 10, Table 9 (total economic output losses for CCSF of $8.248 billion + total economic losses of wholesale customers of $35.179 billion = $43.427 billion).

[48] *Id*. at 11, Table 11 (total job losses of CCSF of 73,886 + total job losses of wholesale customers of 117,533 = 191,419 total projected jobs lost throughout the RWS service territory); *id*. at 10, Table 9 (total economic output losses for CCSF of $18.240 billion + total economic losses of wholesale customers of $50.960 billion = $69.200 billion).

loss of 657,316 jobs in the RWS service territory during the 6-year drought period, and total loss in economic output of over $234 billion.[49]

Assuming RWS pre-drought demand of 223 mgd, comparably severe job losses and loss in economic output would be experienced throughout the RWS service territory if the State Water Board implemented a 30, 40, or 50-percent unimpaired flow objective on the Tuolumne River.[50] San Francisco did not calculate economic losses associated with water supply reductions below the level of actual purchases of RWS water during the recent drought, *i.e.*, 175 mgd (that would result from implementation of a 30, 40, or 50-percent unimpaired flow objective), because, among other reasons, there is too much uncertainty regarding how the Bay Area would be able to accommodate the projected level of growth in the region across the residential, commercial and industrial sectors if the SFPUC restricted its RWS service territory deliveries to 175 mgd.[51]

Additionally, assuming maximum contract demands of 265 mgd, San Francisco and the SFPUC's wholesale customers throughout the Bay Area would need to increase rates for service in response to water supply restrictions and the attendant loss in revenue.[52] For example, if San Francisco were responsible for bypassing flow in compliance with a 40 percent unimpaired flow objective on the Tuolumne River, San Francisco would need to raise its rates by 7 percent, and the wholesale customers would need to increase their rates by 9 percent.[53] These rates increases would not only "come on top of the some of the highest water rates among California water utilities,"[54] but would also be addition to estimated SFPUC rate increases of 8-9 percent for the next four years to pay

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[49] *Id*. at 11, Table 11 (total job losses of CCSF of 179,961 + total job losses of wholesale customers of 477,355 = 657,316 total projected jobs lost throughout RWS service territory); *id*. at 10, Table 9 (total economic output losses for CCSF of $44.707 billion + total economic losses of wholesale customers of $190.057 billion = $234.764 billion).

[50] *Id*. at 10-11, Tables 8 and 10.

[51] *Id*. at 8-9.

[52] *Id*. at 12.

[53] *Id*.

[54] *Id*.

for, among other things, completion of the WSIP and the design and planning of the Sewer System Improvement Program.[55]

F. Increased rationing throughout the RWS service territory would result in significant environmental impacts that the SED did not analyze.

The SED fails to assess the significant environmental impacts that would result if the SFPUC were compelled to drastically reduce water deliveries throughout the RWS service territory in response to the State Water Board's implementation of a 30, 40 or 50-percent unimpaired flow objective on the Tuolumne River. This critical omission constitutes an abuse of discretion because the SED fails to proffer any justification for why these impacts are not significant under CEQA, and, in fact, fails to present any analysis whatsoever regarding such impacts. (Pub. Res. Code, § 21168.5 (emphasis added) [explaining that standard for judicial review of non-adjudicative decisions involving CEQA "shall extend only to whether there was a prejudicial abuse of discretion. *Abuse of discretion is established if the agency has not proceeded in a manner required by law* or if the determination or decision is not supported by substantial evidence."]; Pub. Res. Code, § 21100(b)(1)) (emphasis added) [requiring lead agencies to prepare EIR for any project that they propose to carry out or approve that may have a significant effect on the environment that includes, *inter alia*, a detailed statement setting forth "*[a]ll significant effects* of the proposed project."]; Pub. Res. Code, § 21159(a)(1)) [requiring agencies to perform environmental analysis at time of adoption of performance standard that must include "[a]n analysis of the reasonably foreseeable environmental impacts of the methods of compliance"; Cal. Code Regs., tit. 23, § 3777(b)(2) [requiring that a draft SED prepared by the State Water Board include, *inter alia*, "identification of any significant or potentially significant adverse environmental impacts of the proposed project."].)

More specifically, the SED fails to analyze the substantial loss in park vegetation, landscaping and trees (the urban forest) in jurisdictions throughout the RWS service territory that would result if the State Water Board implemented LSJR Alternatives 3 or 4, and San Francisco was responsible for bypassing 51.7 percent of the requisite flow. As explained, in this scenario, San Francisco would

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[55] SFPUC website, Your Dollars at Work Everyday, *available at* https://sfwater.org/index.aspx?page=749.

experience severe water shortages during sequential-year droughts that would require the SFPUC to significantly reduce deliveries to the RWS service territory. Given the demand hardening that has occurred in San Francisco and throughout the RWS service territory since the 1987-1992 drought as result of increased water use efficiency,[56] it is reasonable to assume that severe cutbacks in outdoor water use would be required. Substantial reductions in outdoor water use would lead to the loss of park vegetation, urban landscaping, and the urban forest, and a corresponding array of adverse environmental impacts. These impacts include, but are not limited to, the following.

1. Adverse impacts to aesthetic and recreational resources.

In accordance with the substantive standards of CEQA, the State Water Board is required to examine aesthetics as part of its environmental review of the Plan Amendment because "courts have recognized that aesthetic issues are properly studied in an EIR to assess the impacts of a project." (*Pocket Protectors v. City Of Sacramento* (2004) 124 Cal.App.4th 903, 937 [citations omitted] [internal quotation omitted]; see also *Preserve Poway v. City of Poway* (2016) 245 Cal.App.4th 560, 577, *reh'g denied* (Apr. 4, 2016), *review denied* (June 22, 2016) [*citing* Pub. Res. Code, § 21060.5) .] [explaining that CEQA defines "environment" as including "objects of historic or aesthetic significance."]; *see also* CEQA Guidelines, Cal. Code Regs., tit. 14, Appendix G, Aesthetics I(b), [requiring the lead agency to determine whether "the project [would] substantially degrade the existing visual character or quality of the site and its surroundings?"].) The loss of vegetation in parks and other public and private outdoor spaces located within the RWS service territory would have an adverse effect on aesthetic resources. Similarly, degradation of outdoor recreational areas would result in reduced use and enjoyment of those areas. The SED must analyze these impacts.

2. Adverse impact to cultural resources.

As the California Supreme Court instructs, "[t]he applicability of CEQA to historic structures is made clear by Public Resources Code sections 5020.1, subdivision (j), 21084, and 21060.5. Section 5020.1, subdivision (j) states: 'Historical resource' includes, but is not limited to, any . . . building, structure, site, area, place . . . which is historically or archaeologically significant, or is significant in

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[56] *See* Section I(A) *supra*.

the architectural, engineering, scientific, economic, agricultural, educational, social, political, military, or cultural annals of California." (*Friends of Sierra Madre v. City of Sierra Madre* (2001) 25 Cal.4th 165, 186, *as modified* (May 2, 2001) [internal quotation omitted].) A number of parks, open spaces, and heritage trees located in the RWS service territory are also cultural resources protected by applicable local, state, and/or national historical preservation requirements. It is reasonable to assume that significant cutbacks in outdoor water use for landscaping could result in degradation of historic landscapes located with the RWS service territory. The SED must analyze these impacts.

3. Increased risk of urban wildfires.

CEQA requires identification of the significant risk of wildfires adjacent to urbanized areas and in areas where residences are intermixed with wildlands.[57] It is reasonable to assume that heightened levels of rationing and water use restrictions would result in parched vegetation and desiccated trees thereby increasing fire hazards within and adjacent to urban areas in the RWS service territory. The SED must analyze these impacts.

4. Adverse impacts to habitat.

A "potential substantial impact on endangered, rare or threatened species is per se significant." (*Vineyard Area Citizens for Responsible Growth, Inc. v. City of Rancho Cordova* (2007) 40 Cal.4th 412, 449, *as modified* (Apr. 18, 2007) [citing Cal. Code Regs., tit. 14, § 15065(a)(1)].) Urban forests and other natural areas within the RWS service territory provide habitat for wildlife, including threatened and endangered species, *e.g.*, the Western Pond turtle, which has been known to inhabit Lake Merced and Golden Gate Park.[58] Degradation of urban forests and loss of vegetation in natural areas in the RWS service territory could adversely affect such species. The SED must analyze these impacts.

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[57] *See* CEQA Environmental Checklist Form, Appendix G, VII(h), *available at* http://resources.ca.gov/ceqa/guidelines/Appendix_G.html.

[58] Significant Natural Resources Area: Management Plan, February 2016, Executive Summary, *available at* http://sfrecpark.org/wp-content/uploads/SNRAMP_Final_Draft/SNRAMP_ExecSummary.pdf, at 18 (noting that Lake Merced contains one of the last populations of Western Pond Turtles in San Francisco); San Francisco Planning Department, Planning Commission Draft Motion for San Francisco Westside Recycled Water Plant Project, California Environmental Quality Act (CEQA) Findings, September 3, 2015, *available at* http://commissions.sfplanning.org/cpcpackets/2015-007190GPR_3500_Great_Hwy_CEQAFindingsMotion.pdf, at 25 (noting that Western Pond turtles may be found at Metson Lake and Lloyd Lake in Golden Gate Park).

5. Effects on energy consumption, human health, water quality, air quality and greenhouse gas emissions from the exacerbation of urban heat islands.

Potentially significant project effects on energy consumption, human health, water quality, air quality, and, more specifically, greenhouse gas emissions, must be analyzed under CEQA. (See *e.g.*, Pub. Res. Code, § 21100(b)(1) .) Urban development replaces permeable moist surfaces with surfaces and infrastructure that are impermeable and dry, such as conventional roofs, sidewalks, roads, and parking lots.[59] This process of urbanization is known to create urban "heat islands" – the phenomenon whereby urban regions experience warmer temperatures than their rural surroundings."[60] Trees, vegetation, and other landscaping in the urban environment provide shade, which helps lower surface temperatures, and "also help reduce air temperatures through a process called evapotranspiration, in which plants release water to the surrounding air, dissipating ambient heat."[61] It is reasonable to assume that increased water rationing and water use restrictions in the RWS service territory would result in the loss of trees, vegetation and other landscaping, and thereby reduce (and potentially eliminate) these cooling effects, thus intensifying the effects of urban heat islands. Exacerbation of urban heat islands has the potential to result in the following adverse environmental impacts.

a. Increased energy consumption.

"Appendix F of the CEQA Guidelines requires that projects assess the energy impacts of a project when a fair argument can be made that the project will have significant environmental impact." (*California Clean Energy Committee v. City of Woodland* (2014) 225 Cal.App.4th 173, 206 (citation omitted).). See also *id*. at 209 (citations omitted) (internal quotation omitted) (emphasis added) ("[u]nder CEQA, *an EIR is fatally defective when it fails to include a detailed statement setting forth the mitigation measures proposed to reduce wasteful, inefficient, and unnecessary consumption of energy*. . . . The requirement to adopt energy impact mitigation measures is substantive and not procedural in nature and was enacted for the purpose of requiring the lead agencies to focus upon the

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[59] U.S. Environmental Protection Agency, Reducing Urban Heat islands: Compendium of Strategies, October, 2008, *available at* https://www.epa.gov/heat-islands/heat-island-compendium, attached hereto as Exhibit 11 (referred to below as "EPA Compendium Urban Heat Islands."), at 7.

[60] *Id*.

[61] *Id*.

energy problem in the preparation of the final EIR.”). Urban heat islands increase energy demand for cooling during elevated summertime temperatures and thereby increase pressure on the electricity grid during peak periods of demand, that generally occur on hot, summer weekday afternoons when offices and homes are running cooling systems, lights, and appliances.[62] The SED must analyze these impacts.

b. Elevated emissions of air pollutants and greenhouse gases.

The CEQA Guideline on Determining the Significance of Impacts from Greenhouse Gas Emissions “provides that a lead agency should attempt to ‘describe, calculate or estimate’ the amount of greenhouse gases the project will emit, but recognizes that agencies have discretion in how to do so.” (*Center for Biological Diversity v. California Dept. of Fish and Wildlife* (2015) 62 Cal.4th 204, 217, *as modified on denial of reh’g* (Feb. 17, 2016) (*citing* Cal. Code Regs., tit. 14, § 15064.4(a).) As explained, urban heat islands increase summertime temperatures that, in turn, increase demand for electricity to run cooling systems. It is reasonable to assume that the generation of this additional electricity will result in increased emissions from power plants, thereby increasing emissions from air pollutants and greenhouse gases.[63] The SED must analyze these impacts.

c. Compromised human health and comfort.

The California Legislature has made clear that public health and safety are of “great importance” in CEQA’s statutory scheme. (*California Bldg. Industry Assn. v. Bay Area Air Quality Management Dist*. (2015) 62 Cal.4th 369, 386 (citing Pub. Res. Code, §§ 21000(b) , (c) , (d) , (g) ; §§ 21001(b), (d) .) For example, Public Resources Code Section 21083(b)(3) requires a finding of a “significant effect on the environment” whenever “[t]he environmental effects of a project will cause substantial adverse effects on human beings, either directly or indirectly.” (Pub. Res. Code, § 21083(b)(3) .) “Increased daytime surface temperatures, reduced nighttime cooling, and higher air pollution levels associated with urban heat islands can affect human health by contributing to general

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[62] *Id*. at 13.

[63] *Id*. at 14.

discomfort, respiratory difficulties, heat cramps and exhaustion, non-fatal heat stroke, and heat-related mortality."[64] The SED must analyze these impacts.

d. Impaired water quality.

The CEQA Guidelines require identification of project effects that will substantially degrade water quality.[65] In the urban environment, the temperature of stormwater can substantially increase as it traverses pavement and rooftop surfaces, reaching "temperatures 50 to 90°F (27 to 50°C) higher than air temperatures."[66] Urban heat islands intensify this effect by transferring excess heat to stormwater and thereby degrading water quality.[67] The elevated temperature of stormwater that becomes runoff raises the water temperature of local streams, rivers, ponds, and lakes.[68] Heightened water temperatures that result from this transference of heat from urban areas to local water bodies may detrimentally affect the reproduction and metabolism of many aquatic species.[69] The SED must analyze these impacts.

G. The adverse environmental impacts of heightened levels of water supply rationing in the RWS service territory may be inconsistent with state and local plans promoting green infrastructure.

"[A]n EIR must 'discuss any inconsistencies between the proposed project and applicable general plans, specific plans and regional plans.'" (*Joshua Tree Downtown Business Alliance v. County of San Bernardino* (2016) 1 Cal.App.5th 677, 695, *review denied* (Oct. 12, 2016) (*citing* Cal. Code Regs., tit. 14, § 15125(d) .) The California Legislature recognizes the social and environmental values of green infrastructure.[70] (*See* Gov. Code, § 65593(d) ["[l]andscapes are essential to the quality

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[64] *Id.*

[65] *See* CEQA Environmental Checklist Form, Appendix G, VIII(f), *available at* http://resources.ca.gov/ceqa/guidelines/Appendix_G.html.

[66] EPA Compendium Urban Heat Islands, *supra* note 59, at 15.

[67] *Id.*

[68] *Id.*

[69] *Id.*

[70] *See* EPA web page entitled "What is Green Infrastructure?", *available at* https://www.epa.gov/green-infrastructure/what-green-infrastructure, attached hereto as Exhibit 12 (explaining that "Green infrastructure uses vegetation, soils, and other elements and practices to restore some of the natural processes required to manage water and create healthier urban environments. At the city or county scale, green infrastructure is a patchwork of natural areas that provides habitat, flood protection, cleaner air, and cleaner water. At the neighborhood or site scale, stormwater management systems that mimic nature soak up and store water.").

of life in California by providing areas for active and passive recreation and as an enhancement to the environment by cleaning air and water, preventing erosion, offering fire protection, and replacing ecosystems lost to development."].) Further, a number of state and local policies encourage green infrastructure, *i.e*., landscaping and open space areas, in order to provide social and environmental benefits, including improved water quality and groundwater recharge.[71] As the State Water Board's implementation of LSJR Alternatives 3 or 4 may have the effect of degrading landscaping and open spaces in the RWS service territory, as discussed, the SED must identify, discuss, and reconcile the inconsistencies with state and applicable local plans that promote green infrastructure.

H. If water supplies were insufficient to serve new customers in the Bay Area, water suppliers throughout the RWS service territory may adopt policies that force new development to go elsewhere, and businesses may choose to locate in areas with more reliable dry-year and future water supplies.

1. California law requires that prior to approving a proposed large-scale development, a local government agency must consider, as part of its environmental review, whether water supplies are available to meet the projected future demand of the project for multiple dry years.

When a proposed, large-scale development is subject to CEQA, and is considered a "project" within the meaning of Water Code Section 10912, a Water Supply Assessment ("WSA") is required.[72] (*Citizens for Responsible Equitable Environmental Development v. City of San Diego* (2011) 196 Cal.App.4th 515, 523–24 [*citing* Wat. Code, § 10910(b).].) The WSA is part of the EIR process and is

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[71] See *e.g*., Strategic Plan for the San Francisco Department of the Environment 2013 – 2017, *available at* https://sfenvironment.org/sites/default/files/agenda/attach/deptoftheenvironment_strategic_plan_final_draft.pdf, at 11 ("Green spaces—natural and planted by humans— provide a broad spectrum of benefits to the environment and to our quality of life. The Department of the Environment is dedicated to protecting and restoring our indigenous natural areas and maximizing the value of all of our vegetated resources, including parks, street trees, green roofs, open spaces, streetscapes, and community gardens, both for people and wildlife."). *See also* At Risk: the Bay Area Greenbelt, 2017, Greenbelt Alliance, *available at* http://www.greenbelt.org/at-risk-2017/, attached hereto as Exhibit 13 (referred to below as "Greenbelt Alliance 2017"), at 9 (identifying an array of policies that may be adopted at the federal, state, or local levels, or through private initiative, to protect open spaces and natural resources from development).

[72] *See* Wat. Code, § 10912 (defining "Project" to mean a proposed large-scale residential, commercial or industrial development, *i.e*., "residential development of more than 500 dwelling units"; "shopping center or business establishment employing more than 1,000 persons or having more than 500,000 square feet of floor space"; "commercial office building employing more than 1,000 persons or having more than 250,000 square feet of floor space"; "hotel or motel, or both, having more than 500 rooms"; "industrial, manufacturing, or processing plant, or industrial park planned to house more than 1,000 persons, occupying more than 40 acres of land, or having more than 650,000 square feet of floor area"; "mixed-use project that includes one or more of the projects specified in this subdivision," or, a "project that would demand an amount of water equivalent to, or greater than, the amount of water required by a 500 dwelling unit project."); *see also* Cal. Code Regs., tit. 14, § 15155(a)(1) (similarly defining a "water-demand project").

intended to assist local governments in deciding whether to approve proposed projects. (*O.W.L. Foundation,* 168 Cal.App.4th at 576.) If the projected water demand of the proposed project was not accounted for in the most recently adopted urban water management plan, or the public water system has no urban water management plan, the WSA must discuss whether the public water system's "total projected water supplies available during normal, single dry, and multiple dry water years" for a 20–year period will meet the "projected water demand [for] the proposed project," taking into account the agency's "existing and planned future uses, including agricultural and manufacturing uses." (Wat. Code, § 10910(c)(3)).) If a local government, *i.e*., a city or county, will provide the water supply, the local government must prepare the WSA. (Wat. Code, § 10910(b).) "The local government must include the WSA in the EIR and consider it when deciding whether to approve the project." (*O.W.L Foundation*, 168 Cal.App.4th at 576 [*citing* Wat. Code, § 10911 (b)].) Further, a provision of CEQA requires compliance with the Water Code Sections pertaining to WSAs. (Pub. Res. Code, § 21151.9.) (*See also* Cal. Code Regs., tit. 14, § 15155(e) [lead agency shall include water assessment in the EIR].) Significantly, if the WSA does not identify sufficient available water, then the lead agency must include that determination in its findings in the EIR for the project. (Cal. Code Regs., tit. 14, § 15155(e).)

2. When water supplies are insufficient to serve new customers, cities, counties, special districts, and other water suppliers may rely on various sources of authority to adopt policies that limit or prohibit growth.

When water supplies are insufficient to serve new customers, water suppliers may rely on various sources of authority to adopt policies that limit or prohibit growth, including the adoption of water neutral programs and development moratoria. Water neutral programs, often referred to as demand offset programs, require new development that causes increased water demand to offset such demand through conservation or new supplies with the goal of ensuring that the new development will not result in increased demand on the water supplier's system.[73] These programs increase costs for developers, which may result in higherArt home prices, less affordable housing, and, if the costs of

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[73] Jennifer L. Harder, *Demand Offsets: Water Neutral Development in California* (2014) 46 McGeorge L. Rev. 103, at 104-105.

offsets and in-lieu fees are too high, may preclude new development altogether.[74] Water suppliers, *e.g*., cities, counties and special districts, have varying degrees of authority to require water conservation, manage and protect water supplies, and mitigate impacts that they may rely on to adopt water neutral programs.[75] Water suppliers that approve a water neutral program by way of ordinance or resolution typically invoke Article X section 2 of the California Constitution, that requires all uses of water in the state to be reasonable and not wasteful, and Water Code Sections 375, *et seq*., that provides all water suppliers in the state with authority to adopt water conservation programs.[76] Cities and counties also routinely identify the police power in their recitals, while special districts cite to specific organic statutes, where such exist, as authorization "to take action to avoid and mitigate the effect of new demand on existing customers."[77]

Distinct from these sources of authority pertaining to water conservation, the Water Code authorizes a water supplier to declare a water shortage emergency in its service area "whenever it finds and determines that the ordinary demands and requirements of water consumers cannot be satisfied without depleting the water supply . . . to the extent that there would be insufficient water for human consumption, sanitation, and fire protection." (Wat. Code, § 350.) "A water shortage emergency condition within the meaning of section 350 includes both an immediate emergency, in which a district is presently unable to meet its customers' needs, and a threatened water shortage, in which a district determines that its supply cannot meet an increased future demand." (*Building Industry Assn. v. Marin Mun. Water Dist*. (1991) 235 Cal.App.3d 1641, 1646 [citation omitted].) Once a government agency has declared a water shortage emergency in its service area, it must adopt regulations to conserve its water supply for "the greatest public benefit with particular regard to domestic use, sanitation, and fire protection." (Wat. Code, § 353.) Water Code Section 356 expressly authorizes the adoption of development moratoria by providing that such regulations "may include the right to deny

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[74] *Id*. at 110 (citations omitted) (noting that "[f]oregone development may result in fewer jobs, less economic growth, and lost amenities to the community.").

[75] *Id*. at 153.

[76] *Id*. at 156; Cal. Const., art. X, § 2; Wat. Code, § 375(a) .

[77] Jennifer L. Harder, *supra* note 73, at 154-155 (citations omitted).

applications for new or additional service connections."[78] (Wat. Code, § 356.) Where a water shortage emergency exists, "the water shortage emergency provisions of the Water Code may provide a basis for adoption of a water neutral program."[79]

3. Municipal waters suppliers in the Bay Area have adopted policies to limit or prohibit growth when there was insufficient water available to serve new customers.

The following two examples illustrate circumstances in which municipal water suppliers in the Bay Area have adopted policies to limit or prohibit growth where providing water service to a new project would impose a risk of water supply shortages on its existing customers, or where the additional water supply needed to serve proposed development was simply not available to the municipal water system.

a. EBMUD's Water Neutral Program.

In order to provide water service to proposed developments, yet avoid imposing "a risk of shortages on its existing customers," the East Bay Municipal Utility District ("EBMUD") adopted its own water neutral program for out-of-service-area subdivisions, that, in at least one instance, required certain developers to offset the water demand of a new residential project by a ratio of 2:1, meaning that "twice as much water would be conserved through various efficiency measures as would be required to serve the development's needs."[80] EBMUD relies on diversions from the Mokelumne

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[78] The adoption of development moratoria during a water shortage emergency, and under circumstances in which significant rationing had already been implemented, would be consistent with the State Water Board's own practice. See *e.g.*, State Water Board Issues Moratorium on New Water Connections, *available at* http://www.dailydemocrat.com/article/ZZ/20141105/NEWS/141103990, attached hereto as Exhibit 14 (explaining that in 2014 the SWRCB "slapped" 22 water districts across the state with development moratoriums due to lack of adequate water supply).

[79] Jennifer L. Harder, *supra* note 73, at 156. See also *Building Industry Assn.*, 235 Cal.App.3d at 1647–48 ("Read together, [Water Code] sections 353 and 356 unquestionably allow districts to distinguish between all existing or current consumers and potential users when deciding how to respond to a water shortage emergency . . . .").

[80] Randele Kanouse, Douglas Wallace, *Optimizing Land Use and Water Supply Planning: A Path to Sustainability?* (2010) 4 Golden Gate U. Envtl. L.J. 145, 148, 156, 158. *See also* Jennifer L. Harder, *supra* note 69, at 149 (explaining that "EBMUD had designed its own water neutral program for out-of-service-area subdivisions . . . ."). It is important to emphasize that EBMUD did not implement its water neutral program for subdivisions located outside of its service territory to mitigate insufficient water supply for existing customers. Instead, EBMUD implemented its water neutral program in order to facilitate development of the proposed subdivisions while simultaneously protecting its existing customers from heightened risk of future water supply shortages. As explained in Section H(4) *infra*, many water agencies in the RWS service territory contemplate

River as its primary source of supply.[81] The Mokelumne River flows west from the central Sierra Nevada into the Central Valley and ultimately the Delta, where it empties into the San Joaquin River. Similar to other water suppliers that depend on runoff from rivers that feed the Delta, EBMUD faces future challenges to the reliability of its water supply, including increasingly stringent environmental requirements to restore degraded habitat in the Delta that "will call for more flow releases by all water users over time," and the threat that climate change will "inflict more frequent and more intense droughts in California, intensifying the already significant challenges to water supply reliability."[82]

The first generation of water neutral residential projects that sought water service from EBMUD required annexation into the utility's service area, and thus, were "inherently controversial and strongly opposed by environmental interests."[83] EBMUD's ultimate agreement to provide water to these projects "was contingent on the implementation of water efficiency measures with a 1:1 offset ratio."[84]

Subsequently, in 2001, a proposed 1,200-home residential development called the Camino Tassajara Integrated Project, that included schools, community centers, and associated buildings, approximately 40 percent of which lay outside of EBMUD's service boundary, sparked an even greater controversy.[85] One of the issues that militated against providing water to the development was the fact that "EBMUD had only just concluded a decades-long process of securing a supplemental supply for drought years, with its Freeport Regional Water Project on the Sacramento River," and "[t]he sizing of that project had not accounted for potential new demand outside EBMUD's service area."[86] EBMUD ultimately annexed the project into its service area on the condition that the developers finance water efficiency features that would achieve a 2:1 offset of the project's demand.[87]

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implementation of water neutral programs to address the more pressing issue of lack of adequate water supply to serve existing customers as part of their drought contingency planning.

[81] Randele Kanouse, *supra* note 80, at 156 (citation omitted).

[82] *Id*. (citations omitted).

[83] *Id*. at 157.

[84] *Id*.

[85] *Id*. (citation omitted).

[86] *Id*. (citation omitted).

[87] *Id*. at 158 (citation omitted).

"This higher requirement was intended to provide a stronger guarantee (with commensurate funding) that existing EBMUD customers would not face a higher risk of water shortages as a result of the EBMUD's agreement to serve Camino Tassajara."[88]

b. East Palo Alto's Development Moratorium.

On July 19, 2016, the City Council for the City of East Palo Alto ("East Palo Alto") approved an ordinance prohibiting new or expanded water connections within the service territory of East Palo Alto's water system.[89] All of the water in East Palo Alto's water system is supplied by the RWS.[90] East Palo Alto has an Interim Supply Guarantee ("ISG") of 1.963 MGD, or approximately 2,199 AF.[91] According to the City Council Agenda Report ("Agenda Report") for the ordinance, on average East Palo Alto has been using "approximately 95%, or practically all of its ISG for the last 14 years, and in some years (2006, 2007, 2012) exceeded its ISG."[92] The Agenda Report explains that for the purpose of long range planning, East Palo Alto "needs to take in account the demand for entitled projects that are under construction, or not yet built, and for potential SFPUC dry year mandatory cutbacks."[93] After accounting for the demand needed to supply entitled projects, only 13 percent of East Palo Alto's supply remains available.[94] Further, if the SFPUC imposes mandatory rationing, it can reduce deliveries to East Palo Alto by 6 percent, leaving only 7 percent of the system's supplies available.[95] As this "very small amount" of water supply "leaves no room for error," the City Council concluded that under these conditions "the City cannot entitle additional projects, and there is a de facto moratorium in place for any new construction in the City that creates demand for additional water

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[88] *Id.* (citation omitted).

[89] City of East Palo Alto Agenda, City Council Regular Meeting, July 19, 2016, City Council Agenda Report, P&A Item No. 10D, *Approving an Ordinance Prohibiting New or Expanded Water Connections to the City of East Palo Alto Water System*, available at http://www.ci.east-palo-alto.ca.us/AgendaCenter/ViewFile/Agenda/07192016-1211, attached hereto as Exhibit 15 (referred to below as "Agenda Report"), at 242. San Francisco understands that East Palo Alto is in the process of attempting to identify alternative ways to address its water needs.

[90] *Id.*

[91] *Id.*

[92] *Id.*

[93] *Id.* at 244.

[94] *Id.*

[95] *Id.*

supply."[96] Numerous proposed projects were rejected in accordance with the moratorium, including "[a]n affordable housing project owned by the city," and "11 other developments that had recently submitted applications to build in East Palo Alto."[97]

Significantly, the Agenda Report provides that the "Water Moratorium period" will provide staff time to study the water shortage issue and "develop new water supply and water demand offset policies for the City Council to consider for adoption."[98] The Agenda Report further explains that upon adoption of a "Water Demand Offset Policy" staff would request that City Council update the exemption provisions in the moratorium ordinance to include projects that use the offset policy.[99]

4. Many of the SFPUC's wholesale customers explicitly contemplate adoption of policies to limit or prohibit growth as part of their drought water supply planning.

Many of the SFPUC's wholesale customers explicitly contemplate adoption of policies to limit or prohibit growth as part of their drought water supply planning. For example, Alameda County Water District's ("ACWD") Water Shortage Contingency Plan calls for a "[n]et zero water demand increase by new developments" if the district experiences a 30 to 50-percent reduction in its water supplies.[100] Similarly, the Water Shortage Contingency Plans for the City of Burlingame and the

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[96] *Id*. at 244, 247. Thus, East Palo Alto did not adopt its development moratorium due to a water shortage brought on by drought, but instead, the crisis in East Palo Alto resulted from the City's insufficient water allocation. As explained in Section H(4) *infra*, many water agencies in the RWS service territory contemplate implementation of development moratoria to address lack of adequate water supply due to drought as part of their drought contingency planning.

[97] Landgraf, K., "East Palo Alto imposes development moratorium due to lack of water," Mercury News (July 20, 2016) *available at* http://www.mercurynews.com/2016/07/20/east-palo-alto-imposes-development-moratorium-due-to-lack-of-water/, attached hereto as Exhibit 16 (explaining that "[a] water crisis three decades in the making came to a head this week when East Palo Alto's City Council imposed a moratorium on development until the city can increase its historically meager water supply. . . . [numerous] proposed developments are out of luck. An affordable housing project owned by the city did not make the cut, nor did 11 other developments that had recently submitted applications to build in East Palo Alto. Many of those developers showed up at Tuesday's meeting to voice their displeasure.").

[98] Agenda Report, *supra* note 89, at 247.

[99] *Id*.

[100] ACWD UWMP, *supra* note 41, at 10-9, Table 10-3d. See also *id*. at G-17, Table 8-3 Retail Only: Stages of Water Shortage Contingency Plan – Consumption Reduction Methods (indicating that at "Stage 4," *i.e*., 30 to 50-percent reduction in water supply, ACWD would adopt a "Moratorium or Net Zero Demand Increase on New Connections," meaning that the district would impose "[t]emporary restrictions on supply to new developments and/or requirements to implement extreme water use efficiency measures, and net zero increase for new developments (stage 4).").

Menlo Park Municipal Water District ("MPMWD") call for the adoption of development moratoriums with limited exceptions, including where the project applicant demonstrates that it will be able to offset completely its water demand, in response to a shortage of between 31 to 50-percent of existing supply.[101] Further, the Water Shortage Contingency Plan for the Westborough Water District ("WWD") requires the establishment of a "moratorium on new connections and new landscaping" in response to a reduction of up to 20 percent of existing supply,[102] and the 2015 Urban Water Management Plan for the City of Redwood City calls for a "[m]oratorium on new water connections" in response to a reduction of 20 to 30-percent of its water supply.[103]

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[101] 2015 Urban Water Management Plan for the City of Burlingame, June 2016, *available at* https://www.burlingame.org/modules/showdocument.aspx?documentid=13858, at Table 8-2 Retail Only: Restrictions and Prohibitions on End Uses (emphasis added) (explaining that during a "Stage 5" water supply reduction, "[n]o new potable water service shall be provided, no new temporary meters or permanent meters shall be provided, and no statements of immediate ability to serve or provide potable water service (such as, will-serve letters, certificates or letters of availability) shall be issued by the City, *with exceptions*."); *id*. at Table 7.5 (identifying 4 exceptions to the prohibition on new water connections referenced above, including where the "applicant provides substantial evidence of an enforceable commitment that water demands for the project will be offset prior to the provision of a new water meter(s) . . . ."); see also *id*. at Table 8-1 Retail: Stages of Water Contingency Plan (defining Stage 5 as circumstance in which there has been a "[d]eclaration by Burlingame City Council . . . or upon the determination that the SFPUC or another governing authority (e.g., the SWRCB) has required a voluntary or mandatory reduction in water use from 31% to 50% due to water supply shortages or emergency.").

2015 Urban Water Management Plan for the Menlo Park Municipal Water District, June 2016, *available at* http://www.menlopark.org/DocumentCenter/View/10111, at Table 8-3 Retail Only: Stages of Water Shortage Contingency Plan – Consumption Reduction Methods (emphasis added) (explaining that during a "Stage 5" water supply reduction "MPMWD shall not approve new potable water service, new temporary meters or permanent meters, or issue statements of immediate availability to serve or provide potable water service (such as, will-serve letters, certificates or letters of availability), except under the following circumstances: (1) a valid, unexpired building permit has been issued for the project; (2) the project is necessary to protect the public's health, safety, and welfare; (3) *the applicant provides substantial evidence of an enforceable commitment that water demands for the project will be offset prior to the provision of a new water meter(s) to the satisfaction of the Public Works Director*; or (4) to provide continuation of water service or to restore service that has been interrupted for a period of one year or less."); see *id*. at Table 8-1 Retail: Stages of Water Shortage Contingency Plan (defining Stage 5 as a circumstance in which there has been a "[d]eclaration by the City Council upon the determination that the SFPUC or another governing authority (e.g., the SWRCB) has required voluntary or mandatory reduction in water use from 31% to 50% due to water supply shortages or emergency.").

[102] WWD UWMP, *supra* note 39, at 65 (explaining that in response to a "Stage 3" reduction in water supply WWD will "[e]stablish moratorium on new connections and new landscaping."); *id*. at 59, Table 7-2 – Stages of Water Shortage Contingency Plan (DWR Table 8-1) (defining "Stage 3" as up to a 20-percent water supply reduction).

[103] 2015 Urban Water Management Plan for the City of Redwood City, June 2016, *available at* http://www.redwoodcity.org/home/showdocument?id=8091, at 109, Table 7-5 (explaining that in response to a "Stage 4" reduction in water supply the City of Redwood City will establish a "[m]oratorium on new water connections" and defining "Stage 4" as a 20-30-percent "[c]utback" in water supply.).

5. If LSJR Alternatives 3 or 4 were implemented, it is reasonable to assume that the pattern of growth called for in Plan Bay Area would be displaced due to inadequate water supply in the RWS service territory.

a. Plan Bay Area calls for consolidation of new growth in urban centers.

Plan Bay Area was adopted by the Association of Bay Area Governments ("ABAG") and the Metropolitan Transportation Commission ("MTC") in 2013 in accordance with "The California Sustainable Communities and Climate Protection Act of 2008" (California Senate Bill 375 ["SB 375"], Steinberg), which requires each of California's 18 metropolitan areas – including the Bay Area – to reduce greenhouse gas emissions from cars and light trucks.[104] SB 375 directs "the Bay Area and other California regions [to] develop a Sustainable Communities Strategy (SCS) – a new element of the regional transportation plan (RTP) – to strive to reach the greenhouse gas (GHG) reduction target established for each region by the California Air Resources Board."[105] SB 375 also "requires regions to plan for housing that can accommodate all projected growth, by income level, so as to reduce the pressures that lead to in-commuting from outside the nine-county region."[106] Plan Bay Area 2013 is the region's first RTP subject to SB 375.[107]

Although Plan Bay Area 2013 has multiple performance targets, "[t]wo of the targets are not only ambitious—they are mandated by state law."[108] The first mandatory target addresses climate protection by requiring the Bay Area to reduce its per-capita CO_2 emissions from cars and light-duty trucks by 7 percent by 2020 and 15 percent by 2035.[109] "The second mandatory target addresses adequate housing by requiring the region to house 100 percent of its projected population growth by income level."[110]

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[104] Plan Bay Area: A Strategy for a Sustainable Region, July 18, 2013, Association of Bay Area Governments, Metropolitan Transportation Commission, *available at* http://files.mtc.ca.gov/pdf/Plan_Bay_Area_FINAL/Plan_Bay_Area.pdf, attached hereto as Exhibit 17 ("referred to below as "Plan Bay Area 2013"), at 4.

[105] *Id*.

[106] *Id*. at 99.

[107] *Id*.

[108] *Id*. at 5.

[109] *Id*. at 4-5.

[110] *Id*. at 5. See also *id*. at 19, 43 (explaining that SB 375 requires that the Bay Area identify a land use pattern for projected growth (from a 2010 baseline year) that will, *inter alia*, house 100-percent of the region's

In order to help achieve the Bay Area's GHG emissions reduction and housing targets, Plan Bay Area 2013 identifies a land use pattern that "directs new growth within locally adopted urban growth boundaries to existing communities along major transit corridors."[111] Plan Bay Area 2013 projects that between 2010 and 2040 the nine-county Bay Area will: grow in population from 7.2 million to 9.3 million, an increase of 2.1 million people, or 30 percent; add 1.1 million jobs; and, increase its housing stock by 3.4 million new homes.[112] Due to the high cost of housing in the region, for decades "an ever-increasing number of people who work in the Bay Area" have been compelled "to look for more affordable housing in the Central Valley or other surrounding regions."[113] To address this incongruity, Plan Bay Area 2013 calls for the majority of projected growth to occur in Priority Development Areas ("PDAs") that are "transit-oriented, infill development opportunity areas within existing communities" because, as explained by ABAG and MTC, "[c]ompact infill development can reduce vehicle use and vehicle miles traveled by 20 to 60-percent when compared to traditional suburban developments."[114] To promote this pattern of development, Plan Bay Area 2013 "makes investments in the region's transportation network that support job growth and new homes in existing communities by focusing the lion's share of investment on maintaining and boosting the efficiency of the existing transit and road system."[115] However, Plan Bay Area 2013 also supports

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projected 25-year population growth by income level (very-low, low, moderate, above-moderate) without displacing current low-income residents.).

[111] *Id*. at 43, 45.

[112] *Id*. at 7, 30.

[113] *Id*. at 99; *id*. at 45 (noting that "past trends saw the outward expansion of urban growth in the region and spillover growth in surrounding regions . . . ."). *See also* SED, at 11-12 ("spillover from the Bay Area is causing growth stress in the San Joaquin Valley as commuters seek affordable housing. Over the past 35 years, the northern San Joaquin Valley, including San Joaquin, Stanislaus and Merced Counties, has experienced explosive growth in the numbers of workers who commute north and west out of the valley each day. By 2010, that was estimated to be about 24 percent of workers working outside their county of residence with about 46,000 heading towards the Bay Area . . . .").

[114] Plan Bay Area 2013, *supra* note 104, at 77, 123. See also *id*. at 99 (explaining that "[t]he resulting longer-distance commutes increase emissions while also raising transportation costs for the residents who must venture so far afield in search of more affordable housing. This places a greater burden on lower-income residents and further increases the divide between the region's more-affluent and less-affluent residents. The region's businesses also suffer, since the dispersal of workers tends to constrain the supply of labor they can draw on."); *id*. at 54 (noting that "[o]ne vehicle (regardless of the number of passengers) traveling one mile constitutes one 'vehicle mile.' The number of vehicle miles traveled is highly correlated with greenhouse gas emissions.").

[115] *Id*. at 63.

focused growth in PDAs, including major new transit projects, such as the extension of BART to serve San Jose.[116]

In addition to reducing GHG emissions and accommodating demand for new housing "within locally adopted urban growth boundaries," the land use pattern posited by Plan Bay Area 2013 conserves existing open space, natural resources and agriculture lands in the region.[117] In fact, one of the four comprehensive objectives for the proposed land use pattern is to protect the region's unique natural environment by promoting compact development within PDAs and reducing development pressure on the Bay Area's open space and agriculture lands.[118] This preservation of open space, forests, and other carbon sinks in the Bay Area, also, in turn, contributes to the reduction of GHG emissions by removing greenhouse gases from the atmosphere.[119]

Plan Bay Area 2013 "is a work in progress" that is to be updated every four years "to reflect new initiatives and priorities."[120] In May 2016, ABAG and MTC released three alternative land use and transportation scenarios that represent "a progression of plausible regional futures, from more intense housing and employment growth in the urban core (Big Cities Scenario); to more evenly apportioned development among PDAs in medium-sized cities with access to rail services (Connected Neighborhoods); to a more dispersed development pattern, with relatively more growth occurring

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[116] *Id*. at 79-80.

[117] *Id*. at 45 ("[i]n contrast to past trends that saw the outward expansion of urban growth in the region and spillover growth in surrounding regions, Plan Bay Area directs new growth within locally adopted urban growth boundaries to existing communities along major transit corridors"); *id*. at 104 ("[a]s the plan assumes that all urban growth boundaries/urban limit lines are held fixed through the year 2040, no sprawl-style development is expected to occur on the region's scenic or agricultural lands. This will help preserve the natural beauty of the Bay Area for future generations to enjoy.").

[118] *Id*. at 42, 45.

[119] *Id*. at 123.

[120] *Id*. at 15. *See also* Memo to Joint MTC Planning Committee with the ABAG Administrative Committee to MTC Deputy Executive Director, Policy / ABAG Executive Director regarding Plan Bay Area 2040 Draft Preferred Land Use Scenario, September 2, 2016, *available at* http://planbayarea.org/the-plan/Draft-Preferred-Scenario.html, attached hereto as Exhibit 18 (referred to below as "Plan Bay Area 2040 Memo"), at 2 (explaining that ABAG relied on updated regional growth projections in its development of Plan Bay Area 2040: "[t]he Bay Area economy has exploded over the past four years, attracting thousands of new people and jobs. As a result, ABAG adopted a revised regional growth forecast in February 2016. This forecast estimates an additional 1.3 million jobs and 2.4 million people, and therefore the need for approximately 820,000 housing units between 2010 and 2040. This represents an increase of 15 percent in employment and a 25 percent increase in households, related to Plan Bay Area [2013].").

outside of PDAs (Main Streets Scenario)."[121] Subsequently, ABAG and MTC developed a Draft Preferred Scenario that they finalized and adopted in December 2016.[122] ABAG and MTC expect to adopt Plan Bay Area 2040 by mid-2017.[123]

b. If LSJR Alternatives 3 or 4 were implemented, the SFPUC would not have the water supply needed to accommodate the pattern of growth called for in Plan Bay Area.

If the State Water Board were to implement LSJR Alternatives 3 or 4, the SFPUC would not have the water supply needed to accommodate the pattern of growth called for in Plan Bay Area 2013, or the patterns of growth considered in the three scenarios evaluated as part of the process for developing the proposed Plan Bay Area 2040. Specifically, if the State Water Board implemented a 30, 40, or 50-percent unimpaired flow objective on the Tuolumne River, the SFPUC would not be able to reliably serve its existing customers in the RWS service territory during protracted drought periods, as explained above, let alone meet projected future demand for 2040, as forecasted in Plan Bay Area 2013 (and augmented by ABAG for purposes of developing the proposed Plan Bay Area 2040), during a single critically dry year.

For example, assuming that San Francisco was responsible for bypassing flow in compliance with a new 40 percent unimpaired flow objective on the Tuolumne River, a reoccurrence of 1987-1992 hydrology, and the level of projected population growth between 2010 and 2040 that is being relied on to develop the proposed Plan Bay Area 2040[124] – without taking into account the land use patterns proposed in any of the three scenarios described above – by 2035 the population of San Francisco is expected to grow by 34 percent, and employment is projected to increase by 42 percent, although the city's water supply would be reduced by 37 percent (under maximum contract deliveries of 265 mgd).[125] The State Water Board's implementation of a 50 percent unimpaired flow objective on the

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[121] Plan Bay Area 2040 Memo, *supra* note 120, at 2 (internal quotation omitted).

[122] *See* Plan Bay Area 2040 website, Plan Bay Area 2040 Final Preferred Scenario Approved, December 6, 2016, *available at* http://planbayarea.org/news/story/PBA-2040-Final-Preferred-Scenario-Approved.html.

[123] *Id.*

[124] See *supra* note 120.

[125] 2017 Socioeconomic Impacts Analysis, *supra* note 46, at 5-6, Tables 3, 4 and 5.

Tuolumne would further exacerbate the level of shortage, resulting in a water supply reduction of 52 percent.[126]

These severe levels of water supply reductions are particularly alarming when considered in the context of the growth projections that correspond to the land use patterns represented by the three scenarios used in the development of Plan Bay Area 2040. Depending on the scenario's underlying assumptions regarding the proposed pattern of growth, San Francisco's population is projected to grow by 40 percent (Main Streets Scenario), 36 percent (Connected Neighborhoods Scenario), or 46 percent (Big Cities).[127] Thus, San Francisco's inability to provide water service to new development increases with the rising estimates of its projected population, as identified in the three scenarios.

This conflict between projected growth in population and reduced water supply reliability in critically dry years manifests throughout the RWS service territory across the Bay Area regardless of whether the analysis assumes concentrated infill development along major transit corridors, proposed in the three Plan Bay Area 2040 scenarios, or simply assumes that growth will occur unbounded by such constraints.[128]

c. It is reasonable to assume that implementation of LSJR Alternatives 3 or 4 would displace the pattern of growth called for in Plan Bay Area.

As explained in Section I(B) *supra*, if San Francisco was required to contribute flow, pursuant to its contractual obligations under the Fourth Agreement, to satisfy a 30, 40, or 50-percent unimpaired flow objective on the Tuolumne River, the SFPUC would experience a substantial water supply deficit during sequential-year droughts, *i.e.*, assuming a reoccurrence of 1987-1992 hydrology. Further, in this scenario San Francisco would be unable to meet its projected future water supply demand for 2040, as forecasted in Plan Bay Area 2013 (and augmented by ABAG for purposes of developing the proposed Plan Bay Area 2040), during a single critically dry year, *i.e.*, 1991 hydrology. This would compel San Francisco, as described in Section I(C)(3) *supra*, to significantly reduce deliveries to the

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[126] *Id.* at 5, Table 3.

[127] *Id.* at 6, Table 5.

[128] *Id.* at 6 (observing that "[t]he apparent mismatch between Bay Area growth projections and expected dry-year shortages raises the question of whether the instream flow restrictions in the SED would alter patterns of growth in the Bay Area.").

RWS service territory. Because of San Francisco's cutbacks in deliveries, water suppliers in the RWS service territory with limited access to alternate supplies would face severe water shortages. The high-density, transit-oriented pattern of development called for in Plan Bay Area 2013 and the three scenarios evaluated for the proposed Plan Bay Area 2040, direct population growth to developed urban areas within the region and thereby amplify these water supply shortages; the same amount of water would need to supply many more people. Due to insufficient water supply, the Bay Area would not be able to absorb the higher level of forecasted growth clustered around major transit corridors, as directed by ABAG and MTC.

In response to such water supply constraints, local government agencies in the RWS service territory would likely take actions to protect existing customers and/or to limit unsustainable growth. If water suppliers in the RWS service territory followed EBMUD's example and adopted water neutral programs, the additional compliance costs would increase the price of new homes, thereby reducing affordable housing, and, ultimately, if the costs were too high, displacing development from the Bay Area.[129] Similarly, if water suppliers followed the example of East Palo Alto and adopted development moratoriums due to insufficient water supplies, businesses that would have otherwise located new development in the region would have to go elsewhere.

However, notwithstanding these water supply constraints, if local government agencies in the RWS service territory did not take actions to either protect existing customers or limit unsustainable growth, businesses might still seek to locate development outside the Bay Area due to the region's lack of reliable dry-year and future water supplies. As discussed in Sections I(C)(3) and I(E)(2) *supra*, if instead of limiting or prohibiting new water connections, water suppliers in the RWS service territory imposed severe – and likely unachievable[130] – levels of mandatory rationing to maintain

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[129] See *supra* note 74 and accompanying text.

[130] As explained above in Section I(C)(3) *supra*, assuming 1987-1992 hydrology and annual deliveries of 223 mgd, if San Francisco was obligated to bypass water in compliance with a 40-percent unimpaired flow objective on the Tuolumne River, the SFPUC would need to reduce deliveries to the RWS service territory by 39-percent in the first 3 years of the drought, and impose 49-percent reductions in the next 3 years. Further, it would likely be impossible to sustain these extreme levels of water supply rationing, *e.g.*, as noted in Sections I(A) and I(C)(1)-(2) *supra*, although during the 1987-1992 drought the SFPUC's mandatory rationing program reduced demand by approximately 30-percent as compared to pre-drought deliveries, the ability of the SFPUC's retail customers to achieve a 25-percent or greater reduction in the future "is highly unlikely due to the 'hardening' of

water service during sequential-year droughts and to meet projected future demand, the Bay Area's economy would be dramatically impacted. Faced with the option of locating new development in an area with more reliable dry-year and future water supplies, it is reasonable to assume businesses would "see the writing on the wall" and migrate away from the Bay Area, thereby displacing the pattern of planned growth in the region's urban core called for by ABAG and MTC.

I. The SED fails to acknowledge the inconsistency between the State Water Board's implementation of LSJR Alternatives 3 or 4 and Plan Bay Area 2013 and other State plans designed to avoid adverse environmental effects.

The EIR must discuss any inconsistencies between the proposed project and regional plans, including "the applicable air quality attainment or maintenance plan or State Implementation Plan . . . regional transportation plans, regional housing allocation plans, regional blueprint plans, plans for the reduction of greenhouse gas emissions, habitat conservation plans, natural community conservation plans and regional land use plans for the protection of . . . San Francisco Bay . . . ." (Cal. Code Regs., tit. 14, § 15125(d); *see also* Appendix G of the CEQA Guidelines [requiring that the lead agency must identify any "[c]onflict with any applicable land use plan, policy, or regulation of an agency with jurisdiction over the project . . . adopted for the purpose of avoiding or mitigating an environmental effect."].)[131] Plan Bay Area 2013 is the Bay Area's first regional plan subject to SB 375, and thus, is designed to meet the legislation's goals by primarily directing future growth into urban infill developments located along major transit corridors.[132] By concentrating development in existing urban areas that are easily accessible to transit, Plan Bay Area 2013 would substantially reduce vehicle miles travelled as compared to suburban development, accommodate demand for new housing in the urban core, and reduce development pressure on undeveloped and agricultural lands, thereby helping to meet the Bay Area's statutorily required per capita GHG emissions reductions and housing targets, and preserving open space, forests and agriculture.[133]

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water demands that occurred during and subsequent to the drought." (SFPUC 2015 UWMP, *supra* note 5, Appendix K, at 3.)

[131] *See* CEQA Environmental Checklist Form, Appendix G, IX(b), *available at* http://resources.ca.gov/ceqa/guidelines/Appendix_G.html.

[132] Plan Bay Area 2013, *supra* note 104, at 4, 123.

[133] *Id*. at 4-5, 103-104, 123.

The SED fails to analyze, or even acknowledge, that the State Water Board's implementation of LSJR Alternatives 3 or 4 will have the reasonably foreseeable effect of frustrating the legislative goals supporting Plan Bay Area 2013, including the mandatory targets for reduction of GHG emissions and housing projected population growth within the region, by displacing the denser, transit-oriented pattern of development called for by ABAG and MTC.[134] Additionally, the more expansive, sprawling pattern of growth would also contravene Plan Bay Area 2013's comprehensive objective to conserve existing open space, natural resources and agriculture in the region.[135] The SED must acknowledge, discuss and reconcile these inconsistencies.

J. The SED fails to analyze the significant environmental impacts that would result if the pattern of growth called for in Plan Bay Area is displaced.

The SED fails to assess the significant environmental impacts that would result if the pattern of growth called for in Plan Bay Area 2013, and posited in the three scenarios used to develop the proposed Plan Bay Area 2040, was displaced. Such displacement would occur under the reasonably foreseeable events in which local governments limit growth due to insufficient water supply and business leaders decide to locate new development in areas with more reliable dry-year and future water supplies. This critical omission constitutes an abuse of discretion because the SED fails to present any analysis whatsoever regarding such impacts. (Pub. Res. Code, § 21168.5; Pub. Res. Code, § 21100(b)(1) ; Pub. Res. Code, § 21159(a)(1); Cal. Code Regs., tit. 23, § 3777(b)(2).) Further, the draft's failure to analyze how the State Water Board's implementation of a new unimpaired flow objective on the Tuolumne River may affect growth in the Bay Area also violates the requirements of the State Water Board's certified regulatory program by failing to analyze the environmental impacts of the reasonable foreseeable method of compliance of reduction in deliveries throughout the RWS service territory, taking into account impacts to "population and geographic areas," (Cal. Code Regs, tit. 23, § 3777(c); Pub. Res. Code, § 21159(c)-d).) In addition, the SED's failure to analyze the

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[134] *Id*. at 5.

[135] *See* Section I(H)(5)(a), *supra*. *See also* Plan Bay Area 2013, *supra* note 104, at 103 ("SB 375 requires consideration of open space and natural resource protection and supports accommodating new housing and commercial development within existing areas designated for urban growth. This is of particular importance to the Bay Area, where so much of the region's spectacular natural setting has been preserved as open space.").

reasonably foreseeable displacement of growth violates the Porter-Cologne Act by failing to analyze the "past, present, and *probable future beneficial uses of water*," (Wat. Code, § 13241 (emphasis added)), a category that expressly includes municipal water supply, (Wat. Code, § 13050(f)). The adverse environmental impacts that the SED failed to analyze include, but are not limited to, the following.

1. Greenhouse Gas Emissions and Other Air Pollutants.

As noted, the State Water Board, as the lead agency, "should attempt to describe, calculate, or estimate, the amount of greenhouse gases the project will emit." (*Center for Biological Diversity* 62 Cal.4th at 217 (*citing* Cal. Code Regs., tit. 14, § 15064.4(a).) Significantly, "Bay Area ecosystems, especially forests and wetlands, are very efficient at storing carbon."[136] If the Bay Area's at-risk landscapes are developed, "the carbon that would be released is equivalent to putting 1.3 million cars on the road every year."[137] In addition to reconciling the aforementioned inconsistency with the GHG emissions reductions targets mandated by SB 375 and incorporated into Plan Bay Area 2013, the State Water Board is also tasked with attempting to "describe, calculate, or estimate" the increased amount of GHG emissions that will result from displacement of the high-density, transit-oriented pattern of growth called for by ABAG and MTC, and the corresponding loss of carbon sinks throughout the region due to the encroachment of sprawling development on existing opens spaces and forests. The SED fails to include any analysis of the reasonably foreseeable increase in GHG emissions that will result from displacement of growth in the urban core in the Bay Area if San Francisco is responsible for bypassing flow in compliance with LSJR Alternatives 3 or 4.

In addition, the SED fails to consider other air quality impacts that are likely to occur in the event that growth is displaced. The SED concludes:

> It is not expected that the flow requirements would result in population or employment growth that would result in a conflict with or obstruct implementation of the applicable air quality plan because they would not require activities associated with population growth (e.g., housing development, business centers, etc.). Consequently, [air quality] impacts would be less than significant.

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[136] Greenbelt Alliance 2017, *supra* note 71, at 28.

[137] *Id*. (citation omitted).

(SED, at B-20.) However, the SED's conclusion fails to consider the air quality impacts that may result if growth is displaced from the Bay Area. For example, growth from the Bay Area displaced to the Central Valley would result in an increase in air pollution in the San Joaquin Air Basin from increased development and traffic. The San Joaquin Air Basin already experiences some of the worst air quality in California.[138] Although the SED recognizes that a project is considered inconsistent with air quality plans if it would result in growth and a consequent increase in emissions that are not accounted for "in the applicable air quality plan emissions budget,"[139] the analysis fails to assess the degradation of air quality that can be expected if growth from the Bay Area is displaced to an outlying region such as the Central Valley.[140]

2. Loss of open space, forests, habitat and agriculture.

Under CEQA, the lead agency must analyze potentially significant adverse environmental effects resulting from loss of open space, forests, habitat and agriculture. (See *e.g.*, Pub. Res. Code, § 21100(b)(1) ; *see also* Appendix G of the CEQA Guidelines [requiring lead agency to identify potentially significant adverse environmental effects resulting from conversion of farmland to non-agriculture use.].)[141] As explained, one of the four comprehensive objectives of Plan Bay Area 2013 is to conserve open space, natural resources and agriculture lands in the region by concentrating new development in existing urban areas and locally adopted urban growth boundaries.[142] To this end, Plan Bay Area 2013 identifies "over 100 regionally significant open spaces about which there exists broad consensus for long-term protection but which face nearer-term development pressures."[143] As explained by ABAG and MTC, past development trends saw the outward expansion of growth within

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[138] *See* Summary of California Air Resources Board Select 8 Summary, accessed March 9, 2017, attached hereto as Exhibit 19.

[139] SED, at B-20 (explaining that "a project is deemed inconsistent with air quality plans if it would result in population and/or employment growth that exceeds growth estimates included in the applicable air quality plan, which, in turn, would generate emissions not accounted for in the applicable air quality plan emissions budget."

[140] See *e.g.*, SED, at 11-12 (wherein the SED acknowledges there is existing pressure to develop affordable residential housing on agricultural land in the Central Valley to accommodate workers who live in the Central Valley yet commute to the Bay Area).

[141] *See* CEQA Environmental Checklist Form, Appendix G, II(a), *available at* http://resources.ca.gov/ceqa/guidelines/Appendix_G.html.

[142] Plan Bay Area 2013, *supra* note 104, at 42, 45.

[143] *Id*. at 45.

the Bay Area and spillover of growth into surrounding regions.[144] At present, 293,100 acres of natural and agricultural lands in the Bay Area "are at risk of sprawl development over the next 30 years. . . . The total land at risk is about 458 square miles, nearly 10 times the size of San Francisco."[145] "The speculative pressure is *acute*, with 63,500 acres of Bay Area land at high risk of development within the next years," most of which is located "just outside cities."[146]

If the high-density, transit-oriented pattern of growth called for in Plan Bay Area 2013 is displaced, the "acute" pressure to develop existing open spaces in the region, including habitat of threatened and endangered species and agricultural lands, will inevitably intensify.[147] For example, Contra Costa County has the most at risk land in any county in the region, 62,000 acres, that includes 41 percent of the "Bay Area's at-risk Critical Habitat lands."[148] "The future of many of the region's remaining burrowing owls, kit foxes, and other rare species depends on the county's growth decisions."[149] Another illustration of this pressure is evident in Santa Clara County, where 56 percent of the county's existing farmland is at risk of development.[150] The SED fails to include any analysis of the reasonably foreseeable loss of open space, forests, habitat and agriculture that will result from displacement of growth in the urban core in the Bay Area assuming San Francisco is responsible for bypassing flow in compliance with LSJR Alternatives 3 or 4.

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[144] *Id.*

[145] Greenbelt Alliance 2017, *supra* note 71, at 3.

[146] *Id.* at 8 (emphasis added).

[147] *Id.* at 27 (noting that the "Bay Area has a total of 2.3 million acres of agricultural land, 1.8 million acres of lands that provide water resources—watersheds and wetlands—and 2.5 million acres of lands that are important for wildlife—habitat corridors, and areas rich in biodiversity.").

[148] *Id.* at 13.

[149] *Id.*

[150] *Id.* at 20 (explaining, "[f]armland in Santa Clara County desperately needs conservation. With an astounding 56 percent of the county's farmland at risk of development, this fertile and irreplaceable resource is very close to being lost forever."). *See also* SED, at 11-12 (wherein the SED explains that the pressure to develop residential housing on agricultural land in the Central Valley is, in part, driven by workers who live in the Central Valley yet commute to the Bay Area). However, the SED fails to acknowledge that agricultural land *within the Bay Area, e.g.,* in Santa Clara County, is also at risk of urbanization.

3. Water-related impacts of bringing sprawling development into affected areas.

Under CEQA, "[t]he EIR shall also analyze any significant environmental effects the project might cause *by bringing development and people into the area affected*." (Cal. Code Regs., tit. 14, § 15126.2.) To the extent that new development is displaced to outer regions of the Bay Area and the Central Valley, it is reasonable to assume there would be adverse environmental impacts, including impacts to groundwater recharge, water quality and heightened risks of erosion and flooding.

For example, development displaced to currently rural areas in the outer Bay Area or Central Valley, and the attendant construction, would increase the presence of impermeable surfaces, which would, in turn, impede and reduce groundwater recharge.[151] "This is a critical issue in counties like Sonoma, "where groundwater is what people drink."[152] More than half of Sonoma County's water supply – used for both drinking and irrigation – comes from groundwater.[153] In Sonoma County, 58,400 acres of land are at risk of development over the next 30 years, including land that collects water relied on to recharge Sonoma County's groundwater supplies.[154] "If the region's at-risk landscapes are lost to sprawl development, 46 billion gallons of water—a year's worth of water for 677,000 households—is at stake."[155]

Further, the increase in impermeable surfaces associated with development, such as roads and parking lots, increases stormwater runoff, which, in turn, "picks up lawn fertilizer and pesticides, pet waste, trash, pollution from vehicles and pavement materials, and chemicals from industrial and commercial activities."[156] Unless stormwater is treated or soaks into the ground, it will transport the

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[151] Greenbelt Alliance 2017, *supra* note 71, at 28 ("[u]ndeveloped Bay Area lands catch and filter rain, replenishing groundwater supplies. But this service is threatened by development; if lands are paved over, they cannot collect water.").

[152] *Id*.

[153] *Id*. at 24.

[154] *Id*. (emphasizing that protecting this land from development "is essential, for water and for the people who depend on it.").

[155] *Id*. (citations omitted).

[156] Our Built and Natural Environments: A Technical Review of the Interactions Among Land Use, Transportation, and Environmental Quality, Second Edition, U.S. Environmental Protection Agency, June 2013, *available at* https://www.epa.gov/sites/production/files/2014-03/documents/our-built-and-natural-

pollutants that it has picked up into a nearby local water body.[157] As explained in Section I(F)(5)(d) *supra*, the transference of heat from impervious surfaces in the urban environment to stormwater runoff also degrades water quality by increasing the temperatures of local water bodies.

The increased speed of flowing stormwater is also problematic; augmented stormwater runoff in developed areas "moves faster, reaches peak flow more quickly after precipitation begins, and flows for a longer period of time, all of which increase erosion and flood risk."[158] Moreover, increased stormwater runoff increases the frequency and severity of flooding during wet periods because water that would have otherwise soaked into the ground is unable to infiltrate the new, impervious surfaces.[159] The SED must analyze all of these impacts.

Additionally, as noted in Section I(A) *supra*, as the RWS service territory has some of the lowest per capita water use in the state, it is reasonable to conclude that development displaced from the Bay Area to other regions, such as the Central Valley, will use more water per capita than if that development occurred in the urban core areas, as called for in Plan Bay Area 2013.[160]

K. The SED fails to consider the potential adverse impact of the State Water Board's proposal on the development of housing within the Bay Area.

Water Code Section 13241 "identifies certain factors that must be evaluated when establishing water quality objectives," (SED, at ES-63), including "the need for developing housing within the region," (Wat. Code, § 13241(e)). Although the SED indicates that the required discussion of the "[n]eed for developing housing within the region" primarily appears in the Executive Summary, (SED, at ES-64), in fact, there is no substantive discussion of *how* the State Water Board's proposal may

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environments.pdf (referred to below as "EPA Technical Review"), at 51. San Francisco incorporates EPA's Technical Review by reference herein.

[157] *Id.*

[158] *Id.*

[159] *Id.* at 48.

[160] See *e.g.*, California Department of Water Resources, California Water Plan Update 2013, Volume 2 Regional Reports, San Francisco Bay Hydrologic Region, 2013, *available at* http://www.water.ca.gov/waterplan/cwpu2013/final/ (referred to below as "California Water Plan Update 2013"), at SFB-40 (explaining that the cool climate, small lot sizes, and high-density development in the Bay Area contribute to low per capita urban water use, whereas per capita water use in communities in the warmer Central Valley can range from 200 to 300 gallons per day). San Francisco incorporates the California Water Plan Update 2013 by reference herein.

affect development of new housing in the Executive Summary or anywhere else in the document. Instead, the discussion of housing effects in the Executive Summary, and scattered throughout various sections of the SED, with very limited exceptions, denies that the State Water Board's proposal will have any appreciable effect on the development of new housing in the plan area, extended plan area, or other potentially impacted areas, including San Francisco and the RWS service territory.[161] The Executive Summary states:

> *The proposed flow and salinity objectives do not directly restrict the development of housing in the plan area and the extended plan area*. Also, as explained in Chapter 17, Cumulative Impacts, Growth-Inducing Effects, and Irreversible Commitment of Resources, of this SED would not induce growth and new housing development. Depending on the alternative, however, the flow objectives could result in reduced surface and groundwater supplies such that additional infrastructure to treat or provide alternative sources of water may need to be constructed, as explained in Chapter 13, Service Providers. *Where alternative sources are not provided, it may affect new housing development because there may be insufficient supplies to serve the development*.

(SED, at ES-65 [emphasis added].) Thus, the SED avoids any substantive discussion of how the State Water Board's proposal may affect new housing development within the affected regions, including the Bay Area, in the same way the analysis leapfrogs over an inconvenient discussion of impacts that would result from draconian reductions in water deliveries to the RWS service territory. Instead of acknowledging that an inability to develop needed housing in the Bay Area is a reasonably foreseeable consequence of the State Water Board's implementation of a new unimpaired flow objective on the Tuolumne River, as proposed in the SED, the draft posits that only the failure of service providers to develop adequate alternative water supplies will result in the reduced development of new housing.[162]

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[161] *See* ES-5—ES-6 (defining the boundaries of the plan area and extended plan area, and explaining that "the plan amendments also have the potential to affect areas outside of the plan area or extended plan area that obtain beneficial use of water from the Stanislaus, Tuolumne, and Merced Rivers, and the LSJR downstream of the Merced River, but are not contiguous with the plan area or extended plan area," including San Francisco and "[a]ny other area served by water delivered from the plan area or extended plan area not otherwise listed above").

[162] *See* Section I(C)(3) *infra* (explaining that if San Francisco was responsible for bypassing flow in compliance with the State Water Board's implementation of LSJR Alternatives 3 or 4, it would be required to impose unsustainable levels of mandatory rationing throughout the RWS service territory during sequential-year droughts).

Further, although the SED concludes that because "[u]nder the LSJR alternatives, changes in river flows would generally result in more water remaining in the three eastside tributaries rather than being used for consumptive purposes," such "changes in river flows would not increase the reliable water supply and would not directly or indirectly induce economic, population, or housing growth," (SED, at 17-69), the draft entirely fail to address the potential correlative increases in economic, population, and housing growth that may therefore occur elsewhere, *i.e.*, in other regions with more reliable dry-year and future water supplies.

As explained in Section I(H)(5)(a) *supra*, Plan Bay Area 2013 is designed to comply with SB 375's statutory requirement that the Bay Area house 100 percent of its projected population growth without displacing current low-income residents.[163] As a reflection of Plan Bay Area 2013's "emphasis on the existing transit network and connecting homes and jobs, San Francisco, San Mateo, Santa Clara and Alameda counties account for the majority of housing growth (77 percent) and job growth (76 percent)."[164] The SFPUC delivers water in each of these counties. As detailed in Section I(C)(3) *supra*, if the SFPUC was responsible for bypassing flow to meet LSJR Alternatives 3 or 4, during sequential-year droughts it would be compelled to significantly reduce deliveries to its in-City retail customers and wholesale customers located in San Mateo, Santa Clara, and Alameda counties. For all of the reasons discussed above, it is reasonable to assume this lack of dry-year and future water supply reliability would inhibit and deter needed housing growth in the Bay Area, and would induce growth in areas with more reliable dry-year and future water supplies. The SED's utter failure to even acknowledge, let alone comprehensively analyze, how the State Water Board's implementation of LSJR Alternatives 3 or 4 may displace the pattern of compact growth called for in Plan Bay Area 2013, and thereby, further intensify the pressure to develop affordable housing elsewhere, violates the express requirement of Water Code Section 13241(e).

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[163] Plan Bay Area 2013, *supra* note 104, at 5, 19, 43.

[164] *Id*. at 56.

L. Reduced hydropower generation would result in substantial economic impacts to San Francisco.

1. The SED fails to consider impacts to the SFPUC's hydropower operations.

The SED fails to consider impacts to the SFPUC's hydropower operations from implementation of the LSJR Alternatives. The SED relies on the water supply effects ("WSE") model to estimate the effects of the LSJR Alternatives on hydropower generation at certain dams. (SED, at J-1 ["This analysis relies on the State Water Resources Control Board's (State Water Board's) water supply effects (WSE) model to estimate the effects of the LSJR alternatives on reservoir releases and storage (elevation head), and allowable diversions to off-stream generation facilities, and then calculates the associated change in monthly and annual energy production. This output then provides input to electric grid reliability modeling, which evaluates the potential impacts of these changes on the electric grid reliability under peak load and outage contingency scenarios."].) The SED focused its analysis of estimated impacts to hydropower operations on three identified "rim dams," *i.e*., New Melones Dam on the Stanislaus River, New Don Pedro Dam on the Tuolumne River, and New Exchequer Dam on the Merced River. (SED, at J-1 (emphasis added) ["Numerous hydropower generation facilities on the three eastside tributaries are evaluated in this analysis. *The major facilities potentially affected, however, are those associated with the New Melones Reservoir (New Melones Dam) on the Stanislaus River, New Don Pedro Reservoir (New Don Pedro Dam) on the Tuolumne River, and Lake McClure (New Exchequer Dam) on the Merced River*."]; SED, at J-1, fn. 4 ["In this document, the term rim dams is used when referencing the three major dams and reservoirs on each of the eastside tributaries: New Melones Dam and Reservoir on the Stanislaus River; New Don Pedro Dam and Reservoir on the Tuolumne River; and New Exchequer Dam and Lake McClure on the Merced River."].) Significantly, hydropower facilities located upstream of these three "rim dams," *e.g*., the SFPUC's hydropower facilities located above New Don Pedro Dam on the Tuolumne River, were not included in the WSE model. (SED, at J-5 (emphasis added) ["*Hydropower generated from facilities upstream of the rim dams on the Stanislaus and Tuolumne Rivers is not included in the WSE model* because the largest hydrologic effects in terms of volume of water will be at and downstream of the rim dams."].)

The SED states that "[u]pstream hydropower effects are qualitatively discussed in Chapter 14, Energy and Greenhouse Gases, in Section 14.4.4, Impacts and Mitigation Measures: Extended Plan Area." (SED, at J-5.) However, to the extent that the general qualitative discussion of impacts to hydropower operations upstream of the three identified "rim dams" that appears in Chapter 14 is intended to apply to the SFPUC's hydropower facilities on the Tuolumne river, that discussion is woefully inadequate because it ignores a critical component of San Francisco's operations during sequential-year droughts. To extend the longevity of its water supply, during a protracted drought San Francisco would impose mandatory rationing and reduce deliveries to the RWS service territory from the San Joaquin Pipelines.[165] This would enable San Francisco to maximize the amount of water that could be stored in its three largest reservoirs on the Tuolumne River and its tributaries – Hetch Hetchy Reservoir, Cherry Reservoir and Lake Eleanor.[166] However, because San Francisco generates electricity when it releases water from Hetch Hetchy Reservoir for delivery to the Bay Area, primarily via Canyon Power Tunnel and Kirkwood Powerhouse, rationing the delivery of water supply to the RWS results in reduced hydropower generation.[167] In its qualitative discussion of impacts to hydropower facilities upstream of the three identified "rim dams," the SED fails to consider that reductions in hydropower generation may occur due to reduced water deliveries.

Although the SED recognize that "[h]ydropower production is related to both water discharge volume and reservoir head," (SED, at 14-53), the qualitative discussion of impacts to hydropower facilities upstream of the "rim dams" in Chapter 14 solely focuses on reductions in generation associated with reduced reservoir volume, and consequent reductions in reservoir head. (SED, at 14-53 [concluding that during drought conditions "there could be significant hydropower production reductions at reservoirs under [LSJR Alternatives 2, 3, and 4] in the extended plan area" due to more

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[165] SFPUC Analysis of Changes to Flow Criteria, *supra* note 26, at 5.

[166] *See* WSIP, *supra* note 7, at 2-7 (explaining that "[w]ater from Lake Eleanor and Lake Lloyd [also known as Cherry Reservoir] is used primarily to meet minimum instream flow requirements to benefit fish and other wildlife, satisfy downstream water rights of the Turlock and Modesto Irrigation Districts . . . produce hydroelectric power, and provide flows to support recreational use including whitewater recreation. However, if necessary during emergency or drought conditions, water from Lake Lloyd or Lake Eleanor can be released to Cherry Creek and then diverted to Mountain Tunnel for transport to the Bay Area, which occurred once during the early 1990s.").

[167] SFPUC Analysis of Changes to Flow Criteria, *supra* note 26, at 5.

frequent and severe reservoir volume reductions.].) Accordingly, the SED fails to analyze, qualitatively discuss, or even acknowledge the hydropower reductions that San Francisco would experience during sequential-year droughts under implementation of LSJR Alternatives 2, 3, or 4.[168]

2. The SFPUC's hydropower operations would be significantly affected by implementation of LSJR Alternatives 3 or 4 during dry hydrologic conditions.

As explained, if San Francisco was responsible for complying with a new unimpaired flow objective on the Tuolumne River, then during dry hydrologic conditions the SFPUC would be compelled to implement water supply rationing in order to preserve system storage. Consequently, less water would flow through the SFPUC's water supply delivery pipeline, thereby reducing hydropower generation at facilities situated along the route of the delivery pipeline, *i.e.*, Kirkwood Powerhouse and Moccasin Powerhouse.[169] For example, assuming maximum annual contract deliveries of 265 mgd, the SFPUC's hydropower generation could be reduced by as much as 11 percent under a 40 percent unimpaired flow objective (assuming FY 1960-61 through FY 1962-63 hydrology), and by as much as 21 percent under a 50 percent unimpaired objective (assuming FY 1976-77 through FY 1977-78 hydrology).[170] Assuming pre-drought demand of 223 mgd, the SFPUC would experience comparably significant reductions in hydropower generation.[171]

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[168] In fact, it appears the reference to a qualitative discussion of effects to hydropower operations upstream of the three "rim dams" in Chapter 14 was primarily intended to allay concern that impacts to upstream hydropower operations, such as the SFPUC's hydropower facilities in the Tuolumne River Watershed, were simply not considered by the State Water Board. *See* Declaration of Jonathan P. Knapp in Support of Comments by the City and County of San Francisco to the Draft Substitute Environmental Document in Support of Potential Changes to the Bay-Delta Plan ("Knapp Decl."), attached hereto as Appendix 4, at ¶ 8, *see* Attachment 2 to Knapp Decl., E-mail from Nicole L. Williams, Senior Environmental Planner, ICF International, to William Anderson and Timothy Nelson, State Water Board, August 15, 2016 (emphasis added) (explaining that "[w]e will edit the text in Appendix J to remove that reservoirs/dams upstream of the rim dams would be unaffected by the LSJR alternatives and to reflect that given the relatively small amount of hydropower generated upstream when compared to the rim dams (Table J-1)) this information was not modeled and Appendix J only focuses on modeling changes associated with the rim dams. *In addition, we could add a sentence that says the upstream hydropower effects are qualitatively discussed in the EPA section of Chapter 14 (so people don't think we've left it out*).").

[169] SFPUC Analysis of Changes to Flow Criteria, *supra* note 26, at 5

[170] *Id*. at 13, Table 5.

[171] *Id*. at 14, Table 6.

3. The SFPUC's hydropower impacts would result in significant economic impacts that have not been analyzed in the SED.

San Francisco estimates that the economic impact of the State Water Board's implementation of a 40 to 50-percent unimpaired flow objective on the Tuolumne River – calculated by determining the foregone revenue as a result of lost sales of hydropower – would be approximately $2 million per year for each successive year of a protracted drought.[172]

II. The State Water Board's conclusion that it is reasonably foreseeable that San Francisco could develop and/or procure sufficient replacement water supplies through the three methods of compliance identified in the SED is not supported by substantial evidence, or reasonable inferences predicated on fact.[173]

A. The State Water Board's assumption that it is reasonably foreseeable that San Francisco would be able to purchase the requisite volume of replacement water from the Modesto Irrigation District and the Turlock Irrigation District is not supported by substantial evidence, or reasonable inferences predicated on fact, and the analysis of environmental and economic impacts associated with such water transfers is inadequate.

Although the SED assumes that San Francisco's primary method of compliance with a new flow objective for the Tuolumne River would be to purchase replacement water from the Districts,[174] the draft concedes that whether such a transfer would actually occur is "uncertain," "speculative and unknowable." (SED, at L-20 [emphasis added] [noting that in 2012, the MID Board of Directors rejected a proposal for long-term transfers to SFPUC. *This rejection makes future temporary drought transfers uncertain*."); *id.* at 16-9 (emphasis added) [acknowledging that "[t]he number and location of surface water transfers that entities would undertake in response to surface water reductions as a result of approving the LSJR alternatives is *speculative and unknowable*."]; *id.* at L-22 (emphasis added)

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[172] *Id.* at 6.

[173] SED, at L-22 (identifying three "potential actions SFPUC could take to replace reductions in water supply resulting under the LSJR alternatives" as "Water transfer," "In-Delta diversion(s)," and "Water supply Desalination Project.").

[174] *Id.* at L-26 ("[i]t is reasonable to assume that SFPUC would purchase and transfer additional water supplies from the Tuolumne River Watershed to its service area to offset water shortages during drought periods."); *id.* at 20-27 ("[t]he analysis presented in this section (and described in greater detail in Appendix L, City and County of San Francisco Analyses) assumes that under LSJR Alternatives 2, 3, and 4, during drought periods, SFPUC could meet its potential water supply shortage by buying water from MID and TID."; *id.* at 20-38 ("To assess the effects of additional water supply costs on the four-county Bay Area regional economy, it is assumed that the SFPUC would meet its water demands during severe drought periods (such as within the 6-year drought 1987-1992) by purchasing water from MID and TID.").

[“*[a] possible water transfer between SFPUC and irrigation districts relies on numerous unknown variables* (*e.g.*, willingness of irrigation districts to enter into a transfer agreement, the price of the water, and the volume of water needed).”]; *id*. at 20-27 [describing “uncertainties of this type of water transfer” as including “price of water, quantity of water available, willingness of parties to enter into an agreement.”].) The State Water Board has failed to identify any substantial evidence in support of its assumption that San Francisco would be able to effectuate such a transfer. (Pub. Res. Code, § 21168.5 (emphasis added) [providing that under CEQA “[a]buse of discretion is established if the agency has not proceeded in a manner required by law *or if the determination or decision is not supported by substantial evidence*.”].) Thus, the proposed large-scale water transfer from the Districts to San Francisco cannot be considered a reasonably foreseeable method of compliance by San Francisco with the LSJR Alternatives. (Pub. Res. Code, § 21159(a); Cal. Code Regs., tit. 23, § 3777(b)(4) .)

1. The State Water Board has no basis for assuming that the Districts would agree to transfer the requisite volume of water to San Francisco in the midst of a sequential-year drought.

a. The State Water Board reaches an unsupported conclusion about past water transfers and provides no support for a water transfer between the Districts and San Francisco of the required magnitude.

i. Contrary to the suggestion in the SED, MID only transferred a minimal amount of water to San Francisco during the 1987-1992 drought.

The SED estimates that if the State Water Board implemented a 40 percent unimpaired flow objective on the Tuolumne River, and San Francisco was responsible under the Fourth Agreement for providing approximately 51.7 percent of the increased flow required from the Districts, San Francisco would experience a water supply deficit of 119,000 AF/year for 6 consecutive years based on the historic hydrology from the 1987-1992 drought.[175] (SED, at L-21, Table L.4-2). The Districts have never transferred this volume of water to any other entity.

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[175] In fact, as explained in Section I(A) *supra*, San Francisco’s deficit under a 40-percent unimpaired flow objective would be 129,884 AF/year for each of the 6 years, resulting in an additional loss of 10,884 AF/year, or 65,304 AF in total for the 6-year period. *See* SFPUC Analysis of Changes to Flow Criteria, *supra* note 26, at 16, Table 9.

The SED relies on the faulty premise that San Francisco purchased a comparable volume of water from the Districts during the 1987-1992 drought.[176] The SED appears to conclude that San Francisco purchased, on average, 18,000 AF/year from the Districts during the 6-year drought of 1987-1992. The SED estimates that "[u]nder historic conditions the maximum amount of water needed to be purchased by the City to make it through the 6-year drought was about 105 [thousand acre-feet or "TAF"], or an average of 18 TAF per year for the 6-year period (1987-1992)." (*Id*. at L-14.) Further, the SED states that the baseline credit balance in San Francisco's water bank in Don Pedro Reservoir that was used by the State Water Board in its analysis "is lower than historically reported because, during [the 1987-1992 drought], the account dropped below zero *and the City purchased water from the districts*. *The details of this purchase agreement between the City and the districts during this period are unknown, but the difference from baseline and the reported balance can be attributed to this purchase*." (*Id*. (emphasis added).) However, the SED is mistaken; San Francisco has never purchased a comparable volume of water from the Districts.

Although during the 1987-1992 drought San Francisco purchased approximately 107,848 AF of water,[177] San Francisco only procured a small fraction of that amount from either of the Districts. The only water transfer completed during the 1987-1992 drought with either of the Districts was a 1990 water transfer from MID to San Francisco for 5,288 AF ("1990 Transfer Agreement").[178]

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[176] December 12th Workshop Transcript, *supra* note 23, at 207:4-12 (emphasis added) (wherein Tom Wegge, Principal Economist at TCW Economics explained, "[w]ell, I mean, we considered all of the options [for replacement water supply for San Francisco], but we felt that the most reasonable assumption, given the existing infrastructure, *the history of having transfers*, the fact that the district -- the SFPUC -- has identified transfers between MID and TID [in] their water supply plan, that based on those factors and the fact that, like I said, the infrastructure was in place, that seemed like the most reasonable assumption for purposes of analysis."); *id*. at 2018:21-25—209:1 (emphasis added) (wherein Will Anderson, Water Resources Engineer with the Division of Water Rights, explains that "the record includes examples of the city pursuing such sales *and don't in fact* [know] *the details of what has actually occurred in the past* but that it would certainly be something that would be possible."); *id*. at 208:18-25—209:1-9 (wherein Mr. Anderson acknowledges that State Water Board Staff generated the assumption that San Francisco would be able to purchase the requisite replacement supply from the Districts that served as the starting point for Mr. Wegge's economic analysis.)

[177] The 107,848 AF of transfer water San Francisco secured during the 1987-1992 drought period pales in comparison to the 129,884 AF/year for 6 consecutive years – a total of 779,304 AF during the 6-year period – that San Francisco would need to obtain to replace the significant water supply reduction that it could experience if the State Water Board implemented a 40-percent flow objective on the Tuolumne River. *See* SFPUC Analysis of Changes to Flow Criteria, *supra* note 26, at 16, Table 9.

[178] Ritchie Decl., *supra* note 3, at ¶ 6; Agreement Relating to the Transfer of Water, December 20, 1990, attached hereto as Exhibit 20.

Although pursuant to the 1990 Transfer Agreement, MID was required to "utilize its best efforts to make available to [San Francisco] up to 20,000 acre-feet of pumped drainage water," (1990 Transfer Agreement, at ¶ 2), MID only made 5,288 AF available to San Francisco for purchase, and of that amount, only 4,891 AF was actually delivered).[179] In accordance with its express terms, the 1990 Transfer Agreement terminated on March 15, 1991.[180] (1990 Transfer Agreement, at ¶ 1).

ii. The vast majority of the water San Francisco purchased during the 1987-1992 drought came from sources that no longer exist, or are no longer a source of reliable replacement supply.

The vast majority of the water purchased by San Francisco during the 1987-1992 drought came from sources that no longer exist, *i.e.*, from the state-sponsored Drought Emergency Water Banks of 1991 and 1992 established by the California Department of Water Resources ("DWR"), or are no longer a source of reliable replacement supply, *i.e.*, Placer County Water Agency ("PCWA").[181] During the 1987-1992 drought, San Francisco obtained a commitment from DWR's Drought Emergency Bank for 69,000 AF and from PCWA for 33,560.[182] However, given that DWR did not organize a drought water bank during the recent drought,[183] and there is no basis to conclude that San

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[179] Ritchie Decl., *supra* note 3, at ¶ 6.

[180] Contrary to the State Water Board's apparent belief that there is an existing water transfer agreement in place between the Districts and San Francisco, no such agreement has been executed since the 1990 Transfer Agreement. *See* SED, at 16-15 (emphasis added) (wherein the draft appears to reference "existing" transfer agreements between San Francisco and the Districts: "the [contemplated] water transfer [between the Districts and San Francisco] would be limited to the capacity of *existing infrastructure and existing agreements*.").

[181] The SED does not identify the possibility of San Francisco obtaining replacement water supplies either from a modern incarnation of the Emergency Drought Water Banks organized and implemented by DWR in 1991 and 1992, or from PCWA. *See* December 12th Workshop Transcript, *supra* note 23, at 212:10-13 (where Mr. Grober acknowledges that State Water Board Staff did not consider transfers to San Francisco from any sources other than the Districts); *id*. at 213:6-12 (where Nicole Williams, Senior Environmental Planner at ICF Jones & Stokes, clarifies that the SED's analysis of the in-Delta diversion project may have relied on "a cost associated with a water transfer that might have come outside of the irrigation districts.").

[182] Of these amounts, only 52,000 AF was actually delivered by DWR, and only 21,042 AF was actually delivered by PCWA. (Ritchie Decl., *supra* note 3, at ¶ 6.)

[183] See *e.g.*, Brekke, Dan, *As California Drought Deepens, Those With Water Can Sell at a High Price*, KQED (July 2, 2014), available at https://ww2.kqed.org/news/2014/07/02/california-drought-water-sales/, attached as Exhibit 21 (emphasis added) (explaining that "[d]uring the last drought, [DWR] ran a drought water bank, which helped broker deals between those who were short of water and those who had plenty. But several environmental groups sued, alleging the state failed to comply with [CEQA] in approving the sales, and won. *This year, the state is standing aside, saying buyers and sellers have not asked for the state's help. 'We think*

Francisco would be able to effectuate a future dry-year water transfer with PCWA, it is not reasonable to assume that San Francisco could secure the requisite volume of replacement water from either of these sources.

Even if DWR organized and implemented a drought water bank in the future, it would need to address an array of challenges, including numerous legal issues that commenters have identified.[184] Assuming that a modern incarnation of the Drought Emergency Water Bank could surmount these challenges, there would inevitably be intense, competing demands on any attainable transfers.[185] Therefore, whether San Francisco would be able to secure the requisite amount of replacement supply, or any significant portion thereof, from the bank would be "speculative and unknowable." (SED, at 16-9.)

Further, whether San Francisco would be able to secure a dry-year water transfer with PCWA during a future sequential-year drought for the requisite volume of replacement supply, or any significant portion thereof, is also "speculative and unknowable" in light of the agency's existing contractual commitments, potentially augmented regulatory obligations, and practical constraints. (*Id.*) PCWA has long-term agreements to sell water to several entities, including the City of Roseville, Sacramento Suburban Water District, and San Juan Water District, and in recent years has made short-

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that buyers and sellers can negotiate their own deals better than the state,' said Nancy Quan, a supervising engineer with the department.").

[184] *See* e.g., Brian E. Gray, *The Market and the Community: Lessons from California's Drought Water Bank* (2008) 14 Hastings W.-N.W. J. Envtl. L. & Pol'y 41 (referred to below as "Lessons from California's Drought Water Bank") (identifying challenges that must be addressed by any future state-sponsored drought water banks, including legal considerations). (See *id*. at *57) (explaining that "because the transfers of water to the [1991 DWR] Bank overwhelmingly involved surface water held pursuant to riparian right and surface water for which groundwater was substituted, both the [State Water Board] and the laws that establish a process for protecting third-party water rights holders, fish and wildlife, instream flows, and other interests within the areas-of-origin were effectively removed from the transfer process. Moreover, because of the decision legally to characterize the transfers for which groundwater was substituted as transfer of surface water for one purpose and transfers of groundwater for another, the laws designed to protect the counties in which groundwater originates were circumvented.").

[185] If the past is any indication of the level and source of competing demands for any transfers that may be available for a future Emergency Drought Water Bank, it is reasonable to assume there will be significant competition from Southern California. *See* Morris Israel & Jay R. Lund, *Recent California Water Transfers: Implications for Water Management* (1995) 35 Nat. Resources J. 1, at *11 (emphasis added) (explaining that "[a] total of 389,970 [AF] was purchased from the 1991 Water Bank by 12 entities, compared to 348 entities selling water. Three jurisdictions, Metropolitan Water District of Southern California (MWD), Kern County Water Agency and [San Francisco] accounted for over 80 percent of the purchases. *MWD alone purchased 55 percent*. Roughly 80 percent of 1991 Water Bank sales were for municipal and industrial uses.").

term water transfers to additional entities, including the San Diego County Water Authority, Westlands Water District and the East Bay Municipal Utilities District ("EBMUD"). Moreover, EBMUD and PCWA are currently working on a long-term water transfer agreement whereby "EBMUD, as the buyer, would purchase between [10,000-47,000 AF/year] of transfer water from PCWA in dry years for diversion at the Freeport intake and delivery to EBMUD customers."[186] Given PCWA's existing (and potential future) contractual commitments regarding water transfers, it is unclear whether PCWA would be able and/or willing to sell a significant volume of replacement supply to San Francisco in the midst of a future, sequential-year drought.

A number of potentially augmented regulatory requirements may also affect PCWA's ability and/or willingness to transfer surface water to other entities. For example, the Middle Fork American River Hydroelectric Project is currently the subject of a Federal Energy Regulatory Commission ("FERC") relicensing proceeding that may result in a new license that will require PCWA, as the licensee, to increase its instream flow releases.[187] It is unclear what effect, if any, new minimum instream flow release requirements imposed by FERC may have on PCWA's ability to provide water to its customers, and consequently, the agency's ability and/or willingness to transfer surface water to other entities. Moreover, the State Water Board plans to propose unimpaired flow objectives on the Sacramento River and its eastside tributaries as part of Phase 2 of the agency's process for amending the Bay-Delta Plan.[188] The State Water Board's ultimate amendment of the Bay-Delta Plan may

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[186] East Bay Utility Management District Urban Water Management Plan 2015, *available at* http://www.ebmud.com/water-and-drought/about-your-water/water-supply/urban-water-management-plan/, at 61 (describing current status of potential long-term water transfer between PCWA and EBMUD: "PCWA and EBMUD are seeking to complete all environmental reviews and approvals to implement the proposed project by 2017.").

[187] See *e.g.*, Final Environmental Impact Statement for Hydropower License, Middle Fork American River Hydroelectric Project—FERC Project No. 2079-069, February 2013, *available at* https://www.ferc.gov/industries/hydropower/enviro/eis/2013/02-22-13.asp, at 117 (emphasis added) (explaining that "[u]nder the proposed and Alternative 1 flow schedules, *summer flows in wet and above normal water years would be higher than under existing conditions in all project-affected reaches. In summers of critical, dry, and below normal water years, minimum flows would be increased or maintained* in all bypassed and peaking reaches compared with existing conditions.")

[188] *See* Working Draft Scientific Basis Report for New and Revised Flow Requirements on the Sacramento River and Tributaries, Eastside Tributaries to the Delta, Delta Outflow, and Interior Delta Operations, State Water Resources Control Board, October 2016, *available at* http://www.waterboards.ca.gov/waterrights/water_issues/programs/bay_delta/docs/20161014_ph2_scireport.pdf at 1-12 (emphasis added) (explaining that "[t]he numeric alternatives currently under development fall within

require PCWA to comply with new regulatory obligations. Implementation of Water Code sections 10720, *et seq*. ("SGMA") will also presumably impose new restrictions on PCWA's extraction of groundwater considering the number of high-priority subbasins located in the agency's service territory.[189]

Additionally, there are myriad practical limitations that could complicate a water transfer from PCWA to the SFPUC. For example, in December 2015, despite having surplus water available for sale, PCWA was unable to effect water transfers with entities south of the Delta due to limited pumping capacity.[190] PCWA, like many other water agencies, also has to contend with protests to proposed water transfers.[191]

iii. The fact that San Francisco and the Districts executed the 1995 Side Agreement does not support the State Water Board's assumption that San Francisco will be able to effectuate the proposed large-scale water transfer with the Districts in the future.

To the extent that the State Water Board is relying on the 1995 Side Agreement in support of the assumption that San Francisco will be able to purchase the requisite volume of replacement water supply from the Districts, such reliance would be misplaced.[192] More specifically, the history and

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the range of 35 to 75 percent of unimpaired flow and will be further refined with modeling to evaluate needs to reserve cold water in storage and other considerations.").

[189] SGMA requires the formation of local groundwater sustainability agencies and the development and implementation of groundwater sustainability plans for each medium- or high-priority basin to provide for sustainable management. (*See* Wat. Code, §§ 10720.1(a) (identifying legislative goals of SGMA), 10723.6 (detailing methods for forming groundwater sustainability agencies), 10727(a) (prescribing that "[a] groundwater sustainability plan shall be developed and implemented for each medium- or high-priority basin by a groundwater sustainability agency to meet the sustainability goal established pursuant to this part.").

[190] Placer County Water Agency, Board of Directors, Regular Meeting, Minutes, July 21, 2016, Book 26, at 117, *available at* https://res.cloudinary.com/pcwa/image/upload/pcwa-website/board-minutes/07-21-2016_Minutes.pdf, attached hereto as Exhibit 22 (emphasis added) (explaining that "[i]n December, parties south of the Delta approached the Agency for water to refill their reservoirs. As hydrology improved, the ability to move water in the transfer season from north to south *became limited because of limited pump capacity in the south Delta* and interested buyers left the market.").

[191] Placer County Water Agency, Board of Directors, Regular Meeting, Minutes, June 18, 2009, Book 21, at 126, *available at* https://res.cloudinary.com/pcwa/image/upload/pcwa-website/board-minutes/06-18-2009_Minutes.pdf, attached hereto as Exhibit 23 (noting protests to the transfer between PCWA and San Diego County Water Authority.).

[192] In its PRA Request, San Francisco specifically asked for: "All public records containing information that served as the basis for Staff's conclusion that the volume of water identified in the 2016 Draft SED, Appendix L, at page L-21, Table L.4.-2, would be available for purchase by San Francisco from the [Districts] during a six-year drought if LSJR Alternatives 2, 3, or 4 were implemented." Knapp Decl., *supra* note 168, *see* Attachment 1 to Knapp Decl., Letter to Tom Howard, Executive Director, State Water Resources Control

existence of the 1995 Side Agreement does not constitute substantial evidence in the administrative record that the State Water Board can rely on for the conclusion that a large-scale water transfer with the Districts is a reasonably foreseeable method of compliance by San Francisco with implementation of a new unimpaired flow objective on the Tuolumne River.[193]

First, based on the modeling assumption used in the SED that the 1995 Side Agreement would continue to obligate the Districts to contribute the total amount of flow required by the 1996 Settlement Agreement, the proposed large-scale water transfer would not replace the 1995 Side Agreement, but instead, would represent an *additional commitment of water* by the Districts on top of the current FERC instream release flow schedule for the Don Pedro Project ("FERC Flow Schedule"). In order to analyze the reduction in San Francisco's water supply that could result if a new flow objective on the Tuolumne River that calls for a percentage of unimpaired flow to remain in the river between February and June is implemented, both San Francisco and the State Water Board assume San Francisco could be required to bypass 51.7 percent of the *additional increment of flow above* the current FERC Flow Schedule, while the Districts would continue to meet the existing FERC Flow Schedule under the terms of the 1995 Side Agreement. In compliance with the existing FERC Flow Schedule, the Districts currently release between 94,000 and 300,923 AF/year depending on the water year type (51.7 percent of that amount equates to approximately 48,598 to 155,577 AF/year).[194] Based on the hydrological record from 1987 through 1992, the Districts would be required, between February and June, to bypass a total of 707,841 AF during the 6-year period under the existing FERC Flow

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Board, from Jonathan Knapp, Deputy City Attorney, San Francisco City Attorney's Office, October 14, 2016 ("referred to below as "CCSF PRA Request"), at 1. In response to this request, the State Water Board identified the 1995 Side Agreement, among other documents. Knapp Decl. at ¶ 4.

[193] *See* Letter from California Sportfishing Protection Alliance, Tuolumne River Trust, American Rivers, American Whitewater, California Trout, Central Sierra Environmental Resource Center, Friends of the River, Golden West Women Flyfishers, Merced Fly Fishing Club, Trout Unlimited (collectively referred to as "Conservation Groups") to the State Water Resources Control Board, October 8, 2014 ("Conservation Groups' Letter"), at 11 (asserting that "[s]ince there is substantial evidence in the FERC record, and now in the record for Phase 1, that this contractual agreement was the solution in the only previous case in which additional flow was required (in this case, by FERC), it is reasonably foreseeable that the City and the Districts might once again conclude a similar agreement.").

[194] 1996 FERC Decision, 76 FERC ¶ 61117, 61608 (explaining that under the 1996 Settlement Agreement "[a]nnual minimum water releases from the project will range from 94 thousand acre feet (TAF) in the driest 6.4 percent of years to 301 TAF in the wettest fifty percent of years.").

Schedule.[195] Assuming continuation of the 1995 Side Agreement, approximately 365,954 AF of this amount would be bypassed by the Districts on San Francisco's behalf.[196]

The State Water Board further assumes that during a 6-year drought sequence, using 1987-1992 hydrology, that beyond the 707,841 AF required to comply with the existing FERC Flow Schedule, the Districts would also be able to bypass – on San Francisco's behalf – an additional 714,000 AF (119,000 AF x 6 years = 714,000 AF) under a 40 percent unimpaired flow objective. (SED, at L-21, Table L.4-2). As explained in Section I(B) *supra*, San Francisco's actual water supply deficit in this scenario is more severe, *i.e.*, 129,884 AF x 6 years = 779,304 AF total.[197] This would be on top of the water that the Districts themselves would be required to bypass under a new unimpaired flow objective, assuming they were responsible for 48.3 percent of the requisite flows. For example, under a 40 percent unimpaired flow objective, and assuming 1987-1992 hydrology, the Districts would be required to bypass, between February and June, 107,504 AF/year for 6 years, or 645,024 AF, in addition to the FERC flow schedule.[198] Thus, based on the historical 1987-1992 hydrology, and assuming implementation of a 40 percent unimpaired flow objective, between February and June, during the 6-year drought sequence the Districts would be required to bypass approximately 707,841 AF under the existing FERC Flow Schedule and an additional 1,424,328 AF (645,024 AF + 779,304 AF) for a total volume of 2,132,169 AF.[199] Significantly, this exceeds the total storage capacity of Don Pedro Reservoir, which is 2,030,000 AF.

In short, the Districts' ability and willingness to bypass flow on behalf of San Francisco to meet the requirements of the existing FERC Flow Schedule, as provided by the 1995 Side Agreement, cannot be relied on as substantial evidence or precedent regarding the Districts' ability or willingness to bypass the *additional, and far larger* volume of water that San Francisco may be required to contribute in order to comply with a new unimpaired flow objective on the Tuolumne River.

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[195] Ritchie Decl., *supra* note 3, at ¶ 7.

[196] *Id.*

[197] *See* SFPUC Analysis of Changes to Flow Criteria, *supra* note 26, at 16, Table 9.

[198] Ritchie Decl., *supra* note 3, at ¶ 7.

[199] *Id.*

Second, under LSJR Alternatives 3 and 4 far more water would have to be bypassed in dry years than is currently required under the existing FERC Flow Schedule. For example, on average, in a critically dry year, the existing FERC Flow Schedule calls for approximately 67,521 AF to be bypassed on the Tuolumne River during the February-June period. By contrast, under a 40 percent unimpaired flow objective approximately 292,495 AF would have to be bypassed during the same period, over 4 times the amount of water. In fact, in 2014 the Conservation Groups referenced above suggested that the State Water Board consider modifying the proposed unimpaired flow requirements to "avoid short-term calamities" that may result during sequential-year droughts and specifically recommended that "the Board should evaluate specific options for limiting or mitigating water supply impacts to urban water users in particular during multiple dry year scenarios."[200] Unfortunately, however, the State Water Board did not act on the Conservation Groups' recommendation, and thus, compliance with the proposed unimpaired flow objectives, particularly LSJR Alternatives 3 and 4, requires a substantially greater volume of water to be bypassed in dry years than the existing FERC Flow Schedule.

Third, the 1995 Side Agreement cannot be relied on as a predictor of any potential, future agreements between San Francisco and the Districts for the simple reason that the 1995 Side Agreement was executed nearly two decades prior to the State Water Board's initial release of its proposal for unimpaired flow objectives in 2012, and thus, the agreement did not contemplate the draconian water supply reductions, particularly in dry years, that could result from implementation of such an amendment to the Bay-Delta Plan for both San Francisco and the Districts, as detailed above.

Additionally, there is no guarantee that San Francisco and the Districts will reach agreement on a new iteration of the 1995 Side Agreement, which terminates by its express terms upon issuance of a new FERC license for the Don Pedro Project.[201] If San Francisco and the Districts are unable to reach agreement regarding the allocation of responsibility for bypassing the volume of water called for in the existing FERC Flow Schedule, San Francisco's water supply shortages would be more severe, and San

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[200] Conservation Groups' Letter, *supra* note 193, at 9.

[201] 1995 Side Agreement, at Provision 1.

Francisco's corresponding need to obtain replacement water supplies would be that much more substantial.

b. Unlike the water transfer between the Districts and San Francisco contemplated by the State Water Board, the 1990 transfer from MID to San Francisco was expressly contingent on the water at issue being surplus to MID's needs.

The 1990 Transfer Agreement was contingent on the water being surplus to MID's needs. MID agreed to pump groundwater during the non-irrigation season from certain wells located on the western side of its irrigation service territory that had historically only been operated during the irrigation season – from approximately March through October – for irrigation drainage and other incidental purposes. (1990 Transfer Agreement, at 1). But the agreement expressly stated that MID could "reduce or discontinue any or all deliveries of water to the City" if MID needed "the facilities to be utilized for the pumping and transportation of water under this agreement . . . to meet other requirements of the District," or the groundwater pumping "will, or is likely to, adversely affect the aquifer from which the water is being pumped or groundwater supply of adjacent or nearby groundwater users." (*Id*. at ¶ 6(a)(1-2).)

By contrast, the SED contemplates that the Districts will transfer an unprecedented amount of water to San Francisco notwithstanding a substantial loss of supply to meet their existing water demands, and other material considerations. The SED assumes that under a 40 percent unimpaired flow objective the Districts will transfer approximately 119,000 AF/year every year for 6 consecutive years during a protracted drought while also bypassing their share of water to satisfy the flow objective on the Tuolumne River, and other associated requirements, *e.g*., the Tuolumne River's share of the proposed year-round minimum requirement of 1,000 cubic feet per second ("cfs") at Vernalis.[202] The Districts have previously informed the State Water Board that even without the

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[202] *See* SED, at K-29 (emphasis added) (explaining that "the LSJR base flow objective for February through June shall be implemented by requiring a minimum base flow of 1,000 cfs, based on a minimum 7-day running average, at Vernalis at all times. . . . When the percentage of unimpaired flow requirement is insufficient to meet the minimum base flow requirement, the Stanislaus River shall provide 29 percent, *the Tuolumne River 47 percent* and the Merced River 24 percent of the additional total outflow needed to achieve and maintain the required base flow at Vernalis."). It is unclear whether the 1,000 cfs minimum baseflow requirement at Vernalis would require additional releases from storage. *See* SFPUC Analysis of Changes to Flow Criteria, *supra* note 29, at 7 (explaining that the "SFPUC could not realistically evaluate the need for additional releases from storage to meet the Vernalis requirement in dry years.") Similarly, it is unclear how the State Water

implementation of a new flow objective on the Tuolumne River, the Districts may simply not have water available to sell to San Francisco in certain dry years.[203]

c. Given the recent history of failed water transfers involving MID, and competing local interests regarding groundwater management in the Central Valley, it is not reasonably foreseeable that MID and TID would agree to export water that may be needed during a protracted drought.

The SED unreasonably assumes that the Districts would willingly transfer water to San Francisco instead of meeting the needs in their respective service territories. (See *e.g.*, SED, at L-22) (emphasis added) ["[t]he analysis *assumes that agricultural resources would not receive their total water supply* to meet needed demand under each of the LSJR alternatives."]; *id*. at L-23 (emphasis added) ["[a] larger water transfer under the LSJR alternatives between SFPUC and the irrigation districts could result in indirect environmental impacts on several resources as a result of the potential reduced surface water supply in the Central Valley (i.e., *surface water supply going to SFPUC would not go to Central Valley surface water users*)."].)

This assumption contravenes the Districts' stated positions concerning their obligations to their respective customers. As the Districts previously explained to the State Water Board, "[f]irst and foremost, there is a broad variety of customers to which the Districts' water is already pledged, and any potential sale would necessarily have to be subject to those needs. The Districts' duty to serve its existing customers' varying demands is the paramount use of District water, if not the very purpose of the Districts' locally-financed water distribution and storage system."[204]

Board's application of the carryover storage requirement described in Appendix K would impact the operations of affected water agencies. (SED, at K-28 ["[w]hen implementing the LSJR flow objectives, the State Water Board will include minimum reservoir carryover storage targets or other requirements to help ensure that providing flows to meet the flow objectives will not have adverse temperature or other impacts on fish and wildlife or, if feasible, on other beneficial uses."].)

[203] *See* Letter from Roger VanHoy, General Manager, Modesto Irrigation District and Casey Hashimoto, General Manager, Turlock Irrigation District, to Mark Gowdy, State Water Resources Control Board, dated August 6, 2014, attached hereto as Exhibit 24 (referred to below as "Districts' Letter"), at 2 [explaining that "as this most recent drought has highlighted, it is hydrological reality that in certain dry years water will not be available to sell to CCSF, willingly or as otherwise contemplated by the State Water Board."].)

[204] Districts' Letter, *supra* note 203, at 2. For a comparable articulation of local sentiment by another irrigation district in the Central Valley *see* Stockton East Water District Water Management Plan, January 20, 2014, *available at* http://www.water.ca.gov/wateruseefficiency/sb7/docs/2014/plans/Stockton-Eeast_WD_WMP-Final_012014.pdf, at 15 (emphasis added) ("Transfer water policy is in the [Stockton East Water District or

Moreover, the SED's assumption ignores the recent history of San Francisco's failed attempts to secure a relatively small water transfer from MID or the Oakdale Irrigation District ("OID") and the related local opposition in Stanislaus County concerning water transfers to San Francisco. The most recent effort to transfer a relatively small amount of water – 2 million gallons per day ("mgd") – from MID to San Francisco met with significant local opposition and MID was unable to approve the agreement.[205] San Francisco also pursued a 2 mgd water transfer with OID that would have required an exchange between OID and MID, but, again, the parties were unable to reach agreement to effectuate the transfer, even though the water in question would have come from OID and not MID.[206]

Local opposition concerning a water transfer to San Francisco also surfaced in the comments of two Stanislaus County Board of Supervisors in 2013 regarding a then proposed local groundwater management ordinance. Prior to its adoption, the two Supervisors "*praised the proposed ordinance because it would prevent an irrigation district from pumping groundwater to replace surface water sold to a buyer outside the county.* That scenario was raised by the Modesto Irrigation District's proposal to sell water to San Francisco, which was dropped last year after months of fierce debate."[207]

"SEWD"] Act under Section 6. *The policy specifies that SEWD can sell water outside the district, as long as the SEWD water users' needs are met first, and water is available.*").

[205] *See* San Francisco Letter, *supra* note 21, at 4, n. 9 (*citing*, Holland, John, "Modesto Irrigation District kills proposed water sale," Modesto Bee (September 18, 2012) *available at* http://www.modbee.com/2012/09/18/2378903/modesto-irrigation-district-kills.html, attached hereto as Exhibit 25 [explaining that MID voted to cease negotiations with CCSF regarding the proposed 2 mgd water transfer].) See also *Closed Session Resolution No. 2012-07 Directing Staff and General Counsel to Discontinue Further Negotiations Regarding the Proposed Sale of Water to the City and County of San Francisco*, Modesto Irrigation District, September 18, 2012. (San Francisco Letter, *supra* note 22, at Attachment 1.) Remarkably, despite relying on a potential future large-scale transfer of water from the Districts to San Francisco in its analysis, the SED recognizes that MID's recent "rejection" of the proposed 2 mgd water transfer "makes further temporary drought transfers uncertain." (SED, at L-20.)

[206] San Francisco Letter, *supra* note 21, at 4, n. 10 (*citing* Stapley, "Modesto Irrigation District blocks Oakdale water sale to SF, for now," The Modesto Bee (January 23, 2014) *available at* http://www.modbee.com/news/special-reports/groundwater-crisis/article3159608.html, attached hereto as Exhibit 26; *see also* Stapley, "OID reveals big-money water sale to outside buyers," The Modesto Bee (October 13, 2015), *available at* http://www.modbee.com/news/article39016221.html, attached hereto as Exhibit 27 ["With the drought worsening two years ago, OID formally sought offers from MID and its partners on the Tuolumne River, the Turlock Irrigation District and San Francisco. At the [Stanislaus Local Agency Formation Commission] meeting, [OID General Manager Steve Knell] said MID and TID 'didn't want any part of it;' at last week's OID meeting, he said, 'after meeting with MID, we decided there was no point in pursuing this.'"].)

[207] Carlson, Ken, *Stanislaus County Supervisors to Vote on Water Export Rules*, Modesto Bee (September 9, 2013), attached hereto as Exhibit 28 (emphasis added).

The State Water Board's assumption that MID, TID, or any other irrigation district or water agency, would willingly sell water to San Francisco that is needed within its respective service territory in the midst of a protracted drought – and following implementation of the proposed LSJR Alternatives, which will exacerbate dry year water supply reductions – is pure speculation. Accordingly, the SED's untenable assumption does not constitute substantial evidence under CEQA. (Pub. Res. Code, § 21080(e)(1-2)) (emphasis added) [explaining that for purposes of CEQA "substantial evidence includes fact, a reasonable assumption predicated upon fact, or expert opinion supported by fact," but does not include "*argument, speculation, unsubstantiated opinion or narrative, [or] evidence that is clearly inaccurate or erroneous* . . . ."].)

d. The analysis in the SED fails to consider the effect of the Sustainable Groundwater Management Act and local groundwater management ordinances in the Central Valley.

By assuming that MID and TID will increase their current levels of groundwater pumping in order to facilitate a large-scale transfer of surface water to San Francisco, the SED not only contradicts its own conclusion that the current level of groundwater pumping in the Modesto and Turlock subbasins is unsustainable, but also ignore the potential limitation on groundwater pumping within the Districts that may result from implementation of SGMA and recently enacted groundwater management ordinances in the Central Valley.

The SED references DWR's classification of the Modesto and Turlock subbasins as high-priority groundwater basins[208] that must be covered by adopted groundwater sustainability plans ("GSP") by January 31, 2022, (SED, at 9-33), and that increases in pumping caused by adoption of the Plan Amendment may not be sustainable. The SED explains that "[a]dditional pumping in any of [the four subbasins in the plan area, *i.e*., the Modesto, Turlock, Merced and Eastern San Joaquin Subbasins] would likely reduce the average groundwater level, with a noticeable effect on groundwater levels over a number of years," and cautions that the estimated rates of groundwater overdraft in these subbasins "bring into question how long such levels of overdraft can be sustained."

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[208] See *e.g*., SED, at 9-27 (noting that "[i]n 2014, DWR's [California Statewide Groundwater Elevation Monitoring or "CASGEM"] Program ranked the Modesto Subbasin as a high priority groundwater basin, partially due to the basin's history of groundwater reliance for agricultural and municipal use, and water quality degradation due to industrial and agricultural practices."); *id*. at 9-29 (noting same for Turlock Subbasin).

(SED, at ES-34.) The draft identifies a number of factors that "should be considered to make estimates and determinations of sustainability," including that "[t]here will be very large associated effects, including subsidence and loss of recharge capacity, that occur long before all water in an aquifer could be removed," and consequently recommend "[t]his means that action is needed <u>now</u> to address groundwater overdraft in the four groundwater subbasins, with or without the plan amendments." (*Id*. at ES-34—ES-35 [emphasis added].)

However, having admonished MID and TID, amongst others in the four subbasins to take action "now" to address groundwater overdraft, prior to the adoption of GSPs in January 2022, the SED nonetheless assumes the Districts will be able to make up the volume of surface water transferred to San Francisco through increased groundwater pumping (not to mention the increased groundwater production within the Districts that would be necessary to offset the Districts' reduced surface water deliveries following implementation of a new unimpaired flow objective). (SED, at 16-14 [emphasis added] ["[s]urface water transfers implemented through groundwater substitution could result in a lowering of groundwater levels if groundwater is pumped in substitution for transferred water and could contribute to impacts on groundwater levels or groundwater quality, as described in Chapter 9, Groundwater Resources. *Chapter 9 assumes that reductions in surface water supply would be replaced with groundwater pumping up to a maximum amount. Based on this analysis, significant impacts would occur on four primary subbasins* (Eastern San Joaquin, *Turlock*, *Modesto*, and the Extended Merced)."]; *id*. at 16-10 (emphasis added) ["*Groundwater wells could potentially be constructed as part of groundwater substitution transfers*, and if this were to occur, potential environmental effects associated with construction and operation would be similar to those impacts discussed for substitution of surface water with groundwater."]; *id*. at 16-16 (emphasis added) ["Reductions in surface water diversions are expected as a result of approving the LSJR alternatives and the respective program of implementation. *A reasonably foreseeable method to augment a surface water supply is to obtain more water from groundwater resources. This could be achieved by additional pumping from existing wells or the development of new groundwater wells*."].)

In fact, the State Water Board acknowledges that its analysis of groundwater impacts does not consider the potential effect of SGMA, which it characterizes as "an ameliorating factor," thus suggesting that the groundwater impacts depicted in the SED would be less severe because SGMA would constrain future groundwater pumping to some extent. (SED, at 9-3) (emphasis added) ["However, since the groundwater protections that will be afforded by SGMA cannot be determined at this time with precision, this chapter evaluates the potential impacts on groundwater levels from LSJR alternatives *without including SGMA as an ameliorating factor*, which means that estimates of impacts are likely more conservative (i.e., worse) than would occur in the groundwater basins over time."].) Significantly, the analysis fails to consider the extent to which SGMA may be a *limiting factor* that could, in the near term, constrain the Districts' ability to replace lost surface water – be it as a result of reduced diversions from the Tuolumne River and/or a large-scale water transfer to San Francisco – by increased reliance on groundwater pumping.

Similarly, although the SED states that a recently enacted groundwater management ordinance in Stanislaus County[209] "restricts out-of-county transfers of groundwater or pumping to replace surface water sold to buyers outside of the county,"[210] (SED, at 9-42), and emphasizes that given SGMA's statutory mandate to local agencies to protect and manage high and medium priority groundwater basins "mitigation to protect the groundwater basin[s] from the indirect impacts of the LSJR alternatives . . . under local authorities is both feasible and required," (*id*. at 9-61), the analysis nevertheless assumes that the Districts may make up the volume of water sold to San Francisco by increased groundwater pumping without analyzing the potential application of the ordinance to such a transfer. The SED makes no attempt to reconcile the existence of Stanislaus County's groundwater management ordinance with the assumption that the reductions in the Districts' water supply – as a result of the implementation of a new flow objective on the Tuolumne River and the contemplated large-scale water transfer to San Francisco – "would be replaced with groundwater pumping up to a maximum amount." (*Id*. at 16-14).

The analysis disregards the significance of materials facts, *i.e.*, the existence of SGMA, the groundwater management ordinance in Stanislaus County, and similar groundwater management

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[209] Both MID and TID are located in Stanislaus County.

[210] *See* Stanislaus County Municipal Code Section 9.37.040 (prohibiting "[t]he export of water," subject to certain express exemptions); *id*. § 9.37.030(7) (emphasis added) [defining "Export of water" to mean "*the act of conveying groundwater, or surface water for which groundwater has been substituted, out of the county*."].)

ordinances that have been enacted in counties throughout the Central Valley.[211] Accordingly, the analysis in the SED is internally inconsistent and fails to provide an adequate factual basis for the State Water Board to conclude that it is reasonably foreseeable that San Francisco can replace its lost water supply through a transfer with the Districts. (*Uphold Our Heritage v. Town of Woodside* (2007) 147 Cal.App.4th 587, 596 (citing *Bakersfield Citizens for Local Control v. City of Bakersfield* (2004) 124 Cal.App.4th 1184, 1198 (internal quotation omitted) (emphasis added) [explaining that "[t]he substantial evidence standard is applied to conclusions, findings and determinations. . . . Substantial evidence shall include *facts*, reasonable assumptions *predicated upon facts*, and expert opinion *supported by facts*."].)

2. The SED's environmental analysis of a large-scale water transfer from the Districts to San Francisco improperly relies on the WSIP PEIR's environmental analysis of a 2 mgd transfer with the Districts.

The SED references the WSIP PEIR's environmental analysis of a proposed 2 mgd transfer from the Districts to San Francisco and states that "this information is useful because it provides context for the potential to transfer water *and the types of impacts associated with the transfer of water*." (SED, at L-23 [emphasis added].) The SED's reliance on the environmental analysis in the WSIP PEIR is misplaced for two reasons. First, the requisite amount of replacement supply that San Francisco would need if it were obligated, under the Fourth Agreement, to contribute flow to satisfy a

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[211] The Draft 2016 repeatedly refers to a future water transfer between the Districts and San Francisco as a source of replacement water supply for San Francisco. (See *e.g.*, SED, at 20-27 (emphasis added) ["[t]he analysis presented in this section (and described in greater detail in Appendix L, City and County of San Francisco Analyses) assumes that under LSJR Alternatives 2, 3, and 4, during drought periods, SFPUC could meet its potential water supply shortage by buying water from MID and TID."].) However, the SED also more obliquely refers, in at least two instances, to San Francisco purchasing water from "willing sellers in the Central Valley." (See *e.g.*, *id*. at 20-34 ["In addition, the potential economic effects of purchasing water (i.e., water transfers) by SFPUC from willing sellers in the Central Valley are analyzed."]; *id*. at L-1 (same).) To the extent the draft is suggesting that it is reasonably foreseeable that San Francisco will be able to secure a large-scale water transfer from a different, unidentified entity in the Central Valley, San Francisco observes, as the SED recognizes, similar groundwater management ordinances have been enacted in several counties in the Central Valley, in addition to Stanislaus County. (*See* SED, at 9-42 [noting that "[s]everal ordinances applicable to groundwater resources that underlie the Stanislaus, Tuolumne, and Merced Rivers and [San Joaquin River] have been passed."]; see *e.g.*, San Joaquin County Municipal Code § 5-8100(c) (emphasis added) [providing that "[i]t is essential for the protection of the health, welfare, and safety of the residents of the County, and the public benefit of the State, *that groundwater resource of San Joaquin County be protected from harm resulting from the extraction of groundwater for use on lands outside the County*, until such time as needed additional surface water supplies are obtained for use on lands of the County, or overdrafting is alleviated, to the satisfaction of the Board."].)

40 percent unimpaired flow objective on the Tuolumne River, assuming 1987-1992 hydrology, *i.e.*, 129,884 AF/year for 6 consecutive years, is exponentially more water than the proposed 2 mgd transfer (equivalent to 2,240 AF/year) that was analyzed in the WSIP PEIR. Second, the potential 2 mgd transfer analyzed in the WSIP PEIR solely involved the use of conserved water – not a transfer of surface water to be replaced by groundwater substitution.[212] (*See* WSIP PEIR, at 9-78 [explaining that the proposed 2 mgd transfer between the Districts and San Francisco involved a "transfer of conserved water only, rather than a transfer of stored water."]; *id*. at 9-81 [emphasis in original] ["the [proposed] water transfer agreement with TID, MID or other agency(ies) specify *conserved* water."]; *see also* SED, Appendix H, at H-5 [excerpting section of Final WSIP PEIR that identifies potential mitigation measures that a seller could implement to supplement its water supply following a water transfer "that involves use only of conserved water."].) By contrast, as noted *supra*, the environmental analysis of surface water transfers implemented through increased groundwater pumping – particularly in groundwater basins designated as "high priority" by DWR – would presumably involve disparate impacts. For example, the SED explains that environmental impacts from the proposed 2 mgd water transfer described in the WSIP PEIR, "would be less than significant" for a number of "resources on the Tuolumne River," including "groundwater." (SED, at L-23). This conclusion, of course, has no relevance to the transfer of surface water to be implemented through groundwater substitution, as contemplated in the SED, because, by the State Water Board's own account, "[s]urface water transfers *implemented through groundwater substitution* could result in a lowering of groundwater levels if groundwater is pumped in substitution for transferred water and could contribute to impacts on groundwater levels or groundwater quality." (*Id*. at 16-14) [emphasis added].)

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[212] DWR and the State Water Board have acknowledged the limited availability of water transfers using conserved water. *See* Background and Recent History of Water Transfers in California Prepared for the Delta Stewardship Council by the Department of Water Resources and the State Water Resources Control Board, July, 2015, *available at* http://www.water.ca.gov/watertransfers/docs/Background_and_Recent_History_of_Water_Transfers.pdf (referred to below as "SWRCB/DWR Water Transfer History"), at 5 (emphasizing that "[t]ransfers based on implementation of water conservation measures have been limited, because most conservation programs" cannot demonstrate, among other things, that the "conservation measures . . . result in a reduction in the consumptive use of water or prevent water from discharging to an unusable water supply [and thereby] make water available for transfer."). San Francisco incorporates the SWRCB/DWR Water Transfer History herein by reference.

The SED's reliance on the environmental analysis of the proposed 2 mgd transfer of conserved water from the Districts to San Francisco that appears in the WSIP PEIR to disclose the environmental impacts of a much larger transfer that could involve groundwater substitution is inaccurate and erroneous. The environmental assessment of impacts associated with the transfer of surface water implemented through conservation fails to identify the disparate impacts associated with the transfer of surface water implemented through groundwater substitution, and thus, does not constitute substantial evidence in the record. (Pub. Res. Code, § 21080(e)(2) (emphasis added) [explaining that for purposes of CEQA "substantial evidence" does not include "*evidence that is clearly inaccurate or erroneous.*"].) Further, by relying on the WSIP PEIR analysis of a transfer of 2 mgd of water to identify the environmental effects of a transfer of 129,884 AF/year for 6 consecutive years (to satisfy San Francisco's potential responsibility for a 40 percent unimpaired flow objective, assuming 1987-1992 hydrology) the analysis fails to identify impacts associated with a transfer of this magnitude. The SED completely fails to disclose the significant environmental impacts that would arise from the massive water transfer, potentially through groundwater substitution, that would be needed to comply with the proposed flow objective.

3. The SED's economic analysis of a large-scale water transfer improperly relies on an assumed purchase price for the water without any reasonable basis for determining such a purchase price.

As noted, pursuant to the certified regulatory program for the State Water Board's water quality control planning program and Water Code Section 13241(d), the State Water Board is required to analyze the economic impacts of reasonably foreseeable methods of compliance with the proposed unimpaired flow objective on the Tuolumne River. (Cal. Code Regs., tit. 23, § 3777(c); Cal. Code Regs., tit. 14, § 15187(d) ; Pub. Res. Code § 21159(c); Wat. Code, § 13241(d); Attwater Memo, *supra* note 16, at 4). However, the SED fails to adequately analyze the economic impacts that would result from reduced water deliveries throughout the RWS service territory.

Although the SED repeatedly emphasizes that the concept of a large-scale water transfer from the Districts to San Francisco for 6 consecutive drought years "relies on numerous unknown variables," including "the price of the water," (SED, at L-22, 20-27), the analysis assumes that San Francisco would be able to purchase water from the Districts for $1,000/AF, (*id*. at 20-48). The SED explains, "*[t]his assumed price is key to the analysis, and is derived based on a review of recent water purchases involving both MID and TID*, as well as by other agricultural districts in California." (*Id*. at 20-48 [emphasis added].) The SED does not disclose any details of these purported recent water purchases involving both MID and TID. In its document request under the California Public Records Act, Government Code Sections 6250, *et seq*. ("PRA"), San Francisco specifically asked the State Water Board to provide:

> All public records containing information that served as the basis for Staff's analysis in the 2016 Draft SED that identify "recent water purchases involving both [Modesto Irrigation District ("MID")] and [Turlock Irrigation District ("TID")], as well as by other agricultural districts in California," as stated in the 2016 Draft SED at page 20-48, including, but not limited to, the price of the water and volume(s) transferred.[213]

In response, the State Water Board failed to identify *any* recent water transfer agreements that involved both MID and TID.[214]

In fact, the only agreement identified in the reference sections for the SED or provided in response to San Francisco's PRA request that involves both MID and TID is the agreement executed between the Districts and San Francisco over 2 decades ago, in 1995, as described above, in which San Francisco agreed to make annual payments to the Districts in exchange for the Districts meeting all the minimum instream flow release requirements prescribed by the 1996 Settlement Agreement (1995 Side Agreement).[215] Reliance on the 1995 Side Agreement in support of the assumed purchase price of $1,000/AF is faulty for at least two reasons. First, as noted, the 1995 Side Agreement was executed

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[213] CCSF PRA Request, *supra* note 192, at 1.

[214] Knapp Decl., *supra* note 168, at ¶¶ 5-6 (explaining that the State Water Board identified the Agricultural Water Management Plan 2015 Update for the Modesto Irrigation District, referred to below as "2015 MID Water Management Plan," in its response to CCSF's PRA Request). The 2015 MID Water Management Plan details MID's limited experience with out-of-district transfers. *See* 2015 MID Water Management Plan, *available at* http://www.water.ca.gov/wateruseefficiency/sb7/docs/2015/plans/Modesto ID 2015 AWMP.pdf, at 39 (recounting that "[d]uring the 1987 through 1992 drought, MID transferred several thousand acre-feet of water to [San Francisco]," and "participated in the transfer of water [between 1999 and 2010] through a U.S. Bureau of Reclamation program for river and fishery enhancement known as the Vernalis Adaptive Management Program (VAMP)," but has not "transferred any water outside its irrigation service area from 2010 to 2014.").

[215] The SED includes the 1995 Side Agreement in the list of references for Appendix L, not Chapter 20, in which the $1,000/AF assumed purchase price is identified. *See* SED, at L-41—L-42 (*citing* City and County of San Francisco (CCSF), Turlock Irrigation District (TID), and Modesto Irrigation District (MID). 1995. *Agreement*. April 21).

over 2 decades ago, and thus, does not constitute substantial evidence of the purchase price of water on the current transfer market. Second, the 1995 Side Agreement does not take into account the water supply impacts on the Districts that would result from the State Water Board's implementation of LSJR Alternatives 3 and 4, particularly during sequential-year droughts, and how such impacts would increase the price of any water that may be available for purchase.

Given the heightened demand for water on the transfer market that would occur as a consequence of the State Water Board's proposal, especially during protracted droughts, the purchase price of water will certainly continue to rise, perhaps precipitously, assuming it is even available for transfer. For example, between 2009 and 2014 the price of water grew "tenfold to as much as $2,200 an acre-foot."[216] While acknowledging that the assumed purchase price of water transfers is key, the SED fails to provide evidentiary support for reasonable assumptions about the probable price of water transfers under its proposal.

4. The assumption that potential water transfers would simply make up for reduced water supply is not reasonable or logical because it fails to take into account that transfers are needed to ensure delivery reliability in dry years and to meet projected future demand.

It is not reasonable to assume that additional, potential water transfers represent a new and unaccounted for source of replacement supply that the SFPUC could use to mitigate water supply reductions that may result from implementation of the LSJR Alternatives during protracted droughts. The SFPUC's water supply plans already rely on a potential water transfer of 2 mgd from the Districts to ensure delivery reliability to meet existing demand in dry years, and on a potential transfer of 25 mgd to meet projected future demand through 2040. Specifically, the Phased WSIP Variant adopted by the SFPUC relies on a potential 2 mgd water transfer with the Districts in order to ensure delivery reliability in dry years.[217] Further, the SFPUC has projected the need for an additional water transfer

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[216] See *e.g.*, Brekke, *supra* note 183.

[217] WSIP CEQA Findings, *supra* note 14, at 3 (explaining that "[u]nder the Phased WSIP Variant, the SFPUC also would implement the delivery and drought reliability elements of the WSIP, including the . . . proposed dry-year transfers from the [Districts].").

of up to 25 mgd in order to meet projected future demand by 2040.[218] This future demand specifically takes into account the additional 19.5 mgd of demand associated with: (1) the SFPUC offering permanent status to Santa Clara and San Jose via combined individual supply guarantees; (2) the SFPUC offering an increase of 1.5 mgd to East Palo Alto's current individual supply guarantee; and (3) recovering net losses in yield of 3.5 mgd resulting from local watershed instream flow requirements in drought and non-drought years.[219] The WaterMAP assumes that a 2 mgd dry-year transfer will be in place by 2018.[220]

By contrast, the SED explicitly states that water transfers, as contemplated in the draft, would solely be used to replace reductions in surface water supply that result from implementation of the LSJR Alternatives in order to meet existing demand. (SED, at 16-16 [emphasis added] ["[a] water transfer is not expected to result in an increase in population or growth or the development of housing, or the need for housing, *because the water would be used to meet existing demand* in a particular service area for a particular duration of time."].) Thus, the SED not only ignores the water supply planning obligations of the affected water agencies, including the SFPUC, but also disregards the agencies' respective Urban Water Management Plans, and other planning documents.[221] In the case of the SFPUC, the SED does not even *attempt* to reconcile the assumption that San Francisco will be able to purchase the requisite volume of replacement supply, with the fact that the SFPUC has already taken the potential availability of water transfers into consideration as part of its water supply planning to meet existing and projected future demand.

It is not reasonable for the SED to assume that in addition to the potential 27 mgd (equivalent to 30,244 AF/year) of water supply that may be available to San Francisco from water transfers –

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[218] WaterMAP, *supra* note 16, at 2 ("[b]ased on regional activity over the past two years, for planning purposes, it is estimated that up to 25 mgd in transfers could be available to the SFPUC. This estimate is consistent with the planning estimate evaluated in the PEIR for the WSIP.").

[219] *Id*. at 1.

[220] *Id*. at 11 ("For the purpose of this water supply planning document, it is assumed that a 2 mgd drought year transfer will be secured as part of the implementation of the Phased WSIP.").

[221] *See* SFPUC 2015 UWMP, *supra* note 5, at 6-5 (describing elements of Phased WSIP Variant adopted by the SFPUC); *id*. at 7-4—7-7 (describing dry year water supply projects identified in the Phased WSIP Variant); *id*. at 7-6 (explaining that "[t]he Phased WSIP . . . only included a 2 mgd dry year transfer [with the Districts] as that was the dry year need associated with meeting a demand of 265 mgd.").

which the SFPUC recognizes are contingent on a number of variables, including that there may simply not be water available to purchase in certain dry years[222] – that San Francisco would also be able to rely on water transfers with the Districts to replace the loss of <u>an additional</u> 119,000 AF/year (106.23 mgd) for 6 consecutive years during a protracted drought, assuming the water would even be available for purchase. (SED, at L-21, Table L.4-2.) (As explained in Section I(B) *supra*, San Francisco's actual water supply deficit in this scenario is more severe, *i.e*., 129,884 AF/year, or 115.95 mgd.) The State Water Board's assumption is unreasonable, as it ignores and disregards the SFPUC's water supply planning process, and, more fundamentally, the SFPUC's responsibility to meet the water supply needs of its customers, that necessarily includes consideration of dry year delivery reliability and ability to meet projected future demands.

B. The State Water Board's assumption that it is reasonably foreseeable that San Francisco would be able to obtain replacement water through the development of a large-scale desalination plant located at Mallard Slough is not supported by substantial evidence and the analysis of environmental and economic impacts is inadequate.

1. The State Water Board's assumption that a desalination-plant at Mallard Slough with more than twice the capacity of any prior proposal for a facility at that location would be feasible is not supported by substantial evidence.

a. The State Water Board reaches an unsupported conclusion that the envisioned large-scale desalination plant located at Mallard Slough would be feasible based on the SED's misplaced reliance on two disparate projects.

There is no basis for the SED's conclusion that it is reasonably foreseeable San Francisco could obtain a significant source of replacement water supply – to mitigate, at least partially, the massive deficit that it could experience from the State Water Board's implementation of LSJR

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[222] WaterMAP, *supra* note 16, at 2 (emphasis added) (explaining that "the SFPUC may pursue additional regional drought and non-drought year transfer opportunities, *but the yield and availability is contingent upon the opportunity*."); *id.* at 41 (emphasis added) (noting that "[*t*]*he water supply available to the SFPUC through transfers will depend largely on the nature and source of the transfer water, and will require further investigation to define more accurately*."); *id.* at 57 (cautioning that "[d]uring drought years, in particular, water transfer opportunities may be limited in duration, quantity, and timing. Water transfers are often short-term and may not be available as a long-term supply planning option. Competition may also increase the price of transfers.").)

Alternatives 3 or 4 – from a large-scale desalination plant located in Mallard Slough.[223] To reach this conclusion, the SED unreasonably relies on the feasibility, environmental, and economic analyses of two disparate projects, and fails to take into account newly enacted legal requirements that apply to desalination plants in California. The draft's untenable assumptions regarding the relevancy of the comparisons drawn in the SED between the contemplated large-scale desalination plant at Mallard Slough and the referenced projects does not constitute substantial evidence under CEQA. (Pub. Res. Code, § 21080(e)(1-2).)

i. The State Water Board's reliance on prior analyses of the BARDP is misplaced because the site specific analyses contemplated a facility that produces no more than 22,400 AF, and fail to address numerous unresolved potential feasibility concerns.

Although the SED references prior analyses of a desalination plant at Mallard Slough in support of their envisioned large-scale facility at the same location, *i.e.*, the 2007 SFPUC Water Supply Options Report ("WSO Report"), the WSIP PEIR, a 2010 report entitled "Pilot Testing at Mallard Slough—Pilot Plant Engineering Report" prepared for the Bay Area Regional Desalination Project ("BARDP"), and the 2014 Bay Area Regional Desalination Project Site Specific Analyses, that included a Site Specific Modeling and Storage Optimization Report,[224] the draft acknowledges that while demand estimates for the partner agencies were revised numerous times over the course of project planning, none of the site-specific analyses that considered the limitations of existing water rights and infrastructure assessed proposals for a facility that would have a capacity to produce more than 22,400 AF.[225] Given that the SED envisions a facility more than double the size of a desalination

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[223] SED at 16-70 (noting that "[u]nder certain LSJR alternatives (i.e., higher unimpaired flow LSJR Alternatives 3 and 4), SFPUC may need multiple new water supplies to augment their current drought supply. One option is desalination of ocean or brackish water.").

[224] Bay Area Regional Desalination Project Site Specific Analyses Final Report, Contra Costa Water District, January 2014 (referred to below as "BARDP Site Specific Delta Modeling Report"), *available at* http://www.regionaldesal.com/downloads/Bay%20Area%20Regional%20Desalination%20Project%20Site%20Specific%20Analyses%20Final%20Report.pdf.

[225] SED, at 16-70 (noting that the WSO Report analyzed a facility with an intake capacity of 28,000 AF/year); *id*. at 16-72 (explaining that the 2010 pilot plant engineering report "estimated the capital cost for a facility that would use 28,000 AF/y of brackish or ocean water to produce approximately 22,175 AF/y of treated water"); *id*. at 16-71 ("[p]resently, water supply desalination is being considered for all hydrologic year types under the BARDP at Mallard Slough in the Delta, with an estimated production of 20,900 AF/y."); *id*. at 16-71 (emphasis

plant that can be supported with existing infrastructure at the Mallard Slough location, *i.e.*, with a capacity of 56,000 AF, the draft's reliance on these previous analyses of the BARDP is misplaced.[226]

Further, these analyses fail to provide a meaningful basis of comparison for purposes of assessing the feasibility, environmental impacts, or costs of the 56,000 AF/year desalination plant at Mallard Slough envisioned in the SED. The draft recognizes that the referenced analysis in the WSIP PEIR provides only "a conceptual-level, generalized impact analysis of the BARDP, which, at the time of the analysis, was based on limited, preliminary information regarding project design and operation, and site location." (SED, at 16-73.) Inexplicably, the SED makes no attempt to update the prior analyses from almost a decade earlier or to undertake an analysis of a larger facility.[227]

Similarly, the State Water Board's reliance on the BARDP Site Specific Delta Modeling Report is improper because these analyses of the BARDP operations "were not considered in a comprehensive regulatory setting." (BARDP Site Specific Delta Modeling Report, at 10.) Although the BARDP Site Specific Delta Modeling Report includes a limited entrainment analysis, it does not contain "a comprehensive examination of all of the potential impacts to aquatic resources that could result from BARDP." (*Id*. at 86.) Instead, the analyses in the BARDP Site Specific Delta Modeling Report were limited to consideration of certain water quality regulations.[228] Accordingly, the report

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added) (noting that a "desalination project would likely need to be larger than analyzed in the WSO report, or the BARDP feasibility studies, for LSJR Alternatives 3 and 4."); *id*. at L-25 (same).

[226] See e.g., *id*. at 16-74 (noting that "[a] facility that is larger than the BARDP (e.g., 56,000 AF/y) would have similar types of construction and operation impacts," and, make further comparisons regarding "[t]he types of construction activities associated with a large desalination facility with a capacity of 56,000 AF/y," and the "[l]ong-term operational impacts associated with a large desalination facility with a capacity of 56,000 AF/y . . . ."").) *C.f.* SED, at 16-74 ("The increased electrical demand as a result of a larger design capacity (i.e., increase from 28,000 to 50,000 AF/y) could result in increases in GHG emissions and air quality impacts under operating conditions.") Although the exact size of the large-scale desalination plant at Mallard Slough envisioned in the SED is not clear from the State Water Board's analysis, based on the number of references to the larger plant size, San Francisco assumes that the State Water Board is contemplating a facility with a production capacity of 56,000 AF/y.

[227] See *id*. at 16-73, 16-74 (referencing findings concerning environmental impacts of BARDP in WSIP PEIR]; *id*. at L-25 (emphasis added) (wherein the SED relies on the SFPUC's environmental impact analysis of the BARDP in the WSIP PEIR, as discussed in Chapter 16 of the SED: "[t]he construction and operation of BARDP could result in potentially significant environmental impacts on various resources, as disclosed in Chapter 16 . . . ."].) Following preparation of the WSIP PEIR, many subsequent studies have demonstrated the limitations on both institutional and physical capacity of the existing infrastructure to support a desalination facility at Mallard Slough with a production capacity greater than 22,400 AF.

[228] BARDP Site Specific Delta Modeling Report, *supra* note 224, at 10 (explaining that "BARDP operations were evaluated within the context of several key water quality regulations: California State Water Resources

explains, "[e]valuation of BARDP operations in a comprehensive regulatory setting would be required in an environmental impact report."[229] (BARDP Site Specific Delta Modeling Report, at 10.)

Additionally, the BARDP Site Specific Delta Modeling Report raises a number of other concerns regarding a desalination plant located at Mallard Slough with a maximum production capacity of 22,400 AF/year, which is substantially smaller than a plant of the envisioned size of 56,000 AF/year. Issues that would need to be resolved during subsequent phases of project development, environmental evaluation and permitting, include necessary coordination amongst BARDP partner agencies in sequential-year droughts to address unmet water supply demands from the project and additional modeling to ensure the project would be able to comply with increasingly more stringent Bay-Delta water quality regulations.[230] The SED fails to identify, let alone substantively address, any of these concerns.

ii. The State Water Board's reliance on analyses of the Carlsbad Desalination Project is misplaced because these analyses address a facility located in a disparate geographic area with a distinct source water intake.

The SED attempts to address the obvious disparity between the envisioned larger scale desalination plant that could be developed at Mallard Slough, as compared to the prior site specific analyses of a facility at that location, by referencing analyses of the "costs and environmental impacts associated with the larger Poseidon Desalination Facility in Carlsbad" ("Carlsbad Desalination Plant"), that has a capacity of 56,000 AF/year. The SED concedes "there are many geographic differences

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Control Board Decision 1641 and California Department of Public Health Secondary Maximum Contaminant Level of Chlorides in drinking water. Changes in compliance with these two regulations were evaluated based on the location of the proposed BARDP facilities and the nature of the operations.").

[229] Memo from Leslie Moulton-Post Leslie Moulton-Post, Alisa Moore, Karen Lancelle, Chris Mueller, Environmental Science Associates to San Francisco City Attorney's Office, *CEQA Adequacy Review of the Desalination Water Supply Alternative in the Draft Substitute Environmental Document (SED) in Support of Potential Changes to the Water Quality Control Plan for the San Francisco Bay-Sacramento / San Joaquin Delta Estuary: San Joaquin River Flows and Southern Delta Water Quality*, March 15, 2017, attached hereto as Appendix 5 (referred to below as "ESA Tech Memo – Desalination Plant"), at 5 (explaining that the BARDP Site Specific Delta Modeling Report identified the need for "[f]uture project planning and evaluation studies . . . to more specifically analyze both general environmental impacts of project construction and operation to aquatic species to identify appropriate project design features and mitigation measures and . . . to address impacts to listed species to achieve compliance with state and federal endangered species regulations.").

[230] *Id*. at 3-5.

between the San Francisco Bay-Delta and Carlsbad," and acknowledges that these differences "could influence the significance of an impact on an environmental resource . . . ."[231] However, the SED fails to describe in any detail, or draw any conclusions about, the nature of the geographical differences between the San Francisco Bay-Delta and coastal Carlsbad, and to explain how these differences might affect impacts of a similarly sized facility at Mallard Slough. For example, important potential impacts overlooked by the SED are those associated with brine discharge into the ocean as opposed to the already stressed ecosystem of the Delta.[232] The draft appears to disregard any difference between a San Francisco-Bay Delta facility and a coastal Carlsbad facility by relying on the 2015 EIR and other findings related to the Carlsbad Desalination Plant to simply conclude "similar environmental impacts were identified for the project-level analyses of the Carlsbad facility." (SED, at 16-75.)

Further, the SED ignores the fact that the Carlsbad Desalination Plant has a distinct source water intake as it relies on source water previously diverted by an adjacent power plant.[233] The power plant intake is located in a constructed lagoon/coastal embayment and the outfall pipeline discharges to the ocean. Because the desalination plant withdraws water from and discharges into "the same seawater outfall pipeline that the power plant uses now," the Carlsbad Desalination Plant EIR concluded that the "effects are essentially the same as current conditions."[234] Thus, the Carlsbad

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[231] SED, at L-25 (where the draft explains that the desalination plant at Mallard Slough they envision "would likely need to be larger" than any prior facility analyzed for that location, and thus, rely on analyses for the Carlsbad Desalination Plant to assess the increased costs and environmental impacts associated with a larger facility: "[t]herefore, costs and environmental impacts associated with the Claude 'Bud' Lewis Carlsbad Desalination Plant . . . which has a larger capacity, are summarized below."); *id*. at 16-71 (same); *id*. at 16-75 (acknowledging "there are many geographic differences between the San Francisco Bay–Delta and Carlsbad").

[232] ESA Tech Memo – Desalination Plant, *supra* note 229, at 8, 11-12.

[233] See *e.g*., water-technology.net website, Carlsbad Desalination Project, *available at* http://www.water-technology.net/projects/carlsbaddesalination (explaining "[s]eawater from the [NRG Energy's Encina Power Station] used for cooling boilers in operation, is diverted to the desalination facility through an existing cooling water discharge system.").

[234] City of Carlsbad California website, FAQs, *available at* http://www.carlsbadca.gov/services/depts/pw/utils/desalination/faq.asp, attached as Exhibit 29 (explaining that because the desalination plant relies on the power plant's existing source water intake "[t]he city's certified EIR concluded that the desalination plant can operate without significant impacts to marine life."). *See also* City of Carlsbad California website, Agua Hedionda Lagoon, *available at* http://www.carlsbadca.gov/residents/fun/lagoons/agua.asp, attached as Exhibit 30 (emphasis added) (describing the lagoon as follows: "[t]he 66 acre outer lagoon, adjacent to the Pacific Ocean, *provides cooling water for the power plant*, shore fishing and is leased to an aquaculture company cultivating shellfish for a wide-ranging market. The 27 acre middle lagoon is home to the North Coast YMCA Aquatic Park. The 295 acre inner lagoon extends approximately 1,800 yards in a southeasterly direction from the Interstate 5 highway bridge.").

facility did not have to grapple with the intake related entrainment issues associated with a new source water intake that any new desalination plant at Mallard Slough withdrawing water directly from the Delta would have to address.[235]

iii. The State Water Board's reliance on prior analyses of the BARDP and Carlsbad Desalination Project is misplaced because those analyses fail to take into account regulatory requirements enacted in 2015 that apply to all new desalination projects.

An additional reason that the SED's reliance on prior analyses of the BARDP and Carlsbad Desalination Project is misplaced is that those analyses fail to take into account 2015 amendments to the Ocean Plan that impose regulatory requirements on all new desalination projects in California. For example, the 2015 amendments to the Ocean Plan require consideration of, and include an express preference for, subsurface intakes for any new desalination projects. (Cal. Code Regs., tit. 23, § 3009; SWRCB Resolution 2015-0033.) Indeed, the 2015 Ocean Plan directs the regional water boards, in consultation with State Water Board Staff, to require subsurface intakes unless it is not feasible. (*See* 2015 Ocean Plan, at III.M.2.d.(1)(a).) The past analyses of the BARDP did not include any analysis of the potential for a subsurface intake at Mallard Slough, and the Carlsbad Desalination Project uses a surface intake. Further, the analyses of the BARDP also fail to take into account the 1.0 mm maximum screen opening size identified in the 2015 Ocean Plan. In fact, the BARDP Site Specific Delta Modeling Report contemplates a surface water intake with screens that have a maximum opening of 2.38 mm. (*See* BARDP Site Specific Delta Modeling Report, at 72-73.) Therefore, the SED's reliance on the analyses of the BARDP and Carlsbad Desalination Project is improper because the referenced analyses were performed before the State Water Board adopted the 2015 amendments to the Ocean Plan, and neither the current proposal for the BARDP nor the completed Carlsbad Desalination Project comply with the new requirements.

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[235] Notwithstanding the Carlsbad Desalination Plant's distinct source water intake (and outfall), the facility has still generated environmental controversy. *See* Gorn, David, *Desalination's Future in California Is Clouded by Cost and Controversy*, KQED Science, October 31, 2016, *available at* https://ww2.kqed.org/science/2016/10/31/desalination-why-tapping-sea-water-has-slowed-to-a-trickle-in-california/, attached as Exhibit 31 (emphasis added) (explaining that "[t]he Carlsbad plant isn't even a year old but state officials have cited it a dozen times for environmental violations. That includes what they call 'chronic toxicity,' from an unknown chemical used in water treatment that has been piped into the ocean. The company is still trying to identify, isolate and clean it up.").

b. The State Water Board fails to account for other limiting factors that may render their envisioned 56,000 AF/year desalination plant at Mallard Slough infeasible.

In addition to failing to address the unresolved issues with a desalination plant at Mallard Slough with a maximum production capacity of 22,400 AF/year identified in the BARDP Site Specific Delta Modeling Report, as referenced above, the SED also fails to account for other limiting factors that may render their envisioned 56,000 AF/year facility infeasible, *e.g.*, the need for a larger source water intake and additional water rights to withdraw the requisite amount of source water from the Delta, and the potential need for a new outfall to discharge the increased amount of brine generated by the larger desalination facility.[236]

2. The State Water Board's environmental analysis of the envisioned 56,000 AF/year desalination plant located at Mallard Slough is woefully inadequate.

The SED's collage of the referenced, prior analyses for the BARDP and Carlsbad Desalination Project does not present an accurate assessment of the feasibility or environmental impacts of the envisioned 56,000 AF/year desalination plant at Mallard Slough. "[I]t is reasonable to expect that a desalination plant at Mallard Slough with twice the intake capacity assumed for the BARDP could have significant unavoidable impacts on biological resources including endangered species, water quality and hydrology, and potentially significant unavoidable impacts related to greenhouse gas and air pollutant emissions."[237] However, the SED "draws *no* conclusions as to significance of the impacts" the 56,000 AF/year desalination plant located at Mallard Slough, as envisioned in the SED, would have.[238] The draft's untenable assumption regarding the propriety of exclusively relying on the feasibility and environmental analyses of disparate projects – that, in the case of the BARDP, are preliminary and incomplete – in lieu of attempting to discretely analyze the feasibility and impacts of

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[236] ESA Tech Memo – Desalination Plant, *supra* note 229, at 5-7.

[237] *Id*. at 9; see also *id*. at 9-11 (summarizing the SED's failure to adequately address or identify impacts of the larger desalination plant at Mallard Slough envisioned in the draft.).

[238] *Id*. at 8 (emphasis in original).

the envisioned 56,000 AF/year desalination plant at Mallard Slough, does not constitute substantial evidence under CEQA.[239] (Pub. Res. Code, § 21080(e)(1-2).)

3. The State Water Board's economic analysis of the envisioned 56,000 AF/year desalination plant located at Mallard Slough is woefully inadequate.

The SED also woefully fails to analyze the economic impacts of the 56,000 AF/year desalination plant at Mallard Slough envisioned in the draft, and thereby violates the requirements of the certified regulatory program for the State Water Board's water quality control planning program and Water Code Section 13241(d). (Cal. Code Regs., tit. 23, § 3777(c) ; Cal. Code Regs., tit. 14, § 15187(d); Pub. Res. Code § 21159(c); Wat. Code, § 13241(d); Attwater Memo, *supra* note 16, at 4). As an initial matter, the SED fails to assess *any* potential rate impacts associated with the large-scale desalination plant. (SED, at 20-34 [explaining that the State Water Board's proposal only includes an analysis of "the potential economic effects of purchasing water (i.e., water transfers) by SFPUC from willing sellers in the Central Valley."].) Further, although the SED includes "[c]ost information" for the other two identified alternative sources of replacement water supplies, (*id*), the analysis does not even attempt to estimate the capital costs associated with the envisioned larger desalination facility at Mallard Slough, but instead appears to suggest that construction costs would total somewhere within the broad range of $168 million to $1 billion. (*See* SED, at L-25 [noting that in the 2007 WSIP PEIR the SFPUC estimated that the cost to construct the BARDP with a production capacity of 22,400 AF/year, "including the intake and pipeline for conveyance to the existing conveyance system," would be $168 million]; *id*. [explaining that the SED includes "costs and environmental impacts" associated with the Carlsbad Desalination Facility because it has a "larger capacity"].) Notably, the SED fails to identify the $1 billion capital cost of the Carlsbad Desalination Facility and the annual operation and maintenance costs associated with the facility of approximately $50 million/year.[240]

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[239] See also *id*. at 9 (explaining that "[t]he inadequacy of the impact analysis thus raises additional questions about the feasibility of the desalination plant anticipated in the [SED] because, given its probable environmental impacts, it is far from obvious such a plant could be permitted."); *id*. at 7 (noting that the SED "provides only a vague indication of how these other project analyses might apply to the desalination water supply option the [SED] anticipates would be needed as an 'additional action' to address drought-period supply shortfalls under the LSJR Alternatives.").

[240] Gorn, *supra* note 235, (emphasis added) (explaining that "[b]eyond the environmental cost is the actual price tag: *the plant in Carlsbad cost $1 billion to build, with a rough estimate of $50 million a year for the power to*

Nor does the SED account for the fact that the State Water Board's implementation of LSJR Alternatives 3 or 4 would make it far more difficult, if not impossible, for the SFPUC to pay for the 56,000 AF/year desalination facility at Mallard Slough envisioned in the draft. The SED fails to mention that the Carlsbad Desalination Plant took decades to develop, and, specifically, that 14 years elapsed between the initial feasibility study for the project and construction of the plant.[241] As discussed in Section I(E)(2) *infra*, during periods of heightened water supply rationing, reduction in utility revenues result in increased utility rates or deferred capital projects. If the State Water Board implemented LSJR Alternatives 3 or 4, and San Francisco was responsible for bypassing flow in compliance with a new unimpaired flow objective on the Tuolumne River, it would be compelled to severely reduce deliveries to the RWS service territory and suffer the attendant loss of revenue. This loss of revenue would make it far more difficult, if not impossible, to fund the development of any large-scale capital project, such as the 56,000 AF/year desalination facility at Mallard Slough envisioned in the SED.

4. The State Water Board's conclusion that a 56,000 AF/year desalination plant located at Mallard Slough would simply make up for reduced water supply is not reasonable or logical because it fails to take into account that the SFPUC already relies on yield from the BARDP to meet projected future demand.

It is not reasonable for the SED to conclude that the envisioned 56,000 AF/year desalination facility at the Mallard Slough location "would not be built to accommodate an increase in population in the service area" (SED, at 16-73). The SFPUC has identified the BARDP, to the extent that it is ever developed, as a potential new source of additional water supply to meet projected future demand,

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run it. The estimated cost of the water to San Diego is about $2,300 dollars an acre-foot — more than double the cost most Southern California cities pay for water. (An acre-foot is enough water to supply one-to-two California households per year.) And ratepayers need to pony up for that water even during rainy seasons when the price of water from more traditional sources plummets."); *see also* Fikes, Bradley J., *State's biggest desal plant to open: What it means*, San Diego Union-Tribune, December 13, 2015, http://www.sandiegouniontribune.com/news/environment/sdut-poseidon-water-desalination-carlsbad-opening-2015dec13-htmlstory.html, attached hereto as Exhibit 32 ("[i]n the early 2000s, the Poseidon plant was estimated to cost about $270 million, a figure that rose to $300 million, to $530 million and finally to about $1 billion.").

[241] See *e.g.*, Fikes, *supra* note 240 ("Poseidon Water's desalination plant in Carlsbad is poised to begin regular operations within days — decades after water officials first considered harvesting drinking water from the sea and 14 years after they formally took the first steps toward its construction."); see *id*. (presenting timeline for construction of the project).

(WaterMAP, at 1-2 [explaining that to meet "the proposed planning objectives," including meeting "new requests for permanent supply," by San Jose and Santa Clara, the WaterMAP identifies that the SFPUC could pursue desalination, among other options]; *id*. at 60-63 [describing Bay Area Brackish Water Treatment Project, also referred to as the "Regional Desalination Project," or BARDP].) Specifically, the SFPUC has currently identified the BARDP as a potential, future source of additional yield of up to 9 mgd (10,080 AF) to meet future demand in the RWS service territory, with the possibility, if more capacity is available (assuming that up to 3 other partner agencies take no water deliveries to meet future demands), of securing up to 15 mgd (16,800 AF). (WaterMAP, at 60.) Thus, the SED not only ignores the SFPUC's water supply planning obligations, but also disregards the specific plans the SFPUC has articulated for potentially meeting projected future demand, *e.g.*, in the WaterMAP. The SED does not even *attempt* to support the conclusion that the envisioned 56,000 AF/year desalination plant at Mallard Slough would only be used to "replace reductions in water supply resulting under the LSJR alternatives," (SED, at 16-70), and "not be built to accommodate an increase in population in the service area," (*id*. at 16-73). As explained, the SFPUC has already considered the potential availability of additional yield from development of the BARDP in its water supply planning to meet projected future water supply needs, not as a source of replacement water supply.

C. The State Water Board's assumption that it is reasonably foreseeable that San Francisco would be able to obtain replacement water through the development of the identified in-Delta diversion project is not supported by substantial evidence, or reasonable inferences predicated on fact, and the analysis of environmental and economic impacts is inadequate.

There is no basis for the SED's conclusion that it is reasonably foreseeable San Francisco could obtain a significant source of replacement water supply – to mitigate, at least partially, the massive deficit that it could experience from the State Water Board's implementation of LSJR Alternatives 3 or 4 – through the development of the identified in-Delta diversion project. To reach this conclusion, the SED unreasonably (and incomprehensibly) relies on the SFPUC's prior determination that the same project was infeasible yet offers no additional analysis, facts, or even an explanation as to why this project should now be considered feasible. The draft recognizes that "[i]n the 2008 WSIP PEIR, the SFPUC concluded that the in-Delta diversion option was infeasible, in part, because it would not achieve consistent year-round diversions due to uncertainties regarding the availability of water supplies and pumping capacities . . . ." (SED, at L-24; *id*. at 16-68 [same].) Although the SED exclusively relies on the SFPUC's previous analysis of the in-Delta diversion project, it casually brushes off the SFPUC's prior determination that it was infeasible, stating: "[nonetheless, a discussion of this possible water supply option has been included *in light of the changing circumstances since 2008* (e.g., Pelagic Organism Decline, climate change, California WaterFix, and the State Water Board's Final Report on the Development of Flow Criteria for the Sacramento Delta Flow Criteria . . . . Thus, it is discussed as a possible option available to the SFPUC that may be explored in the future *in light of the changing circumstances*." (*Id*. at L-24 [emphasis added].) Yet the draft fails to identify how the referenced "changing circumstances" may affect the feasibility of an in-Delta diversion project. In fact, the list of "changing circumstances" presented in the analysis identifies stricter regulation and/or more restrictive environmental conditions and therefore greater project impacts that would likely make a new in-Delta diversion *even less feasible*. In short, the SED has failed to address, in any substantive manner, the feasibility issues regarding the in-Delta diversion project that the SFPUC previously identified.[242] Nor has the draft addressed or even identified other, more recent developments that present additional feasibility concerns, such as the fact that during the interim 9 years since the SFPUC completed its preliminary analysis of the in-Delta diversion project, the SFPUC has developed other WSIP projects on the site contemplated in the SED for the new 18-acre treatment plant and blending facility at Tesla Portal.[243] The SED's untenable suggestion that the project may now be feasible (for some unexplained reason) is mere "[a]rgument, speculation, unsubstantiated opinion or narrative," and thus, does not constitute substantial evidence under CEQA. (Cal. Code Regs., tit. 14, § 15384(a)-(b).)

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[242] *See* Memo from Leslie Moulton-Post and Jill Hamilton, Environmental Science Associates to San Francisco City Attorney's Office, *Adequacy Review of In-Delta Diversion Alternative Analysis in State Water Board SED*, March 15, 2017, attached hereto as Appendix 6 (providing a comprehensive evaluation of the adequacy of the State Water Board's description and analysis of environmental impacts of the in-Delta diversion project contemplated by the SED as a potential source of replacement water supply for San Francisco).

[243] *Id*. at 2. *See* SED, at L-24 (explaining that "[t]his project would include a new Delta intake and pumping plant, a new pipeline, a new Delta Water Treatment Plan and a new blending facility at Tesla Portal.").

The SED also woefully fails to analyze the economic impacts of the larger in-Delta diversion project that the draft envisions, and thereby violates the requirements of the certified regulatory program for the State Water Board's water quality control planning program and Water Code Section 13241(d). (Cal. Code Regs., tit. 23, § 3777(c); Cal. Code Regs., tit. 14, § 15187(d); Pub. Res. Code § 21159(c); Wat. Code, § 13241(d); Attwater Memo, *supra* note 16, at 4). As an initial matter, the analysis fails to assess *any* potential rate impacts associated with the in-Delta diversion project. (SED, at 20-34 [explaining that the State Water Board's proposal only includes an analysis of "the potential economic effects of purchasing water (i.e., water transfers) by SFPUC from willing sellers in the Central Valley.") Further, although the SED includes "[c]ost information" for the other two identified alternative sources of replacement water supplies, (*id*), the draft does not even attempt to estimate the cost of compliance associated with the larger in-Delta diversion project that they envision, (*id*. at 16-69 [emphasis added] [wherein the State Water Board opines that "[t]he size of the project *may need to be larger* than what was examined in the WSO report which is summarized below."]; *id*. at 16-68 [emphasis added] [wherein the draft speculates that the "cost per AF of additional water from delta diversion *for a larger project* could be less than $255 per AF because of the economies of scale (i.e., the larger infrastructure projects are, the less they cost per unit per year)."]; *id*. at L-24 (same)].) Instead, the SED solely references the preliminary cost estimates previously developed by the SFPUC for a smaller project, *i.e*., with a design capacity of 28,000 AF/year. (*Id*. at 16-68 ["[t]his section uses information regarding a delta diversion project as was analyzed in the WSO report to evaluate costs and potentially significant environmental impacts."].)

III. The SED is Inconsistent in its Treatment of Municipal Water Service Providers Resulting in an Unstable Project Description and Deficient Impact Analysis.

The SED's explanation of whether and how various municipal water providers may be required to comply with the State Water Board's proposal is confusing, internally inconsistent, and impermissibly scattered throughout various chapters and appendices.[244] As noted, "[a]n accurate,

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[244] See e.g., *California Oak Foundation*, 133 Cal.App.4th at 1239 (citing *Santa Clarita Organization for Planning the Environment*, 106 Cal.App.4th 715, 723) [explaining that "information 'scattered here and there in EIR appendices,' or a report 'buried in an appendix,' is not a substitute for 'a good faith reasoned analysis in response [to public comments on an EIR].'"].)

stable and finite project description is the [s]ine qua non of an informative and legally sufficient EIR." (*County of Inyo*, 71 Cal.App.3d at 193; see also *City of Santee*, 214 Cal.App.3d at 1454) ["only through an accurate view of the project may the public and interested parties and public agencies balance the proposed project's benefits against its environmental cost, consider appropriate mitigation measures, assess the advantages of terminating the proposal and properly weigh other alternatives."].) The SED fails to present a clear description of the project because it fails to clarify the extent to which municipalities are responsible for complying with the LSJR Alternatives. Instead, the Draft 2016 contains vague, conflicting statements regarding how the LSJR Alternatives will apply to municipalities.

For example, some sections of the SED appear to suggest that municipalities are not responsible for complying with the LSJR Alternatives. Specifically, the SED states that the Water Supply Effects model[245] "assumes that municipal water providers would not experience a reduction in surface water supply." (SED, at 9-44; see *id*. at 11-36 [stating that for purposes of modeling groundwater and agricultural impacts, "[v]olumes of water assumed not to be subject to a water shortage (e.g., municipal and industrial water supply, riparian rights) are subtracted from the total diversions for each river to calculate the remaining water."]; see also *id*. at G-6 [emphasis added] ["[f]or a more conservative estimate of the groundwater and agricultural impacts, *it is assumed that municipal deliveries would not be cut in times of surface water shortage*. This is a simplifying assumption based on the program of implementation in Chapter 3, Alternatives Description, *which describes actions to assure that implementation of the LSJR alternatives (i.e., percent of unimpaired flow requirement) does not impact supplies of water for minimum health and safety needs*."].)[246]

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[245] *See* SED, at 4-24 (explaining that "[t]he WSE model is a monthly water balance spreadsheet model based on the CALSIM II analysis framework that calculates for each tributary reductions in water supply diversions and changes in reservoir operations that could occur based upon user-defined diversion and reservoir operating rules, flood storage curves, and minimum river flow requirements, across 82 years of monthly historical watershed hydrology.").

[246] SED, at G-6 (emphasis added) (explaining that "*[t]here is one exception to the analytical assumption that all municipal demands for surface water would be met.* In the WSE model, SEWD and CSJWCD diversions from the Stanislaus River are calculated separately from the [South San Joaquin Irrigation District or "SSJID"] and [Oakdale Irrigation District or "OID"] diversions because they only receive water after SSJID and OID water rights have been met. As a result, in some years SEWD is not able to meet its municipal demand for Stanislaus River water, which is assumed to be 10 TAF/y . . . . These municipal needs, however, could be met by either Calaveras River water or groundwater."]; *see also* Bay-Delta Phase 1 Staff Technical Workshop of December 5,

Although the SED appears to justify excepting municipal water service providers from compliance with the proposed flow objectives by referring to Water Code Section 106, the explanation provided in the analysis is ambiguous and obscure: "[a]lthough California recognizes water for domestic purposes as the most important use of water and irrigation as the next most important use (Cal. Code Regs., tit. 23, § 106), *this does not necessarily mean that the water supply for domestic uses cannot be modified*." (SED, at 13-61 [emphasis added].)[247] Thus, it remains unclear whether the SED is treating particular municipal water service providers, such as San Francisco, as entities that are responsible for complying with the State Water Board's proposal.

Confusingly, other passages and sections of the SED appear to contemplate that municipal water service providers are responsible for complying with the proposed unimpaired flow objectives. (SED, at G-6 [noting that "[p]otential impacts on municipal and industrial water users are evaluated in Chapter 13, Service Providers"]; *id*. at 13-58 (emphasis added) ["[t]his chapter provides a programmatic-level analysis of *the impacts on service providers* and refers to Chapter 16, Evaluation of Other Indirect and Additional Actions (Section 16.4), *with respect to environmental impacts caused by service provider actions associated with various methods of compliance. Service providers may choose any method of compliance described in Chapter 16, or a combination of methods, or they may identify another as-yet unknown method of compliance to comply with requirements from the revised objectives*."].)

Appendix L states "[San Francisco or "CCSF"] *may be one of the entities responsible for implementing an unimpaired flow requirement*. The principal means by which CCSF would be responsible are [if] [r]esponsibility is assigned specifically to CCSF in a proceeding amending the

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2016, Transcript of Video Recording, attached hereto as Exhibit 33 (referred to below as "December 5th Workshop Transcript"), at 86:18-25 [where Mr. Anderson explained that in the "[water supply] effects analysis, we have not modified the available surface water to the water treatment plants. Those are fixed quantities, and that is a component of demand. And so, *essentially, when there is decreased availability, that would -- that would fall on the irrigation districts rather than on the municipalities in terms of our effects analysis*."].).

[247] December 5th Workshop Transcript, *supra* note 246, at 87:1-9 (emphasis added) (where Anne Huber, a Water Resources Analyst with ICF Jones & Stokes, described how the analysis treats municipalities as follows: "for service providers, we analyze impacts qualitatively because we are -- you know, *it is uncertain at this point to what degree their demands may be cut. So there is some consideration of potential reductions in supply to service providers*, but it was not part of the groundwater analysis. For the groundwater analysis, the assumption was that all reduction and supply effected agriculture.").

agency's water rights [or] [r]esponsibility is assigned to MID and TID in a proceeding amending the districts' water rights, and the SFPUC's water availability is determined by agreements with the irrigation districts." (SED, at L-4 [emphasis added]; see also *id*. at ES-24 [emphasis added] [noting that "water right implementation of the flow proposal *could* affect CCSF and related service water suppliers"]; *id.* at 20-27 (emphasis added) ["[i]n addition to potential effects within the plan area, *implementation of the LSJR alternatives under drought conditions could result in water supply reductions within the SFPUC retail service area, and within the service areas of the 27 agencies in Alameda, San Mateo, and Santa Clara Counties that purchase wholesale water from SFPUC*."]; *id*. at 20-34 ["LSJR Alternatives 2, 3, and 4 may affect the amount of surface water diversions to the SFPUC service area."].)

Elsewhere, the SED concedes that San Francisco would experience "substantial" water supply reductions if the State Water Board implemented its proposal. (SED, at 13-60 (emphasis added) ["[a]t 30 percent unimpaired flow under LSJR Alternative 2 with adaptive implementation method 1, the average percent reduction in water supply on the Stanislaus, Tuolumne, and Merced Rivers was estimated to be 5 percent, 7 percent, and 10 percent, respectively. Thus, surface water supply reductions would be greater at the 30 percent unimpaired flow level compared to 20 percent unimpaired flow. Reductions would be greatest for service providers receiving Merced River diversions (i.e., Merced ID), *but would also be substantial for Tuolumne River service providers* (i.e., TID, MID, and *CCSF*)."].)[248]

What *is* clear is that although the SED explicitly identifies impacts to some municipal water supply providers, the draft fails to identify impacts to all of the potentially affected entities, including San Francisco in any coherent fashion. The SED recognizes that reduction in municipal water supply is an impact that the State Water Board must analyze. (SED, at 13-49 ["*[w]hile substantially reducing existing surface water supplies of service providers can be considered an impact,* the extent to which

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[248] Perplexingly, elsewhere in the SED, while discussing municipal water service providers that rely on the Tuolumne River, the draft fails even to reference either San Francisco or its wholesale customers. (SED, at G-6 ["[m]unicipal and industrial water suppliers use a relatively small portion of the total surface water diversion from the Stanislaus and Tuolumne Rivers. . . . On the Tuolumne River, the City of Modesto has an agreement with MID to purchase surface water from the district."].)

service providers are affected is a function of their ability to use existing alternative supplies (e.g., groundwater) or develop alternative water supplies."].) The SED appropriately analyzes potential impacts to the Central Valley Project ("CVP") and State Water Project ("SWP") export service areas, yet fails to include any such impact analysis for many other municipal water service providers, including San Francisco. (SED, at 13-87—13-89.)[249] However, as San Francisco has previously explained, "[i]t is inconsistent and unreasonable for the draft SED to analyze impacts to service providers relying on CVP/SWP exports and to ignore impacts to service providers relying on the same water resources developed upstream of the rim dams."[250]

Thus, although the SED in scattered locations posits that: San Francisco may be responsible for implementing the proposed unimpaired flow requirement (*id*. at L-4); the impacts to San Francisco would be "substantial," (*id*. at 13-60); and substantial reductions of existing surface water supplies constitute an adverse impact, (*id*. at 13-49), the draft nevertheless fails to identify, let alone analyze, as detailed above, the adverse impacts to the Bay Area that could result from implementation of the State Water Board's proposal. The SED thereby avoids any comprehensible, substantive discussion in the Project Description, or elsewhere, of how the State Water Board's proposal may impact San Francisco – and many other potentially affected municipal water service providers – by leapfrogging over an analysis of the impacts that would result from the proposed draconian water supply reductions. Instead of acknowledging that a reasonably foreseeable consequence of the State Water Board's implementation of an unimpaired flow objective on the Tuolumne River, as proposed in the SED, would be reduced water deliveries throughout the Bay Area and consequent adverse environmental impacts, the draft limits any analysis of adverse impacts to the Bay Area to those impacts associated with mitigation, *i.e*., that would result from the construction of new water supply facilities,[251] or a

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[249] *See* SED, at ES-95, SP-3 (stating that impacts to the CVP/SWP export service areas would be less than significant under LSJR Alternatives 3 and 4 because under these alternatives <u>there would be an average increase in exports of 76 TAF or 194 TAF</u>, respectively). Significantly, by failing to include a comparable summary of impacts from the State Water Board's proposal to other potentially affected water service providers, including San Francisco, the State Water Board violated Section 15132(b)(1) of Title 14 of the California Code of Regulations, that requires "[e]ach significant effect with proposed mitigation measures and alternatives that would reduce or avoid that effect" to be identified in the Executive Summary.

[250] 2013 CCSF Comment Letter, *supra* note 3, at 9.

[251] See *e.g*., SED, at ES-93, SP-1 (explaining that as a result of "[s]urface water diversion reductions on the Stanislaus, Tuolumne and Merced rivers" under LSJR Alternatives 3 or 4, and the consequent "substantial

municipal water service provider's failure to replace their reduced supply. As noted above in Section I *supra*, the SED simply assumes that the SFPUC will not need to reduce deliveries to the RWS service territory in response to the State Water Board's implementation of LSJR Alternatives 3 or 4, but instead will be able to replace the reduction in water supply from alternative sources, (*see* SED, at L-26; *id.* at 20-40), and thereby avoid analyzing the predictable, adverse impacts to the Bay Area. This glaring omission violates the substantive standards of CEQA, the requirements of the certified regulatory program associated with the State Water Board's water quality control program, and the Porter-Cologne Act.

Dated: March 17, 2017

DENNIS J. HERRERA
City Attorney
JONATHAN KNAPP
Deputy City Attorney

By: ______________________
JONATHAN KNAPP

Attorneys for City and County of San Francisco

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reduction of surface water supply on the rivers, it is expected that there would be a substantial depletion of groundwater supplies in the Modesto, Turlock, and Extended Merced Subbasins," and that to the extent such reductions require water service providers "to construct new or expanded water supply or wastewater treatment facilities," the construction of such facilities could result in significant environmental effects.").

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BEFORE THE CALIFORNIA

STATE WATER RESOURCES CONTROL BOARD

DRAFT SUBSTITUTE ENVIRONMENTAL DOCUMENT IN SUPPORT OF POTENTIAL CHANGES TO THE WATER QUALITY CONTROL PLAN FOR THE SAN FRANCISCO BAY-SACRAMENTO/SAN JOAQUIN DELTA ESTUARY; SAN JOAQUIN RIVER FLOWS AND SOUTHERN DELTA WATER QUALITY

CITY AND COUNTY OF SAN FRANCISCO'S EXHIBIT LIST

The City and County of San Francisco ("San Francisco") hereby provides its Exhibit List to its Comments to the Draft Substitute Environmental Document in Support of Potential Changes to the Bay-Delta Plan:

EXH NO.	**DESCRIPTION**
1	Submission to Federal Energy Regulatory Commission by Turlock Irrigation District and Modesto Irrigation District of Settlement Agreement and Request for License Amendments Pursuant to Settlement Agreement, February 5, 1996.
2	Public Utilities Commission, City and County of San Francisco, Resolution 08-0202 adopting CEQA findings for Water System Improvement Program.
3	Memo titled Guidance on Consideration of Economics in the Adoption of Water Quality Objectives, William R. Attwater, Chief Counsel, State Water Resources Control Board, January 4, 1994.

EXH NO.	DESCRIPTION
4	Letter to Mark Gowdy, Division of Water Rights, State Water Resources Control Board, from Jonathan Knapp, Deputy City Attorney, San Francisco City Attorney's Office, July 29, 2014.
5	Bay-Delta Phase 1 Staff Technical Workshop of December 12, 2016, Transcript of Video Recording.
6	Fact Sheet, November 2016 Statewide Conservation Date, State Water Resources Control Board website.
7	Affidavit of Anson B. Moran ("Moran Affidavit"), FERC Project No. 2299, January 26, 1994.
8	Budget Workshop Presentation, Board Meeting, Alameda County Water District, May 26, 2016.
9	"Millbrae Residents Learn About Risks of 60 Year Water System," Public, January 30, 2017.
10	Moody's Investor Service, Credit Opinion, September 27, 2016, San Francisco Public Utilities Commission, Water Enterprise, New Issue – Moody's assigns Aa3 to San Francisco Public Utilities Commission (CA) Water Revenue Bonds Rating Report for SFPUC Bond.
11	U.S. Environmental Protection Agency, Reducing Urban Heat islands: Compendium of Strategies, October, 2008.
12	U.S. Environmental Protection Agency web page entitled "What is Green Infrastructure?"
13	At Risk: the Bay Area Greenbelt, 2017, Greenbelt Alliance.
14	Baumann, Adrian, "State Water Board Issues Moratorium on New Water Connections," Daily Democrat, November 5, 2014.
15	City of East Palo Alto Agenda, City Council Regular Meeting, July 19, 2016, City Council Agenda Report, P&A Item No. 10D, Approving an Ordinance Prohibiting New or Expanded Water Connections to the City of East Palo Alto Water System.
16	Landgraf, K., "East Palo Alto imposes development moratorium due to lack of water," Mercury News, July 20, 2016.
17	Plan Bay Area: A Strategy for a Sustainable Region, July 18, 2013, Association of Bay Area Governments, Metropolitan Transportation Commission.
18	Memo to Joint MTC Planning Committee with the ABAG Administrative Committee to MTC Deputy Executive Director, Policy / ABAG Executive Director regarding Plan Bay Area 2040 Draft Preferred Land Use Scenario, September 2, 2016.
19	Summary of California Air Resources Board Select 8 Summary, accessed March 9, 2017.

EXH NO.	DESCRIPTION
20	Agreement Relating to the Transfer of Water, December 20, 1990.
21	Brekke, Dan, “As California Drought Deepens, Those With Water Can Sell at a High Price,” KQED, July 2, 2014.
22	Placer County Water Agency, Board of Directors, Regular Meeting, Minutes, July 21, 2016.
23	Placer County Water Agency, Board of Directors, Regular Meeting, Minutes, June 18, 2009.
24	Letter from Roger VanHoy, General Manager, Modesto Irrigation District and Casey Hashimoto, General Manager, Turlock Irrigation District, to Mark Gowdy, State Water Resources Control Board, dated August 6, 2014.
25	Holland, John, “Modesto Irrigation District kills proposed water sale,” Modesto Bee (September 18, 2012).
26	Stapley, “Modesto Irrigation District blocks Oakdale water sale to SF, for now,” The Modesto Bee, January 23, 2014.
27	Stapley, “OID reveals big-money water sale to outside buyers,” The Modesto Bee, October 13, 2015.
28	Carlson, Ken, “Stanislaus County Supervisors to Vote on Water Export Rules, Modesto Bee,” September 9, 2013.
29	City of Carlsbad California website, FAQs, Carlsbad Desalination.
30	City of Carlsbad California website, Agua Hedionda Lagoon.
31	Gorn, David, “Desalination’s Future in California Is Clouded by Cost and Controversy,” KQED Science, October 31, 2016.

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EXH NO.	**DESCRIPTION**
32	Fikes, Bradley J., "State's biggest desal plant to open: What it means," San Diego Union-Tribune, December 13, 2015.
33	Bay-Delta Phase 1 Staff Technical Workshop of December 5, 2016, Transcript of Video Recording.

Dated: March 16, 2017

DENNIS J. HERRERA
City Attorney

By: /s/
JONATHAN P. KNAPP
Deputy City Attorney

Attorneys for the City and County of San Francisco

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March 13, 1996

By Hand

FILED
OFFICE OF THE SECRETARY
96 MAR 13 PM 4:25
FEDERAL ENERGY
REGULATORY
COMMISSION

Honorable Lois D. Cashell, Secretary
Federal Energy Regulatory Commission
888 First Street, N. E., Room 1A
Washington, D. C. 20426

Re Turlock Irrigation District and Modesto Irrigation District - Project No. 2299-024
Supplement to February 5, 1996 - Submission of Settlement Agreement

Dear Ms. Cashell:

Transmitted herewith for filing are an original and eight copies of an additional signature page to the Settlement Agreement submitted for filing in this proceeding on February 5, 1996. This signature page evidences the concurrence in the Settlement Agreement of the San Francisco Bay Area Water Users Association.

With the submission of this signature page the support for the Settlement Agreement can now be considered unanimous. All parties to the proceeding including the FERC Staff have now signed the Settlement Agreement.

Respectfully submitted,

W J Madden

William J. Madden, Jr.

Attorney for
Turlock Irrigation District and
Modesto Irrigation District

9603180138

Enclosure
Copy to Service List

FERC DOCKETED
MAR 15 1996

ORIGINAL

OFFICE OF THE SECRETARY
96 FEB -6 PM 1:33
FEDERAL ENERGY REGULATORY COMMISSION

FEDERAL ENERGY REGULATORY COMMISSION
WASHINGTON, D. C. 20426

October 10, 1995

New Don Pedro Settlement

To the participants:

Enclosed is the U.S. Fish and Wildlife Service's (FWS) biological opinion for the New Don Pedro settlement. We are striving to have the settlement signed and filed with the Commission prior to Thanksgiving. If you have not already done so, please obtain authorization to sign the settlement. A specific signing date will be set next week after you have a chance to confer with your respective organizations and have a better idea when you may have the requisite authorization. Tentatively, please consider a signing date in early November. Please keep us informed.

In our comments on the draft biological opinion, we stated:

> We do not, on a practical basis, consider reporting of any take of delta smelt to be objectionable, unreasonable, or inappropriate. This type of cooperation is fundamental to the relationships agreed to among the participants to the initialed settlement. We will discuss this issue with the participants to the settlement and see if a consensual agreement can be reached.

Accordingly, the issue is raised for discussion to see if there is any objection to an informal consensual agreement (**not to be part of the settlement**) that the participants will report to the FWS any take of delta smelt in the Tuolumne River, of which they become aware. Absent any objection, we will assume we have such an agreement.

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ENCLOSURE

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FEB 6 1996

9602150378

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NEW DON PEDRO PROCEEDING

P-2299-024

SETTLEMENT AGREEMENT

1995

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SETTLEMENT AGREEMENT

1. INTRODUCTION

This settlement proposes that Article 37 of the license for the New Don Pedro Project be amended to increase flows released from the New Don Pedro Dam. When this settlement is signed, it shall be binding on the parties to the settlement. The signature of the Federal Energy Regulatory Commission (FERC or Commission) staff represents a commitment by staff to recommend the settlement to the Commission for approval.

The settlement entered into by the participants is more comprehensive than the scope of Article 37; therefore, only the portion of the settlement that resolves the issues related to Article 37 will be filed for approval by the Commission. The proposed changes also affect the ongoing studies required by Article 58 which is also recommended for amendment. The material to be filed for Commission approval is described in Appendix A.

2. LIST OF PARTICIPANTS:

The following is a list of participants who support the settlement agreement:

California Department of Fish and Game (CDFG)
California Sports Fishing Protection Alliance (CSPA)
City and County of San Francisco (City)
Federal Energy Regulatory Commission staff (FERC staff)
Friends of the Tuolumne (FOTT)
Modesto Irrigation District (MID)
Tuolumne River Expeditions (TRE)
Tuolumne River Preservation Trust (TRPT)
Turlock Irrigation District (TID)
U.S. Fish and Wildlife Service (FWS)

Signature of this settlement by a participant indicates that participant's consent to enter into this agreement. The San Francisco Bay Area Water Users Association contributed to the settlement discussions yet chose not to sign the agreement.

3. **EFFECTIVE DATE**: The participants intend that this settlement becomes effective upon signature of the participants. The participants acknowledge that the portion of the settlement filed for Commission approval is subject to ultimate approval by the Commission. No money is required to be transferred among the participants until 30 days after the date of issuance of an order by the Commission amending articles 37 and 58 of the license consistent with Appendix A.

4. **TERM OF THE SETTLEMENT**: The term of this settlement shall correspond with the term of the license.

5. **SUPPORT OF SETTLEMENT**: The participants agree to support this settlement.

6. **FILING OF SETTLEMENT WITH THE COMMISSION**: The participants to the settlement agree that the Districts will file the settlement agreement with the Commission in accordance with Rule 602 of the Commission's Regulations (18 CFR § 385.602), within 5 business days from the date the last participant listed in section 2 signs the settlement.

7. **COMMISSION ACTION**: If the Commission fails to act on the proposed amendment within 6 months from the date the signed settlement is filed with the Commission, or if the Commission amends the license in a manner that is substantially different than that proposed herein, CDFG, CSPA, City, FOTT, MID, TRE, TRPT, TID, and FWS reserve the right, at their own discretion, and within 30 days of the date of Commission action, to notify all other participants in writing that they are withdrawing from the settlement.

8. **STRATEGY FOR RECOVERY OF TUOLUMNE RIVER CHINOOK SALMON**: This recovery strategy attempts to: 1) increase naturally occurring salmon populations, 2) protect any remaining genetic distinction, and 3) increase salmon habitat in the Tuolumne River. Both instream flow and non-flow measures are employed as part of the strategy.

The participants to the settlement agree to the following strategy for recovery of Tuolumne River chinook salmon.

> Implement measures generally agreed upon as necessary to improve chinook salmon habitat and increase salmon populations. These measures include increased flows, habitat rehabilitation and improvement, and measures to improve smolt survival. When the chinook salmon population increases to acceptable levels, implement additional measures of some risk that the Technical Advisory Committee (TAC) agrees may help improve the population.

The participants to the settlement agree to an adaptive management strategy that would initially employ measures considered feasible and have a high chance of success. The success of these initial measures would be evaluated and, based on the results of evaluation, the measures would either be fine-tuned to improve success or alternative measures would be taken.

In support of this adaptive management strategy, a detailed review will be conducted annually to assess progress toward meeting the goals described in this settlement.

9. **GOALS AND TIMETABLE FOR ACHIEVING GOALS**: Many of the factors that will affect the chinook salmon population are beyond the control of the participants to the settlement. Rather than setting numeric goals in this settlement, comparative goals are identified whose attainment may be readily determined. These comparative goals are:

- Improvements in smolt survival and successful escapement in the Tuolumne River.
- Increase in naturally reproducing chinook salmon in this subbasin.
- Barring events outside the control of the participants to the settlement, by 2005 the salmon population should be at levels where there is some resiliency so that some of the management measures described herein may be tested, on an experimental basis.

10. **MEASURES TO BE TAKEN IF GOALS NOT ACHIEVED:** Assessment of achievement of the above goals will require an evaluation of trends established over several years. The participants agree that, given a good faith effort to implement the strategy for recovery of Tuolumne River chinook salmon, a fair assessment of the success of the strategy will require analysis of conditions from implementation to the year 2005. If the above goals are not achieved because of factors within the control of the Districts, or there has not been a good faith effort to fulfill the terms of this settlement, any participant may, at its own discretion, notify all other participants, in writing, that it is withdrawing from the settlement. Examples of factors within the control of the Districts include: New Don Pedro Dam operations (including decisions on the delivery, distribution, and transfer of water within and outside of the Districts) and river flows at LaGrange dam except during flood control operations, and land use activities on District-owned lands within the Tuolumne River riparian corridor. Examples of factors outside the control of the Districts include: Delta export operations, commercial and sport salmon harvest, land use activities on non-District owned lands within the Tuolumne River riparian corridor, and riparian diversions below LaGrange Dam.

In the event the goals are not achieved because of factors within the control of the Districts, the Districts agree to implement additional non-flow measures. The Districts, CDFG, and FWS will determine appropriate measures after reviewing recommendations from the TAC. In the event that goals are not achieved because of factors outside the control of the Districts, no additional measures would be required.

If a participant has a concern regarding fulfillment of the terms of this settlement, the participants agree to make a good faith effort to resolve any concerns. The participants agree to address the concerns at the TAC. If the concern is not resolved by the TAC, it will be addressed by the Management Committee in a timely manner.

11. **FISHERY FLOWS**: The Districts agree to maintain minimum streamflows in the Tuolumne River at La Grange bridge in accordance with the schedules set forth in this agreement or with such schedules as may be mutually agreed to among the Districts, CDFG, and FWS. The total volume of water allocated for a specific fish flow year shall not be less than that identified in the applicable Appendix A flow schedule. These schedules shall be available for public review at the Districts' offices.

By March 15 of each year, CDFG shall submit a preliminary fish flow schedule to the Districts and the FWS for review and comment. By April 10 of each year, CDFG shall submit a final fish flow schedule to the Districts for review and approval.

The water year type and corresponding flow volumes are listed below. Definition of the water year types and how flow volumes will be calculated from year to year are contained in the proposed amendment to article 37, attached as Appendix A.

Water Year Type	Flow Volume (acre-feet)
Critical Water Year and below	94,000
Median Critical Water Year	103,000
Intermediate C-D Water Year	117,016
Median Dry	127,507
Intermediate D-BN	142,502
Median Below Normal	165,002
Intermediate BN-AN	300,923
Median Above Normal	300,923
Intermediate AN-W	300,923
Median Wet/Maximum	300,923

In addition, the participants agree to work cooperatively in an effort to obtain additional flows in the Tuolumne River.

The participants will have fully complied with this cooperative effort to obtain additional flows by implementing, to the extent practicable, the following actions:

- The Districts and the City will seek permission from the Corps of Engineers to modify flood control rules in order to obtain greater flexibility in water releases from New Don Pedro reservoir. The Districts and the City agree to meet with the Corps within 2 months from the effective date of this agreement and to present a preliminary proposal to the Corps within 6 months thereafter. The Districts and the City agree to commit up to $25,000 in support of the request to modify the flood control rule curve.

- The Districts will agree to make water transfers on mutually agreeable terms subject to the Districts' ability to free water from other committed uses.

- The Districts will provide an option to FWS and CDFG to purchase an amount of water cumulatively of up to 20% of any water to be sold by the Districts for diversion above New Don Pedro reservoir for municipal water supply. The sale price to the resource agencies will be no more than that paid by the transferee.

- The FWS will seek funds as appropriate, including Central Valley Project Improvement Act funds, for the purpose of purchasing water from the Districts, monitoring smolt production, and other measures agreed upon in this settlement agreement.

- TID will promote the proposed Turlock Area Drinking Water Project, the diversion for which is proposed to be located between river miles 19 and 26. The project will be implemented so that it will not be injurious to MID's water rights. FWS and CDFG agree to expedite the review of any permits and applications necessary for the drinking water project.

- TID will conduct a feasibility and cost analysis of withdrawing water for irrigation at the proposed Turlock Area Drinking Water Project diversion point. This analysis will be included in the EIR for that project. Based on the results of these analyses, CDFG and FWS will determine if it would be appropriate for them to fund or cost share in the design and construction of alternative irrigation diversion facilities. The parties to the settlement are under no obligation to fund the design, construction, operation, or maintenance of these facilities.

- The participants will work cooperatively through the TAC to achieve any efficiencies available through real-time management in an effort to conserve water deliveries in one year to increase incremental flows in the following year. To the extent that real-time management, in the judgement of the TAC, reduces the required minimum flow in one year, that water may be carried over for use in the following year and attributed to the efforts to achieve incremental flows; however, only 5,000 acre-feet may be carried over beyond October 1 of each year for use until the following October 1.

The water made available through the above measures will be provided as an increment above the minimum flows described above and will be scheduled as may be agreed to by the Districts, CDFG, and FWS except that flows to be diverted for the Tuolumne River Drinking Water Project will not be subject to such scheduling approvals. No water obtained and released pursuant to these measures shall be credited toward the calculation of minimum flow releases.

12. **NON-FLOW OPTIONS:** The parties agree that restoration and maintenance of Tuolumne River salmon habitat and reducing predation losses by isolating gravel ponds from the Tuolumne River channel would be beneficial. A program, overseen by the TAC and administered by the Districts, shall be implemented as follows:

a. The TAC shall determine whether to fund and complete a programmatic environmental document covering all spawning and rearing improvement and channel modifications (e.g. pond isolation projects) anticipated for the lower Tuolumne River, including those not funded through this agreement. Due to the likelihood of both federal and state matching or other funds for planning and implementation, a joint EIR/EIS (CEQA/NEPA) should be considered. Up to $250,000 of the authorized funding under paragraph 12(g)(1) shall be provided for the completion of this document. If additional funds are needed, CDFG, FWS and other parties shall use their best efforts to locate and secure funds. The TAC will provide a recommendation regarding agency roles to the Management Committee for consideration.

b. The selection of priority non-flow options funded under this agreement shall be made by the TAC. The area between Old La Grange Bridge and the two riffles below Basso Bridge constitute the upper one-third segment of the Tuolumne River spawning reach.

This upper one-third segment is the most heavily used portion of the spawning area. Spawning habitats from Basso Bridge downstream to Waterford also receive significant use. There are several pond isolation projects on this reach that have good potential to reduce the recruitment and colonization of predator fish in the ponded sections of the river and restore a more natural river ecosystem. These ponded areas (created by in-channel aggregate mining) provide habitat for smallmouth and largemouth bass which prey on outmigrating chinook salmon smolts, significantly increasing smolt mortality.

c. The TAC will identify 10 priority projects. A minimum of two pond isolation projects will be included in the 10 priority projects. At completion of this phase, there will essentially be "turn key" projects ready for implementation. The objective is to implement the priority projects by 2005.

d. The methods used for implementation of these projects shall include, but not be limited to, simple gravel cleaning, hydraulic gravel cleaning, gravel replacement, gravel additions, ripping, re-contouring, barrier placements or removals, placement of object cover (boulders), restoring floodplain, land acquisition and riparian removal and replanting (e.g. shade). The design of the monitoring program will integrate closely with the timing, location and type of habitat improvement projects to assist in evaluating the merits of these projects.

e. Due to similar requirements for permitting, environmental documentation and implementation management, all other non-flow options will also be evaluated by the TAC in the manner described above. These measures include but are not limited to riparian restoration, land acquisition, sediment source control, predator control, enhancing turbidity during smolt outmigration, reduced poaching, fish screens, sound or behavioral devices to guide fish away from problem areas, livestock management (e.g. fencing, rotational grazing or compensating ranchers for not grazing riparian pastures). Upon recommendation from the TAC and approval by the Management Committee, projects such as these may be substituted for, or identified as part of the 10 priority projects described above, and funded as indicated. The parties agree to pursue outside funds and encourage others to complete these non-flow measures.

f. The Districts shall provide administrative services for these projects. Participants of the TAC shall participate at their own expense.

g. Funding

(1) The total amount of funds to be provided by Districts and the City for the cost of non-flow options shall not exceed $500,000, except that up to an additional $500,000 shall be provided to match, on a dollar-for-dollar basis, funds provided by other sources.

(2) Allowable project costs shall include development of the scope of work, preliminary and design engineering, permitting, environmental review, implementation work, preparation of required reports, and post-implementation monitoring incurred pursuant to a monitoring program approved by the TAC.

(3) The Districts will manage these funds in an efficient manner. CDFG and FWS will actively pursue funding from various sources to assist in completion of the 10 priority projects selected by the TAC. After completion of the 10 priority projects, any remaining funds shall be made available for designing or completing additional habitat projects identified by the TAC.

(4) The parties agree that nothing herein is intended to prevent any of the parties from seeking funds or financial assistance from third parties for the funding of non-flow options and the parties are encouraged to seek and to cooperate in obtaining such outside funding.

13. **MONITORING:** The 1986 Study Agreement shall terminate upon approval by the Commission of the amendment of articles 37 and 58 in accordance with the terms of this agreement. The following activities shall be completed pending Commission approval:

a. Fluctuation Study: GIS mapping of the river reach between river mile 26 and river mile 52 at river flows at approximately 1,100 cfs, 3,100 cfs, and 5,100 cfs and aerial photographs of the river flows at 5,100 cfs at an estimated total cost of $50,000.

b. Juvenile seining study during 1995 at an estimated cost of $20,000.

c. Temperature monitoring during 1995 at an estimated cost of $5,000.

d. Smolt survival index study in spring 1995 at an estimated cost of $50,000.

The fish program for the Tuolumne River shall shift its emphasis from studies to determine appropriate action, to implement and monitor the effectiveness of the fishery improvement measures described herein.

The Districts and the City will provide up to $1,355,000 over the term of the license for funding monitoring costs. The Districts, with the cooperation of CDFG, FWS, and the City, will monitor the following:

Chinook Salmon Fall-Run

a. Spawning Escapement - The number, size distributions, scale or otolith samples for aging, timing, coded-wire tag recovery and decoding, and the linear distribution of redds in the designated salmon spawning area shall be estimated or collected annually from approximately October through mid-January. CDFG will perform the monitoring and use its best effort to fund this monitoring as a collaborative effort with the Districts for the first 10 years of this agreement. CDFG agrees to include funding for this monitoring in its proposed annual budgets and to seek approval of these budgets in good faith, however, the participants understand and agree that the Districts are responsible for this monitoring and that CDFG funding is subject to appropriations in the Governor's budget.

If CDFG cannot obtain funding for this monitoring for any giver year during the first 10 years of this agreement, CDFG shall notify the TAC in writing by September 1 and the Districts will fund this monitoring. In these instances, the $40,000 per year allocation for this monitoring shall be deducted from funds otherwise required to be paid by the Districts for monitoring performed under this agreement. After reviewing alternative funding options, the TAC shall recommend how the scope and extent of the monitoring in section 13 may be modified to adjust for any such funding deficit.

If, at the end of the first 10 years of this agreement, the CDFG finds that it is necessary and appropriate to continue monitoring spawning escapement for the remainder of this agreement, it will do so to the extent possible.

b. Quality and Condition of Spawning Habitat - The TAC will assign responsibility for developing a protocol to monitor the quality and relative condition of spawning riffles from La Grange downstream to Waterford. The

TAC will review the adequacy and validity of implementing this monitoring aspect in relation to the habitat improvement measures planned under this Agreement. The monitoring will be conducted by the Districts and will occur during four years before 2005 as scheduled and funded in Appendix A. CDFG and FWS will actively pursue additional monitoring funds for projects constructed in whole or in part by other funding.

c. Relative Fry Density/Female Spawners - Beach seine survey results over the past ten years for the Tuolumne River from old La Grange Bridge to Waterford shall be analyzed (by reach and by riffle) for the January 15 through March 15 time period (bi-weekly, monthly and season total) to define the range, median and mode, and variance of fry/100m^2/female adult spawned in the reach. An assessment of the validity of using these "indices" or an alternate shall be completed by June 1996 by the TAC. Thereafter, monitoring shall occur during four years before 2005, as scheduled and funded in Appendix A. The purpose is to monitor changes in fry density/female spawner and evaluate the hypothesis that poor quality gravel is constraining salmon production on the Tuolumne River. Additional monitoring performed outside the terms of the Agreement will be summarized and evaluated in combination with these monitoring results by the TAC, when defining the phases approach to gravel restoration projects.

d. Fry Distribution and Survival (Fluctuation) - As a component of the "Flow Fluctuation" monitoring, field monitoring program(s) shall be funded to document the distribution and dislocation of salmon fry produced in the Tuolumne River as they move downstream in the Tuolumne River and San Joaquin River associated with flow fluctuations in late January, February, and early March. Multiple rotary screw traps and a mark and recapture program shall be established for four years during periods of large flow fluctuations within the spawning reach during the period January 15 - March 15 through 2005. A monitoring protocol shall be developed by the Districts and presented to the TAC for review and concurrence. If a pattern of high flows does prove effective in dislocating fry out of the Tuolumne River, the second phase (survival) of the monitoring program shall be designed and reviewed by the TAC and then implemented subject to available funding. The use of coded-wire tags or some other distinguishing mark will be needed to meet the objective of defining and survival rate/contribution rate of fry dislocated from the Tuolumne River associated with regulated flow fluctuations. This monitoring shall be completed by the Districts and CDFG and be funded and scheduled as defined in Appendix A.

e. <u>Juvenile Distribution and Temperature Relationship</u> - The Districts shall perform and summarize beach seine survey results each year from March 15 - June 15, through 2005, to monitor the linear distribution of juvenile salmon. At least five thermographs will be deployed in the river. If determined necessary by the TAC, a weather station (air temps) will be deployed or local weather data during this same time period will be recorded. Fish and weather data will be summarized by the Districts annually. The monitoring will be funded and scheduled as defined in Appendix A.

f. <u>Smolt Survival Indices</u> - The CDFG will be funded to perform annual coded-wire tag monitoring of salmon smolt survival through 2005. A paired release of 150,000 to 200,000 CWT's total and a recovery effort (screw trap or trawl) will be performed each year that adequate numbers of hatchery fish are available.

In addition, a program of marking/tagging and replicate smolt release and recovery shall be funded annually through 2005 to monitor the relative effectiveness of the restoration measures in meeting the agreement goals. A protocol shall be prepared by CDFG and reviewed by the TAC prior to implementation. This monitoring program will be funded and scheduled as defined in Appendix A.

g. <u>Smolt Production</u> - The two monitoring procedures under the "Smolt Survival Indices" will provide extensive information on natural smolt outmigrants. The incremental addition of similar sampling effort (screw traps) extending before and after the CWT and mass marking releases can provide an index of smolt production. The TAC shall review methodologies and determine if this additional effort will result in significant results beneficial to monitoring the benefits of the restoration measures. This monitoring will be funded and scheduled as defined in Appendix A.

h. The TAC is authorized to modify the monitoring activities and studies specified in Section 13 (including, but not limited to, changes in the scope, protocols, number of years, and funding limits for an activity or study) so long as the total funding limit for monitoring is not exceeded.

14. TECHNICAL ADVISORY COMMITTEE: The above participants have established a valuable network of technical interaction and cooperation through the TAC. The Districts, FWS, CDFG, and the City agree to continue to exchange monitoring information for the Tuolumne and other subbasins so that progress in achieving the goals described herein may be evaluated.

Management Committee: The Management Committee is comprised of management representatives of MID, TID, CDFG, FWS, and the City. Their role is to oversee all TAC activities, to request and receive recommendations from the TAC, and to make policy decisions. The Management Committee will be responsible for resolving all issues elevated to it by the TAC. The Management Committee shall operate by consensus.

Under the direction of the Management Committee, the TAC will coordinate, by consensus, flow and non-flow measures for the fishery, monitoring activities, develop adaptive management strategies, and oversee their implementation. Any substantive disagreements among the TAC participants shall be elevated to the Management Committee for timely resolution.

The TAC members agree to continue to exchange information through the TAC. Exchange of information by all participants is encouraged and, to keep the exchange of technical information productive, any representative to the TAC should be a technical specialist in the aquatic sciences. Any party may send non-technical representatives to audit TAC meetings.

The TAC is not subject to the provisions of the Ralph M. Brown Act (California Government Code section 54950 et seq.); however, the TAC shall provide notices of and agendas for formal TAC meetings consistent with the requirements of the Ralph M. Brown Act. Attendees at any TAC meeting will be given an opportunity to comment on any TAC agenda item.

Resources Available to the TAC: The Districts agree to provide the administrative, clerical, and support facilities for the TAC to fulfill its tasks.

15. REPORTING: The Districts, CDFG, and FWS agree to report the above monitoring information and other data relevant to the condition of the fishery resources in the Tuolumne River to the TAC, in a timely manner, to facilitate basin fishery management practices. Timely dissemination of data concerning each of the above items will be necessary for the TAC to effectively implement adaptive management techniques.

The above monitoring information is also to be documented in annual reports, filed by April 1 of each year with the Commission and to be available for public review to further the understanding and management of the chinook salmon.

16. FLOW FLUCTUATIONS: The Districts agree to operate the New Don Pedro Project to minimize abrupt or daily flow fluctuations in the Tuolumne River during salmon spawning, incubation, and fry rearing (generally, October 16 through March 15 or other 150-day period as may be slightly modified by the TAC).

Specifically, the Districts agree to follow the guidelines described below unless modified by the TAC or because of circumstances beyond the control of the Districts.

From October 16 through March 15 of each year, the Districts agree to the following ramping rates for decreasing the indicated flows at La Grange.

Flow (Q) cfs	Ramping Rate cfs/hr
Q < 2,000	500
2,000 < Q < 2,700	700
2,700 < Q < 4,500	900

From October 16 through March 15, the Districts agree not to increase flows by more than 1,800 cfs per hour.

17. TUOLUMNE RIVER FLOWS ABOVE NEW DON PEDRO RESERVOIR: The City agrees to continue to work cooperatively with the organized and permitted recreational river users (rafters and kayakers) to schedule flows and to communicate daily flow schedules. If requested, the City will endeavor to inform the recreational river users of the amount of water it hopes to make available in the year for potential use by recreational river users. The parties agree that the amounts and schedule identified by the City will not be a legal obligation of the City, and further recognize that the City's obligation pursuant to the Raker Act or stipulations with the Department of the Interior are not increased or otherwise altered by this provision.

The Districts and the City agree to work with TRE to develop an understanding of the timing and amounts of flows needed by the recreational river users. TRE will provide the Districts and the City with its desired minimum flow volume and timing schedule. The City will, consistent with the above, attempt to provide the flows requested. The Districts and the City further agree to explore opportunities to improve flows available for recreational river users above New Don Pedro Reservoir, which do not have adverse impacts on either the water or power operations of the Districts or the City.

18. **SUPPORT FOR ANCILLARY PROGRAMS**: The participants to the settlement agree to support the following ancillary programs. Those participants with permitting, licensing, or approval authority agree to work with the applicant to develop acceptable options and to expedite the review and approval process. All other participants agree not to oppose or delay the following:

- Turlock Area Drinking Water Project, the diversion for which is proposed to be located between river miles 19 and 26. The project will be implemented so that it will not be injurious to MID's water rights.
- Flows proposed herein before the California State Water Resources Control Board and the California Central Valley Regional Water Quality Control Board for achieving the goals stated in this settlement agreement.
- Regulation of the salmon harvest rates to achieve the goals stated herein.
- Promotion of the return of 3 and 4 year old female chinook salmon.
- Coordinated system operation within San Joaquin River basin.
- Increased storage in Turlock Lake.
- Review of cattle grazing on public land adjacent to Tuolumne River with the intent of developing protective measures for riparian habitat.
- Encouragement of appropriate agencies to monitor water quality and maintain water quality standards in the Tuolumne basin.
- Management of the Tuolumne River to promote the natural chinook salmon population.
- Maintenance of any increased flow in the Tuolumne River.
- Environmentally acceptable water transfers (subject to applicable water quality standards).
- Change in flood control rule curve to provide for greater storage for fish releases and to better accommodate recreational boating above New Don Pedro Reservoir.
- Coordinated actions to reduce impact on hydropower generation.

19. **RIPARIAN HABITAT AND RECREATION**: The participants to the settlement agree that the flows described herein will help to provide adequate protection and to enhance the existing riparian habitat along the Tuolumne River. Many factors, primarily related to land use, have resulted in a vegetative mosaic ranging from lush habitat to areas where the riparian habitat has been

denuded. The participants to the settlement agree that improving the downstream riparian habitat would not only benefit the chinook salmon population, but also the multipurpose use of the Tuolumne River.

Recreation enhances public appreciation of the river and broadens the economic base of the local communities. Recreational opportunities consistent with the protection and maintenance of the chinook salmon fishery should be promoted. Additional boating access would improve recreational opportunities.

The City agrees to provide $500,000 to an appropriate public agency or agencies mutually acceptable to the City, FOTT, and TRPT. This funding would be used directly to implement riparian improvement measures, recreational facilities, for acquisition of other funds (matching funds), or as otherwise described herein. The money provided by the City will not be used to fund salary or overhead to anyone administering this fund. All costs charged to this fund must be documented and their expenditure subject to audit if requested by the City.

20. **CDFG STAFF POSITION**: The City agrees to provide CDFG $70,000 a year for ten years to fund a fishery biologist position on the CDFG staff for the Tuolumne River. In addition, the City agrees to provide a one-time contribution of $30,000 as start-up costs related to this staff position. The City and CDFG agree to work cooperatively to negotiate an appropriate funding agreement.

21. **FLOW ALLOCATION**: The Districts agree to release the fishery flows described herein. The allocation of that water between the Districts and the City will be shared as they have negotiated.

22. **COST SHARING BETWEEN THE DISTRICTS AND THE CITY**: The Districts and the City agree that costs for non-flow measures shall be shared as prescribed in the FOURTH AGREEMENT, unless otherwise negotiated.

23. **SECTION 7 CONSULTATION**: When a consensual agreement is reached, the participants will initial the settlement and FERC staff will immediately provide the agreement to FWS for consultation under Section 7 of the Endangered Species Act (ESA). FERC staff will identify the mediation participants as designated non-federal representatives for the purpose of assisting FERC and FWS in evaluating the effects of the settlement on any listed species.

Upon completion of ESA consultation, any consensual agreement will be signed by all participants.

24. **REQUESTS FOR EXTENSION OF TIME**: The participants agree not to request extensions of time for the requirements contained herein that are approved by the Commission, unless they have the concurrence of all participants to the settlement.

25. **MODIFICATION OF TERMS AND CONDITIONS OF SETTLEMENT**: Actions beyond the control of the participants may prevent or jeopardize a party's ability to fulfill a condition of the settlement. The participants to the settlement agree to work cooperatively to fulfill the terms and conditions of the settlement.

When a party to the settlement recognizes that it may have difficulty fulfilling a condition of the settlement, the affected party to the settlement agrees to notify, in writing, all other participants, as far in advance as possible, explaining the problem and requesting concurrence for an alternative schedule or an alternative activity to be performed by that party.

The participants to the settlement agree to respond within 30 days of the date of the initial letter with either their concurrence or a request for a meeting of the participants, to occur within 45 days from the date of the initial letter. Absent objection, the settlement will be amended as proposed.

If the participants to the settlement do not initially concur, the participants agree to meet and consider any alternatives presented. If they cannot concur on an alternative course of action, the party will be obligated, to the extent provided by law, to fulfill the original condition of the settlement.

26. **NON-PRECEDENTIAL NATURE OF SETTLEMENT:** Nothing in this settlement agreement, whether or not incorporated into the terms of the Commission license, is intended or shall be construed as a precedent or other basis for any argument that the paries which have signed this agreement have waived or compromised their rights which may be available under state or federal law except as to the matters addressed in this proceeding required by the Federal Power Act and in this settlement agreement. In addition, nothing in this settlement agreement establishes precedent regarding hydroelectric jurisdictional issues.

APPENDIX A

Proposed Amendment of Article 37

Article 37. The licensees shall maintain minimum streamflows in the Tuolumne River at La Grange bridge (river mile 50.5) for fish purposes in accordance with the table and schedules set forth below or with such schedules as may be agreed to among the licensees, the California Department of Fish and Game and the U.S. Fish and Wildlife Service. Any such schedules shall be available for public review at the licensees' offices. These flows may be temporarily modified if required by operating emergencies beyond the control of the licensees.

Water Year Classifications

Water Year Classification*	Cumulative Occurrence	Frequency %	60-20-20 Index (1906-1995)
Critical Water Year and below	< 6.4	6.4	<1500 TAF
Median Critical Water Year	6.4 - < 14.4	8.0	1500
Intermediate C-D Water Year	14.4 - < 20.5	6.1	2000
Median Dry	20.5 - < 31.3	10.8	2200
Intermediate D-BN	31.3 - < 40.4	9.1	2400
Median Below Normal	40.4 - < 50.7	10.3	2700
Intermediate BN-AN	50.7 - < 66.2	15.5	3100
Median Above Normal	66.2 - < 71.3	5.1	3100
Intermediate AN-W	71.3 - < 86.7	15.4	3100
Median Wet/Maximum	86.7 - 100	13.3	3100

* The fish flow year is defined as April 15 through April 14 of the following year. The water year is defined as October 1 through September 30.

The water year classification shall be determined using the California State Water Resources Control Board's San Joaquin Basin 60-20-20 Water Supply Index and the California Department of Water Resources' (DWR) April 1 San Joaquin Valley unimpaired runoff forecast. The 60-20-20 index numbers used each year shall be updated to incorporate subsequent water years pursuant to standard DWR procedures so as to maintain approximately the same frequency distribution of water-year types. The volume of annual flow shall be periodically readjusted upon agreement among the licensees, the California Department of Fish and Game, and the U.S. Fish and Wildlife Service after April 1 of each year as more current unimpaired flow information becomes available.

Between a Median Critical Water Year and an Intermediate Below Normal-Above Normal Water Year, the precise volume of flow to be released by the licensees each fish flow year is to be determined using accepted methods of interpolation between index values given above.

FLOW SCHEDULE

Schedule Occurrence	Days	Critical & below 6.4 %	Median Critical 8.0 %	Intermediate C-D 6.1 %	Median Dry 10.8 %	Intermediate D-BN 9.1 %	Median Below Normal 10.3 %	Intermediate BN-AN 15.5 %	Median Above Normal 5.1 %	Intermediate AN-W 15.4 %	Median Wet/ Maximum 13.3 %
October 1 - October 15	15	100 cfs 2,975 ac-ft	100 cfs 2,975 ac-ft	150 cfs 4,463 ac-ft	150 cfs 4,463 ac-ft	180 cfs 5,355 ac-ft	200 cfs 5,950 ac-ft	300 cfs 8,926 ac-ft	300 cfs 8,926 ac-ft	300 cfs 8,926 ac-ft	300 cfs 8,926 ac-ft
Attraction Pulse Flow		none	none	none	none	1,676 ac-ft	1,736 ac-ft	5,950 ac-ft	5,950 ac-ft	5,950 ac-ft	5,950 ac-ft
October 16 - May 31	228	150 cfs 67,835 ac-ft	150 cfs 67,835 ac-ft	150 cfs 67,835 ac-ft	150 cfs 67,835 ac-ft	180 cfs 81,402 ac-ft	175 cfs 79,140 ac-ft	300 cfs 135,669 ac-ft	300 cfs 135,669 ac-ft	300 cfs 135,669 ac-ft	300 cfs 135,669 ac-ft
Outmigration Pulse Flow		11,091 ac-ft	20,091 ac-ft	32,619 ac-ft	37,060 ac-ft	35,920 ac-ft	60,027 ac-ft	89,882 ac-ft	89,882 ac-ft	89,882 ac-ft	89,882 ac-ft
June 1 - September 30	122	50 cfs 12,099 ac-ft	50 cfs 12,099 ac-ft	50 cfs 12,099 ac-ft	75 cfs 18,149 ac-ft	75 cfs 18,149 ac-ft	75 cfs 18,149 ac-ft	250 cfs 60,496 ac-ft	250 cfs 60,496 ac-ft	250 cfs 60,496 ac-ft	250 cfs 60,496 ac-ft
Volume (ac-ft)	365	94,000	103,000	117,016	127,507	142,502	165,002	300,923	300,923	300,923	300,923

Proposed Amendment of 1986 Agreement

On February 2, 1987, the Commission issued an order amending the license for the New Don Pedro Project. Article 58 approved a fish study plan filed on November 11, 1986, and set as June 30, 1998, or two years after completion of the Smolt Survival Index Study, whichever is later, for filing the results of the fishery studies.

This settlement requires monitoring to determine the effectiveness of the measures proposed herein. The fishery studies approved on February 2, 1987, should be amended to switch the emphasis from studies to determine what actions may be appropriate, to monitoring to determine the effectiveness of the measures implemented by this settlement.

The results of any fishery study, already completed pursuant to the fish study plan and not already filed with the Commission, should be filed by April 1, 2005. Article 58 should be amended accordingly.

Article 58. The licensees, after consulting with the California Department of Fish and Game and the U.S. Fish and Wildlife Service, shall implement a program to monitor chinook salmon populations and habitat in the Tuolumne River. The monitoring program shall conform to the monitoring schedule set forth below and shall include:

- Spawning Escapement Estimates
- Quality and Condition of Spawning Habitat
- Relative Fry Density/Female Spawners
- Fry Distribution and Survival
- Juvenile Distribution and Temperature Relationships
- Smolt Survival

The monitoring frequencies and methods shall be agreeable among the licensees and the consulted agencies. Any disagreements regarding the conduct of these studies, not resolved among the licensees and consulted entities, shall be filed with the Commission for determination.

The above monitoring information is to be documented in annual reports which will be filed with the Commission by April 1 of each year and be available for public review. The results of any fishery studies, already completed and not yet filed with the Commission, shall be filed by the licensees by April 1, 2005.

APPENDIX A
MONITORING SCHEDULE

Item	Action Entity	Cost	Number of Years	Total Cost	Funding Source
A. Monitoring Salmon Spawning Escapement	CDFG	$ 40,000/year	10, possibly 20	$400,000 possibly to $800,000	CDFG
B. Monitoring Quality and Condition of Spawning Habitat	Districts	Base Year $25,000 2nd Year $10,000 3rd Year $10,000 Final Year $10,000	4	$ 25,000 $ 10,000 $ 10,000 $ 10,000	Districts, City
C. Monitoring Relative Fry Density/Female Spawners (Yrs immediately following Item B)	Districts	$ 25,000/year	4	$100,000	Districts, City
D. Monitoring Fry Distribution and Survival (Jan. - Mar. flow fluctuations)	Districts/CDFG	$ 50,000/year	4	$200,000	Districts, City
E. Monitoring Juvenile Distribution and Temperature Relationships (Real-time Management)	Districts	$ 25,000/year	10	$250,000	Districts, City
F. Monitoring Smolt Survival (Real-time Management)	CDFG	$ 75,000/year	10	$750,000	Districts, City
G. Monitoring Smolt Production (Real-time Management)	TBD*	$ 50,000/year	10	$500,000	CVPIA**

* To be determined by the TAC

** The FWS agrees to seek external funding for this activity from various programs, including CVPIA.

APPENDIX B

NEW DON PEDRO PROCEEDING - LIST OF INITIALS

The following initials reflect agreement to the settlement prior to Endangered Species Act consultation.

Organization	*Representative*	*Date*
California Department of Fish and Game		4/23/95
California Sports Fishing Protection Alliance		
City and County of San Francisco		4/23/95
Federal Energy Regulatory Commission staff		23 April 95
Friends of the Tuolumne	mab	4/23/95
Modesto Irrigation District		4-23-95
San Francisco Bay Area Water Users Association		
Tuolumne River Expeditions		4/23/95
Tuolumne River Preservation Trust		4/23/95
Turlock Irrigation District		4.23.95
U.S. Fish and Wildlife Service		4/23/95

NEW DON PEDRO PROCEEDING - SIGNATURE SHEET

The following signatures reflect agreement to the settlement.

Organization	*Representative*	*Date*
California Department of Fish and Game		
California Sports Fishing Protection Alliance		
City and County of San Francisco		
Federal Energy Regulatory Commission staff		
Friends of the Tuolumne		
Modesto Irrigation District		
Tuolumne River Expeditions		
Tuolumne River Preservation Trust		
Turlock Irrigation District		
U.S. Fish and Wildlife Service		

NEW DON PEDRO PROCEEDING - SIGNATURE SHEET

The following signatures reflect agreement to the settlement.

Organization	*Representative*	*Date*
California Department of Fish and Game		
California Sports Fishing Protection Alliance		
City and County of San Francisco		
Federal Energy Regulatory Commission staff		
Friends of the Tuolumne		
Modesto Irrigation District		
San Francisco Bay Area Water Users Association	Douglas M. Short	3/7/96
Tuolumne River Expeditions		
Tuolumne River Preservation Trust		
Turlock Irrigation District		
U.S. Fish and Wildlife Service		

Signature page to New Don Pedro
Settlement Agreement Project No.
2299-024

EXHIBIT 2

EXHIBIT 3

PUBLIC UTILITIES COMMISSION

City and County of San Francisco

RESOLUTION NO. **08-0202**

WHEREAS, The San Francisco Public Utilities Commission determined the need for the WSIP to address various water system deficiencies including aging infrastructure; and achieve the goals of maintaining water quality, strengthening the system to avoid major damages and failures following earthquakes, improving delivery reliability and operational flexibility to accommodate planned and unplanned system outages, meeting customer demands, and providing drought protection; and

WHEREAS, San Francisco voters adopted Propositions A and E in November 2002, providing financing for water system improvements, and State Assembly Bill No. 1823 was also approved in 2002, requiring the City and County of San Francisco to adopt a capital improvement program designed to restore and improve the regional water system. The SFPUC prepared and presented a proposed WSIP to the Planning Department for environmental review; and

WHEREAS, On October 30, 2008, the Planning Commission reviewed and considered the Final Program Environmental Impact Report (consisting of the Draft Program Environmental Impact Report (PEIR) and the Comments and Responses document) and found that the contents of said report and the procedures through which the Final PEIR was prepared, publicized and reviewed complied with the provisions of the CEQA and the CEQA Guidelines and Chapter 31 of the San Francisco Administrative Code and found further that the Final PEIR reflects the independent judgment and analysis of the City and County of San Francisco, is adequate, accurate and objective, and that the Comments and Responses document contains no significant revisions to the Draft PEIR, and certified the completion of said Final PEIR in compliance with CEQA and the CEQA Guidelines in its Motion No. 17734; and

WHEREAS, On October 30, 2008, this Commission reviewed and considered the Final PEIR, adopted the CEQA Findings, including the Statement of Overriding Considerations, and the Mitigation Monitoring and Reporting Program by its Resolution No. 08-0200, including the attachments to that Resolution, all of which are incorporated herein as part of this Resolution by this reference thereto; and

WHEREAS, On October 30, 2008, this Commission approved the Phased Water System Improvement Program by its Resolution No. 08-0200, and

WHEREAS, In order to facilitate a comprehensive approach to financing implementation of the Phased Water System Improvement Program through June 2010, staff prepared forecasts of anticipated expenditures, and recommend a request for supplemental appropriation as described in the staff report and related attachments presented for Commission consideration and action on this Resolution; and

WHEREAS, The requested supplemental appropriation funding will be placed on a Controller's Appropriation Reserve, so that, where required by law, expenditures will not be authorized until two conditions are satisfied: 1) the subsequent discretionary approval of the project by the Commission and Board, following review and consideration of project related environmental analysis, and adoption of Findings, pursuant to CEQA, the State CEQA Guidelines, and Chapter 31 of the San Francisco Administrative Code, and 2) the certification of funds availability, which may include proceeds of indebtedness (either commercial paper, short-term borrowing or long-term bonds); and

WHEREAS, in anticipation of the issuance of Water Bonds authorized under the City's Proposition A, approved by voters on November 5, 2002, the Commission and the Board of Supervisors previously authorized the issuance of not to exceed $250,000,000 of commercial paper notes or bank notes, and in order to provide funds for the WSIP, the Commission desires to increase such authorization and authorize the issuance of an additional not to exceed $250,000,000 of commercial paper notes or bank notes so that the Commission may have a total of $500,000,000 of commercial paper notes or bank notes outstanding at any one time for the Water Commercial Paper Program; and

WHEREAS, A supplemental appropriation in the amount of $1,923,629,194 is requested to fund the Phased Water System Improvement Program (WSIP), as approved by this Commission in its Resolution No. 08-0200, through June 30, 2010; and

WHEREAS, $1,551,454,144 is requested to fund the Regional Water Program projected expenditures and encumbrances; and

WHEREAS, $119,528,912 is requested to fund the Local Water Program projected expenditures and encumbrances; and

WHEREAS, $252,646,138 is requested to fund the program's financing costs for the period of January 2009 thru June 2010; now therefore be it

RESOLVED, That this Commission hereby adopts the CEQA Findings, including the Statement of Overriding Considerations, and the Mitigation Monitoring and Reporting Program (MMRP) previously adopted by the Commission by its Resolution No. 08-0200, including the attachments to that Resolution, all of which are incorporated herein as part of this Resolution by this reference thereto; and be it

FURTHER RESOLVED, That this Commission finds that the supplemental appropriation request is within the scope of the Program and activities evaluated in the Final PEIR, subject to the requirement that funding be placed on Controller's Appropriation Reserve, so that, where required by law, expenditures will not be authorized until two conditions are satisfied: 1) the subsequent discretionary approval of the project by the Commission and Board, following review and consideration of project related environmental analysis, and adoption of Findings, pursuant to CEQA, the State CEQA Guidelines, and Chapter 31 of the San Francisco Administrative Code, and 2) the certification of funds availability, which may include proceeds of indebtedness (commercial paper, short-term borrowing or long-term bonds); and be it

FURTHER RESOLVED, That this Commission authorizes the supplemental appropriation request based on the limitation that this Commission and the Board of Supervisors each reserve absolute discretion, following review and consideration of project related environmental analysis, if required, prepared pursuant to CEQA, the State CEQA Guidelines, and Chapter 31 of the San Francisco Administrative Code, to: (1) modify the Project to mitigate significant adverse environmental impacts, (2) select feasible alternatives that avoid significant adverse impacts of the Project, (3) require the implementation of specific measures to mitigate the significant adverse environmental impacts of the Project, as identified upon environmental evaluation in compliance with CEQA and San Francisco's Environmental Quality Regulations, (4) reject the Project as proposed if the economic and social benefits of the Project do not outweigh otherwise unavoidable significant adverse impacts of the Project, or (5) approve the Project upon a finding that the benefits of the Project outweigh otherwise unavoidable significant adverse impacts by adopting a Statement of Overriding Considerations; and, be it

FURTHER RESOLVED, That this Commission authorizes the issuance of an additional not to exceed $250,000,000 of commercial paper notes or bank notes so that together with the $250,000,000 of commercial paper notes or bank notes previously authorized by the Commission and the Board of Supervisors, the Commission may have a total of $500,000,000 of commercial paper notes or bank notes outstanding at any one time for the Water Commercial Paper Program and authorizes the SFPUC General Manager to cause the preparation of forms of such documents and agreements as necessary to effectuate the issuance of such commercial paper notes or bank notes, which forms shall be submitted for approval to this Commission prior to their execution; and, be it

FURTHER RESOLVED, That this Commission hereby authorizes the SFPUC General Manager to request the Mayor to recommend to the Board of Supervisor a supplemental appropriation in the amount of $1,923,629,194 to fund the Phased WSIP through June 30, 2010, subject to the Controller's Appropriation Reserve and the conditions set forth herein, for the purposes described in the staff report and attachments presented to the Commission for consideration and action on this Resolution.

I hereby certify that the foregoing resolution was adopted by the Public Utilities Commission at its meeting of October 30, 2008 ____________________________________

Michael Housh

Secretary, Public Utilities Commission

ATTACHMENT A

WATER SYSTEM IMPROVEMENT PROGRAM

CALIFORNIA ENVIRONMENTAL QUALITY ACT FINDINGS: FINDINGS OF FACT, EVALUATION OF MITIGATION MEASURES AND ALTERNATIVES, AND STATEMENT OF OVERRIDING CONSIDERATIONS

SAN FRANCISCO PUBLIC UTILITIES COMMISSION

In determining to approve the Phased Variant of the Water System Improvement Program (“Phased WSIP Variant” or the "Program"), the San Francisco Public Utilities Commission (“SFPUC”) makes and adopts the following findings of fact and decisions regarding mitigation measures and alternatives, and adopts the statement of overriding considerations, based on substantial evidence in the whole record of this proceeding and under the California Environmental Quality Act (“CEQA”), California Public Resources Code Sections 21000 et seq., particularly Sections 21081 and 21081.5, the Guidelines for Implementation of CEQA (“CEQA Guidelines”), 14 California Code of Regulations Sections 15000 et seq., particularly Sections 15091 through 15093, and Chapter 31 of the San Francisco Administration Code.

This document is organized as follows:

Section I provides a description of the Program proposed for adoption (the Phased WSIP Variant), the environmental review process for the Program, the approval actions to be taken and the location of records;

Section II identifies the impacts found not to be significant that do not require mitigation;

Section III identifies potentially significant impacts that can be avoided or reduced to less-than-significant levels through mitigation and describes the disposition of the mitigation measures;

Section IV identifies significant impacts that cannot be avoided or reduced to less-than significant levels and describes any applicable mitigation measures as well as the disposition of the mitigation measures;

Section V evaluates the different Program alternatives and the economic, legal, social, technological, and other considerations that support approval of the Phased WSIP Variant and the rejection of the alternatives, or elements thereof, analyzed; and

Section VI presents a statement of overriding considerations setting forth specific reasons in support of the Commission's actions and its rejection of the alternatives not incorporated into the Program.

The Mitigation Monitoring and Reporting Program (“MMRP”) for the mitigation measures that have been proposed for adoption is attached with these findings as **Attachment B**. The MMRP is required by CEQA Section 21081.6 and CEQA Guidelines Section 15091. Attachment B provides a table setting forth each mitigation measure listed in the Final Program Environmental Impact Report for the WSIP ("Final PEIR" or "PEIR") that is required to reduce or avoid a significant adverse impact. Attachment B also specifies the agency responsible for implementation of each measure and establishes monitoring actions and a monitoring schedule. The full text of the mitigation measures is set forth in Attachment B.

These findings are based upon substantial evidence in the entire record before the Commission. The references set forth in these findings to certain pages or sections of the Draft Program Environmental Impact Report ("Draft PEIR" or "DEIR") or the Comments and Responses document ("C&R") in the Final PEIR are for ease of reference and are not intended to provide an exhaustive list of the evidence relied upon for these findings.

I. APPROVAL OF THE PROGRAM

A. Program Description

By this action, the SFPUC adopts and implements substantially the Program identified as the Phased WSIP Variant in Chapter 13, Section 13.4 of the PEIR, to increase the reliability of the regional water system that serves 2.4 million people in San Francisco and the San Francisco Bay Area; the Phased WSIP Variant is a variation of the original WSIP described in Chapter 3 of the PEIR. The Phased WSIP Variant involves *full implementation of all proposed WSIP facility improvement projects* as described in Chapter 3 of the Draft EIR to insure that the public health, seismic safety and delivery reliability goals are achieved as soon as possible *and phased implementation of a water supply program to meet projected water purchases through 2030.* Under the Phased WSIP Variant, the SFPUC establishes an interim mid-term planning horizon – 2018. The Commission is making a decision about providing water supply to the water customers through 2018 only, and is deferring a decision regarding long-term water supply after 2018 and through 2030 until it undertakes further water supply planning and demand analysis. All non-water supply related goals and system performance objectives identified for the original WSIP would be achieved under the Phased WSIP Variant and all individual WSIP facility improvement projects proposed in the original WSIP would be constructed.

Under the Phased WSIP Variant, the SFPUC will construct and operate all the regional water system WSIP facility improvement projects while (1) limiting water sales to an average annual of 265 million gallons per day (mgd) from the watersheds through 2018; and (2) improving water supply reliability to meet the goals and objectives of the WSIP including no greater than 20 percent rationing systemwide in any one year of a drought. The Phased WSIP Variant would not provide water supply to meet 300 mgd average annual water sales in 2030 as proposed under the WSIP. Rather, the SFPUC would limit deliveries to no more than an annual average of 265 mgd from the watersheds through 2018, and the SFPUC and wholesale customers would collectively develop 20 mgd in conservation, recycled water, and groundwater to meet or offset the projected regional water system purchase request of 285 mgd in 2018. This 20 mgd of conservation, recycled water, and groundwater includes development of 10 mgd of conservation, recycled water and groundwater in San Francisco as proposed under the WSIP and 10 mgd of conservation, recycled water and groundwater developed by the wholesale customers, which is in addition to 15 mgd of conservation, recycled water and groundwater already assumed by the wholesale customers in preparing their regional water system purchase requests.

There is no change between the WSIP and the Phased WSIP Variant in the average annual water delivery proposed for the SFPUC's retail customers; the current average annual retail customer demand is approximately 91 mgd and this same amount would be provided to the retail customers through 2018, although 10 mgd of this amount would be provided through conservation, recycled water, and groundwater developed in San Francisco. While the WSIP proposed to provide the full 2030 projected wholesale customer average annual purchase requests of 209 mgd, the Phased WSIP Variant instead is designed to meet a projected 2018 wholesale customer average annual purchase request of 194 mgd in 2018, although 10 mgd of this amount would be provided through conservation, recycled water, and groundwater projects.

Under the Phased WSIP Variant, the SFPUC also would implement the delivery and drought reliability elements of the WSIP, including the Westside Basin Conjunctive Use Project and proposed dry-year transfers from the Modesto Irrigation District ("MID") and the Turlock Irrigation District ("TID"), which would increase average annual diversions from the Tuolumne River by about 2 mgd over existing conditions.

Before 2018, the SFPUC would engage in a new planning process to re-evaluate water system demands and water supply options. As part of the process, San Francisco would conduct additional environmental studies and CEQA review as appropriate to address the SFPUC's recommendation regarding water supply and proposed water system deliveries after 2018. This Commission would review and consider approval of the terms of any new master Water Sales Agreement that would take effect after 2018.

As originally proposed, the WSIP established program goals for improvements to the regional water system and system performance objectives in the areas of water quality, seismic reliability, delivery reliability, and water supply through the year 2030. The facility improvement projects and the proposed water supply option included in the WSIP as originally proposed were designed to: (1) ensure compliance with existing and anticipated future water quality standards under all operating conditions; (2) upgrade the seismic standards of critical facilities to improve seismic reliability and to reduce the system's vulnerability to earthquakes; (3) improve water delivery reliability under a variety of operating conditions by improving overall operations of the system; and (4) assure that the SFPUC has an adequate supply of water available to deliver to customers during both non-drought and drought periods through 2030.

The SFPUC initially proposed the draft WSIP in early 2005 as the result of long-term planning and in response to legislative mandates, including a 2002 voter-approved bond measure. The draft WSIP is described in PEIR Chapter 3. For budgeting and management purposes, the SFPUC categorized as part of the WSIP all capital improvements and projects that will receive financing from the 2002 voter-approved bond measure. Some, but not all, of the activities and projects that the SFPUC has identified for financing purposes as part of the WSIP are analyzed in the Program EIR as explained in PEIR Section 3.4. (CEQA Guidelines section 15168.) Other proposed WSIP activities that are not evaluated in the PEIR are undergoing independent project-level CEQA review as explained in EIR Section 3.4.6. For purposes of these CEQA findings, the facility projects included under the "Program," "WSIP," or "Variant" refer only to the facility improvement projects included in the PEIR. WSIP facility improvement projects included in the PEIR will also undergo independent project-level CEQA review.

In March 2008, the SFPUC determined that it would like the option to consider approval and implementation of a variation of the WSIP. The program variation is called the Phased WSIP Variant and is a hybrid combination of the WSIP program as originally proposed and the No Purchase Request Increase Alternative analyzed in the Draft EIR at pages 9-7 through 9-16, 9-40 through 9-47 and 9-84 through 9-96, as well as the Modified WSIP Alternative analyzed in the Draft PEIR at pages 9-7 through 9-16 and 9-78 through 9-96 and in the C&R pages 14.10-1 through 14.10-26. The Phased WSIP Variant also includes some elements of the Aggressive Conservation and Recycling Alternative analyzed in the Draft EIR at pages 9-7 through 9-16, 9-47 through 9-59, and 9-84 through 9-96.

The Phased WSIP Variant includes the following key program elements:

- Full implementation of all of the 17 proposed WSIP facility improvement projects described in the PEIR (Draft EIR Sections 3.4.6 and 3.8; C&R Chapter 16, pages 16-14 to 16-17).
- Water supply delivery to regional water system customers through 2018 only of 265 mgd average annual target delivery originating from the Tuolumne, Alameda and Peninsula watersheds. This includes 184 mgd for the wholesale customers (including 9 mgd for the cities of San Jose and Santa Clara), and 81 mgd for the retail customers.
- Development of 20 mgd of conservation, recycled water and groundwater within the service area (10 mgd retail; 10 mgd wholesale).
- Dry year transfer from MID and/or TID of about 2 mgd coupled with the Westside Groundwater Basin conjunctive-use project to meet the drought year goal of limiting rationing to no more than 20 percent on a systemwide basis.
- Re-evaluation of 2030 demand projections, potential regional water system purchase requests, and water supply options by 2018 and a separate SFPUC decision in 2018 regarding regional water system water deliveries after 2018.
- Financial incentives to limit water sales to an annual average of 265 mgd from the watersheds.

The SFPUC will deliver to customers up to 265 mgd from the SFPUC watersheds on an average annual basis. While average annual deliveries from the SFPUC watersheds would be limited to 265 mgd such that there would be no increase in diversions from the Tuolumne River to serve additional demand, there would be a small increase in average annual Tuolumne River diversions of about 2 mgd over existing conditions in order to meet the delivery and drought reliability elements through 2018. As part of adoption of this Program, the SFPUC will implement the mitigation measures identified for the Phased WSIP Variant in the Final PEIR, including measures addressing interim impacts from potential increases in deliveries from the SFPUC watersheds over the total average annual of 265 mgd in the event that conservation, recycled water and groundwater projects are not completed prior to the increase in customers' demand.

The SFPUC must maintain water deliveries to all its customers for the protection of public health and safety. Therefore, the SFPUC will work with its customers to develop financial incentives to limit water sales to an average annual amount of 265 mgd from the watersheds through 2018.

With the projected 20 mgd of conservation, recycled water and groundwater projects, the system would meet average daily demand of 285 mgd in 2018.

Summaries of the WSIP facility improvement projects and the WSIP water supply under the Phased WSIP Variant are provided in the SFPUC staff memorandum dated September 30, 2008, and summaries of the WSIP facility improvement projects are set forth in PEIR Chapter 3, pages 3-48 through 3-73 and Appendix C, and are listed below. The projects are analyzed in the PEIR, Chapter 4. This approval action slightly modified the staff recommendation as set forth in the Resolution.

Phased WSIP Variant Facility Improvement Projects

The size and design of the WSIP facility improvement projects are driven by the system performance objectives and would not change as a result of the water supply decision proposed in the Phased WSIP Variant. The SFPUC prepared a memorandum describing the factors affecting facilities capacity, dated July 29, 2008, and the information from that memorandum is incorporated by reference here. The draft WSIP included multiple program goals for improving seismic reliability and water delivery reliability, meeting current and future water quality regulations, and meeting water supply reliability goals through the year 2030. Design and capacity of the WSIP facility improvement projects is driven by all four of the WSIP objectives -- the need to improve system performance for seismic reliability and water delivery reliability as well as maintaining high water quality standards and meeting water supply goals. All four of these objectives are factored into the decision on how to size the WSIP's individual facilities. As is explained in the SFPUC memorandum, even if the goal of meeting projected increases in water supply demands were dropped from the mix of program objectives, the other program goals would cause the SFPUC to design WSIP facility improvement projects of the same size. The sizing of the facilities is necessary to reliably deliver an average annual amount up to 300 mgd in light of the regional system's needs for seismic and delivery reliability during both drought and non-drought periods, and to meet water quality requirements.

The Phased WSIP Variant includes the following facility improvement projects:

San Joaquin Region
SJ-1, Advanced Disinfection
SJ-2, Lawrence Livermore Supply Improvements
SJ-3, San Joaquin Pipeline System
SJ-5, Tesla Portal Disinfection Station

Sunol Valley Region
SV-1, Alameda Creek Fishery Enhancement
SV-2, Calaveras Dam Replacement
SV-3, Additional 40-mgd Treated Water Supply
SV-4, New Irvington Tunnel
SV-5, SVWTP – Treated Water Reservoirs
SV-6, San Antonio Back-Up Pipeline

Bay Division Region
BD-1, Bay Division Pipeline Reliability Upgrade

Peninsula Region
PN-2, Crystal Springs/San Andreas Transmission Upgrade
PN-3, HTWTP Long-Term Improvements
PN-4, Lower Crystal Springs Dam Improvement:

San Francisco Region
SF-1, San Andreas Pipeline No. 3 Installation
SF-2, Groundwater Projects
SF-3, Recycled Water Projects

B. Program Objectives

The SFPUC developed the WSIP to address several problems and issues that it had identified with its regional water system. In developing the WSIP goals and objectives, the SFPUC incorporated two fundamental principles pertaining to the existing regional system: (1) maintaining a clean, unfiltered water source from the Hetch Hetchy system, and (2) maintaining a gravity-driven system.

Among the considerations leading to identification of the WSIP were the following:

- *Aging Infrastructure.* The SFPUC regional water system is old. Many of its components were built in the 1800s and early 1900s; parts of the regional water system were built using now-outdated construction materials and/or methods and are currently in need of major repair. As the system ages, its reliability decreases and the risk of failure increases.

- *Exposure to Seismic and Other Hazards.* The 167-mile-long system crosses five active earthquake faults. Many of the SFPUC regional water system components are located on or in the immediate vicinity of major earthquake faults. Due to the age of the system, many facilities do not meet modern seismic standards. To protect public safety, the California Department of Water Resources, Division of Safety of Dams has imposed operating restrictions on Calaveras and Crystal Springs Reservoirs, reducing the local storage capacity and impairing normal system operations; this storage capacity needs to be restored.

- *Maintain Water Quality.* The regional water system currently meets or exceeds existing water quality standards. However, system upgrades are needed to improve the SFPUC's ability to continue to maintain compliance with current water quality standards and to meet anticipated future water quality standards under a range of operating conditions, including such events as a major earthquake, without reducing system reliability.

- *Improve Asset Management and Delivery Reliability.* In order to implement a feasible asset management program in the future that will provide continuous maintenance and repairs to facilities, the regional water system requires redundancy (i.e., backup) of some critical facilities necessary to meeting day-to-day customer water supply needs. Without adequate redundancy of critical facilities, the SFPUC has limited operational flexibility in the event of an emergency or a system failure, as well as constraints on conducting adequate system inspection and maintenance.

• *Meet Customer Water Demands.* Additional supplies are needed to satisfy current demand in drought years and projected 2030 demand in all years. The experience of the last 150 years of record as well as recent studies on California's climate show the region is susceptible to droughts. Two of the most severe droughts occurred during the past 30 years. The regional water system currently has insufficient water supply to meet customer demand during a prolonged drought, and this situation will worsen in the future.

To address these challenges to the reliability of the regional water system, the SFPUC must replace or upgrade numerous components of the system and add some new components—thus the need for the WSIP and its associated facility improvement projects.

Goals and objectives were established for the WSIP described and analyzed in the PEIR. Because of the decision to phase implementation of a water supply program to meet projected water purchases through 2030, the water supply objective for the Phased WSIP Variant is slightly different from the water supply objective originally proposed, as revised below. The goals and objectives of the Phased WSIP Variant are presented below.

Phased WSIP GOALS AND OBJECTIVES

Program Goal	System Performance Objective
Water Quality – *maintain high water quality*	• Design improvements to meet current and foreseeable future federal and state water quality requirements. • Provide clean, unfiltered water originating from Hetch Hetchy Reservoir and filtered water from local watersheds. • Continue to implement watershed protection measures.
Seismic Reliability – *reduce vulnerability to earthquakes*	• Design improvements to meet current seismic standards. • Deliver basic service to the three regions in the service area (East/ South Bay, Peninsula, and San Francisco) within 24 hours after a major earthquake. Basic service is defined as average winter-month usage, and the performance objective for design of the regional system is 229 mgd. The performance objective is to provide delivery to at least 70 percent of the turnouts in each region, with 104, 44, and 81 mgd delivered to the East/South Bay, Peninsula, and San Francisco, respectively. • Restore facilities to meet average-day demand of up to 300 mgd within 30 days after a major earthquake.

Program Goal	System Performance Objective
Delivery Reliability – *increase delivery reliability and improve ability to maintain the system*	• Provide operational flexibility to allow planned maintenance shutdown of individual facilities without interrupting customer service. • Provide operational flexibility to minimize the risk of service interruption due to unplanned facility upsets or outages. • Provide operational flexibility and system capacity to replenish local reservoirs as needed. • Meet the estimated average annual demand of up to 300 mgd under the conditions of one planned shutdown of a major facility for maintenance concurrent with one unplanned facility outage due to a natural disaster, emergency, or facility failure/upset.
Water Supply – *meet customer water needs in non-drought and drought periods*	• Meet average annual water demand of 265 mgd from the SFPUC watersheds for retail and wholesale customers during non -drought years for system demands through 2018. • Meet dry-year delivery needs through 2018 while limiting rationing to a maximum 20 percent system-wide reduction in water service during extended droughts. • Diversify water supply options during non-drought and drought periods. • Improve use of new water sources and drought management, including groundwater, recycled water, conservation, and transfers.
Sustainability – *enhance sustainability in all system activities*	• Manage natural resources and physical systems to protect watershed ecosystems. • Meet, at a minimum, all current and anticipated legal requirements for protection of fish and wildlife habitat. • Manage natural resources and physical systems to protect public health and safety.
Cost-effectiveness – *achieve a cost-effective, fully operational system*	• Ensure cost-effective use of funds. • Maintain gravity-driven system. • Implement regular inspection and maintenance program for all facilities.

C. Environmental Review

In accordance with Sections 15063 and 15082 of the CEQA Guidelines, the San Francisco Planning Department, as lead agency, prepared a Notice of Preparation (NOP) of an EIR and conducted scoping meetings (see Draft PEIR, Appendix A). The NOP was circulated to local, state, and federal agencies and to other interested parties on September 6, 2005, initiating a public comment period that extended through October 24, 2005.

As indicated in the NOP, the Program EIR addresses the full range of environmental impacts of the WSIP. The NOP included a preliminary list of the potential environmental impacts related to the following resource topics: surface water resources; groundwater resources; fisheries and aquatic resources; terrestrial vegetation and wildlife; geology, soils, and seismicity; cultural resources; land use, plans, and policies; recreation; agricultural resources; traffic, transportation, and circulation; air quality; noise and vibration; public services, utilities, and energy; hazards and public safety; visual quality; socioeconomics; growth-inducement potential and secondary effects of growth; and cumulative effects. The NOP provided a general description of the proposed action, the need for the program and program benefits, the proposed facilities, and the program location.

Pursuant to CEQA Guidelines Section 15083, the San Francisco Planning Department held five public scoping meetings, one each in Sonora, Modesto, Fremont, Palo Alto and San Francisco, between October 5, 2005 and October 19, 2005. The purpose of the meetings was to present the proposed WSIP to the public and receive public input regarding the proposed scope of the Program EIR analysis. Attendees were provided an opportunity to voice comments or concerns regarding potential effects of the WSIP.

A scoping report was prepared to summarize the public scoping process and the comments received in response to the NOP, and the main body of the report is included in Appendix A of the Draft Program EIR. Based on sign-in sheets at each of the meetings, 260 participants attended the scoping meetings, with 75 of those participants providing oral comments. Transcripts of each scoping meeting are included in the full scoping report on file with the San Francisco Planning Department.

The San Francisco Planning Department also held a scoping meeting for resource agencies on Thursday, November 3, 2005 in San Francisco. Representatives from the following agencies attended: U.S. Army Corps of Engineers, San Francisco Bay Regional Water Quality Control Board, California Department of Fish and Game, and U.S. Fish and Wildlife Service. Representatives of the U.S. Environmental Protection Agency and the National Marine Fisheries Service were invited but unable to attend. Additional coordination with public agencies through informal consultation and telephone interviews was conducted throughout the EIR process.

In addition to comments received during scoping meetings, comments on the NOP were received by letter sent via mail, email, or fax (104, including 5 form letters counted once each but submitted multiple times), orally by speakers at the scoping meetings (79), and by phone (187 voicemail messages left with the San Francisco Planning Department). The comments addressed concerns regarding the full range of potential environmental issues as well as program alternatives and the CEQA process.

The San Francisco Planning Department then prepared the Draft Program EIR, which describes the WSIP and the environmental setting for the proposed program, identifies potential impacts, presents mitigation measures for impacts found to be significant or potentially significant, and evaluates program alternatives. It also includes an analysis of three variants to the proposed WSIP, as requested by the SFPUC. The analysis of environmental impacts is divided into three main groups: (1) construction and operational impact of the WSIP facility improvement projects; (2) water supply and system operational impacts of the WSIP; and (3) growth-inducing impacts. In assessing construction and operational impacts of the facility improvement projects, the Program EIR considers impacts of individual projects, the “collective” construction and operational impacts from multiple WSIP facility improvement projects, and cumulative impacts associated with construction and operation of WSIP projects in combination with other past, present, and future actions with potential for similar impacts on the same resources as those affected by the WSIP. Similarly, in assessing water supply and system operations impacts, the Program EIR includes analysis of cumulative impacts associated with the WSIP water supply and system operations in combination with other past, present, and future actions with potential for impacts on the same resources as those affected by the WSIP.

Each environmental issue presented in this Draft PEIR is analyzed with respect to significance criteria that are based on the San Francisco Planning Department Major Environmental Analysis Division (MEA) guidance regarding the environmental effects to be considered significant. MEA guidance is, in turn, based on CEQA Guidelines Appendix G with some modifications. In cases where potential environmental issues associated with the WSIP are identified but are not clearly addressed by MEA's standard Initial Study checklist, additional impact significance criteria are presented. (Draft EIR, Appendix B.)

The Draft EIR was circulated to local, state, and federal agencies and to interested organizations and individuals for review and comment on June 29, 2007 for a 90-day public review period, which was extended once and closed on October 15, 2007, for a total of 108 days. Six public hearings on the Draft PEIR to accept written or oral comments were held in Sonora, Modesto, Fremont, Palo Alto, and San Francisco (two hearings) between September 5, 2007 and October 11, 2007. During the public review period, the San Francisco Planning Department received approximately 1,500 written comments sent through the mail or by hand-delivery, fax, or email as well as approximately 200 oral comments made at six public hearings. A court reporter was present at each of the public hearings, transcribed the oral comments verbatim, and prepared written transcripts. Appendix J of the PEIR includes a summary of the Draft PEIR notification and public hearing process.

The Comments and Responses ("C&R") document was published on September 30, 2008 and it provides copies of all of the comments received on the Draft PEIR as well as individual responses to those comments. In some cases, the responses to individual comments are presented as master responses, which consist of comprehensive discussions of issues that received numerous comments. In addition, the C&R includes descriptions of changes in the WSIP that were proposed by the SFPUC after publication of the Draft PEIR, and it includes a description and analysis of the Phased WSIP Variant.

The C&R provided additional, updated information and clarification on issues raised by commenters, as well as consultant, SFPUC and Planning Department experts. The Final PEIR incorporates information obtained and produced after the Draft PEIR was completed, and contains additions, clarifications, and modifications, including a description and analysis of the Phased WSIP Variant. The Planning Commission reviewed and considered the Final PEIR and all of the supporting information. The Final PEIR provided augmented and updated information on many issues presented in the Draft PEIR, including (but not limited to) the following topics: revisions to the Hetch Hetchy/Local Simulation Model; additional analysis of the Tuolumne River impacts; changes and clarifications on the Pilarcitos Watershed analysis and impact conclusions; an analysis of the Alameda Creek Fisheries issues, including future potentially occurring steelhead in the Alameda Creek watershed; updated information on the San Joaquin River and the San Francisco Bay Delta; an update to the information provided on climate change issues; and WSIP facility improvement projects updates. In certifying the Final PEIR, the Planning Commission found that the Final PEIR does not add significant new information to the Draft EIR that would require recirculation of the PEIR under CEQA because the Final PEIR contains no information revealing (1) any new significant environmental impact that would result from the Phased WSIP Variant or from a new mitigation measure proposed to be implemented, (2) any substantial increase in the severity of a previously identified environmental impact, (3) any feasible project alternative or mitigation measure considerably different from others previously analyzed that would clearly lessen the environmental impacts of the Phased WSIP Variant, but that was rejected by the project's proponents, or (4) that the Draft EIR was so fundamentally and basically inadequate and conclusory in nature that meaningful public review and comment were precluded. This Commission concurs in that determination.

D. Environmental Analysis of the Phased WSIP Variant

The Final PEIR included a description and analysis of the Phased WSIP Variant, as discussed in the C&R, Chapter 13, Section 13.4. The C&R analysis concluded that the potential environmental effects of the Phased WSIP Variant fall within the range of impacts already evaluated in the Draft PEIR for the WSIP and the alternatives. This Variant is similar to the No Purchase Request Increase Alternative analyzed in the Draft EIR. Also relevant are the analyses of the No Program Alternative, the Aggressive Conservation/Water Recycling and Local Groundwater Alternative, and the Modified WSIP Alternative.

The Phased WSIP Variant would have the same impacts associated with proposed facility construction and operation as the WSIP. The 17 facility improvement projects proposed under the WSIP and analyzed in the Program EIR would also be implemented under the Phased WSIP Variant to meet the intent of the water quality, seismic reliability, delivery reliability, and water supply goals of the WSIP.

The Phased WSIP Variant would have impacts associated with its proposed water supply program similar to those described in the Draft PEIR for the alternatives where the wholesale customer purchase requests for 2030 would not be provided by the regional water system. Under those alternatives, the Draft PEIR assumed that the wholesale customers might pursue other types of projects to either reduce demand and/or to supplement the surface water supplies delivered by the regional water system from the SFPUC watersheds. The potential facility and operations impacts associated with such projects are discussed in the Draft EIR in Section 9.2.2, No Program Alternative (Vol. 4, Chapter 9, pp. 9-34 to 9-37), Section 9.2.3, No Purchase Request Increase Alternative (Vol. 4, Chapter 9, pp. 9-40 to 9-45), and Section 9.2.4, Aggressive Conservation/Water Recycling and Local Groundwater Alternative (Vol. 4, Chapter 9, pp. 9-55 to 9-57).

Similar to the Modified WSIP Alternative and the Aggressive Conservation/Water Recycling and Local Groundwater Alternative, the Phased WSIP Variant, which envisions developing additional local conservation, recycled water and groundwater projects, could result in construction and operation of additional recycled water and groundwater facilities in the wholesale customer service areas; thus, collective impacts in the Bay Division and Peninsula Regions and associated cumulative effects would occur. The types of impacts associated with implementation of the local recycled water and groundwater projects are summarized in Table

13.9 (which is the same as Draft EIR Table 9.12) in C&R Section 13.4 (C&R, page 13-34) and generally relate to construction of new infrastructure, water quality, and groundwater resources, and operational uses of energy and long-term air quality emissions.

In the event local conservation, recycled water or groundwater projects are not sufficient or cannot be developed in time to meet the demands of each of the wholesale customers, SFPUC customers could be expected to pursue alternative water supply sources. The types of impacts associated with water supply acquisition projects are summarized in Table 13.8 (which is the same as Draft EIR Table 9.10) in C&R Section 13.4 (C&R, pages 13-31 to 13-32). Depending on the facilities needed to convey the supplemental supplies to the wholesale customer service areas, the construction and operation of such facilities could result in a full range of construction and operational impacts similar to those described in Draft EIR Chapter 4 for the WSIP facility improvement projects in the South Bay and Peninsula areas (such as traffic, air quality, noise, energy use, waste disposal, and vibration). In general, certain types of impacts are common to water supply transfers/acquisition and include: the cessation of water application to lands irrigated by the water being transferred; changes related to flows, fisheries, and water quality; and impacts caused by the use of existing or the construction of new infrastructure. If water is transferred from agricultural customers, without implementation of agricultural conservation measures, the transfer can result in the conversion of agricultural land to nonagricultural land. Beneficial environmental effects (related to retiring drainage-impaired lands, reducing the application of pesticides, etc.) can also occur. The need for new facilities and/or changes in the operations of existing facilities depend on the source of supply (e.g., the Tuolumne River through transfers with TID and MID, water-rights holders north of the Delta, in the Delta, or south of the Delta), the quantity of supply, the means of conveyance, and any additional storage requirements. Construction or expansion of interties or connecting pipelines could be required, potentially resulting in impacts similar to those described for the WSIP pipeline projects.

If desalination technologies were used to supplement potable water supplies, implementation of a desalination project to augment wholesale customer water supplies would result in the full range of construction impacts at the proposed facility location (such as traffic, air quality, noise, and vibration) as well as operational impacts related to aquatic resources, water quality, energy consumption, air quality, visual resources, land use and planning, traffic, and greenhouse gas emissions. The programmatic impacts of construction and operation of a desalination facility are described in the Draft EIR under WSIP Variant 2, Regional Desalination for Drought (Draft EIR, Chapter 8, pp. 8-24 to 8-32).

The water supply impacts of the Phased WSIP Variant would be similar to those analyzed in Chapter 9 of the Draft PEIR for the No Purchase Request Increase Alternative, and overall the impacts of the Phased WSIP Variant through 2018 would be less than the water supply impacts of the WSIP set out in Chapter 5 of the PEIR. With a few exceptions, the water supply impacts identified as potentially significant and mitigable for the proposed WSIP remain potentially significant and mitigable for the Phased WSIP Variant. Two impacts on the lower Tuolumne River were determined to be less than significant as long as the SFPUC does not increase deliveries to customers above 265 mgd from the watersheds: Impact 5.3.6-4, effects on fishery resources along the Tuolumne River below La Grange Dam; and, Impact 5.3.7-6, impacts on terrestrial biological resources along the Tuolumne River below La Grange Dam. Although the

Phased WSIP Variant is designed to keep deliveries from exceeding an annual average level of about 265 mgd, in the event the SFPUC must deliver more than 265 mgd to its customers from the watersheds, the SFPUC shall implement the mitigation measures associated with these impacts in proportion to the extent of the exceedance. In implementing the Phased WSIP Variant, the need could arise to temporarily increase deliveries from the Tuolumne River and local watersheds over the 265 mgd average annual target levels to meet customer water delivery needs in the near term, because of public health and safety considerations and because it might not be possible to implement all of the local conservation, recycling and groundwater projects and actions in time to meet increasing customer demands. Although avoidance of these impacts on the lower Tuolumne River is not assured, the magnitude, frequency, and duration of the impacts are likely to be less than the originally proposed WSIP. The impact analysis for the Phased WSIP Variant recognized that, between now and 2018, deliveries from the Tuolumne River and local watersheds might increase above the 265 mgd average annual level (to a possible 275 mgd average annual) for up to a few years. By 2018, and perhaps well before, it is expected that local projects would provide sufficient local supply and conservation to bring SFPUC watershed deliveries back down to current levels, average annual 265 mgd.

Under the Phased WSIP Variant, the SFPUC would monitor sales to ensure that sales delivered from the SFPUC watersheds are limited to an average annual of 265 mgd through 2018. The SFPUC would measure and review average annual sales at the close of each fiscal year. Mitigation Measures 5.3.6-4a or 5.3.6-4b, as well as Mitigation Measure 5.3.7-6, will be implemented when the average annual sales exceed 265 mgd from the watersheds. The SFPUC would continue to implement the necessary measure(s) until the average annual SFPUC watershed deliveries are 265 mgd or less. Similar to the WSIP, implementation of Measure 5.3.6-4a is the preferred mitigation approach, and for the Phased WSIP Variant, the amount of conserved water required to reduce the impact to less than significant would be proportional to the amount of increased diversions from the Tuolumne River contributing to exceeding the 265 mgd deliveries restriction.

Four impacts in the Pilarcitos watershed were determined to be potentially significant and mitigable for the originally proposed WSIP, but are considered less than significant for the Phased WSIP Variant through 2018: Surface Water Quality Impact 5.5.3-2, effects on water quality in Pilarcitos Creek between Pilarcitos Reservoir and Stone Dam; Fisheries Impacts 5.5.5-4, effects on fishery resources in Pilarcitos Reservoir, and 5.5.5-5, effects on fishery resources along Pilarcitos Creek below Pilarcitos Reservoir and below Stone Dam; and, Terrestrial Biology Impact 5.5.6-4, impacts on biological resources in Pilarcitos Reservoir. With the Phased WSIP Variant, operations for Pilarcitos Reservoir and releases to Pilarcitos Creek will be similar to existing conditions resulting in a less than significant impact. Thus no mitigation is required. (DEIR pages 5.5.3-5 through 5.5.3-7; C&R pages 13-39 and 13-44; DEIR page 5.5.5-7; C&R pages 13-39 and 13-44; DEIR pages 5.5.6-17 through 5.5.6-22; C&R pages 13-39, 13-44 and 16-80 to 16-82.)

E. Changes to Facility Improvement Projects in the Alameda Creek Watershed

Since publication of the Draft PEIR in June 2007, SFPUC staff proposed modifications to the project descriptions of two of the facility improvement projects—the Alameda Creek Fishery

Enhancement (SV-1) and Calaveras Dam Replacement (SV-2) projects—and these proposed changes would affect overall system operations.[1] These modifications were made due to the numerous comments received on the potential impacts on future steelhead fishery resources in the Alameda Creek watershed as well as to actions taken in July 2007 by other agencies in the watershed. The SFPUC has incorporated project revisions and protective measures into these two projects to reduce the WSIP's potential to affect habitat conditions for potential future-occurring steelhead in the upper watershed. The project revisions would occur regardless of steelhead presence or absence in the upper watershed, while the protective measures are designed to reduce the WSIP's potential to affect habitat conditions for potential, future-occurring steelhead in the Alameda Creek watershed in the event that man-made barriers in Alameda Creek are removed and steelhead gain access to the upper watershed. The following project revisions have been incorporated into the Alameda Creek Fishery Enhancement (SV-1) and Calaveras Dam Replacement (SV-2) projects:

- The Calaveras Dam Replacement project would include facility modifications at the Alameda Creek Diversion Dam (ACDD) to construct a new bypass structure needed to implement bypass stream flows.

- If a structural alternative involving construction of a recapture facility is selected under the Alameda Creek Fishery Enhancement project, the recapture facility would be located at the downstream end of the reach of Alameda Creek between the lower Sunol Valley and the confluence with Arroyo de la Laguna. As an alternative to the recapture facility, the SFPUC may coordinate with other water agencies to develop and implement other means of recapturing fishery enhancement flows consistent with the 1997 California Department of Fish and Game Memorandum of Understanding (CDFG MOU).[2]

The project components designed to provide protective measures for future-occurring steelhead in the upper Alameda Creek watershed will include the following:

- An operational plan to provide minimum stream flows to support steelhead spawning below the ACDD to the confluence with Calaveras Creek when precipitation naturally generates runoff and flow in the creek, including the site-specific studies needed to determine the specific minimum stream flow requirements to support steelhead spawning in this reach of the creek.

- A detailed monitoring plan to survey and document steelhead spawning, subject to review and comment by the appropriate resource agencies.

- Interim minimum flows would be implemented consistent with the 1997 CDFG MOU, with the additional requirement that these flows would be achieved through bypass flows

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[1] See Memorandum from Michael Carlin to the Planning Department dated July 16, 2008.

[2] Under the 1997 CDFG MOU, the SFPUC and CDFG reached agreement on the magnitude and timing of flows to be released from Calaveras Reservoir for the purposes of improving fishery habitat conditions. The MOU includes provisions for the SFPUC to divert flows from Alameda Creek to the SFPUC regional system at a suitable downstream location equivalent to the magnitude and timing of these releases; the MOU refers to this as "recapture."

at the ACDD at all times when flows are available in upper Alameda Creek, rather than through releases at Calaveras Dam, and with the following conditions:

- ☐ The SFPUC would provide seasonal flow bypasses at the ACDD and/or flow releases from Calaveras Dam, either (1) without recapture or (2) with recapture at a point approximately at the downstream end of the reach of Alameda Creek between the lower Sunol Valley and the confluence with Arroyo de la Laguna, below critical riffle locations or lower in the creek, between December 1 and June 30 (combined adult and juvenile migration period) in an amount equivalent to the flow release schedule provided in the 1997 CDFG MOU.

- ☐ As an alternative to the recapture facility, the SFPUC would coordinate with other water agencies to develop and implement other means of recapturing enhancement flows consistent with the 1997 CDFG MOU at a location downstream of the reach of Alameda Creek between the lower Sunol Valley and the confluence with Arroyo de la Laguna.

The C&R also proposed a minor revision to an existing mitigation measure (Mitigation Measure 5.4.5-3a, Minimum Flows for Resident Trout on Alameda Creek) to address other native stream species, including steelhead. The mitigation measures are set forth in the MMRP attached to these Findings as Attachment B. The project description modifications would generally reduce the impacts identified in the Draft PEIR, and, in some cases, would reduce impacts from potentially significant to less than significant (i.e., Impacts 5.4.7-1 and 5.4.7-2). Implementation of the project revisions and protective measures, along with the mitigation measures designed to reduce impacts on resident trout, would be effective in assuring that if in the future steelhead successfully migrate above the BART weir, that the Phased WSIP Variant will not result in a significant adverse effect on steelhead life stages and habitat in Alameda Creek.

F. Approval Actions

1. Planning Commission Actions

On October 30, 2008, the Planning Commission certified the Final PEIR.

2. Public Utilities Commission Actions

The San Francisco Public Utilities Commission is taking the following actions and approvals to implement the Program.

- Adopt these CEQA findings and the attached Mitigation Monitoring and Reporting Program.
- Approve the Water System Improvement Program, the Phased WSIP Variant, as described herein.
- Endorse the selected Water Supply Elements of a new Water Sales Agreement ("Elements") and authorize the General Manager to negotiate such Agreement with the wholesale customers in substantial conformance with the water supply principles.

3. San Francisco Board of Supervisors Actions

- The Planning Commission's certification of the EIR may be appealed to the Board of Supervisors. If appealed, the Board of Supervisors will determine whether to uphold the certification or to remand the EIR to the Planning Department for further review.

- The San Francisco Board of Supervisors approves an allocation of bond monies to pay for mitigation measures necessary to implement the Program.

4. Other -- Federal, State, and Local Agencies

Implementation of the water supply mitigation measures will involve consultation with/required approvals by other local, state and federal regulatory agencies, including:

- Modesto Irrigation District
- Turlock Irrigation District
- California Water Resources Control Board
- California Department of Fish and Game
- California Department of Health Services (for approval and permits required for drinking water source assessments for groundwater wells)
- U.S. Army Corps of Engineers
- U.S. Fish and Wildlife Service
- NOAA Fisheries- National Marine Fisheries Service
- U.S. Department of the Interior, National Park Service, Yosemite National Park (for consultation on and sharing data from ongoing studies in the Poopenaut Valley)

To the extent that the identified mitigation measures require consultation or approval by these other agencies, this Commission urges these agencies to assist in implementing, coordinating or approving the mitigation measures, as appropriate to the particular measure.

There will be further project approvals following project-specific environmental review, for each of the individual WSIP projects. The actions described herein contemplate only the approval and implementation of the Program as a whole and not each and every project-specific approval.

G. Content and Location of Record

The record upon which all findings and determinations related to the Program are based includes the following:

- The draft Water System Improvement Program and the Phased WSIP Variant.

- The PEIR, and all documents referenced in or relied upon by the PEIR. (The references in these findings to the Program EIR or the PEIR include both the Draft EIR and the C&R documents.)

- All information (including written evidence and testimony) provided by City staff to the SFPUC and the Planning Commission relating to the PEIR, the WSIP, the proposed Program, and the alternatives set forth in the PEIR.

- All information (including written evidence and testimony) presented to the SFPUC and the Planning Commission by the environmental consultant and sub-consultants who prepared the PEIR, or incorporated into reports presented to the SFPUC.

- All information (including written evidence and testimony) presented to the City from other public agencies relating to the WSIP, the Program or the PEIR.

- All information (including written evidence and testimony) presented at any public hearing or workshop related to the WSIP, the Program and the PEIR.

- For documentary and information purposes, all locally-adopted land use plans and ordinances, including, without limitation, general plans, specific plans and ordinances, together with environmental review documents, findings, mitigation monitoring programs and other documentation relevant to planned growth in the area.

- The Mitigation Monitoring and Reporting Program.

- All other documents available to the SFPUC and the public, comprising the administrative record pursuant to Public Resources Code Section 21167.6(e).

The Public Utilities Commission has relied on all of the documents listed above in reaching its decision on the Program, even if not every document was formally presented to the Commission. Without exception, any documents set forth above not so presented fall into one of two categories. Many of them reflect prior planning or legislative decisions with which the Commission was aware in approving the Program. Other documents influenced the expert advice provided to Planning Department and PUC staff or consultants, who then provided advice to the Commission. For that reason, such documents form part of the underlying factual basis for the Commission's decisions relating to the adoption of the Program.

The public hearing transcript, a copy of all letters regarding the Draft EIR received during the public review period, the administrative record, and background documentation for the Final PEIR, as well as additional materials concerning approval of the Phased WSIP Variant and adoption of these findings are contained in SFPUC files, located at the SFPUC, 1155 Market Street, San Francisco. **Kelley Capone** is the custodian of records for the SFPUC. CEQA files are also available at the San Francisco Planning Department, 1650 Mission Street, San Francisco. **Linda Avery** is the Custodian of Records for the Planning Department. All files have been available to the SFPUC and the public for review in considering these findings and whether to approve the Program.

H. Findings About Significant Environmental Impacts And Mitigation Measures

The following Sections II, III and IV set forth the SFPUC's findings about the Final PEIR's determinations regarding significant environmental impacts and the mitigation measures proposed to address them. These findings provide the written analysis and conclusions of the SFPUC regarding the environmental impacts of the Phased WSIP Variant and the mitigation measures included as part of the Final PEIR and adopted by the SFPUC as part of the Phased WSIP Variant. To avoid duplication and redundancy, and because the SFPUC agrees with, and hereby adopts, the conclusions in the Final PEIR, these findings will not repeat the analysis and conclusions in the Final PEIR, but instead incorporates them by reference herein and relies upon them as substantial evidence supporting these findings.

In making these findings, the SFPUC has considered the opinions of SFPUC staff and experts, other agencies and members of the public. The SFPUC finds that the determination of significance thresholds is a judgment decision within the discretion of the City and County of San Francisco; the significance thresholds used in the PEIR are supported by substantial evidence in the record, including the expert opinion of the PEIR preparers and City staff; and the significance thresholds used in the PEIR provide reasonable and appropriate means of assessing the significance of the adverse environmental effects of the Program. Thus, although, as a legal matter, the SFPUC is not bound by the significance determinations in the PEIR (see Pub. Resources Code, § 21082.2, subd. (e)), the SFPUC finds them persuasive and hereby adopts them as its own.

These findings do not attempt to describe the full analysis of each environmental impact contained in the Final PEIR. Instead, a full explanation of these environmental findings and conclusions can be found in the Final PEIR and these findings hereby incorporate by reference the discussion and analysis in the Final PEIR supporting the Final PEIR’s determination regarding the Phased WSIP Variant’s impacts and mitigation measures designed to address those impacts. In making these findings, the SFPUC ratifies, adopts and incorporates in these findings the determinations and conclusions of the Final PEIR relating to environmental impacts and mitigation measures, except to the extent any such determinations and conclusions are specifically and expressly modified by these findings.

As set forth below, the SFPUC adopts and incorporates all of the mitigation measures set forth in the Final PEIR and the attached MMRP to substantially lessen or avoid the potentially significant and significant impacts of the Phased WSIP Variant. In adopting these mitigation measures, the SFPUC intends to adopt each of the mitigation measures proposed in the Final PEIR for the Phased WSIP Variant. Accordingly, in the event a mitigation measure recommended in the Final EIR has inadvertently been omitted in these findings or the MMRP, such mitigation measure is hereby adopted and incorporated in the findings below by reference. In addition, in the event the language describing a mitigation measure set forth in these findings or the MMRP fails to accurately reflect the mitigation measures in the Final PEIR due to a clerical error, the language of the policies and implementation measures as set forth in the Final PEIR shall control. The impact numbers and mitigation measure numbers used in these findings reflect the impact and mitigation measure numbers used in the Final PEIR.

In the sections II, III and IV below, the same findings are made for a category of environmental impacts and mitigation measures. Rather than repeat the identical finding dozens of times to address each and every significant effect and mitigation measure, the initial finding obviates the need for such repetition because in no instance is the SFPUC rejecting the conclusions of the Final PEIR or the mitigation measures recommended in the Final PEIR for the Phased WSIP Variant. There are determinations of significance regarding the originally proposed WSIP and proposed mitigation measures identified in the PEIR that are not applicable to the Phased WSIP Variant, and therefore, those impacts and mitigation measures are not included in these findings.

II. IMPACTS FOUND TO BE LESS THAN SIGNIFICANT AND THUS REQUIRING NO MITIGATION

A. WSIP Water Supply Impacts

Under CEQA, no mitigation measures are required for impacts that are less than significant. (Pub. Resources Code, § 21002; CEQA Guidelines, §§ 15126.4, subd. (a)(3), 15091.) The Phased WSIP Variant diverts less water than the proposed WSIP and therefore the water supply impacts are generally the same as or less than those of the originally proposed WSIP. (See C&R section 13.4, pp. 13-29 through 13-44.) Based on substantial evidence in the whole record of this proceeding, the SFPUC finds that implementation of the water supply portion of the Phased WSIP Variant will not result in any significant impacts in the following areas and that these impact areas therefore do not require mitigation:

1. Tuolumne River System and Downstream Water Bodies

- **Stream Flow** (**Impacts 5.3.1-1**, effects on flow along the river below O'Shaughnessy Dam; **5.3.1-2**; effects of flow along Cherry Creek below Cherry Dam; **5.3.1-3**; effects of flow along Eleanor Creek below Eleanor Dam; **5.3-1-4**; effects of flow along the river below La Grange Dam; **5-.3-1-5**, effects of flow along the San Joaquin River and the Sacramento-San Joaquin Delta) (DEIR pages 5.3.1-20 through 5.3.1-39; C&R pages 14.6-8 to 14.6-10, 14.7-12 to 14.7-14, 14.8-2 to 14.8-9 and 16-47);
- **Geomorphology** (**Impacts 5.3.2-1**, effects on sediment transport and channel characteristics between O'Shaughnessy Dam and Don Pedro Reservoir; **5.3.2-2**, effects on sediment transport and channel characteristics below La Grange Dam) (DEIR pages 5.3.2-5 through 5.3.2-7; C&R pages 14.6-10 to 14.6-12 and 14.7-15 to 14.7-16);
- **Surface Water Quality** (**Impacts 5.3.3-1**, effects on quality in Hetch Hetchy Reservoir and along the Tuolumne River below O'Shaughnessy Dam; **5.3.3-2**, effects on quality in Don Pedro Reservoir and along the Tuolumne River below La Grange Dam; **5.3.3-3**, effects on quality along the San Joaquin River and the Sacramento-San Joaquin Delta) (DEIR pages 5.3.3-13 through 5.3.3-20; C&R pages 14.6-12 to 14.6-13, 14.7-10 to 14.7-11, and 14.8-2 to 14.8-16);
- **Surface Water Supplies** (**Impacts 5.3.4-1**, effects on Tuolumne River, San Joaquin River, and Stanislaus River water users; **5.3.4-2**, effects on Delta water users) (DEIR pages 5.3.4-5 through 5.3.4-11; C&R pages 14.8-9 to 14.8-16, 15-4-217 to 15.4-218, and 16-48);
- **Groundwater** (**Impacts 5.3.5-1**, alteration of stream flows along the Tuolumne River, which could affect local groundwater recharge and levels; **5.3.5-2**, alteration of stream

flows along the Tuolumne River, which could affect local groundwater quality) (DEIR pages 5.3.5-3 through 5.3.5-5);

- **Fisheries** (**Impacts 5.3.6-1**, impacts on effects on fishery resources in Hetch Hetchy Reservoir; **5.3.6-2**, effects on fishery resources along the Tuolumne River between Hetch Hetchy Reservoir and Don Pedro Reservoir; **5.3.6-3**, effects on fishery resources in Don Pedro Reservoir; **5.3.6-5**, fishery resources along the San Joaquin River) (DEIR pages 5.3.6-24 through 5.3.6-28 and 5.3.6-32 through 5.3.6-33; C&R pages 15.4-226 to 15.4-227 and 16-49);
- **Terrestrial Biology** (**Impacts 5.3.7-1**, impacts on riparian habitat and related biological resources in Hetch Hetchy Reservoir and along the bedrock channel portions of the Tuolumne River from O'Shaughnessy Dam to Don Pedro Reservoir; **5.3.7-3**, impacts on biological resources in Lake Eleanor and along Eleanor Creek; **5.3.7-4,** biological resources in Lake Lloyd and along Cherry Creek; **5.3.7-5**, biological resources in Don Pedro Reservoir; **5.3.7-7**, conflicts with the provisions of adopted conservation plans or other approved biological resource plans for the Tuolumne Wild and Scenic River) (DEIR pages 5.3.7-14 through 5.3.7-27);
- **Recreational and Visual Resources** (**Impact 5.3.8-1**, effects on reservoir recreation due to changes in water system operations; **5.3.8-2**, effects on river recreation due to changes in water system operations; **5.3.8-3**, effects on the aesthetic values of the Tuolumne Wild and Scenic River.) (DEIR pages 5.3.8-23 through 5.3.8-35; C&R pages 16-49);
- **Energy Resources** (**Impact 5.3.9-1**, Effects on hydropower generation at facilities along Tuolumne River (beneficial).) (DEIR pages 5.3.9-2 through 5.3.9-3);
- **Cumulative Impacts (Impacts 5.7.2-1**, cumulative effects on the Tuolumne River from Hetch Hetchy Reservoir to Don Pedro Reservoir; **5.7.2-2**, cumulative effects on the Tuolumne River from Don Pedro Reservoir to the San Joaquin River; and **5.7.2-3**, cumulative effects on the San Joaquin River, Stanislaus River, and Delta) (DEIR pages 5.7-22 through 5.7-52).

2. Alameda Creek Watershed

- **Stream Flow** (**Impacts 5.4.1-1,** effects on flow along Calaveras Creek below Calaveras Reservoir; **5.4.1-3**, effects in San Antonio Reservoir and along San Antonio Creek; **5.4.1-4**, effects on flow along Alameda Creek below the confluence of San Antonio Creek) (DEIR pages 5.4.1-19 through 5.4.1-25 and 5.4.1-35 through 5.4.1-43; C&R pages 16-50 through 16-57);
- **Geomorphology** (**Impacts 5.4.2-1**, effects on channel formation and sediment transport along Calaveras Creek; **5.4.2-2,** effects on channel formation and sediment transport along Alameda Creek downstream of the diversion dam and downstream of the San Antonio Creek confluence; **5.4.2-3,** effects on channel formation and sediment transport along San Antonio Creek downstream of San Antonio Reservoir) (DEIR pages 5.4.2-3 and -4; C&R pages 15.2-29 to 15.2-34, 15.3-15 to 15.3-17 and 16-57 to 16-58);
- **Surface Water Quality** (**Impacts 5.4.3-1**, effects on water quality in Calaveras Reservoir; **5.4.3-2,** effects on water quality in San Antonio Reservoir; **5.4.3-3,** changes in water quality along Calaveras, San Antonio, and Alameda Creeks) (DEIR pages 5.4.3-6 through 5.4.3-12; C&R pages 15.2-34 to 15.2-38 and 16-59 to 16-60);

- **Groundwater Bodies** (**Impact 5.4.4-1**, changes in groundwater levels, flows, quality, and supplies) (DEIR pages 5.4.4-5 through 5.4.4-7; C&R pages15.3-19 and 16-60);
- **Fisheries** (**Impacts 5.4.5-1**, effects on fishery resources in Calaveras Reservoir (beneficial); **5.4.5-2**, Effects on fishery resources along Calaveras Creek below Calaveras Dam and along Alameda Creek below confluence with Calaveras Creek (beneficial); **5.4.5-4**, effects on fishery resources in San Antonio Reservoir (beneficial); **5.4.5-5**, effects on fishery resources along San Antonio Creek below San Antonio Reservoir; **5.4.5-6,** effects on fishery resources along Alameda Creek below confluence with San Antonio Creek) (DEIR pages 5.4.5-16 through 5.4.5-18 and 5.4.5-21 and 22);
- **Terrestrial Biology** (**Impacts 5.4.6-1 Other Species of Concern/Common Habitats and Species,** effects on riparian habitat and related biological resources in Calaveras Reservoir; **5.4.6-2, Sensitive Habitats/Others Species of Concern,** effects on riparian habitat and related biological resources along Alameda Creek, from below the diversion dam to the confluence with Calaveras Creek; **5.4.6-3, Sensitive Habitats/Other Species of Concern/Common Habitats and Species,** effects on riparian habitat and related biological resources along Calaveras Creek, from Calaveras Reservoir to the confluence with Alameda Creek; **5.4.6-4, Sensitive Habitats/Other Species of Concern/Common Habitats and Species,** effects on riparian habitat and related biological resources along Alameda Creek, from the confluence with Calaveras Creek to the confluence with San Antonio Creek; **5.4.6-5,** effects on riparian habitat and related biological resources in San Antonio Reservoir; **5.4.6-6,** effects on riparian habitat and related biological resources along San Antonio Creek between Turner Dam and the confluence with Alameda Creek; **5.4.6-7**, effects on riparian habitat and related biological resources along Alameda Creek below the confluence with San Antonio Creek; **5.4.6-8,** conflicts with the provisions of adopted conservation plans or other approved biological resource plans) (DEIR pages 5.4.6-14 through 5.4.6-26; C&R pages 5.2-13 to 15.2-14, 16-62 to 16-64);

- **Recreational and Visual Impact -- (Impacts 5.4.7-1,** effects on recreational facilities and/or activities; and **5.4.7-2**, visual effects on scenic resources or visual character of water bodies (DEIR, pp. 5.4.7-5 and 5.4.7-6; C&R pp. 13-5 and 16-65 to 16-66). Operations under the Phased WSIP Variant would substantially reduce flows along Alameda Creek in the Sunol Regional Wilderness during winter and early spring months and could affect the recreational experience for hikers. However, protective measures included in the Calaveras Dam Replacement project would include bypass flows at the Alameda Creek Diversion Dam when flow is available, thereby retaining flowing water in the creek and maintain the recreational and visual qualities. On July 16, 2008 the SFPUC revised the project description for the Calaveras Dam Replacement project. The revised project description includes specific operational protocols for seasonal bypass flows at the Alameda Creek Diversion Dam (ACDD) and the Calaveras Dam. Bypassing flow from the ACDD, when such flows are present, results in water in Alameda Creek below the ACDD to the confluence with Calaveras Creek. The addition of the flow releases from ACDD resulted in a determination that this impact is now less than significant for recreation and visual effects.
- **Cumulative Impacts (Impact 5.7.3-1**, cumulative effects on the Alameda Creek watershed). (DEIR, pages 5.7-61 through 5.7-67; C&R, pages 14.9-24 through 14.9-50).

3. Peninsula Watersheds

- **Stream Flow** (**Impacts 5.5.1-1**, effects on flow along the San Mateo Creek; **5.5.1-2**, effects on flow along Pilarcitos Creek) (DEIR pages 5.5.1-12 through 5.5.1-22; C&R pages 16-61 to 16-73);
- **Geomorphology** (**Impact 5.5.2-1**, changes in sediment transport and channel morphology in the Peninsula watershed) (DEIR pages 5.5.2-2 through 5.5.2-4);
- **Surface Water Quality** (**Impacts 5.5.3-1,** effects on water quality in Crystal Springs Reservoir, San Andreas Reservoir, and San Mateo Creek; **5.5.3-2,** effects on water quality in Pilarcitos Creek between Pilarcitos Reservoir and Stone Dam.) (DEIR pages 5.5.3-5 through 5.5.3-7; C&R pages 13-39 and 13-44). (Note: The PEIR determined Impact 5.5.3-2 to be potentially significant and mitigable for the WSIP, but this impact determination is less than significant for the Phased WSIP Variant through 2018.) With the Phased WSIP Variant, operations for Pilarcitos Reservoir and releases to Pilarcitos Creek will be similar to existing conditions, resulting in a less than significant impact;
- **Groundwater** (**Impact 5.5.4-1,** alteration of stream flows along Pilarcitos Creek, which could affect groundwater levels and water quality) (DEIR pages 5.5.4-1 through 5.5.4-3);
- **Fisheries** (**Impacts 5.5.5-2,** effects on fishery resources in San Andreas Reservoir; **5.5.5-3**, effects on fishery resources along San Mateo Creek; **5.5.5-4**, effects on fishery resources in Pilarcitos Reservoir; **5.5.5-5**, effects on fishery resources along Pilarcitos Creek below Pilarcitos Reservoir and below Stone Dam) (DEIR page 5.5.5-7; C&R pages 13-39 and 13-44). (Note: The PEIR determined Impacts 5.5.5-4 and 5.5.5-5 to be potentially significant and mitigable for the WSIP, but these impact determinations are less than significant for the Phased WSIP Variant through 2018.) Proposed operations under the Phased WSIP Variant would be within the same range as existing conditions, resulting in a less than significant impact);
- **Terrestrial Biology** (**Impacts 5.5.6-2**, impacts on biological resources in San Andreas Reservoir; **5.5.6-3**, impacts on biological resources along San Mateo Creek below Lower Crystal Springs Dam; **5.5.6-4**, impacts on biological resources in Pilarcitos Reservoir; **5.5.6-5,** impacts on biological resources along Pilarcitos Creek below Pilarcitos Reservoir; **5.5.6-6,** impacts on biological resources along Pilarcitos Creek below Stone Dam; **5.5.6-7,** conflicts with the provisions of adopted conservation plans or other approved biological resource plans) (DEIR pages 5.5.6-17 through 5.5.6-22; C&R pages 13-39, 13-40, 13-44 and 16-80 to 16-82). (Note: The PEIR determined Impact 5.5.6-4 to be potentially significant and mitigable for special status species for the originally proposed WSIP with implementation of a mitigation measure for the originally proposed WSIP. Since the Phased WSIP Variant does not result in impacts that require mitigation, this impact is less than significant for the Phased WSIP Variant through 2018);
- **Recreational and Visual Resources** (**Impact 5.5.7-1**, effects on recreational facilities and/or activities; **5.5.7-2**, visual effects on scenic resources or the visual character of water bodies.) (DEIR pages 5.5.7-4 through 5.5.7-6);
- **Cumulative Impacts (Impacts 5.7.4-1**, cumulative effects on the San Mateo Creek watershed, **5.7.4-2**, cumulative effects on the Pilarcitos Creek watershed). (DEIR, pages 5.7-74 through 5.7-84).

4. South Westside Groundwater Basin

- **Groundwater -- Impacts 5.6-1 --** basin overdraft due to pumping from the Westside Groundwater Basin; **5.6-3 --** seawater intrusion due to decreased groundwater levels in the Westside Groundwater Basin. (DEIR pages 5.6-25 through 5.6-27 and 5.6-29)

5. North and South Westside Groundwater Basin

- **Groundwater -- Impacts 5.6-4,** land subsidence due to decreased groundwater levels in the Westside Groundwater Basin if the historical low water levels are exceeded; **Impact 5.6-6**, drinking water contaminants above maximum contaminant levels and adverse effects of adding treated groundwater to the distribution system.) (DEIR pages 5.6-23 through 5.6-27 and 5.6-28 through 5.6-32)
- **Cumulative Impacts (Impacts 5.7.5-1**, cumulative effects on the North Westside Groundwater Basin, **5.7.5-2,** cumulative effects on the South Westside Groundwater Basin). (DEIR pages 5.7-89 to 5.7-91.)

Each of these topics is analyzed and discussed in detail in the record, including in, but not limited to, the Draft PEIR at Chapter 5, Sections 5.3, 5.4, 5.5, and 5.6 and in the C&R Chapter 13, Section 13.4.

B. WSIP Facility Construction and Operation Impacts

Under CEQA, no mitigation measures are required for impacts that are less than significant. (Pub. Resources Code, § 21002; CEQA Guidelines, §§ 15126.4, subd. (a)(3), 15091.) The Phased WSIP Variant will have the same facility construction and operation impacts as the originally proposed WSIP because the Phased WSIP Variant implements all the same projects as the originally proposed WSIP. (See C&R pages 13-17, 13-30 through 33.) Based on substantial evidence in the whole record of this proceeding, the SFPUC finds that implementation of the Facility Construction and Operations portion of the Phased WSIP Variant will not result in any significant impacts in the following areas and that these impact areas therefore do not require mitigation:

- **Land Use and Visual Quality** (Impact **4.3-3**, Temporary construction impacts on scenic vistas or visual character) (DEIR, pp. 4.3-28 to 4.3-29);
- **Geology, Soils, and Seismicity** (Impacts **4.4-2**, Erosion during construction; **4.4-3**, Substantial alteration of topography; **4.4-5**, Surface fault rupture; **4.4-6**, Seismically induced ground shaking; **4.4-7**, Seismically induced ground failure, including liquefaction and settlement; **4.4-8** Seismically induced landslides or other slope failures) (DEIR, pp. 4.4-27 to 4.4-29, 4.4-31 to 4.4-41);
- **Hydrology and Water Quality** (Impacts **4.5-1**, Degradation of water bodies as a result of erosion and sedimentation or a hazardous materials release during construction; **4.5-3a**, Degradation of water quality due to dewatering discharges; **4.5-3b**, Degradation of water quality due to construction-related discharges of treated water; **4.5-5**, Degradation of water quality and increased flows due to discharges to surface water during operation) (DEIR, pp. 4.5-21 to 4.5-28, 4.5-31 to 4.5-37, 4.5-41 to 4.5-49);

- **Traffic, Transportation and Circulation** (Impact **4.8-6**, Long-term traffic increases during facility operation) (DEIR, pp. 4.8-28 to 4.8-31);
- **Air Quality** (Impacts **4.9-4**, Air pollutant emissions during project operation; **4.9-5**, Odors generated during project operation; **4.9-6**, Secondary emissions at power plants; **4.9-7**, Conflict with implementation of applicable regional air quality plans addressing criteria air pollutants and state goals for reducing greenhouse gas emissions) (DEIR, pp. 4.9-37 to 4.9-47);
- **Noise and Vibration** (Impact **4.10-4**, Disturbance due to long-term noise increases) (DEIR, pp. 4.10-33 to 4.10-38);
- **Hazards** (Impacts **4.14-3**, Risk of fires during construction; **4.14-4**, Gassy conditions in tunnels; **4.14-6**, Accidental hazardous materials release from construction equipment; **4.14-7**, Increased use of hazardous materials during operation; **4.14-8**, Emission or use of hazardous materials within ¼ mile of a school) (DEIR, pp. 4.14-26 to 4.14-31, 4.14-35 to 4.14-42);
- **Collective** (Impacts **4.16-2**, Collective exposure of people or structures to geologic and seismic hazards; **4.16-9**, Collective impacts on utilities and landfill capacity) (DEIR, pp. 4.16-13, 4.16-33);
- **Cumulative** (Impacts **4.17-1**, Cumulative disruption of established communities, changes in existing land use patterns, and impacts on the existing visual character; **4.17-2**, Cumulative exposure of people or structures to geologic and seismic hazards; **4.17-3**, Cumulative impacts related to the degradation of water quality, alteration of drainage patterns, increased surface runoff, and flooding hazards; **4.17-4**, Cumulative loss of sensitive biological resources; **4.17-9**, Cumulative impacts related to disruption of utility service or relocation of utilities; **4.17-10**, Cumulative effects on recreational resources during construction; **4.17-11**, Cumulative conversion of farmland to nonagricultural uses; **4.17-12**, Cumulative effects related to hazardous conditions and exposure to or release of hazardous materials; **4.17-13**, Cumulative increases in the use of nonrenewable energy resources) (DEIR, pp. 4.17-46 to 4.17-52, 4.17-60 to 4.17-64).

Each of these topics is analyzed and discussed in detail in the record, including in, but not limited to, the Draft PEIR at Chapter 4, Sections 4.3, 4.4, 4.5, 4.8, 4.9, 4.10, 4.14, 4.16, and 4.17.

III. FINDINGS OF POTENTIALLY SIGNIFICANT IMPACTS THAT CAN BE AVOIDED OR REDUCED TO A LESS-THAN-SIGNIFICANT LEVEL

CEQA requires agencies to adopt mitigation measures that would avoid or substantially lessen a project's identified significant impacts or potential significant impacts if such measures are feasible (unless mitigation to such levels is achieved through adoption of a project alternative). The findings in this Section III and in Section IV concern mitigation measures set forth in the PEIR. These findings discuss mitigation measures as proposed in the PEIR and recommended for adoption by the SFPUC, which can be implemented by the SFPUC. The mitigation measures proposed for adoption in this section are the same as the mitigation measures identified in the Final PEIR for the Phased WSIP Variant. The full explanation of the potentially significant environmental impacts is contained in Chapters 4, 5, and 13 of the Final PEIR. The full text of the mitigation measures is contained in the Final PEIR and in **Attachment B**, the Mitigation Monitoring and Reporting Program.

As explained previously, **Attachment B** contains the Mitigation Monitoring and Reporting Program required by CEQA Section 21081.6 and CEQA Guidelines Section 15091. It provides a table setting forth each mitigation measure listed in the PEIR that is required to reduce or avoid a significant adverse impact. **Attachment B** also specifies the agency responsible for implementation of each measure, establishes monitoring actions and a monitoring schedule.

The SFPUC adopts all of the mitigation measures proposed for the Phased WSIP Variant. The SFPUC will implement all of the water supply and system operations mitigation measures as part of adoption of the Phased WSIP Variant. The SFPUC will implement the programmatic mitigation measures identified to address WSIP facility improvement projects impacts as part of approval and adoption of individual WSIP projects, and these programmatic mitigation measures will be re-evaluated as part of the project-level CEQA review and will be confirmed, refined or replaced with an equivalent measure, as applicable. The SFPUC finds that all the mitigation measures are appropriate and feasible, and that changes or alterations will be required in, or incorporated into, the Program and the projects that mitigate or avoid the significant environmental effect as identified in the PEIR. Based on the analysis contained in the PEIR, other considerations in the record, and the standards of significance, the SFPUC finds that implementation of all of the proposed mitigation measures will reduce potentially significant impacts to a ***less-than-significant*** level, discussed in this Section III.

A. WSIP Water Supply and System Operations Impacts

1. Tuolumne River System and Downstream Water Bodies

Fisheries

Impact 5.3.6-4 – Fisheries: Effects on fishery resources along the Tuolumne River below La Grange Dam in the event diversions from the Tuolumne River substantially increase over existing conditions. (DEIR, pp. 5.3.6-28 to 5.3.6-32; C&R pp. 14.7-2 to 14.7-7 and 13-43 to 13-44.) Under the Phased WSIP Variant, there may be a short-term increase in deliveries to customers from the watersheds above the existing level of 265 mgd, while the SFPUC and/or BAWSCA and wholesale customers implement the local conservation, recycled water and projects needed to meet demands through 2018. In this interim period, there is a potential for increased diversions from Hetch Hetchy Reservoir to serve SFPUC customers, which in turn would result in flow reductions below La Grange Dam and infrequent water temperature increases, which could adversely affect habitat conditions for juvenile salmonids. Flow changes with the Phased WSIP Variant with the 265 mgd delivery limitation and a small increase in average annual diversions from the Tuolumne River of 2 mgd in order to implement delivery and drought reliability elements of the WSIP through 2018 were determined to be less than significant. However, it is recognized that under the Phased WSIP Variant, deliveries could exceed 265 mgd while the SFPUC and/or wholesale customers implement the local conservation, recycled water and groundwater projects needed to meet increasing demands. Therefore, it was conservatively assumed that total water deliveries above 265 mgd could cause potentially significant impacts on the lower Tuolumne River during these periods until average annual deliveries were reduced to 265 mgd. This impact is less than significant if the annual average deliveries to customers does not exceed 265 mgd from the watersheds and does not require mitigation.

Mitigation Measure 5.3.6-4a, Avoidance of Flow Changes by Reducing Demand for Don Pedro Reservoir Water, OR Mitigation Measure 5.3.6-4b, Fishery Habitat Enhancement

This Commission recognizes that mitigation measure 5.3.6-4a is partially within the jurisdiction of MID and TID. The Commission urges MID and TID to assist in implementing this mitigation measure, and finds that MID and TID can and should participate in implementing this mitigation measure.

This Commission also recognizes that mitigation measure 5.3.6-4b is partially within the jurisdiction of other agencies, including the California Department of Fish and Game. The Commission urges this agency to assist in implementing this mitigation measure, and finds that this agency can and should participate in implementing this mitigation measure if measure 5.3.6-4a is determined to be infeasible.

Terrestrial Biological Resources

Impact 5.3.7-2 – Terrestrial Biology: Impacts on alluvial features that support meadow and riparian habitat along the Tuolumne River from O'Shaughnessy Dam to Don Pedro Reservoir. (DEIR, pp. 5.3.7-21 to 5.3.7-22; C&R pages 14.6-4 to 14.6-7.) The alluvial area supporting the largest wetland complex in this section of the Tuolumne River is the Poopenaut Valley, although smaller alluvial areas downstream, where larger tributaries empty into the Tuolumne River, also support riparian and/or wetland habitats. Delayed snowmelt releases, reductions in flow, and the resulting reduction in groundwater recharge would result in an incremental reduction in the extent and diversity of wetland and riparian habitats, including sensitive wetland and riparian habitats in the Poopenaut Valley. A reduction in wetland and riparian habitat would reduce suitable breeding habitat for key special-status species potentially occurring along this reach (e.g., foothill yellow-legged frog, California red-legged frog, and willow flycatcher), the populations of which are already critically reduced in the Sierra Nevada. A reduction in the extent and diversity of wetland and riparian habitats would reduce habitat quality and extent for animal and plant species of concern. All natural habitats affected by the Program are considered sensitive. The Program could affect a large number of common animal species that depend on sensitive meadows and larger riparian areas for food and cover.

Mitigation Measure 5.3.7-2, Controlled Releases to Recharge Groundwater in Streamside Meadows and Other Alluvial Deposits.

Impact 5.3.7-6 – Terrestrial Biology: Impacts on biological resources along the Tuolumne River below La Grange Dam in the event that diversions from Hetch Hetchy Reservoir substantially increase over existing conditions (DEIR, pages 5.3.7-25 to 5.3.7-26; C&R pages 14.4-13 and 13-43 to 13-44). Under the Phased WSIP Variant, there may be a short-term increase in deliveries to customers from the watersheds above the existing level of 265 mgd, while the SFPUC and/or BAWSCA and wholesale customers implement the local conservation, recycled water and projects needed to meet demands through 2018. In this interim period, there is a potential for increased diversions from Hetch Hetchy Reservoir to serve SFPUC customers, which in turn would result in flow reductions below La Grange Dam. Delayed spring releases and reductions in average and total flow (particularly during and following an extended drought) below La Grange Dam would reduce or eliminate suitable conditions for the recruitment of some riparian species along the river. Because of the known presence of key special-status species and the very limited amount of remaining suitable habitat along this reach of the Tuolumne River, this incremental impact would be potentially significant. Flow changes with the Phased WSIP Variant with the 265 mgd delivery limitation and a small increase in average annual diversions from the Tuolumne River of 2 mgd in order to implement delivery and drought reliability elements of the WSIP through 2018 were determined to be less than significant. However, it is recognized that under the Phased WSIP Variant, deliveries could exceed 265 mgd while the SFPUC and/or wholesale customers implement the local conservation, recycled water and groundwater projects needed to meet increasing demands. Therefore, it was conservatively assumed that deliveries above 265 mgd could cause potentially significant impacts on the lower Tuolumne River during these periods until average annual deliveries were reduced to 265 mgd. Species of concern that would be adversely affected by changes in the extent and quality of suitable riparian habitat include western pond turtle, several bat species, and a wide variety of riparian- and marsh-associated bird species. The populations of common species that depend on riparian habitat could be adversely affected by the alteration of habitat. This impact is less than significant if the annual average deliveries to customers does not exceed 265 mgd from the watersheds, and would not require mitigation.

Mitigation Measure 5.3.6-4a, Avoidance of Flow Changes by Reducing Demand for Don Pedro Reservoir Water OR Mitigation Measure 5.3.7-6, Lower Tuolumne River Riparian Habitat Enhancement

This Commission recognizes that mitigation measure 5.3.6-4a is the preferred mitigation approach but implementation is partially within the jurisdiction of MID and TID or other water agencies. The Commission urges MID and TID or other water agencies to assist in implementing this mitigation measure, and finds that MID and TID or other water agencies can and should participate in implementing this mitigation measure.

This Commission also recognizes that mitigation measure 5.3.7-6 is partially within the jurisdiction of other agencies, depending on the selected action and could include the California Department of Fish and Game, U. S. Fish and Wildlife Service and U.S. Army Corps of Engineers. The Commission urges these agencies to assist in implementing this mitigation measure, and finds that these agencies can and should participate in implementing this mitigation measure if measure 5.3.6-4a is determined to be infeasible.

2. Alameda Creek Watershed

Fisheries

Impact 5.4.5-3 – Fisheries: Effects on fishery resources along Alameda Creek downstream of Alameda Creek Diversion Dam. (DEIR, pp. 5.4.5-18 to 5.4-20 and C&R, pp. 13-37 and 13-38; 13-44; 16-61 and 16-62.) Following implementation of the Calaveras Dam Replacement project (SV-2) as one of the WSIP facility improvement projects, operation of Calaveras Reservoir and the Alameda Creek Diversion Dam would be restored to pre-2002 conditions. A substantial increase in diversions from Alameda Creek to Calaveras Reservoir would reduce flows in this stretch of the creek, despite proposed bypass flows at the diversion dam. Diversion of most or all flows during late winter and spring months would reduce the ability of resident rainbow trout to spawn and for eggs to incubate; additional monitoring would be needed to determine the effectiveness of proposed bypass flows to sustain trout population. In addition, the increased diversion of flows to the reservoir would prevent fish passage to downstream reaches of the creek, and increase the potential for fish entrainment since there are currently no screens on the diversion dam. If monitoring indicates that resident trout populations are not being sustained, the SFPUC shall either modify the minimum stream flow or implement mitigation measure 5.4.5-3b.

Mitigation Measure 5.4.5-3a, Minimum Flows for Resident Trout on Alameda Creek
Mitigation Measure 5.4.5-3b, Alameda Diversion Dam Diversion Restrictions or Fish Screens

This Commission recognizes that mitigation measures 5.4.5-3a and 5.4.5-3b are partially within the jurisdiction of other agencies, including the California Department of Fish and Game, the California Regional Water Quality Control Board and the U.S. Army Corps of Engineers. The Commission urges these agencies to assist in implementing this mitigation measure, and finds that these agencies can and should participate in implementing this mitigation measure.

Terrestrial Biological Resources

Impact 5.4.6-1 – Terrestrial Biology: Effects on riparian habitat and related biological resources in Calaveras Reservoir. (DEIR, pp. 5.4.6-14 to 5.4.6-17; C&R pp. 13-37 and 13-38; 13-44.) Increased reservoir storage elevations would result in inundation and permanent loss of seasonal wetlands, seeps, perennial freshwater marsh, and riparian habitat that have established since 2002. Since 2002, foothill yellow-legged frogs have occupied approximately 10,000 linear feet of stream channel along Arroyo Hondo between the maximum reservoir elevation mandated by the Division of Safety of Dams and the spillway elevation. Higher maintained reservoir levels would reduce the length of this high-quality habitat along the creek and adversely affect existing populations of foothill yellow-legged frog.

Mitigation Measure 5.4.6-1, Compensation for Impacts on Terrestrial Biological Resources

This Commission recognizes that mitigation measure 5.4.6-1 is partially within the jurisdiction of other agencies, including the California Department of Fish and Game, the California Regional Water Quality Control Board, and the U.S. Army Corps of Engineers. The Commission urges these agencies to assist in implementing this mitigation measure, and finds that these agencies can and should participate in implementing this mitigation measure.

Impact 5.4.6-2 – Terrestrial Biology: Effects on riparian habitat and related biological resources along Alameda Creek, from below the diversion dam to the confluence with Calaveras Creek. (DEIR, pp. 5.4.6.2-18 to 5.4.6-19; C&R pp. 13-37 and 13-38; 13-44; 15.2-12.) A reduction in the frequency, duration, and magnitude of flows below the diversion dam would reduce the total available aquatic breeding habitat and food sources for California red-legged frog and foothill yellow-legged frog populations that currently occupy this reach of Alameda Creek.

Mitigation Measure 5.4.1-2, Diversion Tunnel Operation
Mitigation Measure 5.4.5-3a, Minimum Flows for Resident Trout on Alameda Creek

This Commission recognizes that mitigation measures 5.4.5-3a and 5.4.1-2 are partially within the jurisdiction of other agencies, including the California Department of Fish and Game. The Commission urges these agencies to assist in implementing this mitigation measure, and finds that these agencies can and should participate in implementing this mitigation measure.

Impact 5.4.6-3 – Terrestrial Biology: Effects on riparian habitat and related biological resources along Calaveras Creek, from Calaveras Reservoir to the confluence with Alameda Creek. (DEIR, pp. 5.4.6-19 to 5.4.6-22; C&R pp. 13-37 and 38; 13-44.) Future outlet work at Calaveras Dam would have the capacity to make higher-volume releases than under existing conditions. Depending on the timing and volume of operational releases, they could adversely affect the reproductive success of special-status amphibian species along this reach (e.g., California red-legged frog and foothill yellow-legged frog).

Mitigation Measure 5.4.6-3, Operational Procedures for Calaveras Dam Releases

Impact 5.4.6-4 – Terrestrial Biology: Effects on riparian habitat and related biological resources along Alameda Creek, from the confluence with Calaveras Creek to the confluence with San Antonio Creek. (DEIR, pp. 5.4.6-22 to 5.4.6-23; C&R pp. 13-37 and 13-38; 13-44.) Depending on annual rainfall and localized site conditions along this creek segment, changes in winter and summer flows along this reach could result in both beneficial and adverse impacts on habitat for California red-legged frog and foothill yellow-legged frog populations.

Mitigation Measure 5.4.6-3, Operational Procedures for Calaveras Dam Releases
Mitigation Measure 5.4.5-3a, Minimum Flows for Resident Trout on Alameda Creek

This Commission recognizes that mitigation measures 5.4.6-3 and 5.4.5-3a are partially within the jurisdiction of other agencies, including the California Department of Fish and Game. The Commission urges this agency to assist in implementing this mitigation measure, and finds that this agency can and should participate in implementing this mitigation measure.

3. Peninsula Watersheds

Terrestrial Biological Resources

1. **Impact 5.5.6-1** – Terrestrial Biology: Impacts on biological resources in upper and Lower Crystal Springs Reservoirs. (DEIR, pp. 5.5.6-14 to 5.5.6-17; C&R pp. 13-39 to 13-41; 13-44.) Implementation of the Lower Crystal Springs Dam Improvements project (PN-4) would raise average monthly water levels in Crystal Springs Reservoir and result in a short-term reduction in the overall extent of freshwater marsh as the reservoir fills. Proposed changes in operations would maintain maximum reservoir levels during summer for longer periods than under existing conditions, which could affect the composition and structure of riparian habitats. In addition, sensitive upland habitats that are unable to tolerate these longer periods of inundation would be lost. Elevated reservoir levels would inundate existing populations of special-status plant species, including serpentine-associated fountain thistle and Marin western

flax, and their habitat could be permanently lost. The extent of available habitat for San Francisco garter snake and California red-legged frog would be temporarily reduced during reservoir refill, but wetland habitat that would establish at higher elevations could be more extensive. Raised reservoir levels would provide greater opportunities for largemouth bass and other predators to access frogs and snakes. Periodic drawdown during planned maintenance could adversely affect San Francisco garter snake foraging habitat. Changes in wetland habitat due to reservoir refill and proposed operations would adversely affect reptile and bird species of concern, particularly if permanent changes in the composition of wetland vegetation occur. Permanent loss of upland habitat, including upland trees, grassland, and coastal scrub, would result in significant impacts on several bird and mammal species of concern. Serpentine- and grassland-associated plant species unable to tolerate extended periods of inundation would be lost. Due to the extent of area involved, impacts on common habitats and species would be significant.

Mitigation Measure 5.5.6-1a, Adaptive Management of Freshwater Marsh and Wetlands at Upper and Lower Crystal Springs Reservoirs

Mitigation Measure 5.5.6-1b, Compensation for Impacts on Terrestrial Biological Resources

Mitigation Measure 5.5.6-1c, Compensation for Serpentine Seep-Related Special-Status Plants

This Commission recognizes that mitigation measure5.5.6-1 is partially within the jurisdiction of other agencies, including the California Department of Fish and Game, the California Regional Water Quality Control Board, the U.S. Army Corps of Engineers and possibly the National Marine Fisheries Service. The Commission urges these agencies to assist in implementing this mitigation measure, and finds that these agencies can and should participate in implementing this mitigation measure.

4. North Westside Groundwater Basin

1. **Impact 5.6-1 – Groundwater**: Basin overdraft due to pumping from the Westside Groundwater Basin. (DEIR, pp. 5.6-23 to 5.6-24; C&R pp. 13-10; 13-29 and 13-30.) The proposed water supply option would include installation of up to four primary production and deep aquifer production wells in San Francisco to provide a total of 2 mgd of annualized production rate, as implemented through Local Groundwater Projects (part of SF-2). With implementation of the Phased WSIP Variant, production of up to 4 mgd (4,500 afy) under the Local Groundwater Projects (SF-2) and continued nonpotable pumping of 0.5 mgd (560 afy) would be the major groundwater use in the North Westside Groundwater Basin once irrigation pumping is replaced with recycled water at the San Francisco Zoo and Golden Gate Park; thus, the maximum total annual pumping by 2018 is estimated to be 5,060 afy. Based on water years 1987 and 1988, the annual recharge to this basin was estimated at 4,850 afy. However, this analysis was done during the first two-years of an on-going drought and therefore is considered to be a low estimate of groundwater recharge to the North Westside Groundwater Basin relative to average conditions. Estimates of recharge to the basin are being refined as part of ongoing groundwater modeling efforts on behalf of the SFPUC, and this analysis indicates that recharge to the basin could range from about 4,850 afy to 6,950 afy. The total proposed pumping rate of 4.5 mgd (5,060 afy) would be within the range of recharge to the groundwater basin. However, because it exceeds the lower end of the range, and the studies indicating the range have not been completed at this program-level of analysis, potential impacts related to depletion of

groundwater resources in the North Westside Groundwater Basin would be considered *potentially significant*.

Mitigation Measure 5.6-1, Groundwater Monitoring to Determine Basin Safe Yield

Impact 5.6-2 – Surface water: changes in water levels in Lake Merced and other surface water features, including Pine Lake, due to decreased groundwater levels in the Westside Groundwater Basin. (DEIR, pp. 5.6-27 to 5.6-28; C&R pp. 13-10; 13-29 and 30.) Because the primary production aquifer is not in direct hydraulic connection with the shallow aquifer in the Lake Merced vicinity or with Lake Merced, proposed pumping from the primary production aquifer under Local Groundwater Projects is not expected to have a direct effect on lake levels, but could potentially cause an indirect effect. Shallow groundwater levels could decline due to flow from the shallow aquifer under Lake Merced toward the primary production aquifer in which future production wells would be completed under the proposed program. Therefore, the potential to adversely affect water levels in Lake Merced and other surface water features would be *potentially significant*.

Mitigation Measure 5.6-1, Groundwater Monitoring to Determine Basin Safe Yield
Mitigation Measure 5.6-2, Implementation of a Lake Level Management Plan

Impact 5.6-3 – Groundwater: Seawater intrusion due to decreased groundwater levels in the Westside Groundwater Basin. (DEIR, pp. 5.6-28 to 5.6-29; C&R pp. 13-10; 13-29 and 13-30.) In the North Westside Groundwater Basin, the shallow aquifer is in direct connection with the ocean from approximately Lake Merced to the north. Because the shallow aquifer is in direct connection with the ocean and groundwater pumping would lower groundwater levels, impacts related to the potential to cause seawater intrusion in the North Westside Groundwater Basin would be *potentially significant*.

Mitigation Measure 5.6-1, Groundwater Monitoring to Determine Basin Safe Yield

5. North and South Westside Groundwater Basins

- **Impact 5.6-5 – Groundwater**: Contamination of drinking water due to groundwater pumping in the Westside Groundwater Basin. (DEIR, pp. 5.6-31 to 5.6-32; C&R pp. 13-10; 13-29 and 30.) During operation, groundwater production wells constructed under the Local and Regional Groundwater Projects could induce migration of chemical or microbiological contamination from sources surrounding the wells, potentially resulting in an exceedance of drinking water standards in the groundwater. However, under the California Department of Public Health Drinking Water Source Assessment Protection (DWSAP) program, the SFPUC would develop a drinking water source assessment. The second step in the DWSAP program is the voluntary development and implementation of a source water protection program. Development of this program is not mandated under the DWSAP program, but protection of water quality is an important component of a complete wellhead protection program for the protection of drinking water quality. Until production well locations are selected and a drinking water source assessment performed, the potential for contamination of a drinking water well cannot be fully evaluated. Therefore, impacts related to potential contamination of a drinking water source are considered *potentially significant* for the Local and Regional Groundwater Projects (SF-2)

Mitigation Measure 5.6.5, Drinking Water Source Assessments for Groundwater Wells

B. WSIP Facility Improvement Projects Construction and Operation Impacts

The Phased WSIP Variant will have the same impacts as the originally proposed WSIP because it implements all facility improvement projects as the originally proposed WSIP. (C&R pp. 13-17; 13-30 – 33.)

1. Land Use and Visual Quality

Impact 4.3-1 – Land Use: Temporary Disruption or Displacement of Existing Land Uses During Construction. Potentially significant land use impacts were identified in association with the following facility improvement projects: SJ-3, BD-1, BD-2, SF-1, SF-2, and SF-3. (DEIR, pp. 4.3-9 to 4.3-20, 6-4 to 6-6, 6-30 to 32, 6-34 to 6-42, 6-44.)

Mitigation Measure 4.8-1a, Traffic Control Plan Measures
Mitigation Measure 4.8-1b, Coordination of Individual Traffic Control Plans
Mitigation Measure 4.9-1a, SJVAPCD Dust Control Measures
Mitigation Measure 4.9-1b, SJVAPCD Exhaust Control Measures
Mitigation Measure 4.9-1c, BAAQMD Dust Control Measures
Mitigation Measure 4.9-1d, BAAQMD Exhaust Control Measures
Mitigation Measure 4.9-2a, Health Risk Screening or Use of Soot Filters
Mitigation Measure 4.9-2b, Vacate SFPUC Land Managers' Residences in Sunol Valley
Mitigation Measure 4.10-1a, Noise Controls
Mitigation Measure 4.10-1b, Vacate SFPUC Caretaker's Residence at Tesla Portal
Mitigation Measure 4.10-2a, Limit Hourly Truck Volumes
Mitigation Measure 4.10-2b, Restrict Truck Operations
Mitigation Measure 4.10-2c, Vacate SFPUC Land Manager's Residence
Mitigation Measure 4.10-3a, Vibration Controls to Prevent Cosmetic or Structural Damage
Mitigation Measure 4.10-3b, Limit Vibration Levels at or Below Vibration Perception Threshold
Mitigation Measure 4.10-3c, Limit Tunnel-Related Detonation to Daylight Hours
Mitigation Measure 4.12-1, Coordination with Golf Course/Recreational Facility Managers

Impact 4.3-4 – Visual Quality: Permanent Adverse Impacts on Scenic Vistas or Visual Character. Potentially significant visual quality impacts were identified in association with the following facility improvement projects: SJ-1, SJ-5, SV-1, SV-4, BD-1, BD-2, PN-2, PN-3, PN-4, SF-1, SF-2, and SF-3. (DEIR, pp. 4.3-29 to 4.3-43, 6-7 to 6-8.)

Mitigation Measure 4.3-4a, Architectural Design
Mitigation Measure 4.3-4b, Landscaping Plans
Mitigation Measure 4.3-4c, Landscape Screens
Mitigation Measure 4.3-4d, Minimize Tree Removal

Impact 4.3-5 – Visual Quality: New Permanent Sources of Light and Glare. Potentially significant glare impacts were identified in association with all of the facility improvement projects. (DEIR, pp. 4.3-43 to 4.3-44, 6-8.)

Mitigation Measure 4.3-5, Reduce Lighting Effects

2. Geology, Soils, and Seismicity

Impact 4.4-1 – Geology, Soils, and Seismicity: Slope instability during construction. Potentially significant geology, soils, and seismicity impacts were identified in association with the following facility improvement projects: SJ-2, SV-1, SV-2, SV-3, SV-4, SV-5, PN-3, SF-2, and SF-3. (DEIR, pp. 4.4-23 to 4.4-27, 6-4, 6-9.)

Mitigation Measure 4.4-1, Quantified Landslide Analysis

Impact 4.4-4 – Geology, Soils and Seismicity: Squeezing Ground and Subsidence During Tunneling. Potentially significant geology, soils and seismicity impacts were identified in association with the following facility improvement projects: SV-4 and BD-1. (DEIR, pp. 4.4-29 to 4.4-31, 6-9.)

Mitigation Measure 4.4-4, Subsidence Monitoring Program

Impact 4.4-9 – Geology, Soils and Seismicity: Expansive or Corrosive Soils. Potentially significant geology, soils and seismicity impacts were identified in association with all of the facility improvement projects. (DEIR, pp. 4.4-42 to 4.4-47, 6-4, 6-9.)

Mitigation Measure 4.4-9, Characterize Extent of Expansive and Corrosive Soil

3. Hydrology and Water Quality

Impact 4.5-2 – Hydrology and Water Quality: Depletion of Groundwater Resources. Potentially significant hydrology and water quality impacts were identified in association with the following facility improvement projects: SV-4. (DEIR, pp. 4.5-28 to 4.5-30, 6-9 to 6-10.)

Mitigation Measure 4.5-2, Site Specific Groundwater Analysis and Identified Measures

Impact 4.5-4 – Hydrology and Water Quality: Flooding or water quality impacts associated with impeding or redirecting flood flows. Potentially significant hydrology and water quality impacts were identified in association with the following facility improvement projects: SJ-3, SV-1, SV-4, BD-1, BD-2, and SF-2. (DEIR, pp. 4.5-37 to 4.5-41, 6-10.)

Mitigation Measure 4.5-4a, Flood Flow Protection Measures
Mitigation Measure 4.5-4b, Site Specific Flooding Analysis and Identified Measures

Impact 4.5-5 – Hydrology and Water Quality: Degradation of water quality and increased flows due to discharges to surface water during operation. Potentially significant hydrology and water quality impacts were identified in association with the following facility improvement projects: SF-2. (DEIR, pp. 4.5-41 to 4.5-49, 6-10.)

Mitigation Measure 4.5-5, Stormwater Treatment and Groundwater Monitoring

Impact 4.5-6 – Hydrology and Water Quality: Degradation of water quality as a result of alteration of drainage patterns or an increase in impervious surfaces. Potentially significant hydrology and water quality impacts were identified in association with the following facility improvement projects: SJ-2. (DEIR, pp. 4.5-49 to 4.5-54, 6-6, 6-10.)

Mitigation Measure 4.5-6, Appropriate Source Control and Site Design Measures

4. Biological Resources

Impact 4.6-1 – Biological Resources: Impacts on wetlands and aquatic resources. Potentially significant impacts to biological resources were identified in association with the following facility improvements: SJ-1, SJ-2, SJ-3, SJ-5, SV-1, SV-2, SV-3, SV-4, SV-5, BD-1, BD-2, PN-2, PN-4, SF-1, SF-2, and SF-3. (DEIR, pp. 4.6-43 to 4.6-51, 6-4 to 6-6, 6-11 to 21.)

Mitigation Measure 4.6-1a, Wetlands Assessment
Mitigation Measure 4.6-1b, Compensation for Wetlands and Other Biological Resources

Impact 4.6-2 – Biological Resources: Impacts on Sensitive Habitats, Common Habitats, and Heritage Trees. Potentially significant impacts to biological resources were identified in association with the following facility improvements: SJ-1, SJ-2, SJ-3, SJ-5, SV-1, SV-2, SV-3, SV-4, SV-5, BD-1, BD-2, PN-2, PN-4, SF-1, SF-2, and SF-3. (DEIR, pp. 4.6-52 to 4.6-59, 6-4 to 6-6, 6-12 to 6-13.)

Mitigation Measure 4.6-1b, Compensation for Wetlands and Other Biological Resources
Mitigation Measure 4.6-2, Habitat Restoration/Tree Replacement

Impact 4.6-3 – Biological Resources: Impacts on key special status species – direct mortality and/or habitat effects. Potentially significant impacts to biological resources were identified in association with the following facility improvements: SJ-1, SJ-2, SJ-3, SJ-5, SV-1, SV-2, SV-3, SV-4, SV-5, BD-1, BD-2, PN-2, and PN-4. (DEIR, pp. 4.6-59 to 4.6-68, 6-4 to 6-6, 6-11 to 6-13.)

Mitigation Measure 4.6-1b, Compensation for Wetlands and Other Biological Resources
Mitigation Measure 4.6-3a, Protection Measures During Construction for Key Special-Status Species and Other Species of Concern
Mitigation Measure 4.6-3b, Standard Mitigation Measures for Specific Plants and Animals

Impact 4.6-4 – Biological Resources: Water discharge effects on riparian and/or aquatic resources. Potentially significant impacts to biological resources were identified in association with the following facility improvements: SJ-3, SV-4, BD-1, and BD-2. (DEIR, pp. 4.6-69 to 4.6-73, 6-13.)

Mitigation Measure 4.6-4, Pipeline and Water Treatment Plant Treated Water Discharge Restrictions

Impact 4.6-5 – Biological Resources: Conflicts with adopted conservation plans, or other approved biological resources plans. Potentially significant impacts to biological resources were identified in association with the following facility improvements: SJ-3. (DEIR, pp. 4.6-73 to 4.6-74, 6-11 to 6-13.)

Mitigation Measure 4.6-1a, **Wetlands Assessment**
Mitigation Measure 4.6-1b, Compensation for Wetlands and Other Biological Resources
Mitigation Measure 4.6-2, Habitat Restoration/Tree Replacement
Mitigation Measure 4.6-3a, Protection Measures During Construction for Key Special-Status Species and Other Species of Concern
Mitigation Measure 4.6-3b, Standard Mitigation Measures for Specific Plants and Animals

5. Cultural Resources

Impact 4.7-1 – Cultural Resources: Impacts on paleontological resources. Potentially significant impacts to cultural resources were identified in association with the following facility improvements: SJ-1, SJ-3, SJ-5, SV-1, SV-2, SV-3, SV-4, SV-5, PN-3, SF-1, SF-2, and SF-3. (DEIR, pp. 4.7-47 to 4.7-55, 6-4 to 6-6, 6-22.)

Mitigation Measure 4.7-1, Suspend Construction Work if Paleontological Resource is Identified

Impact 4.7-2 – Cultural Resources: Impacts on unknown and known prehistoric and historic archaeological resources. Potentially significant impacts to cultural resources were identified in association with all of the facility improvements. (DEIR, pp. 4.7-55 to 4.7-63, 6-4 to 6-6, 6-22 to 6-26.)

Mitigation Measure 4.7-2a, Archeological Testing, Monitoring, and Treatment of Human Remains
Mitigation Measure 4.7-2b, Accidental Discovery Measures

Impact 4.7-3 – Cultural Resources: Impacts on the historical significance of a historic district or a contributor to a historic district. Potentially significant impacts to cultural resources were identified in association with the following facility improvements: SJ-1, SJ-3, SV-4, BD-1, BD-2, PN-4, and SF-1. (DEIR, pp. 4.7-69 to 4.7-75, 6-26 to 6-30.)

Mitigation Measure 4.7-3, Protection of Historic Districts
Mitigation Measure 4.7-4a, Alternatives Identification and Resource Relocation
Mitigation Measure 4.7-4b, Historical Resources Documentation

Mitigation Measure 4.7-4c, Secretary of the Interior's Standards for Treatment of Historic Properties
Mitigation Measure 4.7-4d, Historic Resources Survey and Redesign
Mitigation Measure 4.7-4e, Historic Resources Protection Plan
Mitigation Measure 4.7-4f, Preconstruction Surveys and Vibration Monitoring

Impact 4.7-4 – Cultural Resources: Impacts on the historical significance of individual facilities resulting from demolition or alteration. Potentially significant impacts to cultural resources were identified in association with the following facility improvements: SJ-1, SJ-3, BD-1, BD-2, and SF-1. (DEIR, pp. 4.7-76 to 4.7-83, 6-4 to 6-6, 6-26 to 6-30.)

Mitigation Measure 4.7-4a, Alternatives Identification and Resource Relocation
Mitigation Measure 4.7-4b, Historical Resources Documentation
Mitigation Measure 4.7-4c, Secretary of the Interior's Standards for Treatment of Historic Properties
Mitigation Measure 4.7-4d, Historic Resources Survey and Redesign
Mitigation Measure 4.7-4e, Historic Resources Protection Plan
Mitigation Measure 4.7-4f, Preconstruction Surveys and Vibration Monitoring

Impact 4.7-5 – Cultural Resources: Impacts on adjacent historic architectural resources. Potentially significant impacts to cultural resources were identified in association with the following facility improvements: SJ-3, SJ-5, SV-2, SV-4, BD-1, BD-2, PN-2, PN-4, SF-1, and SF-3. (DEIR, pp. 4.7-83 to 4.7-86, 6-4 to 6-6, 6-26 to 6-30.)

Mitigation Measure 4.7-4a, Alternatives Identification and Resource Relocation
Mitigation Measure 4.7-4b, Historical Resources Documentation
Mitigation Measure 4.7-4c, Secretary of the Interior's Standards for Treatment of Historic Properties
Mitigation Measure 4.7-4d, Historic Resources Survey and Redesign
Mitigation Measure 4.7-4e, Historic Resources Protection Plan
Mitigation Measure 4.7-4f, Preconstruction Surveys and Vibration Monitoring

6. Traffic, Transportation, and Circulation

Impact 4.8-1 – Traffic, Transportation, and Circulation: Temporary reduction in roadway capacity and increased traffic delays. Potentially significant impacts to traffic, transportation, and circulation were identified in association with the following facility improvements: SJ-3, SV-2, BD-1, PN-2, PN-4, SF-1, SF-2, and SF-3. (DEIR, pp. 4.8-10 to 4.8-15, 6-4 to 6-6, 6-30 to 6-31.)

Mitigation Measure 4.8-1a, Traffic Control Plan Measures
Mitigation Measure 4.8-1b, Coordination of Individual Traffic Control Plans

Impact 4.8-2: Short-term traffic increases on roadways due to construction related vehicle trips. Potentially significant impacts to traffic, transportation, and circulation were identified in association with the following facility improvements: SJ-1, SJ-2, SJ-3, SJ-5, SV-1, SV-2, SV-3,

SV-4, SV-5, BD-1, BD-2, PN-2, PN-3, PN-4, SF-1, and SF-3. (DEIR, pp. 4.8-15 to 4.8-20, 6-4 to 6-6, 6-30 to 6-32.)

Mitigation Measure 4.8-1a, Traffic Control Plan Measures
Mitigation Measure 4.8-1b, Coordination of Individual Traffic Control Plans

Impact 4.8-3 – Traffic, Transportation, and Circulation: Impaired access to adjacent roadways and land uses. Potentially significant impacts to traffic, transportation, and circulation were identified in association with the following facility improvements: SJ-3, SV-2, BD-1, BD-2, PN-4, SF-1, SF-2, and SF-3. (DEIR, pp. 4.8-20 to 4.8-24, 6-4 to 6-6, 6-30 to 6-32.)

Mitigation Measure 4.8-1a, Traffic Control Plan Measures

Impact 4.8-4 – Traffic, Transportation, and Circulation: Temporary displacement of on-street parking. Potentially significant impacts to traffic, transportation, and circulation were identified in association with the following facility improvements: BD-1, PN-4, SF-1, SF-2, and SF-3. (DEIR, pp. 4.8-24 to 4.8-27. 6-4 to 6-6, 6-30 to 6-32.)

Mitigation Measure 4.8-1a, Traffic Control Plan Measures
Mitigation Measure 4.8-4, **Accommodation of Displaced Public Parking Supply for Recreational Visitors**

Impact 4.8-5 – Traffic, Transportation, and Circulation**:** Increased potential traffic safety hazards during construction. Potentially significant impacts to traffic, transportation, and circulation were identified in association with all of the facility improvements. (DEIR, pp. 4.8-27 to 4.8-28, 6-4 to 6-6, 6-30 to 6-31.)

Mitigation Measure 4.8-1a, Traffic Control Plan Measures

7. Air Quality

Impact 4.9-1 – Air Quality: Construction emissions of criteria pollutants. Potentially significant impacts to air quality were identified in association with the following facility improvements: SJ-1, SJ-2, SJ-3, SJ-5, SV-1, SV-2, SV-3, SV-4, SV-5, BD-1, and BD-2. (DEIR, pp. 4.9-21 to 4.9-27, 6-4 to 6-6, 6-34 to 6-37.)

Mitigation Measure 4.9-1a, SJVAPCD Dust Control Measures
Mitigation Measure 4.9-1b, SJVAPCD Exhaust Control Measure
Mitigation Measure 4.9-1c, BAAQMD Dust Control Measures
Mitigation Measure 4.9-1d, BAAQMD Exhaust Control Measures

Impact 4.9-2 – Air Quality: Exposure to diesel particulate matter (DPM) during construction. Potentially significant impacts to air quality were identified in association with the following facility improvements: SV-2, SV-5, and BD-1. (DEIR, pp. 4.9-27 to 4.9-34, 6-37 to 6-38.)

Mitigation Measure 4.9-2a, Health Risk Screening or Use of Soot Filters

Mitigation Measure 4.9-2b, Vacate SFPUC Land Managers' Residences in Sunol Valley

Impact 4.9-3 – Air Quality: Exposure to emissions (possibly including asbestos) from tunneling. Potentially significant impacts to air quality were identified in association with the following facility improvements: SJ-3, SV-4, BD-1, PN-2, SF-1, SF-2, and SF-3. (DEIR, pp. 4.9-34 to 4.9-36, 6-38.)

Mitigation Measure 4.9-3, Tunnel Gas Odor Control

8. Noise and Vibration

Impact 4.10-2, Noise and Vibration: Temporary Noise Disturbance Along Construction Haul Routes. Potentially significant noise impacts were identified in association with the following facility improvement project: SV-4. (DEIR, pp. 4.10-23 to 4.10-26, 6-41 to 6-42.)

Mitigation Measure 4.10-2c, Vacate SFPUC Land Manager's Residence

Impact 4.10-3 – Noise and Vibration: Disturbance due to construction related vibration. Potentially significant vibration impacts were identified in association with the following facility improvement project: SV-4. (DEIR, pp. 4.10-27 to 4.10-33, 6-42.)

Mitigation Measure 4.10-1a, Noise Controls
Mitigation Measure 4.10-3a, Vibration Controls to Prevent Cosmetic or Structural Damage

9. Public Services and Utilities

Impact 4.11-1 – Public Services and Utilities: Potential temporary damage to, or disruption of existing regional or local public utilities. Potentially significant impacts to public services and utilities were identified in association with the following facility improvement projects: SJ-3, SV-1, SV-2, SV-3, SV-4, BD-1, BD-2, PN-2, PN-4, SF-1, SF-2, and SF-3. (DEIR, pp. 4.11-10 to 4.11-15, 6-4 to 6-6, 6-43 to 6-44.)

Mitigation Measure 4.11-1a, Notify Neighbors of Potential Utility Service Disruption
Mitigation Measure 4.11-1b, Locate Utility Lines Prior to Excavation
Mitigation Measure 4.11-1c, Confirmation of Utility Line Information
Mitigation Measure 4.11-1d, Safeguard Employees from Potential Accidents Related to Underground Utilities
Mitigation Measure 4.11-1e, Notify Local Fire Departments
Mitigation Measure 4.11-1f, Emergency Response Plan
Mitigation Measure 4.11-1g, Prompt Reconnection of Utilities
Mitigation Measure 4.11-1h, Coordinate Final Construction Plans with Affected Utilities

Impact 4.11-2 – Public Services and Utilities: Temporary Solid Waste Effects on Solid Waste Landfill Capacity. Potentially significant impacts to public services and utilities were identified in association with all of the facility improvement projects. (DEIR, pp. 4.11-15 to 4.11-21, 6-44.)

Mitigation Measure 4.11-2, Waste Reduction Measures

Impact 4.11-3 – Public Services and Utilities: Impacts related to compliance with federal, state, and local statutes and regulations related to solid waste. Potentially significant impacts to public services and utilities were identified in association with all of the facility improvement projects. (DEIR, pp. 4.11-22, 6-44.)

Mitigation Measure 4.11-2, Waste Reduction Measures

Impact 4.11-4 – Public Services and Utilities: Impacts related to the relocation of utilities. Potentially significant impacts to public services and utilities were identified in association with all of the facility improvement projects. (DEIR, pp. 4.11-22 to 4.11-23, 6-4 to 6-6, 6-43 to 6-44.)

Mitigation Measure 4.11-1a, Notify Neighbors of Potential Utility Service Disruption
Mitigation Measure 4.11-1b, Locate Utility Lines Prior to Excavation
Mitigation Measure 4.11-1c, Confirmation of Utility Line Information
Mitigation Measure 4.11-1d, Safeguard Employees from Potential Accidents Related to Underground Utilities
Mitigation Measure 4.11-1e, Notify Local Fire Departments
Mitigation Measure 4.11-1f, Emergency Response Plan
Mitigation Measure 4.11-1g, Prompt Reconnection of Utilities
Mitigation Measure 4.11-1h, Coordinate Final Construction Plans with Affected Utilities

10. Recreational Resources

Impact 4.12-1 – Recreational Resources: Temporary Conflicts with established recreational uses during construction. Potentially significant impacts to recreational resources were identified in association with the following facility improvement projects: SJ-3, SV-4, BD-1, BD-2, PN-2, SF-1, SF-2, and SF-3. (DEIR, pp. 4.12-18 to 4.12-27, 6-4 to 6-6, 6-30 to 6-32, 6-34 to 6-44.)

Mitigation Measure 4.12-1, Coordination with Golf Course/Recreational Facility Managers
Mitigation Measure 4.8-1a, Traffic Control Plan Measures
Mitigation Measure 4.8-1b, Coordination of Individual Traffic Control Plans
Mitigation Measure 4.9-1a, SJVAPCD Dust Control Measures
Mitigation Measure 4.9-1b, SJVAPCD Exhaust Control Measure
Mitigation Measure 4.9-2a, Health Risk Screening or Use of Soot Filters
Mitigation Measure 4.9-2b, Vacate SFPUC Land Managers' Residences in Sunol Valley
Mitigation Measure 4.10-1a, Noise Controls
Mitigation Measure 4.10-1b, Vacate SFPUC Caretaker's Residence at Tesla Portal
Mitigation Measure 4.10-2a, Limit Hourly Truck Volumes
Mitigation Measure 4.10-2b, Restrict Truck Operations
Mitigation Measure 4.10-2c, Vacate SFPUC Land Manager's Residence
Mitigation Measure 4.10-3a, Vibration Controls to Prevent Cosmetic or Structural Damage
Mitigation Measure 4.10-3b, Limit Vibration Levels at or Below Vibration Perception Threshold

Impact 4.12-2 – Recreational Resources: Conflicts with established recreational uses due to facility siting and project operation. Potentially significant impacts to recreational resources were identified in association with the following facility improvement projects: SF-1, SF-2, and SF-3. (DEIR, pp. 4.12-27 to 4.12-28, 6-7 to 6-8, 6-44.)

Mitigation Measure 4.3-4a, Architectural Design
Mitigation Measure 4.3-4b, Landscaping Plans
Mitigation Measure 4.3-4c, Landscape Screens
Mitigation Measure 4.3-4d, Minimize Tree Removal
Mitigation Measure 4.12-2, Appropriate Siting of Proposed Facilities

11. Agricultural Resources

Impact 4.13-1 – Agricultural Resources: Temporary conflicts with established agricultural resources. Potentially significant impacts to agricultural resources were identified in association with the following facility improvement projects: SJ-3, SV-1, SV-2, SV-3, and SV-4. (DEIR, pp. 4.13-11 to 4.13-15, 6-4 to 6-6, 6-45.)

Mitigation Measure 4.13-1a, Supplemental Noticing and Soil Stockpiling
Mitigation Measure 4.13-1b, Avoidance or Soil Stockpiling

Impact 4.13-2 - Agricultural Resources: Conversion of farmlands to non-agricultural uses. Potentially significant impacts to agricultural resources were identified in association with the following facility improvement projects: SJ-3, SV-3, and SV-5. (DEIR, pp. 4.13-15 to 4.13-17, 6-45.)

Mitigation Measure 4.13-2, Siting Facilities to Avoid Prime Farmland

12. Hazards

Impact 4.14-1 – Hazards: Potential to encounter hazardous materials in soil or groundwater. Potentially significant hazards impacts were identified in association with the following facility improvement projects: BD-1, BD-2, SF-1, SF-2, and SF-3. (DEIR, pp. 4.14-16 to 4.14-22, 6-4 to 6-6, 6-45 to 6-46.)

Mitigation Measure 4.14-1a, Site Health and Safety Plan
Mitigation Measure 4.14-1b, Materials Disposal Plan
Mitigation Measure 4.14-1c, Coordination with Property Owners and Regulatory Agencies

Impact 4.14-2 – Hazards: Exposure to naturally occurring asbestos. Potentially significant hazards impacts were identified in association with the following facility improvement project: BD-1. (DEIR, pp. 4.14-23 to 4.14-26, 6-46.)

Mitigation Measure 4.14-2, Health Risk Screening and Airborne Asbestos Monitoring Plan

Impact 4.14-5 – Hazards: Exposure to hazardous building materials. Potentially significant hazards impacts were identified in association with the following facility improvement projects: SJ-3, SJ-5, SV-2, SV-4, BD-1, PN-2, PN-3, PN-4, SF-1, SF-2, and SF-3. (DEIR, pp. 4.14-31 to 4.14-35, 6-46.)

Mitigation Measure 4.14-5, Hazardous Building Materials Surveys and Abatement

13. Energy Resources

Impact 4.15-1 – Energy Resources: Construction related energy use. Potentially significant energy impacts were identified in association with all of the facility improvement projects. (DEIR, p. 4.15-8, 6-34 to 6-37, 6-47.)

Mitigation Measure 4.9-1b, SJVAPCD Exhaust Control Measure
Mitigation Measure 4.9-1d, BAAQMD Exhaust Control Measures

Impact 4.15-2 – Energy Resources: Long-term energy use during operation. Potentially significant energy impacts were identified in association with the following facility improvement projects: SJ-1, SJ-2, SJ-3, SJ-5, SV-1, SV-3, SV-5, BD-1, BD-2, PN-2, PN-3, SF-1, SF-2, and SF-3. (DEIR, pp. 4.15-8 to 4.15-14, 6-47.)

Mitigation Measure 4.15-2, Incorporation of Energy Efficient Measures

14. Collective Facilities Impacts

Impact 4.16-1a – Collective temporary and permanent impacts on existing land uses in the vicinity of the proposed facility site. Potentially significant collective land use impacts were identified in association with the following facility improvement project regions: Peninsula Region Improvements. (DEIR, pp. 4.16-8 to 4.16-11, 6-32.)

Mitigation Measure 4.8.-4, Accommodation of Displaced Public Parking Supply for Recreational Visitors

Impact 4.16-1b – Collective temporary and permanent impacts on the visual character the surrounding area. Potentially significant collective visual quality impacts were identified in association with the following facility improvement project regions: San Joaquin Region, Bay Division Region, Peninsula Region, San Francisco Region. (DEIR, pp. 4.16-11 to 4.16-12, 6-7 to 6-8.)

Mitigation Measure 4.3-4a, Architectural Design
Mitigation Measure 4.3-4b, Landscaping Plans
Mitigation Measure 4.3-4c, Landscaping Screens

Impact 4.16-3 – Collective WSIP impacts related to the degradation of surface waters and flooding hazards. Potentially significant collective hydrology and water quality impacts were identified in association with multi-regional effects as well as the following facility improvement project regions: San Joaquin Region, Sunol Valley Region, Bay Division Region, Peninsula Region and San Francisco Region. (DEIR, pp. 4.16-13 to 4.16-16, 6-10.)

Mitigation Measure 4.5-4a, Flood Flow Protection Measures
Mitigation Measure 4.5-4b, Site-Specific Flooding Analysis and Identified Measures
Mitigation Measure 4.5-5, Stormwater Treatment and Groundwater Monitoring
Mitigation Measure 4.5-6, Appropriate Source Control and Site Design Measure

Impact 4.16-4 – Collective loss of sensitive biological resources. Potentially significant collective biological resource impacts were identified in association with multi-regional effects as well as the following facility improvement project regions: San Joaquin Region and Bay Division Region. (DEIR, pp. 4.16-16 to 4.16-19, 6-11 to 6-21.)

Mitigation Measures 4.6-1a, Wetlands Assessment
Mitigation Measure 4.6-1b, Compensation for Wetlands and Other Biological Resources
Mitigation Measure 4.6-2, Habitat Restoration/Tree Replacement
Mitigation Measure 4.6-3a, Protection Measures During Construction for Key Special-Status Species and Other Species of Concern
Mitigation Measure 4.6-3b, Standard Mitigation Measures for Specific Plants and Animals
Mitigation Measure 4.16-4a, Bioregional Habitat Restoration Measures
Mitigation Measure 4.16-4b, Coordination of Construction Staging and Access

Impact 4.16-5 – Collective increase in impacts related to archaeological, paleontological and historical resources. Potentially significant collective cultural resource impacts were identified in association with multi-regional effects as well as the following facility improvement project regions: San Joaquin Region and Bay Division Region. (DEIR, pp. 4.16-19 to 4.16-22, 6-26 to 6-30.)

Mitigation Measure 4.7-4a, Alternatives Identification and Resource Relocation
Mitigation Measure 4.7-4b, Historical Resources Documentation
Mitigation Measure 4.7-4c, Secretary of the Interior's Standards for Treatment of Historic Properties
Mitigation Measure 4.7-4d, Historic Resources Survey and Redesign
Mitigation Measure 4.7-4e, Historic Resources Protection Plan
Mitigation Measure 4.7-4f, Preconstruction Surveys and Vibration Monitoring

Impact 4.16-6 – Collective traffic increases on local and regional roads. Potentially significant collective traffic impacts were identified in association with the following facility improvement project regions: San Joaquin Region, Sunol Valley Region, Bay Division Region, Peninsula Region and San Francisco Region. (DEIR, pp. 4.16-23 to 4.16-26, 6-30 to 6-33.)

Mitigation Measure 4.8-1a, Traffic Control Plan Measures
Mitigation Measure 4.8-1b, Coordination of Individual Traffic Control Plans
Mitigation Measure 4.16-6a, SFPUC WSIP Projects Construction Coordinator
Mitigation Measure 4.16-6b, Combined San Joaquin Traffic Control Plan
Mitigation Measure 4.16-6c, Combined Sunol Valley Traffic Control Plan

Impact 4.16-7 – Collective increases in construction and/or operational emission in the region. Potentially significant collective air quality impacts were identified in association with the following facility improvement project regions: San Joaquin Region, Sunol Valley Region, and Bay Division Region. (DEIR, pp. 4.16-26 to 4.16-29, 6-37 to 6-39.)

Mitigation Measure 4.9-2a, Health Risk Screening or Use of Soot Filters
Mitigation Measure 4.9-2b, Vacate SFPUC Land Managers' Residences in Sunol Valley
Mitigation Measure 4.16-7a, Dust and Exhaust Control Measures for All WSIP Projects
Mitigation Measure 4.16-7b, Health Risk Screening or Use of Soot Filters for All Projects in the San Joaquin and Sunol Valley Regions
Mitigation Measure 4.16-7c, Vacate SFPUC Land Managers' Residences for All Projects in the Sunol Valley Region

Impact 4.16-8 – Collective increases in construction-related and operational noise. Potentially significant collective noise impacts were identified in association with the following facility improvement project regions: Sunol Valley Region. (DEIR, pp. 4.16-30 to 4.16-33, 42 to 6-43.)

Mitigation Measure 4.16-8b, Vacate Land Manager's Residence for All Projects in Sunol Valley Region

Impact 4.16-9 – Collective impacts on landfill capacity. Potentially significant impacts on landfill capacity were identified in association with all of the facility improvement project regions (Draft PEIR, p. 4.16-33.)

Mitigation Measure 4.11-2, Waste Reduction Measures

Impact 4.16-10 – Collective effect on recreational resources during construction. Potentially significant collective recreational resource impacts were identified in association with the following facility improvement project regions: San Joaquin Region, Sunol Valley Region, Bay Division Region, Peninsula Region and San Francisco Region. (DEIR, pp. 4.16-33 to 4.16-34, 6-44.)

Mitigation Measure 4.12-1, Coordination with Golf Course/Recreational Facility Managers
Mitigation Measure 4.12-2, Appropriate Siting of Proposed Facilities

Impact 4.16-11 – Collective conversion of farmland to nonagricultural uses. Potentially significant collective agricultural resource impacts were identified in association with the following facility improvement project regions: San Joaquin Region and Sunol Valley Region. (DEIR, p. 4.16-34, 6-45.)

Mitigation Measure 4.13-2, Siting Facilities to Avoid Prime Farmland

Impact 4.16-12 – Collective effects related to hazardous conditions and exposure to ore release of hazardous materials. Potentially significant collective hazard impacts were identified in association with the following facility improvement project regions: San Joaquin Region, Sunol

Valley Region, Bay Division Region, Peninsula Region and San Francisco Region. (DEIR, pp. 4.16-35 to 4.16-36, 6-30 to 6-32, 6-46.)

Mitigation Measure 4.8-1a, Traffic Control Plan Measures
Mitigation Measure 4.8-1b, Coordination of Individual Traffic Control Plans
Mitigation Measure 4.14-1b, Materials Disposal Plan

Impact 4.16-13 – Collective increases in the use of nonrenewable energy resources. Potentially significant collective energy resource impacts were identified in association with multi-regional effects as well as the following facility improvement project regions: San Joaquin Region, Sunol Valley Region, Bay Division Region, Peninsula Region, and San Francisco Region. (DEIR, pp. 4.16-36 to 4.16-38, 6-35 to 6-37, 6-47.)

Mitigation Measure 4.9-1b, SJVAPCD Exhaust Control Measures
Mitigation Measure 4.9-1d, BAAQMD Exhaust Control Measures
Mitigation Measure 4.15-2, Incorporation of Energy Efficiency Measures

Conservation, Recycling and Groundwater Programs: The Final PEIR also identified possible impacts and mitigation strategies for facilities potentially developed by the wholesale customers to decrease demand for water or to supplement water supply as well. (See C&R pages 13-30 – 34; see also DEIR pp. 9-34 to 9-37; 9-55 to 9-57.) While it is difficult to predict what facilities will be implemented by the wholesale customers, any decisions to approve new projects or programs will undergo further CEQA review and will be approved by the individual customer or by BAWSCA. This Commission recommends that the wholesale customers approve projects that incorporate the mitigation strategies set forth in the Final PEIR, and finds that the wholesale customers can and should adopt applicable mitigation measures and strategies.

IV. SIGNIFICANT IMPACTS THAT CANNOT BE AVOIDED OR REDUCED TO A LESS THAN SIGNIFICANT LEVEL

Based on substantial evidence in the whole record of these proceedings, the SFPUC finds that, where feasible, changes or alterations have been required, or incorporated into, the Phased WSIP Variant to reduce the significant environmental impacts listed below as identified in the FEIR. The SFPUC finds that the mitigation measures in the PEIR and described below are appropriate, and that changes have been required in, or incorporated into, the Phased WSIP Variant that, to use the language of Public Resources Code section 21002 and CEQA Guidelines section 15091, may substantially lessen, but do not avoid (i.e., reduce to less than significant levels), the potentially significant environmental effect associated with implementation of the individual WSIP facility improvement projects, as described in the Program EIR Chapter 4, and the potentially significant or significant environmental effects associated with implementation of the water supply program, as described in the Program EIR, Chapter 13. The SFPUC adopts all of the mitigation measures proposed in the Program EIR that are relevant to the Phased WSIP Variant and set forth in the MMRP, attached hereto as Attachment B. The SFPUC further finds, however, for the impacts listed below, that no mitigation is currently available to render the effects less than significant. The effects therefore remain significant and unavoidable. Based on the analysis contained within the Program EIR, other considerations in the record, and the standards of significance, the SFPUC finds that because some aspects of the Phased WSIP Variant would cause potentially significant impacts for which feasible mitigation measures are not available to reduce the impact to a less-than-significant level, the impacts are ***significant and unavoidable***.

With respect to the facility improvement projects impacts and those water supply/system operations impacts directly related to one of the WSIP projects, the PEIR provides a program-level of analysis based on preliminary project information. Due to the lack of site-specific details, the impacts are based on reasonable worst-case assumptions, and the feasibility of many mitigation measures is uncertain. Thus, to be conservative, these impacts are considered ***potentially significant and unavoidable***. However, subsequent environmental review and analysis of all WSIP facility improvement projects will occur when more detailed, site-specific information is available, and it may be determined that either the impacts no longer apply or that feasible mitigation measures may be available.

The SFPUC determines that the following significant impacts on the environment, as reflected in the Program EIR, are unavoidable, but under Public Resources Code Section 21081(a)(3) and (b), and CEQA Guidelines 15091(a)(3), 15092(b)(2)(B), and 15093, the SFPUC determines that the impacts are acceptable due to the overriding considerations described in Section VII below. This finding is supported by substantial evidence in the record of this proceeding.

A. WSIP Water Supply and System Operations Impacts

1. Alameda Creek Stream Flow

Impact 5.4.1-2 – Stream Flow: Effects on flow along Alameda Creek below the Alameda Creek Diversion Dam. (DEIR, pp. 5.4.1-25 to 5.4.1-33, C&R page 13-37.) Restoring the levels of the Calaveras Dam reservoir under the Calaveras Dam Replacement Project would increase diversions from Alameda Creek to Calaveras Reservoir, nearly eliminating the low and moderate (1 to 650 cfs) flows in Alameda Creek downstream of the diversion dam that currently occur when the diversion gates are closed, and substantially reducing many higher (greater than 650 cfs) flows. Under the Phased WSIP Variant, flows in Alameda Creek in the reach below the diversion dam to the Calaveras Creek confluence and in the reach below the confluence would be substantially reduced compared to the conditions in existence since December 2001, when the California Department of Water Resources, Division of Safety of Dams imposed storage capacity restrictions on Calaveras Reservoir. This reduction of stream flows and alteration of the stream hydrograph is considered a substantial hydrologic effect and, as a result, this impact is *significant and unavoidable*. Implementation of Measure 5.4.1-2 would reduce the impact by requiring the SFPUC to close the diversion dam and cease Alameda Creek diversions to Calaveras Reservoir as soon as possible each year, once the reservoir is at desired levels, such that the later-season storm flows not needed to refill Calaveras Reservoir are allowed to flow down Alameda Creek past the diversion dam to the lower reaches. This measure would help reduce the impact, but not to a less than significant level.

Mitigation Measure 5.4.1-2, Diversion Tunnel Operation

2. San Francisco Peninsula Fisheries

Impact 5.5.5-1 –Fisheries: Effects on fishery resources in Crystal Springs Reservoir (Upper and Lower). (DEIR, pp. 5.5.5-6 to 5.5.5-7; C&R, pp. 15.2-15 and 15.2-16.) Restoring the levels of the reservoir under the Lower Crystal Springs Dam Improvements project (PN-4) could cause a potential loss of stream channel and potential spawning area in San Mateo Creek. However, upstream areas may provide suitable replacement habitat to support the population and this prospect is currently under evaluation in the project-level CEQA review for the Lower Crystal Springs Dam Improvements project. Thus, implementation of Measure 5.5.5-1, Create New Spawning Habitat Above Crystal Springs Reservoir, if feasible, may reduce this impact to less than significant. The project-level CEQA review for the Lower Crystal Springs Dam Improvements project will further evaluate the severity of this impact and the feasibility and efficacy of Measure 5.5.5-1. To be conservative, at the program-level of analysis, this impact is considered *potentially significant and unavoidable*.

Mitigation Measure 5.5.5-1, Create New Spawning Habitat Above Crystal Springs Reservoir

B. Growth Inducing Impacts

CEQA Guidelines section 15126.2, subdivision (d) requires a discussion of the ways in which projects could be growth inducing, including the ways in which "the proposed project could foster economic and population growth, or the construction of additional housing, either directly or indirectly, in the surrounding environment." CEQA also requires a discussion of ways in which a project may remove obstacles to growth, as well as ways in which a project may set a precedent for future growth or encourage and facilitate other activities that could significantly affect the environment, either individually or cumulatively. PEIR Chapter 7 and Appendix E provide detailed analysis of the growth-inducing effects of the originally proposed WSIP in the Draft PEIR and concluded in the C&R document, page 13-45, that the Phased WSIP Variant would have similar growth-inducing impacts through 2018.

Impact 7-1 – By removing the lack of a reliable water supply system as one potential obstacle to growth within the SFPUC service area and providing, and assisting in development of, additional water supply sources such as recycled water and groundwater projects as well as promotion of more efficient use of water through conservation measures, the Phased WSIP Variant would have an indirect growth-inducing effect according to the CEQA definition above. The Phased WSIP Variant would support planned growth in the SFPUC service area through 2018, although it appears that some growth would occur irrespective of the Phased WSIP Variant due to increased water delivery efficiencies (e.g., plumbing code changes), conservation, and other water supply sources. Growth would in turn result in indirect effects. In most cases, the effects of planned population and employment growth have been identified and addressed in the EIRs for the general plans and associated area plans and specific plans adopted by the jurisdictions in the service area. Some of the identified indirect effects of growth are significant and unavoidable; others are significant but can be mitigated.

Potentially significant and unavoidable impacts as a result of planned growth in the SFPUC service area have been identified in the following areas: traffic congestion, air pollution, traffic noise, construction noise, increased demand for public schools and other public services, loss of recreational opportunities and impacts on visual quality resulting from the loss of open space, cumulative effects on over-utilized parks, loss of wildlife habitat and wetlands and impacts on other biological resources, cumulative impacts on cultural resources, increased flooding potential, increased urban runoff pollutants, seismic hazards, induced population growth, failure to meet housing demand for projected population growth, exposure of new development to contaminated soil or groundwater, insufficient water supply, insufficient wastewater disposal capacity, loss of agricultural resources, land use conflicts, conflicts with existing land use plans or policies, and changes in density, scale, and character of an area.

The Phased WSIP Variant would have the same growth-inducement potential through 2018 as the WSIP because the SFPUC (with the cooperation of BAWSCA and the wholesale customers) would provide the additional water supply to meet 2018 purchase requests. The Phased WSIP Variant would support much of the planned growth through 2018 in the jurisdictions served by the SFPUC regional water system. In general, development planned and approved through the general plan process in the SFPUC service area would have environmental impacts. The environmental consequences of this planned growth have been largely addressed in local plans and the associated CEQA review as well as in other, project-specific documentation. In a number of jurisdictions, negative declarations or mitigated negative declarations were prepared for general plans and related planning documents that were found not to have significant environmental effects. (DEIR, pp. 7-1 to 7-78; C&R page 13-45.)

With the exception of the No Purchase Request Alternative, all of the alternatives analyzed in the PEIR contribute in similar ways to growth inducement impacts, since each of the Alternatives provides alternative ways of meeting future water supply demand as one of the WSIP objectives. It is also likely that the water customers would find alternate sources of water to meet future demand under the alternatives that are not effective in meeting demand like the Aggressive Conservation and Recycling Alternative. Under this scenario, the Alternative itself may not be growth-inducing, but growth could still occur. There are no mitigation measures proposed for implementation by the SFPUC that could substantially decrease or eliminate growth-inducing impacts because the SFPUC does not have control over the decisions that each local agency will make with respect to growth in their jurisdictions. Individual agencies' general plans and environmental documents contain actions, limitations and mitigation measures that will be implemented in the individual jurisdictions with local development project or program approvals. These kinds of mitigation measures were identified in the PEIR pages 7-67 through 7-78 and in PEIR Appendix E, Section E.5 and Table E.5.1. This Commission urges the local agencies to implement those mitigation measures already identified as feasible, and finds that these agencies can and should implement those mitigation measures

B. WSIP Facility Construction and Operation Impacts

1. Land Use and Visual Quality

Impact 4.3-1 – Land Use: Temporary disruption or displacement of existing land uses during construction. Potentially significant and unavoidable land use impacts were identified in association with the following facility improvement project: SV-4. (DEIR, pp. 4.3-9 to 4.3-16, 6-4 to 6-6, 6-8, 6-30 to 6-32, 6-34 to 6-42.)

Mitigation Measure 4.16-1a, Construction Coordination at Irvington Portal
Mitigation Measure 4.8-1a, Traffic Control Plan Measures
Mitigation Measure 4.8-1b, Coordination of Individual Traffic Control Plans
Mitigation Measure 4.9-1c, BAAQMD Dust Control Measures
Mitigation Measure 4.9-1d, BAAQMD Exhaust Control Measures
Mitigation Measure 4.9-2a, Health Risk Screening or Use of Soot Filters
Mitigation Measure 4.9-2b, Vacate SFPUC Land Managers' Residences in Sunol Valley
Mitigation Measure 4.10-1a, Noise Controls
Mitigation Measures 4.10-2a, Limit Hourly Truck Volumes
Mitigation Measure 4.10-2b, Restrict Truck Operations
Mitigation Measure 4.10-2c, Vacate SFPUC Land Manager's Residence
Mitigation Measure 4.10-3a, Vibration Controls to Prevent Cosmetic or Structural Damage
Mitigation Measure 4.10-3b, Limit Vibration Levels at or Below Vibration Perception Threshold
Mitigation Measure 4.10-3c, Limit Tunnel-Related Detonation to Daylight Hours

Impact 4.3-2 – Land Use: Permanent Displacement or Long-Term Disruption of Existing Land Uses. Potentially significant and unavoidable land use impacts were identified in association with the following facility improvement projects: SJ-3, SV-3, BD-1, PN-2, SF-2, and SF-3. (DEIR, pp. 4.3-20 to 4.3-28, 6-7.)

Mitigation Measure 4.3-2, Facility Siting Studies

Impact 4.3-4 – Visual Quality: Permanent Adverse Impacts on Scenic Vistas or Visual Character. Potentially significant and unavoidable visual quality impacts were identified in association with the following facility improvement project: SV-2. (DEIR, pp. 4.3-29 to 4.3-39, 6-7 to 6-8.)

Mitigation Measure 4.3-4a, Architectural Design
Mitigation Measure 4.3-4b, Landscaping Plans
Mitigation Measure 4.3-4c, Landscape Screens
Mitigation Measure 4.3-4d, Minimize Tree Removal

2. Cultural Resources

Impact 4.7-3 – Cultural Resources: Impacts on historical significance of a district or a contributor to a historic district. Potentially significant and unavoidable cultural resource impacts were identified in association with the following facility improvement projects: SV-2 and PN-2. (DEIR, pp. 4.7-69 to 4.7-75, 6-7 to 6-8, 6-26, 6-29 to 6-30.)

Mitigation Measure 4.7-3, Protection of Historic Districts
Mitigation Measure 4.7-4a, Alternatives Identification and Resource Relocation
Mitigation Measure 4.7-4b, Historical Resources Documentation

Mitigation Measure 4.7-4c, Secretary of the Interior's Standards for Treatment of Historic Properties
Mitigation Measure 4.7-4d, Historic Resources Survey and Redesign
Mitigation Measure 4.7-4e, Historic Resources Protection Plan
Mitigation Measure 4.7-4f, Preconstruction Surveys and Vibration Monitoring

Impact 4.7-4 – Cultural Resources: Impacts on the historical significance of individual facilities resulting from demolition or alteration. Potentially significant and unavoidable cultural resource impacts were identified in association with the following facility improvement projects: SV-2, SV-4, PN-2, and PN-4. (DEIR, pp. 4.7-76 to 4.7-82, 6-4 to 6-6, 6-26 to 6-30.)

Mitigation Measure 4.7-4a, Alternatives Identification and Resource Relocation
Mitigation Measure 4.7-4b, Historical Resources Documentation
Mitigation Measure 4.7-4c, Secretary of the Interior's Standards for Treatment of Historic Properties
Mitigation Measure 4.7-4d, Historic Resources Survey and Redesign
Mitigation Measure 4.7-4e, Historic Resources Protection Plan
Mitigation Measure 4.7-4f, Preconstruction Surveys and Vibration Monitoring

3. Noise and Vibration

Impact 4.10-1 –Noise: Disturbance from temporary construction-related noise increases. Potentially significant and unavoidable noise impacts were identified in association with all of the facility improvement projects. (DEIR, pp. 4.10-10 to 4.10-23, 6-4 to 6-6, 6-39 to 6-41.)

Mitigation Measure 4.10-1a, Noise Controls
Mitigation Measure 4.10-1b, Vacate SFPUC Caretaker's Residence at Tesla Portal

Impact 4.10-2 – Noise: Temporary noise disturbance along construction haul routes. Potentially significant and unavoidable noise impacts were identified in association with the following facility improvement projects: SJ-1, SJ-3, SJ-5, BD-1, BD-2, PN-3, SF-1, SF-2, and SF-3. (DEIR, pp. 4.10-23 to 4.10-26, 6-41 to 6-42.)

Mitigation Measure 4.10-2a, Limit Hourly Truck Volumes
Mitigation Measure 4.10-2b, Restrict Truck Operations

Impact 4.10-3 –Vibration: Disturbance due to construction-related vibration. Potentially significant and unavoidable vibration impacts were identified in association with the following facility improvement projects: SJ-3, SV-3, BD-1, BD-2, SF-1, SF-2, and SF-3. (DEIR, pp. 4.10-27 to 4.10-33, 6-42.)

Mitigation Measure 4.10-3a, Vibration Controls to Prevent Cosmetic or Structural Damage
Mitigation Measure 4.10-3b, Limit Vibration Levels at or Below Vibration Perception Threshold
Mitigation Measure 4.10-3c, Limit Tunnel-Related Detonation to Daylight Hours

4. Collective Facilities Impacts

Impact 4.16-1a – Collective temporary and permanent impacts on existing land uses in the vicinity of the proposed facility site. Potentially significant and unavoidable collective land use impacts were identified in association with the following facility improvement project regions: Bay Division Region. (DEIR, pp. 4.16-8 to 4.16-11, 6-32.)

Mitigation Measure 4.16-1a, Construction Coordination at Irvington Portal

Impact 4.16-4 – Collective loss of sensitive biological resources. Potentially significant and unavoidable collective biological resource impacts were identified in association with the following facility improvement project regions: Sunol Valley Region and Peninsula Region. (DEIR, pp. 4.16-16 to 4.16-19, 6-11 to 6-21.)

Mitigation Measure 4.6-1a, Wetlands Assessment
Mitigation Measure 4.6-1b, Compensation for Wetlands and Other Biological Resources
Mitigation Measure 4.6-2, Habitat Restoration/Tree Replacement
Mitigation Measure 4.6-3a, Protection Measures During Construction for Key Special-Status Species and Other Species of Concern
Mitigation Measure 4.6-3b, Standard Mitigation Measures for Specific Plants and Animals
Mitigation Measure 4.16-4b, Coordination of Construction Staging and Access

Impact 4.16-5 – Collective increase in impacts related to archaeological, paleontological and historical resources. Potentially significant and unavoidable collective cultural resource impacts were identified in association with the following facility improvement project regions: Sunol Valley Region and Peninsula Region. (DEIR, pp. 4.16-19 to 4.16-22, 6-26 to 6-30.)

Mitigation Measures 4.7-4a, Alternatives Identification and Resource Relocation
Mitigation Measure 4.7-4b, Historical Resources Documentation
Mitigation Measure 4.7-4c, Secretary of the Interior's Standards for Treatment of Historic Properties
Mitigation Measure 4.7-4d, Historic Resources Survey and Redesign
Mitigation Measure 4.7-4e, Historic Resources Protection Plan
Mitigation Measure 4.7-4f, Preconstruction Surveys and Vibration Monitoring

Impact 4.16-6 – Collective impact from multi-regional effects on traffic, transportation, and circulation were identified as potentially significant and unavoidable due to multiple roadways affected by construction activities within one or more regions and/or when construction vehicles use regional roadways. (DEIR, pp. 4.16-23 and 6-32)

Mitigation Measure 4.16-6a, SFPUC WSIP Projects Construction Coordinator

Impact 4.16-7 – Collective impact from multi-regional effects on air quality was identified as potentially significant and unavoidable due to residual contributions to ozone and particulate matter emissions during construction. (DEIR, pp. 4.16-26, 6-34 to 6-38)

Mitigation Measure 4.16-7a, Dust and Exhaust Control Measures for All WSIP Projects

Impact 4.16-8 – Collective increases in construction-related and operational noise. Potentially significant and unavoidable collective noise impacts were identified in association with the following facility improvement project regions: San Joaquin Region, Bay Division Region, Peninsula Region and San Francisco Region. (DEIR, pp. 4.16-30 to 4.16-33, 6-42 to 6-43.)

Mitigation Measure 4.10-1a, Noise Controls
Mitigation Measure 4.10-1b, Vacate SFPUC Caretaker's Residence at Tesla Portal
Mitigation Measure 4.10-2a, Limit Hourly Truck Volumes
Mitigation Measure 4.10-2b, Restrict Truck Operations
Mitigation Measure 4.16-8a, Limiting Hourly Truck Volumes and Restricting Truck Operations on Haul Routes for Multiple WSIP Projects
Mitigation Measure 4.16-8b, Vacate Land Manager's Residence for All Projects in Sunol Valley Region

5. Cumulative Facilities Impacts

Impact 4.17-5 – Cumulative increase in impacts on archaeological, paleontological, and historical resources. Potentially significant and unavoidable cumulative cultural resource impacts were identified in association with all of the following facility improvement project regions. (DEIR, pp. 4.17-52 to 4.17-53, 6-26 to 6-30.)

Mitigation Measure 4.7-4a, Alternatives Identification and Resource Relocation
Mitigation Measure 4.7-4b, Historical Resources Documentation
Mitigation Measure 4.7-4c, Secretary of the Interior's Standards for Treatment of Historic Properties
Mitigation Measure 4.7-4d, Historic Resources Survey and Redesign
Mitigation Measure 4.7-4e, Historic Resources Protection Plan
Mitigation Measure 4.7-4f, Preconstruction Surveys and Vibration Monitoring

Impact 4.17-6 – Cumulative traffic increases on local and regional roads. Potentially significant and unavoidable cumulative traffic impacts were identified in association with all of the following facility improvement project regions. (DEIR, pp. 4.17-54 to 4.17-57, 6-33.)

Mitigation Measure 4.8-1a, Traffic Control Plan Measures
Mitigation Measure 4.8-1b, Coordination of Individual Traffic Control Plans
Mitigation Measure 4.16-6a, SFPUC WSIP Projects Construction Coordinator
Mitigation Measure 4.16-6b, Combined San Joaquin Traffic Control Plan
Mitigation Measure 4.16-6c, Combined Sunol Valley Traffic Control Plan
Mitigation Measure 4.17-6, SFPUC WSIP Projects Construction Coordinator – Other Agencies

Impact 4.17-7 – Cumulative increases in construction and/or operational emissions in the region. Potentially significant and unavoidable cumulative air quality impacts were identified in association with all of the following facility improvement project regions. (DEIR, pp. 4.17-57 to 4.17-59, 6-34 to 6-38.)

Mitigation Measure 4.9-1a, SJVAPCD Dust Control Measures
Mitigation Measure 4.9-1b, SJVAPCD Exhaust Control Measure
Mitigation Measure 4.9-1c, BAAQMD Dust Control Measures
Mitigation Measure 4.9-1d, BAAQMD Exhaust Control Measures
Mitigation Measure 4.11-2, Waste Reduction Measures
Mitigation Measure 4.15-2, Incorporation of Energy Efficient Measures
Mitigation Measure 4.16-7a, Dust and Exhaust Control Measures for All WSIP Projects
Mitigation Measure 4.17-6, SFPUC WSIP Projects Construction Coordinator – Other Agencies

Impact 4.17-8 – Cumulative increases in construction-related and operational noise. Potentially significant and unavoidable cumulative noise impacts were identified in association with all of the following facility improvement project regions. (DEIR, pp. 4.17-59 to 4.17-60, 6-43.)

Mitigation Measure 4.10-2a, Limit Hourly Truck Volumes
Mitigation Measure 4.10-2b, Restrict Truck Operations
Mitigation Measure 4.17-8, Coordination of Truck Traffic on Local Streets

V. EVALUATION OF PROGRAM ALTERNATIVES

This Section describes the Phased WSIP Variant as well as the Program Alternatives and the reasons for approving the Phased WSIP Variant and for rejecting the Alternatives. This Article also outlines the Phased WSIP Variant's purposes and provides a context for understanding the reasons for selecting or rejecting alternatives.

CEQA mandates that an EIR evaluate a reasonable range of alternatives to the Project or the Project location that generally reduce or avoid potentially significant impacts of the Project. CEQA requires that every EIR also evaluate a "No Project" alternative. Alternatives provide a basis of comparison to the Project in terms of their significant impacts and their ability to meet Program objectives. This comparative analysis is used to consider reasonable, potentially feasible options for minimizing environmental consequences of the Project.

A. Reasons for Selection of the 2018 Phased Project Variant

The overall goals of the Phased WSIP Variant for the regional water system are to:

- Maintain high-quality water and a gravity-driven system
- Reduce vulnerability to earthquakes
- Increase delivery reliability
- Meet customer water supply needs through 2018
- Enhance sustainability
- Achieve a cost-effective, fully operational system

The SFPUC staff recommended this Variant in order to fully implement all proposed WSIP facility improvement projects to insure that the public health, seismic safety and delivery reliability goals of the WSIP are achieved as soon as possible while phasing implementation of a water supply program to meet projected water purchases through 2030. Deferring a decision on the 2030 water supply element of the WSIP until 2018 allows the SFPUC and its wholesale customers to focus first on implementing additional local recycled water, groundwater and demand management actions while minimizing additional diversions from the Tuolumne River. Under the Phased WSIP Variant, the SFPUC would establish an interim mid-term planning horizon – 2018. By adopting this Variant, the SFPUC is deferring a decision regarding long-term water supply until 2018 in light of then-current information and updated analysis. Because it remains at present unclear whether in 2018 the SFPUC will approve a water supply scenario for 2030 with adverse environmental effects beyond those associated with the Phased WSIP Variant, the Phased WSIP Variant may, in the long run, have a lesser level of environmental effect than the original WSIP. All non-water supply related WSIP goals and level of service objectives would be achieved under this Variant and all individual WSIP facility improvement projects proposed in the original WSIP would be constructed.

It is necessary to implement all of the WSIP facility improvement projects in order to achieve the program goals of the Phased WSIP Variant, as set forth in Section I of these findings, above. The Phased WSIP Variant is superior to the Alternatives in achieving the urgent goals of the WSIP; it allows the SFPUC to meet its water quality, seismic safety and water delivery reliability goals while minimizing effects on the SFPUC watersheds through 2018. The Phased WSIP Variant also focuses efforts on conservation, recycling and groundwater projects before deciding whether to increase deliveries from the watersheds.

As discussed above, impacts from Phased WSIP Variant would be less than those for the original WSIP because (1) the impact on Tuolumne River would be less and likely of shorter duration, and (2) certain impacts in the Pilarcitos watershed and in the Alameda Creek watersheds would not occur with Phased WSIP Variant.

B. Alternatives Rejected and Reasons for Rejection

The Commission rejects the Alternatives set forth in the Final PEIR and listed below because the Commission finds that there is substantial evidence, including evidence of economic, legal, social, technological, and other considerations described in this Section in addition to those described in Section VII below under CEQA Guidelines 15091(a)(3), that make infeasible such Alternatives. In making these determinations, the Commission is aware that CEQA defines “feasibility” to mean "capable of being accomplished in a successful manner within a reasonable period of time, taking into account economic, environmental, social, legal, and technological factors.” The Commission is also aware that under CEQA case law the concept of “feasibility” encompasses (i) the question of whether a particular alternative promotes the underlying goals and objectives of a project. and (ii) the question of whether an alternative is “desirable” from a policy standpoint to the extent that desirability is based on a reasonable balancing of the relevant economic, environmental, social, legal, and technological factors.

In addition, adoption of the Phased WSIP Variant will reduce many of the water supply impacts associated with increased diversions until at least 2018, and the additional water conservation, recycling and groundwater projects will have the effect of reducing the projected demand for water to be diverted from the SFPUC watersheds through 2018 and beyond. Some of the alternatives are less effective in reducing environmental impacts associated with water supply than the Phased WSIP Variant and are not environmentally superior to the Phased WSIP Variant because they do not attempt to reduce projected demand for water but would look to development of alternative sources of water, each of which has environmental effects. While some of the other alternatives would avoid or lessen certain WSIP impacts, they would also result in substantial additional impacts that the Phased WSIP Variant would not generate, because these alternatives would require substantial additional major facilities and affect other environmental resources in different geographic locations in addition to those affected by the Phased WSIP Variant. There would thus be no basis under CEQA for selecting a particular alternative where this is the case. The Phased WSIP Variant also incorporates elements of three alternatives, the No Purchase Request Alternative, the Aggressive Conservation/Water Recycling and Groundwater Alternative, and the Modified WSIP Alternative, as described below. Therefore, the Commission is not rejecting those alternatives in their entirety.

1. No Program Alternative

Under the No Program Alternative, the SFPUC would implement only those facility improvement projects driven by regulatory requirements or existing agreements with regulatory agencies. The system would meet the water quality goals of the WSIP, but it would fail to meet the seismic and delivery reliability goals and would have limited ability to serve the increase in customer purchase requests through 2018, as both the magnitude and frequency of rationing would increase in response to droughts. The SFPUC would endeavor to meet increasing customer purchase requests by diverting additional Tuolumne River water only when available. It would not secure an additional dry-year supply transfer of Tuolumne River water, implement the Westside Basin groundwater conjunctive-use program, or develop the proposed recycled water and groundwater projects in San Francisco or the wholesale customer service area. The wholesale customers may decide to pursue supplemental supply sources and/or conservation measures to make up for the reduced reliability and the supply shortfall under this alternative, but this would occur outside of and independent of the WSIP. Compared to the Phased WSIP Variant, this alternative would develop less in terms of new water supplies for the regional system and would implement far fewer of the proposed facility improvement projects. (DEIR, pages 9-23 to 9-40.)

Although it appears that fewer facility improvement projects would be implemented under the No Program Alternative and that, as a result, there would be fewer facility construction and operation impacts, it is expected that there would be much more emergency facility repair and replacement projects under this alternative as the system continues to age without proactive improvement. Ultimately, through required repair and replacement efforts, a similar level of facility improvement projects as that proposed under the Phased WSIP Variant might have to be conducted under the No Program Alternative, resulting in much of the same facility impacts as the Phased WSIP Variant; however, these repair and replacement projects would likely occur over a longer period of time and in a less coordinated and comprehensive manner. In addition, implementing system improvements through a piecemeal and largely emergency response approach could result in greater environmental impacts and less mitigation for such impacts;

when projects are implemented under emergency conditions, they often require little or no environmental review (see Pub. Resources Code, § 21080, subds. (b)(2), (b)(4)) and thus could be implemented without the same level of mitigation and mitigation compliance monitoring that would be required for the Phased WSIP Variant. Furthermore, piecemeal implementation could also increase the cumulative effects of multiple, sequential facility repair and replacement projects throughout the system.

The Commission rejects this Alternative because it will not meet the fundamental and most pressing needs of the water system – to improve the seismic safety and reliability of the water system as a means of saving human life and property under a catastrophic earthquake scenario or even a disaster scenario not rising to the level of catastrophic. As the system ages, its reliability decreases and the risk of failure increases. The 167-mile-long system crosses five active earthquake faults. Many of the SFPUC regional water system components are located on or in the immediate vicinity of major earthquake faults. Due to the age of the system, many facilities do not meet modern seismic standards. In order to implement a feasible asset management program in the future that will provide continuous maintenance and repairs to facilities, the regional water system requires redundancy (i.e., backup) of some critical facilities necessary to meeting day-to-day customer water supply needs. Without adequate redundancy of critical facilities, the SFPUC has limited operational flexibility in the event of an emergency or a system failure, as well as constraints on conducting adequate system inspection and maintenance. This Alternative would place the water system at significant risk to seismic hazards, increased facility failures, and increased supply shortages on a day-to-day basis, as well as result in prolonged service disruptions to many customers in the event of an earthquake or other emergency due to inadequate facility redundancy and operational flexibility. This Alternative is rejected as infeasible because it meets none of the vitally important Program objectives.

2. No Purchase Request Increase Alternative

As described in the PEIR, the No Purchase Request Increase Alternative is designed to serve wholesale customers only the amount of water required under the existing Master Water Sales Agreement between the City and County of San Francisco and each of the wholesale customers through 2030. Under the No Purchase Request Increase Alternative, the SFPUC would implement all of the proposed WSIP facility improvement projects. It is expected that the wholesale customers would pursue supplemental supply sources and/or conservation measures to make up the supply shortfall under this alternative, but this would occur outside of and independent of the WSIP. This alternative was included in the alternatives analysis in an effort to avoid or minimize the potential growth-inducing effects and secondary effects of growth associated with providing more water to the regional customers, and the PEIR evaluates the effects of this water supply approach on the SFPUC watersheds.

This Commission acknowledges that the Phased WSIP Variant is similar to this Alternative through the 2018 planning period. However, unlike the No Purchase Request Alternative, the Phased WSIP Variant includes financial incentives to induce the wholesale customers to limit water use and thus minimize increases in diversions from the SFPUC watersheds or other locations, and instead, emphasizes the development of alternative sources of water, including conservation measures, recycling projects and local groundwater development. This Commission adopts those portions of the No Purchase Request Increase Alternative that are the same as those included within the Phased WSIP Variant and rejects the remaining aspects of the No Purchase Request Increase Alternative as infeasible, as they do not incorporate the mitigation measures, the financial incentives or the re-evaluation of the customer demands in 2018. The Commission finds that the Phased WSIP Variant is similar to this Alternative, but the Variant provides a mechanism to re-evaluate the long term water demands and the need to divert more water from the SFPUC watersheds in 2018. The Phased WSIP Variant also provides that the SFPUC and the customers will develop the most effective and financially feasible methods of providing recycled water and implementing conservation measures as a priority in the next ten years.

To the extent that the No Purchase Request Increase Alternative would fail to increase SFPUC water deliveries through 2030 and not just through 2018, the Commission rejects the alternative as infeasible for that reason alone. It is foreseeable that, within the next 22 years, the population and economic trends within the SFPUC service area will create a substantial demand for new water supplies, even with aggressive conservation efforts. Under the Phased WSIP Variant, the SFPUC would wait until 2018 to determine whether and how to address demands arising between 2018 and 2030. This latter approach is more realistic and responsible from a public policy standpoint, in that it (i) acknowledges the likelihood of increasing customer demands between 2018 and 2030 and (ii) does not essentially force existing SFPUC customers to seek other sources for their needed new long-term water supplies, some of which may be more environmentally damaging than increasing the yield from the SFPUC system from averages of 265 mgd annually to an average of 300 mgd annually. Compared with the No Purchase Increase Alternative, the Phased WSIP Variant delays a decision on supply needs between 2018 and 2030 for a decade in order to give SFPUC customers the chance to maximize their conservation efforts and identify any available, environmentally sustainable source alternatives, while not making any irrevocable decision to deny SFPUC supply increases after 2018. In short, after balancing competing policy considerations and the extent to which the No Purchase Request Increase Alternative would address the SFPUC's long-term water supply objective, the Commission rejects as infeasible within the meaning of CEQA those portions of the No Purchase Request Increase Alternative not included within the Phased WSIP Variant.

3. Aggressive Conservation/Water Recycling and Local Groundwater Alternative

As described in the PEIR, under this alternative, the SFPUC would implement all of the proposed WSIP facility improvement projects, but would endeavor to serve the projected increase in customer purchase requests through 2030 using only additional conservation, water recycling, and local groundwater projects. It does not appear feasible, however, to fully meet the 2030 purchase requests with reasonably foreseeable conservation, recycled water, and groundwater projects within the service area. Therefore, under the Aggressive Conservation/Water Recycling and Local Groundwater Alternative, the SFPUC would have to either: (a) limit future customer purchase deliveries to the level that can be met, short of the 2030 requests (approximately 294 mgd under the most optimistic scenario instead of 300 mgd average annual) and increase the level of rationing to 25 percent or more during droughts, or (b) provide a supplemental supply to make up the delivery shortfall to meet the 300 mgd.

The Phased WSIP Variant incorporates the most important elements of this Alternative through 2018. The Variant establishes financial incentives to induce the wholesale customers to develop conservation, recycled water and groundwater projects and thus limit deliveries from the SFPUC watersheds to an average annual 265 mgd. The Phased WSIP Variant allows the SFPUC to re-evaluate water demands and the efficacy of the conservation, recycling and groundwater programs in 2018. In the Phased WSIP Variant, the SFPUC will implement 10 mgd of conservation, recycling and groundwater projects in San Francisco, and the wholesale customers will develop an additional 10 mgd of conservation, recycling and groundwater projects in the wholesale customer service area. This Commission rejects this Alternative insofar as it makes a water supply decision to attempt to meet demand of 300 mgd through 2030 (although it may be ineffective in meeting that demand and force customers to seek water from other entities); instead, the Phased WSIP Variant focuses the SFPUC and the customers on implementation of conservation, recycling and local groundwater projects before 2018. The SFPUC will then re-evaluate the water supply decision in 2018.

To the extent that the Aggressive Conservation/Water Recycling and Local Groundwater Alternative does not include sufficient supplies to deal with foreseeable customer demand through 2030, the Commission rejects those portions of the Aggressive Conservation/Water Recycling and Local Groundwater Alternative not included within the Phased WSIP Variant as infeasible for that reason alone. Under the Phased WSIP Variant, unlike the Aggressive Conservation/Water Recycling and Local Groundwater Alternative, the SFPUC has not refused to supply the amounts of water predicted to be needed by customers in 2030, but rather has delayed any such decision until 2018. The Phased WSIP Variant thus has the virtues of being more realistic and responsible from a public policy standpoint, in that it (i) acknowledges the likelihood of increasing customer demands between 2018 and 2030 and (ii) does not essentially force existing SFPUC customers to seek other sources for their needed new long-term water supplies, some of which may be more environmentally damaging than increasing the yield from the SFPUC system to the levels predicted to be needed in 2030. Compared with the Aggressive Conservation/Water Recycling and Local Groundwater Alternative, the Phased WSIP Variant delays a decision on supply needs between 2018 and 2030 for a decade in order to give all SFPUC customers the chance to maximize their conservation efforts and identify any available, environmentally sustainable source alternatives, while not making any irrevocable decision to deny SFPUC supply increases after 2018. In short, after balancing competing policy considerations and the extent to which the Aggressive Conservation/Water Recycling and Local Groundwater Alternative would address the SFPUC's long-term water supply objective, the Commission rejects as infeasible within the meaning of CEQA those portions of the Aggressive Conservation/Water Recycling and Local Groundwater Alternative not included within the Phased WSIP Variant.

4. Lower Tuolumne River Diversion Alternative

As described in the PEIR, under the Lower Tuolumne River Diversion Alternative, the SFPUC would implement all of the proposed facility improvement projects and would serve the projected increase in customer purchase requests through 2030 through diversions from the lower Tuolumne River near its confluence with the San Joaquin River, assuming it could reach agreement with TID and MID. This alternative would include construction and operation of additional conveyance and treatment facilities to divert, transport, treat, and blend the new supply into the regional system. This Alternative represented an alternative source of supply and was evaluated to address impacts on the Tuolumne River and related resources.

This Commission rejects this Alternative as infeasible. The ability to implement this Alternative is uncertain, given the number of agreements and approvals that would be required to construct the diversion and treatment facilities. Because the Phased WSIP Variant proposes to limit sales of water from the SFPUC watersheds to 265 mgd through 2018, the effects on the Tuolumne River would be substantially less since much less water would be diverted from the Tuolumne River watershed. Through 2018, the Phased WSIP Variant will divert an average annual 2 mgd more than SFPUC currently diverts from the Tuolumne River to meet its delivery and drought reliability objectives. There will be no need to construct additional conveyance and treatment facilities to divert, transport, treat, and blend the new supply into the regional system and incur the financial or the environmental costs that such construction will necessitate, as analyzed by the SFPUC in its Report (SFPUC, Water Supply Options, 2007 [Appendix C, *WSIP Alternative Water Supply Option 3*, prepared by SFPUC and Parsons, June 2006).

The analysis in the Draft PEIR concluded that the environmental impacts of this alternative would result in greater impacts on the Tuolumne River resources than the original WSIP or the Phased WSIP Variant. This Alternative would not meet the SFPUC's most basic objective of maintaining a gravity-driven system. This Alternative would require construction of pumping and treatment facilities in order to divert water from the lower Tuolumne River. This Alternative will result in far more impacts than the Phased WSIP Variant on the watershed and its resources, including fisheries, due to the construction and operation of the facilities that must be constructed to implement this Alternative. The Phased WSIP Variant is superior to this Alternative because the Phased WSIP Variant focuses first on developing more conservation, water recycling and groundwater projects before determining to divert more water from the Tuolumne River on a long-term, extended basis. Therefore, there should be no need to construct a diversion structure prior to 2018.

In short, after balancing competing policy considerations and the extent to which the Lower Tuolumne River Diversion Alternative would result in greater environmental impacts and address the SFPUC’s long-term water supply objective, the Commission rejects the Lower Tuolumne River Diversion Alternative as infeasible within the meaning of CEQA.

5. Year-round Desalination at Oceanside Alternative

As described in the PEIR, under the Year-round Desalination at Oceanside Alternative, the SFPUC would implement all of the proposed WSIP facility improvement projects and would construct a 25-mgd desalination plant in San Francisco to serve the projected increase in customer purchase requests through 2030. This alternative would not involve increased levels of diversions from the Tuolumne River. The desalination plant would provide year-round supplies during all hydrologic year types to blend into the regional system at the Sunset Reservoir in San Francisco. Compared to the originally proposed WSIP, this alternative represents an alternative source of supply and was evaluated to address the potential impacts on the Tuolumne River, Alameda Creek, and Peninsula watersheds, including Pilarcitos Creek, and related resources. (DEIR, pp. 9-66 to 9-74.) Compared to the Phased WSIP Variant, it provides a supply of water that is not yet needed but has significant environmental effects of its own, as discussed below.

This Commission rejects this Alternative as infeasible at this time for the following reasons. Construction and operation of a desalination facility raises unresolved environmental issues, including questions about protecting aquatic resources, water quality and brine disposal issues. The plant would require significant increases in long-term energy use compared to the Phased WSIP Variant. Because in California today, such energy generation typically involves the use of fossil fuels, the energy demands of a desalination facility will exacerbate global climate change by increasing emissions of greenhouse gases (GHGs), in contravention of state policy as embodied in the California Global Warming Solutions Act of 2006, also known as AB 32. This Alternative is also likely to be quite costly for the SFPUC, as analyzed by the SFPUC in its Report (SFPUC, Water Supply Options, 2007 [Appendix C, *WSIP Alternative Water Supply Option 3*, prepared by SFPUC and Parsons, June 2006). Feasibility of the desalination plant is also uncertain at this time; it would require numerous additional permits and approvals from, among other agencies, the California Department of Health Services, the U.S. Army Corps of Engineers, the RWQCB and the California Coastal Commission. It is unlikely that this facility can be approved and constructed in time to meet demand projections in the next 10 years. Thus the Phased WSIP Variant is not only more feasible from technological and timing perspectives but also will have fewer environmental impacts because of its focus on conservation, recycling and local groundwater projects. Instead, this Commission believes that efforts should be made to implement conservation measures, recycling projects and groundwater projects to meet additional water supply demands in the relative short term; following those efforts, demand for water supply can be reassessed in 2018.

In short, after balancing competing policy considerations and the extent to which the Year-round Desalination at Oceanside Alternative would add a great deal of complexity and uncertainty to the satisfaction of the SFPUC's long-term water supply objective, the Commission rejects the Year-round Desalination at Oceanside Alternative as infeasible within the meaning of CEQA.

6. Regional Desalination for Drought Alternative

As described in the PEIR, under the Regional Desalination for Drought Alternative, the SFPUC would implement all of the proposed WSIP facility improvement projects and would partner with other Bay Area water agencies to construct and operate a regional desalination plant that would provide the SFPUC with supplemental supply during drought years. Compared to the originally proposed WSIP, this alternative represents an alternative source of water supply and was evaluated to address the potential impacts on the Tuolumne River.

This Commission does not fully reject this Alternative because the SFPUC is currently exploring a regional desalination plant for drought, as a partial long-term solution to water supply and demand. The SFPUC is participating in the development of feasibility studies and pilot testing to determine the viability of the regional desalination plant. If found to be feasible, the SFPUC would contribute funds towards environmental review, project construction and operation of the plant. Development of this Alternative would require construction of multiple components, cooperation agreements with other agencies, and local, state and federal regulatory approvals. There are many unresolved environmental issues, including questions about protecting aquatic resources, water quality and brine disposal issues. The plant would require significant increases in long-term energy use compared to the Phased WSIP Variant. Because in California today, such energy generation typically involves the use of fossil fuels, the energy demands of a desalination facility will exacerbate global climate change by increasing GHG emissions, in contravention of state policy as embodied in AB 32. Depending on the agreements with other participating agencies, this Alternative could also be quite costly for the SFPUC as analyzed by the SFPUC in the Bay Area Regional Desalination Project Pre-feasibility Study, Final Report, prepared by URS Corporation, 2003. While the desalination may provide a partial solution to diverting more water from the SFPUC watersheds, it does not appear to be environmentally superior to the Phased WSIP Variant through 2018. Instead, this Commission believes that a combination of efforts to be made under the Phased WSIP Variant to limit deliveries from the SFPUC watersheds to approximately 265 mgd, average annual, as well as implementation of conservation measures, recycled water projects and groundwater projects to meet additional water supply demands in the relative short term, presents a better approach to water system management. In the near-term, this Commission considers this Alternative to be infeasible to fulfill dry year or drought water supply needs because of the potential financial and environmental costs and the uncertainty regarding the SFPUC's ability to secure all necessary agreements and approvals to implement the Alternative. This Alternative proposes a desalination facility that is in the beginning stages of feasibility analyses, and many issues remain to be resolved.

After balancing competing policy considerations and the extent to which the Regional Desalination for Drought Alternative would add a great deal of complexity and uncertainty to the satisfaction of the SFPUC’s long-term water supply objective, the Commission presently rejects the Regional Desalination for Drought Alternative as infeasible within the meaning of CEQA. In doing so, however, the SFPUC is by no means closing the door permanently on eventual participation in a regional desalination facility. As part of its assessment in 2018 as to whether to increase Tuolumne River diversions to meet anticipated 2030 demand in its service area, the SFPUC will assess any progress the region has made towards putting in place, on a timely basis and under acceptable environmental conditions, a facility for desalinating seawater as a source of supplemental water supply during droughts. Any such facility is simply too ill-defined and uncertain at present to be adopted at this time.

7. Modified WSIP Alternative

The Modified WSIP Alternative would implement all of the proposed facility improvement projects, but would modify proposed system operations to minimize environmental effects. This alternative would include as part of its "Project description" the implementation of key mitigation measures identified for the originally proposed WSIP in the PEIR, including acquiring a water transfer of conserved water as a supplemental dry-year source, implementing a minimum instream flow requirement for resident fish in a portion of Alameda Creek, incorporating mitigation measures to address impacts in the Pilarcitos Creek watershed**,** managing the inundation levels at Crystal Springs Reservoir to preserve upland habitat to the extent possible, and increasing recycled water, conservation, and local groundwater in partnership with wholesale customers. It also requires that any additional water diverted from the upper Tuolumne River must be offset by conservation efforts for water to be released to the lower Tuolumne River. This Alternative proposes to divert an average annual 15 mgd additional water from the Tuolumne River between Hetch Hetchy and Don Pedro Reservoirs compared to existing conditions. This alternative was evaluated to address the impacts identified for the originally proposed WSIP on the Tuolumne River, Alameda Creek, and Peninsula watersheds, including Pilarcitos Creek and Crystal Springs Reservoir, and related resources. (DEIR, pp. 9-78 to 9-84; C&R Section 14.10.)

Water supply sources in both the Modified WSIP Alternative and the Phased WSIP Variant are similar, but differ in a few respects. First, the Modified WSIP Alternative proposes to divert an additional annual average of 15 mgd from the upper Tuolumne River compared to existing conditions through 2030 and thus would result in diverting more water from the Tuolumne River than would occur under the Phased WSIP Variant through 2018. Under the Modified WSIP Alternative, water would be diverted at Hetch Hetchy Reservoir to meet 2030 demand. That diversion would result in reduced inflow to Don Pedro Reservoir, which, under this Alternative, would be offset by reduced outflow from Don Pedro because of conservation measures undertaken by MID or TID (and/or in the service area of another nearby water agency). Water releases from Don Pedro Reservoir to the lower Tuolumne River thus would be the similar to existing conditions under the Modified WSIP Alternative. The Phased WSIP Variant proposes long-term increases in diversions of about 2 mgd, average annual, from the Tuolumne River to meet the Program's reliability and drought rationing objectives and would maintain total deliveries to customers from the watersheds at 265 mgd, average annual. In the short term, the Phased WSIP Variant may result in the need to deliver more than a total of 265 mgd, average annual, to customers for a limited period while local conservation, recycling and groundwater programs are being implemented. Where the Phased WSIP Variant diverts more than an average annual of 265 mgd from the watersheds, mitigation measures will be implemented for the Lower Tuolumne River.

Second, the approach to the dry-year transfer is slightly different for the Modified WSIP Alternative and the Phased WSIP Variant. The Westside Groundwater Basin conjunctive use program would provide a supplemental dry-year water supply source for both the Phased WSIP Variant and the Modified WSIP Alternative. The dry-year water transfer from TID and MID under the Modified WSIP Alternative would be a transfer made only from conserved water (approximately 17.5 mgd average over the design drought). The Phased WSIP Variant does not rule out the possibility of using conserved water only, and includes preferred mitigation measure 5.3.6-4a to be implemented if average annual deliveries of water from the watersheds exceeds 265 mgd, but it does not require that dry-year transfers be conserved water only (approximately 2 mgd average over the design drought). Thus, the substantially reduced size of the dry-year transfer under the Phased WSIP Variant compared to the Modified WSIP Alternative combined with the urgency of undertaking the improvements and increasing reliability through implementation of the dry year supply measures make it difficult to require that no transfer occur without equal and balancing conservation measures in MID/TID service area at this time.

Third, the Phased WSIP Variant proposes more conservation, recycling and groundwater programs than the Modified WSIP Alternative. Both the Alternative and the Variant assume 10 mgd of conservation, recycling and groundwater programs in San Francisco. While the Modified WSIP Alternative commits to 5 – 10 mgd of additional conservation, recycling and groundwater programs in the wholesale customer area through 2030, the Phased WSIP Variant requires that a minimum of 10 mgd of additional conservation, recycling and groundwater programs be implemented in the wholesale customer area by 2018.

The Modified WSIP Alternative would result in more impacts on the upper Tuolumne River watershed than the Phased WSIP Alternative, but possibly fewer impacts on the lower Tuolumne River watershed if under the Phased WSIP Variant, average annual deliveries from the watersheds were to exceed 265 mgd in the short-term. The Modified WSIP Alternative would lessen but not entirely eliminate impacts on the lower Tuolumne River, but the impacts would be considered less than significant. (See C&R, Section 14.10, pages 14.10-2 – 14.10-26.) As long as average annual deliveries from the watersheds do not exceed 265 mgd under the Phased WSIP Variant, impacts on the lower Tuolumne River would be considered less than significant; mitigation measures will be implemented any time the SFPUC's average annual deliveries from the watersheds exceed an average annual total of 265 mgd.

In the Alameda Creek watershed, the impacts of the Phased WSIP Variant and the Modified WSIP Alternative are essentially the same. The SFPUC has already incorporated the Alameda Creek bypass flows between the Alameda Creek Diversion Dam and the confluence with Calaveras Creek as protective measures under the Calaveras Dam Replacement project (SV-2), and is adopting now the mitigation measures proposed for the Alameda Creek watershed, so the Modified WSIP Alternative and the Phased WSIP Variant result in similar impacts in the Alameda Creek watershed.

The Modified WSIP Alternative incorporated as part of its "project description" four mitigation measures proposed for operations at Pilarcitos Reservoir and Stone Dam to reduce identified significant impacts of the originally proposed WSIP in the Pilarcitos Creek watershed to a less than significant level. The Phased WSIP Variant would not have any significant impacts in the Pilarcitos watershed through 2018 because operations would be similar to existing conditions. The impacts of the Modified WSIP Alternative and the Phased WSIP Variant are fairly similar; the Phased WSIP Variant avoids the significant impacts, and the Modified WSIP Alternative incorporates mitigation measures to reduce the significant impacts to a less than significant level.

The Final PEIR concluded that impacts of the proposed Crystal Springs Reservoir operations would be potentially significant and unavoidable for both the Modified WSIP Alternative and the Phased WSIP Variant with respect to Impact 5.5.5-1, effects on trout spawning habitat along Laguna and San Mateo Creeks. The impacts would be reduced with implementation of mitigation measures, but impacts would remain potentially significant under both scenarios. Both scenarios assume that the impacts and mitigation measures will be re-evaluated in detail at the project level and refined as part of the environmental review of the Lower Crystal Springs Dam Improvements project (PN-4). Impacts on terrestrial biological resources in upper and lower Crystal Springs Reservoirs are significant and mitigable for both the Phased WSIP Variant and the Modified WSIP Alternative, although the impacts may be slightly less under the Modified WSIP Alternative.

The Modified WSIP Alternative includes implementation of potentially fewer long-term conservation, water recycling and local groundwater projects within the regional service area than under the Phased WSIP Variant. While construction of these facilities would cause temporary construction disruption and related environmental impacts, long-term implementation of these regional conservation, water recycling, and local groundwater projects would offset impacts of the operational modifications proposed under the Modified WSIP Alternative on the Tuolumne River. Compared to the Phased WSIP Variant, the Modified WSIP Alternative would result in approximately the same impacts on land use, air quality, noise, traffic, and energy in urban environments (expected to be largely mitigable). Both the Phased WSIP Variant and the Modified WSIP Alternative will result in fewer and significantly less severe impacts on biological and fishery resources in natural habitats than the originally proposed WSIP.

The Modified WSIP Alternative was identified as the environmentally superior alternative in the Draft PEIR for the 2030 planning horizon. It would reduce key impacts of the originally proposed WSIP on natural resources along the lower Tuolumne River, in Alameda and Pilarcitos Creeks, and in/around Crystal Springs and Pilarcitos Reservoirs, but it would continue to meet the WSIP's primary goals and objectives. Like the Phased WSIP Variant, this alternative would maximize the use of existing facilities and the largely gravity-driven system without also requiring the construction of additional major facilities called for under many other alternatives, or substantially increasing the energy demand of the system or need for pumping. This Alternative will have more impacts on the upper Tuolumne River, and possible less on the Lower Tuolumne River. It is not entirely clear that the Modified WSIP Alternative is substantially environmentally superior to the Phased WSIP Variant and does not provide a strong basis for selecting this Alternative.

This Commission finds that the Phased WSIP Variant is substantially similar to this Alternative in that it includes essentially the same elements relevant through 2018. The Commission rejects this Alternative insofar as it makes a decision through 2030; instead, the Phased WSIP Variant focuses the SFPUC and the customers on implementation of conservation, recycling and groundwater projects before 2018. The SFPUC will then re-evaluate the water supply decision in 2018. The Modified WSIP Alternative incorporates as part of the program most of the mitigation measures proposed for the original WSIP in the PEIR. Because this Commission is adopting all relevant mitigation measures as part of this Phased WSIP Variant approval, most of the impacts of the two approaches are similar.

The feasibility of this Alternative is not easily confirmed because of its reliance on MID and TID and/or another water supplier for conserved water of 15 mgd average annual, as well as the dry year transfer. If the SFPUC could not procure conserved water from the MID, TID or another water supplier, then no additional diversions from the Tuolumne River could occur under this Alternative. Such an outcome would push the Alternative in the direction of the No Purchase Request Increase Alternative, and the impacts of this Alternative would thus become similar to the No Purchase Request Increase Alternative.

After balancing competing policy considerations, including the extent to which those components of the Modified WSIP Alternative not included in the Phased WSIP Variant would delay resolution of key issues relating to the TID-MID dry-year “conserved water” transfer and operating criteria at Crystal Springs Reservoir, the Commission presently rejects as infeasible within the meaning of CEQA those components the Modified WSIP Alternative not included within the Phased WSIP Variant. In doing so, however, the SFPUC recognizes that mitigation measure 5.3.6-4a is the preferred mitigation measure and should be undertaken as part of the Phased WSIP Variant. The SFPUC is by no means closing the door on the possibility of an dry-year “conserved water” transfer from TID and MID. Whether the SFPUC will ultimately be able to implement the dry year transfer of conserved water will depend on complex negotiations, regulatory issues, cost considerations, and other issues that may or may not be possible for the various agencies involved to resolve within a reasonable time frame or during implementation of the Phased WSIP Variant.

VII. STATEMENT OF OVERRIDING CONSIDERATIONS

Pursuant to CEQA section 21081 and CEQA Guideline 15093, the Commission hereby finds, after consideration of the Final PEIR and the evidence in the record, that each of the specific overriding economic, legal, social, technological and other benefits of the Program as set forth below independently and collectively outweighs these significant and unavoidable impacts and is an overriding consideration warranting approval of the Program. Any one of the reasons for approval cited below is sufficient to justify approval of the Program. Thus, even if a court were to conclude that not every reason is supported by substantial evidence, the Commission will stand by its determination that each individual reason is sufficient. The substantial evidence supporting the various benefits can be found in the preceding findings, which are incorporated by reference into this Section, and in the documents found in the Record of Proceedings, as defined in Section I.

On the basis of the above findings and the substantial evidence in the whole record of this proceeding, the Commission specially finds that there are significant benefits of the proposed Program to support approval of the Phased WSIP Variant in spite of the unavoidable significant impacts, and therefore makes this Statement of Overriding Considerations. The Commission further finds that, as part of the process of obtaining Program approval, all significant effects on the environment from implementation of the Phased WSIP Variant have been eliminated or substantially lessened where feasible. All mitigation measures proposed in the PEIR for this Variant are adopted as part of this approval action. Furthermore, the Commission has determined that any remaining significant effects on the environment found to be unavoidable are acceptable due to the following specific overriding economic, technical, legal, social and other considerations.

The Phased WSIP Variant has the following benefits:

1. Implementation of facility improvement projects will reduce vulnerability to earthquakes. Improvements are designed to meet current seismic standards. The regional water system is a critical and vulnerable link in the City’s and wholesale customer’s ability to survive after a major earthquake and to maintain access to critically needed water supplies. Not only will water be

necessary for human consumption, but will provide emergency water supply after an earthquake to protect the public health and safety. The SFPUC will be able to meet the fundamental and most pressing needs of the water system – to improve the seismic safety and reliability of the water system as a means of saving human life and property under a catastrophic earthquake scenario or even a disaster scenario not rising to the level of catastrophic. As the system ages, its reliability decreases and the risk of failure increases. The 167-mile-long system crosses five active earthquake faults. Facilities located near these points of intersection are at risk of failure in the event of a major earthquake, an event considered likely in the next 30 years. Due to the age of the system, many facilities do not meet modern seismic standards. A failure of the water system could leave some customers without water for 10 – 30 days, and in some instances as long as 60 days. Alternative supplies will be limited. Many communities have only a few days of locally stored reserves in tanks and small reservoirs, most of which would be depleted within the first 48-72 hours of an emergency to meet the initial spike in demand for emergency services. Potential economic losses to the region from a water supply interruption as well as incremental damage from lack of adequate water supply to suppress post-quake fires would likely total tens of billions of dollars. The SFPUC system is a critical regional asset providing an essential service and commodity to the Bay Area economy. Its deteriorating condition places the regional economy and the welfare of millions of Bay Area residents at risk. Effecting the necessary repairs and improvements to assure the water system's continued reliability, and developing it as part of a larger, integrated water security strategy, is critical to the Bay Area's economic security, competitiveness and quality of life. (See "Hetch Hetchy Water and the Bay Area Economy", Bay Area Economic Forum 2002)

2. The SFPUC will be able to deliver basic service to the three regions in the service area (East/South Bay, Peninsula, and San Francisco) within 24 hours after a major earthquake.

3. The SFPUC will be able to restore facilities to meet projected average-day demand within 30 days after a major earthquake.

4. The Program reduces the physical, social, and economic impacts associated with the potential rupture of the existing system including, but not limited to, public health and safety, flooding, erosion, biological impacts, traffic interruption, and property damage.

5. The Program supports the economic vitality of the Region by fulfilling the water demands under emergency conditions.

6. The Water system will maintain high-quality water and a gravity-driven system, allowing the SFPUC to continue to provide clean, unfiltered water originating from Hetch Hetchy Reservoir and filter all other surface water sources.

7. Improvements are designed to meet current and foreseeable future federal and state water quality requirements.

8. The Phased WSIP Variant promotes on-going monitoring of watershed areas, limiting diversions while exploring all options and demand by 2018 – the dynamic nature of information and technology weighs in favor of making a decision on water supply only through 2018.

9. The Program will increase delivery reliability and improve the ability to maintain the water system, providing operational flexibility to allow planned maintenance shutdown of individual facilities without interrupting customer service, operational flexibility to minimize the risk of service interruption due to unplanned facility upsets or outages, and operational flexibility and system capacity to replenish local reservoirs as needed. In order to implement a feasible asset management program in the future that will provide continuous maintenance and repairs to facilities, the regional water system requires redundancy (i.e., backup) of some critical facilities necessary to meeting day-to-day customer water supply needs. Without adequate redundancy of critical facilities, the SFPUC has limited operational flexibility in the event of an emergency or a system failure, as well as constraints on conducting adequate system inspection and maintenance. Failure to implement the Program would place the water system at significant risk to seismic hazards, increased facility failures, and increased supply shortages on a day-to-day basis, as well as result in prolonged service disruptions to many customers in the event of an earthquake or other emergency due to inadequate facility redundancy and operational flexibility.

10. The SFPUC can meet the estimated average annual demand under the conditions of one planned shutdown of a major facility for maintenance concurrent with one unplanned facility outage.

11. The SFPUC can meet customer water supply needs; the Phased WSIP Variant would serve 265 mgd of retail and wholesale customer purchases from the SFPUC watersheds, and meet or offset the remaining 20 mgd through conservation, recycled water, and groundwater in the retail and wholesale service areas. Ten mgd of this would be met, as proposed under the WSIP, through conservation, recycled water, and groundwater projects in San Francisco, and 10 mgd would be met through local conservation, recycled water and groundwater in the wholesale service area.

12. The Phased WSIP Variant can meet dry-year delivery needs through 2018 while limiting rationing to a maximum 20 percent system-wide reduction in water service during extended droughts.

13. The Phased WSIP Variant diversifies water supply options during non-drought and drought periods.

14. The Phased WSIP Variant will substantially improve use of new water sources and drought management, including use of groundwater, recycled water, conservation, and transfers.

15. The Program will enhance sustainability in all system activities, including management of natural resources and physical systems to protect watershed ecosystems and to protect public health and safety.

16. The Phased WSIP Variant will achieve a cost-effective, fully operational system, ensuring cost-effective use of funds, and maintaining a gravity-driven system.

17. The water system will continue to provide a source of clean energy and require a low level of energy to run the system, both of which help maintain and minimize GHG emissions associated with water and power utility services.

18. The PEIR identified climate change as a factor that may affect regional water system operations due to potential changes in precipitation that originates as rainfall or snowmelt in the Tuolumne watershed, and the magnitude of rain events in the local system watersheds. Understanding and adapting to climate change as it affects watershed ecosystems will be an ongoing task for regional water system operators, but the science underlying the changes may be better known in 2018 than it is today. The Phased WSIP Variant will allow the SFPUC to benefit from a better understanding of the science and potential effects of climate change when it evaluates whether to increase water supply deliveries in 2018.

19. The PEIR identified at least three watersheds where increases in instream releases may be required by regulatory changes or in conformance with SFPUC stewardship goals, with corresponding reductions in regional water system yield. By 2018 most of these regulatory requirements or stewardship programs will have been implemented, thereby clarifying the reliability and yield of the regional water system. The Program gives the SFPUC the flexibility to take into consideration these issues when it evaluates whether to increase water supply deliveries in 2018.

To accomplish all of the SFPUC's objectives, it must move forward with the WSIP facility improvement projects as proposed, to improve seismic and water delivery reliability, to meet current and future water quality regulations, to provide for additional system conveyance for maintenance and delivery reliability, and to meet water supply reliability goals for 2018 and possibly beyond. Like all water utilities, the SFPUC must consider current needs as well as possible future changes and unplanned outages, and design a system that achieves a balance among the numerous objectives, functions and risks a water supplier must face. As prudent water managers, the SFPUC must make decisions about how to manage its water system effectively. Approval of the Phased WSIP Variant will allow the SFPUC to accomplish these many goals.

Having considered these benefits, including the benefits discussed in Section I above, the Commission finds that the benefits of the Program outweigh the unavoidable adverse environmental effects, and that the adverse environmental effects are therefore acceptable.

RF

State of California

Memorandum

To : Regional Water Board
Executive Officers

Regional Water Board Attorneys

Date: SAN - 4 1994

William R. Attwater
Chief Counsel
OFFICE OF THE CHIEF COUNSEL

From : STATE WATER RESOURCES **CONTROL** BOARD
901 P Street, Sacramento, CA 95814
Mail Code: G-8

Subject: GUIDANCE ON CONSIDERATION OF ECONOMICS IN THE ADOPTION OF WATER QUALITY OBJECTIVES

ISSUE

What is required of a Regional Water Quality Control Board (Regional Water Board). in order to fulfill its statutory duty to consider economics when adopting water quality objectives in water quality control plans or in waste discharge requirements?

CONCLUSION

A Regional Water Board is under an affirmative duty to consider economics when adopting water quality objectives in water quality control plans or, in the absence of applicable objectives in a water quality control plan, when adopting objectives on a case-by-case basis in waste discharge requirements. To fulfill this duty, the Regional Water Board should assess the costs of the proposed adoption of a water quality objective. This assessment will generally require the Regional Water Board to review available information to determine the following: (1) whether the objective is currently being attained; (2) what methods are available to achieve compliance with the objective, if it is not currently being attained; and (3) the costs of those methods. The Regional Water Board should also consider any information on economic impacts provided by the regulated community and other interested parties.

If the potential economic impacts of the proposed adoption of a water quality objective appear to be significant, the Regional Water Board must articulate why adoption of the objective is necessary to assure the reasonable protection of beneficial uses of state waters, despite the potential adverse economic consequences. For water quality control plan amendments, this discussion could be included in the staff report or resolution for the proposed amendment. For waste discharge requirements, the rationale must be reflected in the findings.

DISCUSSION

A. Legal Analysis

1. Porter-Cologne Water Quality Control Act

Under the Porter-Cologne Water Quality Control Act, Water Code Section 13000 et seq. (Porter-Cologne Act or Act), the State Water Resources Control Board (State Water Board) and the Regional Water Boards are the principal state agencies charged with responsibility for water quality protection. The State and Regional Water Boards (Boards) exercise this responsibility primarily through the adoption of water quality control plans and the regulation of waste discharges which could affect water quality. See Water Code Secs. 1317.0, 13170.2, 13240, 13263, 13377, 13391.

Water quality control plans contain water quality objectives, as well as beneficial uses for the waters designated for protection and a program of implementation to achieve the objectives. Id. Sec. 13050(j). In the absence of applicable water quality objectives in a water quality control plan, the Regional Water Board may also develop objectives on a case-by-case basis in waste discharge requirements. See id. Sec. 13263(a).[1]

When adopting objectives either in a water quality control plan or in waste discharge requirements, the Boards are required to exercise their judgment to "ensure the reasonable protection of beneficial uses and the prevention of nuisance". Id. Se-cs. 13241, 13263; see id. Sec. 13170. The Porter-Cologne Act recognizes that water quality may change to some degree without

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[1] *The focus of this memorandum is limited to an analysis of the Boards' obligation to consider economics when adopting water quality objectives either in water quality control plans or, on a case-by-case basis, in waste discharge requirements. This memorandum does not discuss the extent to which the Boards' are required to consider the factors specified in Water Code Section 13241 in other situations. Specifically, this memorandum does not discuss the applicability of Section 13241 to the development of numeric effluent limitations, implementing narrative objectives contained in a water quality control plan. Further guidance on the latter topic will be developed at a later date.*

causing an unreasonable effect on beneficial uses. Id. The Act, therefore, identifies factors which the Boards must consider in determining what level of protection is reasonable. Id.[2] These factors include economic considerations. Id.[3]

The legislative history of the Porter-Cologne Act indicates that "[c]onservatism in the direction of high quality should guide the establishment of objectives both in water quality control plans and in waste discharge requirements". Recommended Changes in Water Quality Control, Final Report of the Study Panel to the [State Water Board], Study Project--Water Quality Control Program, p. 15 (1969) (Final Report). Objectives should "be tailored on the high quality side of needs of the present and future beneficial uses". Id. at 12. Nevertheless, objectives must be reasonable, and economic considerations are a necessary part of the determination of reasonableness. "The regional boards must balance environmental characteristics, past, present and future beneficial uses, and economic considerations (both the cost of providing treatment facilities and the economic value of development) in establishing plans to achieve the highest water quality which is reasonable." Id. at 13.

2. <u>Senate Bill 919</u>

The Boards are under an additional mandate to consider economics when adopting objectives as a result of the recent enactment of Senate Bill 919. 1993 Cal. Stats., Chap. 1131, Sec. 8, to be codified at Pub. Res. Code, Div. 13, Ch. 4.5, Art. 4. The legislation, which is

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[2] *Other factors which must be considered include:*

(a) Past, present, and probable future beneficial uses of water;
(b) Environmental characteristics of the hydrographic unit under consideration, including the quality of water available thereto;
(c) Water quality conditions that could reasonably be achieved through the coordinated control of all factors which affect water quality in the area;
(d) The need for developing housing within the region;
(e) The need to develop and use recycled water.

[3] *See also Water Code Section 13000 which mandates that activities and factors which may affect water quality "shall be regulated to attain the highest water quality which is reasonable, considering all demands being made and to be made on those waters and the total values involved, beneficial and detrimental, <u>economic</u> and social, tangible and intangible" (emphasis added).*

effective January 1, 1994, amended the California Environmental Quality Control Act, Public Resources Code Section 21000 et seq. (CEQA), to require that, whenever the Boards adopt rules requiring the installation of pollution control equipment or establishing a performance standard or treatment requirement, the Boards must conduct an environmental analysis of the reasonably foreseeable methods of compliance. This analysis must take into account a reasonable range of factors, including economics. For the reasons explained above, the latter requirement is duplicative of existing requirements under the Porter-Cologne Act regarding consideration of economics.

B. Recommendation

The meaning of the mandate to "consider economics" in the Porter-Cologne Act is not entirely clear. It is clear that the Porter-Cologne Act does not specify the weight which must be given to economic considerations. Consequently, the Boards may adopt water quality objectives even though adoption may result in significant economic consequences to the regulated community. The Porter-Cologne Act also does not require the Boards to do a formal cost-benefit analysis.

The Porter-Cologne Act does impose an affirmative duty on the Boards to consider economics when adopting water quality objectives. The Boards probably cannot fulfill this duty simply by responding to economic information supplied by the regulated community. Rather, the Boards should'assess the costs of adoption of a proposed water quality objective. This assessment will normally entail three steps. First, the Boards should review any available information on receiving water and effluent quality to determine whether the proposed objective is currently being attained or can be attained. If the proposed objective is not currently attainable, the Boards should identify the methods which are presently available for complying with the objective. Finally, the Boards should consider any available information on the costs associated with the treatment technologies or other methods which they have identified for complying with a proposed objective.[4]

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[4] See, *for example,* *Managing Wastewater In Coastal Urban Areas*, *National Research Council (1993). This text provides data on ten technically feasible wastewater treatment technologies, which can be used to make comparative judgments about performance and to estimate the approximate costs of meeting various effluent discharge standards, including standards for toxic organics and metals.*

In making their assessment of the cost impacts of a proposed objective, the Boards are not required to engage in speculation. Rather, the Boards should review currently available information. In addition, the Boards should consider, and respond on the record, to any information provided by dischargers or other interested persons regarding the potential cost implications of adoption of a proposed objective.

If the economic consequences of adoption of a proposed water quality objective are potentially significant, the Boards must articulate why adoption of the objective is necessary to ensure reasonable protection of beneficial uses. If the objective is later subjected to a legal challenge, the courts will consider whether the Boards adequately considered all relevant factors and demonstrated a rational connection between those factors, the choice made, and the purposes of the Porter-Cologne Act. See California Hotel & Motel Assn. v. Industrial Welfare Com., 25 Cal.3d 200, 212, 157 Cal.Rptr. 840, 599 P.2d 31 (1979).

Reasons for adopting a water quality objective, despite adverse economic consequences, could include the sensitivity of the receiving waterbody and its beneficial uses, the toxicity of the regulated substance, the reliability of economic or attainability data provided by the regulated community, public health implications of adopting a less stringent objective, or other appropriate factors. These factors may also include the legislative directive that a "margin of safety [ ] be maintained to assure the protection of all beneficial uses." Final Report, p. 15 and App. A, p. 59.

If objectives are proposed for surface waters and adverse economic consequences stemming from adoption of the objectives could be avoided only if beneficial uses were downgraded, the Boards should address whether dedesignation would be feasible under the applicable requirements of the Clean Water Act and implementing regulations. See 40 C.F.R. Sec. 131.10. Dedesignation is feasible only for potential, rather than existing, uses. See id. Sec. 131.10(g). If dedesignation of potential beneficial uses is infeasible, the Boards should explain why, e.g., that there is a lack of data supporting dedesignation.[5]

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[5] *It should also be noted that, even if dedesignation of potential beneficial uses is feasible, in the great majority of cases it will not have any significant effect on the selection of a proposed objective. This is so because the proposed objective will be necessary to protect existing beneficial uses, which cannot be dedesignated.*

The State or Regional Water Board's rationale for determining that adoption of a proposed objective is necessary to protect water quality, despite adverse economic consequences, must be discernible from the record. This reasoning could be included in the staff report or in the resolution adopting a proposed water quality control plan amendment. When objectives are established on a case-by-case basis in waste discharge requirements, the rationale must be included in the findings.

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EXHIBIT 4

CITY AND COUNTY OF SAN FRANCISCO

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July 29, 2014

State Water Resources Control Board
Division of Water Rights
Attn: Mark Gowdy
P.O. Box 2000
Sacramento, CA 95812

Dear Mr. Gowdy,

In a recent letter dated May 6, 2014 to the San Francisco Public Utilities Commission ("SFPUC"), the Division of Water Rights outlined certain "key assumptions" that State Water Resources Control Board ("State Water Board") staff will use in their impact analysis for the revised *Draft Substitute Environmental Document in Support of Potential Changes to the Water Quality Control Plan for the Bay-Delta: San Joaquin River Flows and Southern Delta Water Quality* ("Phase 1 SED"), to evaluate impacts to the City and County of San Francisco ("CCSF") that may result from the proposed Tuolumne River flow alternatives.[1] The purpose of this letter is to comment on the propriety of staff's reliance on the "key assumptions" identified in the May 6, 2014 letter.[2]

The May 6, 2014 letter identifies assumptions by State Water Board staff ("staff") regarding how CCSF will fulfill its obligations under the Raker Act and the Fourth Agreement to the Modesto Irrigation District and the Turlock Irrigation District ("Districts") as a result of new instream flow requirements on the Tuolumne River if the CCSF's storage credits in its Water Bank account in the Don Pedro Project are reduced to zero. In this scenario, staff will assume that economic impacts to CCSF from increased instream flow requirements will be limited to those arising from increased water rates because CCSF will be able to purchase sufficient water from the Districts to avoid water shortages and consequent reductions in water deliveries throughout the Hetch Hetchy Regional Water System ("RWS") service territory.

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[1] Letter from Barbara Evoy, Deputy Director, Division of Water Rights, State Water Resources Control Board, to Ellen Levin, Deputy Manager, Water Enterprise, San Francisco Public Utilities Commission, May 6, 2014 (referred to below as the "May 6, 2014 letter" or "letter"). The State Water Board also filed the letter in the Federal Energy Regulatory Commission ("FERC") docket for the Don Pedro Hydroelectric Project, FERC No. 2299 ("Don Pedro Project"), on May 12, 2014. The letter is available through the FERC eLibrary under Accession Number 20140513-0028.

[2] CCSF reserves the right to argue how the Raker Act or the Fourth Agreement should be interpreted in future proceedings before the State Water Board or other bodies.

I. The Phase 1 SED Must Analyze Impacts from Reduced Water Deliveries throughout the Hetch Hetchy Regional Water System as a Result of Implementation of the Proposed Tuolumne River Flow Alternatives Because Reduction in Deliveries is the Reasonably Foreseeable Method of Compliance.

The May 6, 2014 letter suggests that the Phase 1 SED may not include analysis of the impacts from reduced water deliveries throughout the RWS service territory that may result from implementation of the proposed Tuolumne River flow alternatives. Such an omission would render staff's California Environmental Quality Act ("CEQA") impact analysis inadequate.

The Phase 1 SED must analyze the impacts of reduction in deliveries throughout the RWS service territory that may result from implementation of the proposed Tuolumne River flow alternatives because reduction in deliveries is the only method of compliance that is within the SFPUC's control, and thus, it is the reasonably foreseeable consequence of the State Water Board's contemplated action. The Phase 1 SED must contain "[a]n environmental analysis of the reasonably foreseeable methods of compliance . . . ."[3] As explained by the California Court of Appeal, under CEQA whether one or more methods of future compliance with a new regulatory requirement are reasonably foreseeable "depends upon the quality and quantity of evidence in the administrative record."[4] Evidence introduced into the administrative record for the Phase 1 SED by CCSF shows that the foreseeable method of compliance with the proposed Tuolumne River flow alternatives will be reduction in water deliveries throughout the RWS service territory.[5] More specifically, CCSF submitted comments on the Draft SED for Phase 1 in which it explained that,

> SFPUC's analysis of the proposed action [*i.e.*, the preferred alternative which would require 35% of unimpaired flow to remain in the stream] shows there would be dramatic and significant impacts on the SFPUC's diversions from the Hetch Hetchy Project to its Regional Water System service area and the Bay Area economy assuming – as the draft SED recognizes – that revised water release requirements ordered by FERC could result under the Fourth Agreement in a reallocation of water bank credits so as to apportion an additional burden on CCSF of 51.7121%. Assuming current demands and a recurrence of the 1987-1992 drought, the SFPUC's annual diversions from the Tuolumne River could be reduced by 111,700 [acre-feet] for each of the six years of the drought. This additional annual reduction in supply – when added

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[3] 23 CCR § 3777 (b)(4) (identifying required elements of Substitute Environmental Documentation ("SED") prepared by the State Water Board, and specifying that "[t]he Draft SED shall include, at a minimum, the following information . . . An environmental analysis of the reasonably foreseeable methods of compliance.").

[4] *Cnty. Sanitation Dist. No. 2 of Los Angeles Cnty. v. Cnty. of Kern* ("*County Sanitation District*") (2005) 127 Cal. App. 4th 1544, 1586.

[5] Comment Letter – Bay Delta Plan SED, CCSF, March 29, 2013, *available at* http://www.waterboards.ca.gov/waterrights/water_issues/programs/hearings/baydelta_pdsed/docs/comments032913/dennis_herrera.pdf (referred to below as "CCSF Comment Letter"), at pp. 6-7.

> to reductions in deliveries of up to 20% already imposed by the SFPUC to ensure delivery of water to customers throughout the 1987-1992 drought – results in a single year of reduction in deliveries of 42%, and five years of reduction in deliveries of 52%. In 2009 the SFPUC presented testimony to FERC on the economic impacts of 41% and 51% rationing within the service area of the Regional Water System. . . . *The impacts of such levels of rationing on the Bay Area economy are staggering*.[6]

Thus, CCSF's predicted method of compliance with the proposed Tuolumne River flow alternatives, *i.e.*, reduction in deliveries throughout the RWS service territory, and the information upon which the prediction is based, *e.g.*, the analyses of CCSF's experts, Mr. Steiner and Professor Sunding, constitute substantial evidence which supports a fair argument that reduction in deliveries to the RWS service territory is a reasonably foreseeable consequence of the SWB's proposed action.[7] Therefore, staff's impact analysis in the Phase 1 SED must consider reduction in deliveries to the RWS service territory and the impacts that would result from such reductions.

In particular, staff's analysis must consider direct and indirect physical impacts on the environment from reduction in deliveries to the RWS service territory. (*Bakersfield Citizens for Local Control v. City of Bakersfield* (*"Bakersfield"*) (2004) 124 Cal. App. 4th 1184, 1205 (explaining, "if the forecasted economic or social effects of a proposed project directly or indirectly will lead to adverse physical changes in the environment, then CEQA requires disclosure and analysis of these resulting physical impacts.").) A reasonable analysis should evaluate the physical impacts associated with insufficient water supplies and rationing. These types of analyses should be undertaken to provide the decision makers with a full understanding of the environmental consequences of their decision, as required by CEQA.

II. The Phase 1 SED Should Not Analyze CCSF's Purchase of the Required Water from the Districts Because it is Not Reasonably Foreseeable that CCSF and the Districts Would be Able to Effectuate Such a Water Transfer.

Under staff's assumption that CCSF would be able to purchase the requisite volume of water from the Districts, the economic impacts to CCSF from increased instream flow requirements will be limited to rate impacts of the additional cost of purchasing such water:

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[6] *Id*. at pp. 6-7 (italics added) (*citing* Attachment C to CCSF Comment Letter, *CCSF Exposure to SWRCB 35 Percent February-June Flow Requirement*, Daniel B. Steiner, Consulting Engineer; Attachment D to CCSF Comment Letter, *Answering Testimony of David L. Sunding on Behalf of San Francisco Public Utilities Commission Before the Federal Energy Regulatory Commission* (*Turlock Irrigation District and Modesto Irrigation District*, Project No. 2299 (Don Pedro Project), September 2009)).

[7] *County Sanitation District*, 127 Cal. App. 4th at 1587 (wherein the Court of Appeal concluded that predicted methods of compliance with new regulatory requirements, and the information upon which the predictions are based, "constitute substantial evidence supporting a fair argument" that the predicted methods of compliance are "reasonably foreseeable alternatives" that must be analyzed under CEQA).

> For purposes of the Phase 1 SED analysis . . . staff believes it is reasonable to evaluate CCSF's purchase of the required water from the Districts. The Phase 1 SED, therefore, will evaluate economic impacts by assuming a purchase price for this water from the Districts and then estimate the corresponding increase in water rates in the SFPUC service area and associated indirect and induced impacts in the regional economy. The corresponding fiscal benefit to the Districts of these water sales will also be evaluated.[8]

It is not reasonably foreseeable that CCSF and the Districts would be able to effectuate such a water transfer for at least three reasons. First, there is no agreement between CCSF and the Modesto Irrigation District (MID) or Turlock Irrigation District (TID) that would enable CCSF to purchase the required volume of water from either of the Districts. The most recent effort to transfer a relatively small amount of water – 2 million gallons per day ("MGD") – from MID to CCSF met with significant opposition and the parties were unable to reach agreement.[9] CCSF also pursued a 2 MGD water transfer with Oakdale Irrigation District ("OID") that would have required a transfer between OID and MID, but the parties were unable to reach agreement to effectuate the transfer, even though the water in question would have come from OID and not MID.[10]

Second, even if such a water transfer could be agreed upon, neither MID nor TID has ever transferred the volume of water that CCSF may be required to contribute under the proposed Tuolumne River flow alternatives. Under the "key assumptions" that the May 6, 2014 letter states staff will use, the preferred alternative analyzed in the Draft SED would require purchase of 111,700 acre-feet ("AF") for each of the six years of the drought. On average, 85 percent of RWS supplies come from the Tuolumne River watershed. At recent delivery rates this amounts to approximately 222,510 AF/year. Thus, to replace the forecasted shortage amount of 111,700 AF/year, CCSF would need to obtain more than half of the water that it currently diverts from the Tuolumne River for each of six consecutive drought years. Neither MID nor TID has ever transferred that much water to any other entity, and thus, it is not reasonably foreseeable that they would do so during a severe and prolonged drought. Indeed, it is unclear whether the requisite volume of water – over 100,000 AF – would be available for transfer by the Districts in any water year type, let alone a dry or critically dry year.

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[8] May 6, 2014 letter, *supra* note 1, at p. 1.

[9] See *e.g.*, Holland, "Modesto Irrigation District kills proposed water sale," Modesto Bee (September 18, 2012) *available at* http://www.modbee.com/2012/09/18/2378903/modesto-irrigation-district-kills.html (explaining that MID voted to cease negotiations with CCSF regarding the proposed 2 MGD water transfer). See also *Closed Session Resolution No. 2012-07 Directing Staff and General Counsel to Discontinue Further Negotiations Regarding the Proposed Sale of Water to the City and County of San Francisco*, Modesto Irrigation District, September 18, 2012, included hereto as Attachment 1.

[10] Stapley, "Modesto Irrigation District blocks Oakdale water sale to SF, for now," The Modesto Bee (January 23, 2014) *available at* http://www.modbee.com/2014/01/23/3150103/modesto-irrigation-district-not.html.

Third, staff's proposed impact analysis will be based on an assumed purchase price for water to be sold by the Districts to CCSF, without any reasonable basis for determining such a price. Since the hypothetical water transfer proposed by staff is neither based on any existing agreement, nor remotely comparable in scale to any completed or contemplated water transfer by either of the Districts, a purchase price for that water cannot be predicted with any reasonable assurance of accuracy. Staff nevertheless appears to envision that this speculative, assumed purchase price will be the basis for its evaluation of impacts to CCSF from the proposed Tuolumne River flow alternatives, *i.e.*, impacts that would result from rate increases to account for the additional costs borne by CCSF to purchase the required water.

Staff's assumption that it will be feasible for CCSF to purchase the required volume of water from the Districts at staff's assumed purchase price must be supported by substantial evidence in the administrative record. (*Bakersfield*, 124 Cal. App. 4th at 1198 (explaining, "[t]he substantial evidence standard is applied to conclusions, findings and determinations.").) Argument, speculation, unsubstantiated opinion or narrative, and evidence which is clearly inaccurate or erroneous is not substantial evidence. (Cal. Pub. Res. Code § 21082.2(c); 14 CCR § 15384(a).) In the May 16, 2014 letter, staff indicates, but fails to identify, the bases for its assumptions.[11] If staff is unable to support its assumptions regarding the feasibility of CCSF purchasing the requisite volume of water from the Districts at staff's assumed purchase price with substantial evidence, then the State Water Board will be unable to rely upon any analysis based on such assumptions in the Phase 1 SED.

Thank you for the opportunity to comment on the May 6, 2014 letter.

Very truly yours,

DENNIS J. HERRERA
City Attorney

Jonathan P. Knapp
Deputy City Attorney

Enclosure

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[11] May 6, 2014 letter, *supra* note 1, at p. 2.

Attachment 1

CLOSED SESSION RESOLUTION NO. 2012-07
DIRECTING STAFF AND GENERAL COUNSEL TO DISCONTINUE FURTHER NEGOTIATIONS REGARDING THE PROPOSED SALE OF WATER TO THE CITY AND COUNTY OF SAN FRANCISCO

BE IT RESOLVED, That based on information received from the City and County of San Francisco, the Board of Directors of the Modesto Irrigation District directed staff and General Counsel to discontinue further negotiations regarding the proposed sale of water to the City and County of San Francisco.

Moved by Director Byrd, seconded by Director Warda, that the foregoing resolution be adopted.

The following vote wad had:

Ayes:	Directors Blom, Byrd, Van Groningen, Warda and Wild
Noes:	Directors None
Absent:	Directors None

The President declared the resolution adopted.

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I, Pat Mills, Secretary of the Board of Directors of the Modesto Irrigation District, do hereby CERTIFY that the foregoing is a full, true and correct copy of a closed session resolution duly adopted at a special meeting of said Board of Directors held the 18th day of September 2012.

Pat Mills

Secretary of the Board of Directors
of the Modesto Irrigation District

EXHIBIT 5

BAY-DELTA PHASE I STAFF

TECHNICAL WORKSHOP OF DECEMBER 12, 2016

TRANSCRIPT OF VIDEO RECORDING

Reported by: Amanda Johnson, CSR No. 13922

LES GROBER: Good morning. We would like to get started with the second day of two days of technical workshops having to do with the phase one update of the water quality control plan for the Sacramento and San Joaquin River Delta estuary phase one update, having to do with San Joaquin River flows and Southern Delta salinity objectives.

I am going to provide a brief introduction -- a very brief introduction and then talk to you about some changes in the agenda, and then I am going to hand it off to Gita Kapahi to talk about how we are going to be running -- facilitating the meeting today. First, a couple of sundry items.

First thing, for those of you familiar with our processes, I would like you to take a moment to look around the room to find the nearest exit. If an alarm should sound, we have to evacuate the room immediately. Please take your valuables with you. Take the stairways, not the elevators. Our relocation site is across the street in Cesar Chavez Park, and if you cannot use the stairs, you will be directed to a protected area inside of a stairwell.

So today's webcast is being broadcast and recorded, as was the last webcast, which is now available on our Website. So when you ask questions, please use a microphone -- we will have people with roving mics helping you with that -- and state your name and affiliation. I think that is it for the sundry items.

In the interest of time, I have a very brief introduction update to the project. As I said, this is the second day of the workshop. We had one last Monday, and today we are going to describe some of the models that were used and the development of the SED for the amendment of the plan. And we are going to answer questions that will help you to provide comments at both the upcoming hearing days. We already had one hearing day on November 29th, and we have four more coming. But today is to help you answer technical questions so you can make good targeted technical comments on the proposal with written comments until January 17th.

A little bit of change in the outline of what we are covering today, we have this welcome introduction. As I said, Gita Kapahi is going to provide you some additional information about the facilitation of the project. We are not going to go through a refresher of the water supply effects model. It seems a number of you were here for the last round. If you want to get that detailed information, both the PowerPoint and the webcast is available on our Website.

We are, however, going to continue to do an overview of the impact analysis. That is going to be part one. There is going to be six parts that we are going to move into -- groundwater use, methodology, and results. We are going to describe the ag economic effects and the model that was used, the SWAP model, and how that folds into the regional economic effects and IMPLAN multipliers followed by Southern Delta salinity ag effects and the city and county of San Francisco.

The first two items will be before the lunch break and the other four after the lunch break. The four matters for each of these is going to be staff presentation followed by a question session and responses to help clarify. But if you have clarifying questions in the midst, you can do that as well.

The project, as I said, is the update of the water quality control plan -- two elements of the plan, the San Joaquin River Flow Objectives for the Reasonable Protection of Fish and Wildlife and the Southern Delta Salinity Objectives for the Reasonable Protection of Agricultural uses and the program and implementation for those two elements.

The project area is the lower San Joaquin River, including the Merced, the Tuolumne, and the Stanislaus River and the valley floor area -- that is for the flow component of it -- and including into the Southern Delta, shown on the map here, the area kind of northwest of Vernalis in the Southern Delta.

This shows the time line for the project and for some other critical elements that I will be referring to. It shows going back -- not completely linear -- the last major update of the water quality control plan in 1995 with a minor update in 2006. There it starts becoming linear.

We released a notice of preparation for this project in 2009, and in 2010, per the Delta Reform Act, we prepared this thing called the flow criteria report, which I will be referring to in a moment. We did a scientific peer review and a release of the draft SED in 2012 -- 2011 and 2012. But based on responses -- based on comments that we received on that draft, we went back and had prepared this recirculated and revised draft SED. We also had in that time period the intervening drought, which delayed the rerelease of the document but also helped to inform the document because of the dry conditions and how that was important. Moving forward, we plan to release a revised draft later this spring for the board to consider adoption by the summer of 2017.

So a few major points before we move on to the technical elements. As I mentioned in the previous slide, the last time the plan was significantly updated was in 1995. A lot has happened since that time. There has been a decline of species. We have had a change of conditions. We have identified the need for the update in the last minor update of the plan in 2006.

In that time we have seen in the Delta and also in the San Joaquin River and the Stanislaus the endangered species act has been increasing water restrictions. We have also had the development of the administration's water action plan, which has identified the critical need as part of it for the state water board to complete the update for the water quality control plan and to achieve the coequal goals in the Delta for a more reliable water supply and for ecosystem protection.

A big part of this update is flow. The question is always asked, "Why are we focusing on flow?" Flow is an important element at -- that gets directly at the board's responsibilities and authorities. And scientific studies have shown that flow is a major factor in the survival and resiliency of fish like salmon. Aside from some of the direct improvements of flow that can be achieved, like water temperature and increased habitat, it can also do other things. It can reduce the risk of predation. It can improve reproductive success and a number of other things. So flow is one of those kind of major factors.

And that being said, the board recognizes that non-flow measures are important. So that is why non-flow is considered in the program as part of the adaptive implementation elements of the plan so that you can do things other than flow to achieve the goals of fish and wildlife protection.

Because this involves big quantities of water and basically taking some of the water that currently now is available for public interest uses and keeping more of it instream to protect fish and wildlife, this is a hard thing to do. That 2010 document that I referred to in the time line, in that report, we just did the scientific assessment asking the question of, "How much flow is needed to protect fish and wildlife without consideration of other uses of water?"

And that report concluded that 60 percent of the flow should be left in the river to protect fish and wildlife, but it didn't consider uses like ag, municipal, drinking water, or hydropower. So there is a tension there because the current uses, as this report shows, can use 80 percent or more of the flow in that critical period of February through June in which the flow proposal applies. So how do you balance that? So that is the hard thing that the board has to deal with.

So unlike the 2010 report, the SED that we released back in September does all of the analysis. And that is what this technical analysis is about is, "How do you balance the flow proposal, the benefits of the flow against the other uses of the water", and "What are the water supply effects, the ag effect, the economic effects?"

So tied to both the adaptive implementation and the recognition that non-flow measures can be brought to bear, the staff proposal recommends a range of 30 to 50 percent of unimpaired flow from February through June with a starting point of 40 percent so that you can operate within that adaptive range to achieve goals of fish and wildlife protection, but you make the best use of the limited quantities of water.

It allows for flow shifting within that time period. It also allows for flow shifting -- when I say, "flow shifting," using a bunch of water, taking the total quantity of water for that February and June and shaping it to best achieve the fish and wildlife protection goals. A portion of that water can also be used outside of that February through June period.

So the final point to punch -- and why this is hard -- is the flow proposal. Clearly then, it is not at that 60 percent. It is at 30 to 50 percent with a 40 percent starting point. So it is less than what the science shows is needed, but it is more than what ag and urban users would want because it would require shifting some of that water from those uses to the fish and wildlife protection. But it gets at the core of what the state water board has to do. It is that balancing.

And because it is hard, the board -- there is one final element here that I would like to call out. It is that the adaptive implementation component and the entire program implementation is intended to encourage and allow for settlements so that you can come up with a solution that won't require the board to go, with the risk of litigation and other things, through a lengthy process, but rather to encourage local solutions that can get the best bang for the buck with the limited quantities of water. And that really is tied to that adaptive implementation component.

So we are looking to local water agencies, local interests, working with fish agencies and others to map out the foundation for the durable solutions. I know the state water board has this proposal. You know, it has been in communication with the -- and the California Natural Resources Agency is the agency that is leading settlement discussions. So as we are moving forward with this proposal and these hearings and workshops, those settlement discussions are proceeding. And that is not just for the San Joaquin River but also for the Sacramento River, to look for durable solutions for the entire Sacramento and San Joaquin Delta watershed.

So with that I am going to hand it off to Gita Kapahi. Oh, and I also should have noted that I have some folks with me here today. I will do introductions after. I will let Gita go through her introduction.

GITA KAPAHI: Good morning, everyone. Again, this is the second of two technical workshops. I am Gita Kapahi. I am the director of the Office of Public Participation. I will be facilitating the meeting today. My job is to make sure that all of you get your questions responded to and that we get out of here on time.

A couple of ground rules, if you could turn off any noisemaking devices. And in the interest of time, if you have clarifying questions during presentations, raise your hand. If it gets too cumbersome, I may ask you to hold them until the end of the presentation. And with the interest of time as well, I may limit how much time you spend on your questions so we can get through everyone.

There are speaker cards at the back of the room. They have boxes for the various subjects that we are covering today. We probably won't use them for the actual questions during the presentations, but at the end of the day if there are burning questions that you still want responses to, if you could fill them out with your contact information, we will make sure we have staff follow up with you. Finally, there are a couple of breaks during the day, and we will make sure that you get through everything.

And for those that are on the web, we want to make sure that you hear the presentations and the questions that are being asked. So again, we will have microphones that are being brought through the room so that you will be able to ask those questions and folks can hear you on the web. Please, again, state your name and your affiliation.

With that, we will turn to the first presenter.

LES GROBER: And actually, just for the morning session, we have staff from ICF here this morning. We have to my left Nicole Williams and then Anne Huber and Bill Mitchell. We will have a rotating staff up here depending on the topics, but for this first morning session before the morning break, it is going to be ICF staff.

And now, I will turn it over to Nicole.

NICOLE WILLIAMS: Thanks, Les.

Good morning, everyone. My name is Nicole Williams, and I am a senior environmental consultant with the consulting firm ICF. I first have to apologize. I am suffering from a bit of a cold. So if my voice fluctuates or if you can't hear me, I will try to speak louder.

ICF has been assisting the state water board staff with phase one of the update to the Bay-Delta Plan. Today I will start off the second day of the technical workshop with part one and provide a broad overview of the analytical tools as they relate to the impact and the economic analyses described in the SED.

The purpose of my presentation today is to connect the analytical tools to the impact and economic analyses. On December 5th, you heard about several analytical tools including the water supply effects model that influenced the impact analyses. Later today we will provide more details regarding additional analytical tools related to groundwater and economics. But before we get to the rest of the day, I will provide an overview of the various analytical tools, the general types of results, and how they are incorporated throughout the impact and economic analyses.

So we will start off with an overview. I will discuss those tools and how they relate to the resources analyzed in the document. I will provide a bit more detail about the different environmental variables analyzed for different resources and the types of results and information used in the analysis. Finally, I will walk through general methods and a few example resources, including hydrology and water quality, agricultural resources, groundwater resources, and service providers.

The focus of the presentation today is the analytical tools and impact analyses that use or consider output from these tools, as such assessments that did not directly use these tools or did not consider results or output from these tools are not being described. The presentation also generally focuses on the LSJR alternatives. However, I will wrap up at the end with a few additional considerations and some conclusions.

Here we have our first table. This table has a lot of information on it because there are a lot of different tools that are used in the SED. This table summarizes the water supply effects model, different fish habitat models and tools, the electrical conductivity increment analysis, the export analysis, and the types of results that are provided.

The WSE informs most of the resources evaluated in the SED because it provides results for reservoir storage, diversions, stream flow, and hydropower under each of the LSJR alternatives evaluated. The colors used on this table to identify specific tools are used throughout the presentation. The tools identified in pink on the slide are grouped together because they relate to fish habitat.

The second table summarizes the different tools related to groundwater, agriculture, and economic analyses. The types of results that each of the analytical tools provides is used either directly as criteria in the impact analysis or is used to inform the impact analysis, depending on whether the analysis is ultimately quantitative or qualitative.

Now that we have a bit of an understanding of the different tools and the types of results provided from those, they can be matched to the different resources in the SED. The next series of slides walks through that matching. Analytical tools are on your left, and resources are listed on your right.

The first one is the WSE model. The results of the WSE model are used for the impact analyses for the resources highlighted here in blue, everything except for groundwater resources. Again, resources -- these impacts -- the impact analysis for these resources uses output related to changes in reservoir storage, diversions, flow, and hydropower. For example, impact flow 2 in Chapter 6, Flooding and Erosion, is using WSE results and estimating the peak monthly flows on the

Stanislaus, Tuolumne, and Merced Rivers during the wettest years to analyze the potential for flooding impacts.

Excuse me.

Here is our second tool. The EC increment between Vernalis and the Southern Delta compliance points uses WSE estimated flow and EC at Vernalis' impact. So as we are getting into building this flowchart, you will note that the larger arrow represents direct input from one analytical tool to another. Smaller arrows then start to identify where the results of that tool are used. There will be more large and small arrows to come.

The EC increment analysis helps describe salinity and water quality effects and was used to identify potential exceedances of salinity objectives and salinity effects on Southern Delta agriculture and service providers. Impacts water quality 1 and water quality 2 in Chapter 5, Hydrology and Water Quality, and impact SP-2(A) in Chapter 13, Service Providers, uses estimated changes during different parts of the year at different compliance points to evaluate whether a water quality violation would occur. Tim Nelson later today will provide more information regarding salinity in the Southern Delta.

And we continue to build our flowchart. On

December 5th, you learned about the different tools related to fish benefits and fish impact analyses. They included HEC5Q, weighted usable area, and floodplain inundation analysis.

The HEC5Q model uses estimated flow of reservoir storage from the WSE as input, and the output is incorporated into impacts aqua 4 in Chapter 7, Aquatic Biological Resources. WUA floodplain and export analysis tools use estimated flow from the WSE for input, and the output is used as impact aqua 3 and aqua 12 in Chapter 7 to evaluate changes in potential habitat and entrainment. In addition, aqua 10 and impact aqua 11, predation risk and disease risk, respectively consider the model results of all of these tools.

Our next tool is the groundwater use analysis. Output from the WSE model, including WSE results related to reductions and surface water diversions, are used as input to the groundwater use tool. There is some overlap between the WSE model and the groundwater use analysis, but surface water diversions are key input. As such, the groundwater use analysis tool uses the WSE model estimated reductions and surface water supply.

This information is used to inform several resource chapters -- groundwater, service providers, energy and greenhouse gases, and then economic impact analyses. For example, impact GW-1 and GW-2 in Chapter 9, Groundwater Resources, uses predicted changes in groundwater pumping and surface water recharge under the alternatives based on water supply reductions to identify potential impacts to subbasins. The potential cost of groundwater pumping associated with reduced water supply is discussed in Chapter 20, the Economic Analysis.

Much of the information related to this tool is described in Appendix G, Agricultural Economic Effects of the LSJR Alternatives Methodology and Modeling Results. And the next presentation after the break will be about the details of Appendix G and the input and output of the groundwater use analysis.

Output from the groundwater use analysis is used as input to the statewide agricultural production, or SWAP model. Results from the SWAP model inform the impact analyses for agricultural resources, particularly impact AG-1 in Chapter 11, Agricultural Resources, and then are also used to inform the economic analyses associated with a reduction of agricultural revenue and regional economics in Chapter 20. This is also described in Appendix G, and later today you will hear about the details of those two models.

Output from the SWAP model is used as input to the regional economic analyses of agricultural effects.

The SWAP estimates are aggregated into eight crop categories from the impact analyses for planning, or IMPLAN model, and the multipliers are applied to the crop categories to determine potential regional impacts. The analysis uses IMPLAN multipliers to identify the direct, indirect, and induced effects resulting from the reduction in agricultural revenue. The results of regional economic analyses of agricultural effects is used to inform all of the economic analyses summarized in Chapter 20, and again, there will be more on this particular method today.

Output from the WSE is used as input for the IMPLAN analysis to evaluate potential regional economic effects associated with a potential water supply reduction to the city and county of San Francisco. The input to the analysis is the annual average New Don Pedro Reservoir water bank deficit for a six-year drought period as created by WSE. Later this afternoon on our agenda, the details of this analysis will be described, but the information is also contained in Appendix L, and it is rolled up into the economics discussion in Chapter 20.

This might be our last tool. Output from the WSE is used as input for the power flow analysis using PSLF, the positive sequence load flow model. The input is the largest reduction in the cumulative distribution for hydropower capacity in July and August, basically representing peak demand. Results of these analyses are used to inform the energy analysis and to assess electrical grid stability. This information is described in Appendix J, and the information is also used in Chapter 14 related to energy and impact EG 1, Chapter 14, Energy and Greenhouse Gases.

So when we put everything together, we have over ten analytical tools that are informing the impact analyses for various environmental resources and economic effects. Now that we have some understanding of the ten-plus analytical tools and how they align with the resources, we can then begin to summarize the types of environmental variables evaluated for the different resources.

The next series of tables that I am going to build on top of one another show the resources, tools used, and the type of environmental variable evaluated in the table cells. The first group of resources presented in this table are water quality, flooding and erosion, fish, terrestrial, biological resources, recreation and aesthetics, and service providers.

The WSE model is used for all of these resources to evaluate impacts associated with changes in flow, reservoir elevation, and diversions. It is depending on the resource, predicted changes in the timing, frequency, magnitude, and duration of a variable, which are evaluated as a part of the impact analysis. And I will summarize these changes when I discuss our example resources later in the presentation.

For aquatic biological resources, we use the three additional tools in addition to the WSE to evaluate impacts of water temperature and habitat, and you heard the details about these on December 5th. In general, the results of these three tools address habitat variables or functions that relate to the survival or growth of different life stages of fish. This information is used in the impact analyses in Chapter 7 as the particular life stage of a fish as a line of the change estimated by one of these analytical tools.

Then for water quality and service providers, we use the EC increment analysis tool to estimate the timing and magnitude of changes in southern salinity. And finally, for official and service providers, we also use the export analysis to evaluate the potential changes in exports and in treatment.

Based on the existing Delta objectives and NIMS biop rules, the most likely changes in export for each month were estimated based on the changes in flow at

Vernalis simulated by the WSE model and the most likely regulations to be controlling the Delta exports for a given month. This estimation is ultimately used to evaluate effects on fish and service providers.

Similar to the other fish tools, estimated changes in exports are aligned with the life stage to evaluate impacts to fish, and a potential decrease in exports was evaluated in the service provider's chapter to identify whether impacts would occur to an export service area.

And here is the second set of resources -- groundwater, agriculture, cultural resources, service providers -- again because it relies on additional tools -- energy and greenhouse gases and economics. The WSE model results are used in the evaluation of all of these resources except groundwater. The groundwater use analysis, SWAP, and regional economics are all used to inform the impact analyses for these different resources, all except for cultural. And finally, our last two tools. IMPLAN for the city and county of San Francisco analyses and PSLF for the electrical grid stability.

So before getting into some of our example resources, I am just going to walk through a few examples of how the results are discussed in the document. Results from the analytical tools are conveyed and used in the SED in many ways. In many cases, the full distribution of results is presented either as tables of monthly percentiles showing the cumulative distribution, exceedance curves, or time series graphs.

And we will just walk through a few examples. So here we have an exceedance curve -- oops. That was a little too quick. Hydrologic conditions are often described by showing exceedance curves or the cumulative distribution. The exceedance curve is the reverse of the cumulative distribution. For example, the 10th percentile value is exceeded 90 percent of the time. This exceedance plot shows WSE flow results for the Stanislaus River and gives a basic overview of how the flows are expected to change on the Stanislaus River as a result of the LSJR alternatives. It shows the amount of increased flow for the full range of hydrologic conditions for the full period of record.

This percentile table shows information that is similar to the previous figure, namely the changes to the Stanislaus River flow for a wide range of hydrologic conditions, 10th percentiles to 90th percentiles, but it shows values for all months separately. The cumulative distribution of a particular variable -- for example, flow at a particular location -- provides a basic summary of the distribution of the values. These results are looked at to understand estimated changes within groups of years over the historic record. For example, dry years at the 10th percentile or wet years at the 90th percentile.

In some cases, results are presented as time series plots to show the changes for all months. It allows you to see the results over time for a particular set of years or a particular month within a set of years. Annual time series plots in Chapter 21, Drought Evaluation, allow the reader to visually compare the drought sequence with past drought sequences.

The previous examples identified are all used to assess impacts in a general sense, but in some cases a more precise metric is used to assess impacts based on a particular resource being evaluated. For example, the 10th and 50th percentile values in this table, which I showed you a few slides back, were used to assess the potential for an increase in surface water contaminants under impact water quality 3 in Chapter 5, Surface Water Hydrology and Water Quality.

For this assessment, any decrease in the median, the 50th percentile, or the 10th percentile flow of more than 33 percent was used as a metric for further evaluation. These percentiles were selected because they indicated lower flows where there might be a problem with surface water quality. As can be seen in this table, there were no decreases greater than 33 percent relative to the baseline flow, shown in purple bold numbers.

The specific methodology and approach for the different resource impact analyses and economic analyses describe the specific analytical tool or tools used, the type of results used, and other information considered in the impact analysis. However, I am going to walk through a few common themes here about the methods. The entire document is under the umbrella of a programmatic analysis. A programmatic document may be prepared on a series of actions that can be characterized as one large project and are related to logical parts in a chain of a contemplated series of actions.

For example, specific measures to achieve the flow objectives will need to undergo evaluation as to whether additional environmental review is necessary. Typically, programmatic documents have a broader approach to analyzing impacts. This also relates to how reductions in surface water diversions were characterized and analyzed in the document, and I will get to that in a minute.

The analytical tools are used to produce baseline results, which are then compared against alternative results. However, other information can also inform the baseline condition in the analysis. For example, in Chapter 13, Service Providers, a broad discussion of the different mechanisms of how service providers receive water is provided and incorporated into the analysis as well as the discussion of the characteristics of the different types of service providers. So, for example, those that rely solely on groundwater and those that rely on a combination of groundwater and surface water.

In general, impacts are typically assessed based on geography, which allows for distinctions to be made if needed. Ultimately the overall significance impact determination is a roll-up of different geographic components. As such, analyses throughout the SED is presented by alternatives, with or without adaptive implementation, and generally provided by tributary, river, watershed, or reservoir, depending on what is being evaluated. A lot of information is considered and ultimately rolled up into a single impact determination.

So I am just going to walk through some discussion points about surface water diversions and reductions. Surface water diversions from the WSE model include both agricultural and municipal water supply. We cannot know where and exactly how water supply effects will occur, and we cannot know all of the exact different permutations. As such, we look at surface water reductions slightly differently between different resources.

For the purposes of agricultural resources, the full reduction on surface water supply would occur to all agricultural crops. For the purposes of groundwater resources, we link this to the agricultural analysis and that the shortfall expected to occur in the agricultural analysis would result in an increasing groundwater pumping over a subbase scenario and a reduction in groundwater recharge.

Excuse me.

However, because the WSE includes municipal and agricultural demand together, the analysis accounts for the overall changes in supply as they relate to a particular groundwater subbasin. For service providers, WSE model results are considered to identify the potential magnitude for surface water reduction on a particular river, but the impact analysis is also based on service provider characteristics and that service providers could experience some part of the reduction and surface water supply that was assumed for agriculture.

In addition, in this service provider analysis, our analysis for CCSF is quantitative and is based on WSE model results over a six-year severe drought period, as mentioned previously. Because of all of these different considerations, the degree of impacts analyzed in the SED may be more conservative or worse than what might actually occur because all types and magnitudes of impacts cannot occur to multiple resource areas simultaneously. For example, if CCFS were to experience a reduction in water supply, or another water service provider, agricultural resource impacts currently disclosed in Chapter 11 could likely be reduced.

In addition to the previous methods we previously discussed, there are some general ways that adaptive implementation is considered in the document. There are four methods of adaptive implementation, which generally allow for an increase or decrease of unimpaired flow or shifting of that unimpaired flow between months and within months. Frequently adaptive implementation is addressed qualitatively in the document. However, numeric results may be presented at either 30 percent or 50 percent unimpaired flow depending on the evaluation because method 1 could increase or decrease the unimpaired flow by up to 10 percent within the range of 20 to 40 to 60 percent of unimpaired flow.

The analysis assumes that the adjustment to unimpaired flow under adaptive implementation would be a longer term. Typically, numeric results are presented if there is a change in determination between 20, 40, or 60 percent unimpaired flow. For example, if there is a change in the determination between 20 and 40 percent, then the numeric results at a 30 percent unimpaired flow are presented and incorporated into the analysis to disclose the full potential effects.

So now, I am going to walk through some of the resources evaluated and the different approaches and tools within each of those resources for a particular impact statement. I didn't include the specific impact statements on each of these slides because there is already probably too much text. So I will provide summaries to those as I move along.

Impact water quality one and two discuss potential increases in salinity in the Southern Delta whereas water quality three is related to potential increases in surface water pollutants generally. Ultimately all impacts to water quality under the LSJR alternatives are less than significant because in general increases in flow are expected to reduce salinity and improve water quality. The interplay between the LSJR alternatives and the SDWQ alternatives is captured in impacts water quality 1 in Chapter 5. The SDWQ alternatives are not expected to cause a change in the Southern Delta salinity because under baseline conditions, the program of implementation would require 0.7 and 1.0 DSM to continue to be met at Vernalis.

Groundwater resources are evaluated based on depleting groundwater supplies or interfering with groundwater recharge or resulting in subsidence. Groundwater resources were primarily evaluated quantitatively. As discussed before, the full shortage of surface water supply associated with the alternatives is considered for each subbasin in the groundwater analysis. This is considered using both the 2009 and 2014 maximum groundwater pumping capacity.

Ultimately, impacts to groundwater resources under LSJR Alternative 3 with or without adaptive implementation are significant and unavoidable because of expected effects on the Modesto, Turlock, and extended Merced subbasins without adaptive implementation and then also on the eastern San Joaquin subbasin with adaptive implementation. This is primarily attributed to method one as a result of an increase of unimpaired flow from 40 percent to 50 percent.

Impact AG-1 looks at the conversion of prime and unique farmland of statewide importance to nonagricultural uses. Impact AG-2 looks at other circumstances which would convert farmland to nonagricultural uses. The analysis uses information from the WSE model and the SWAP model to analyze impacts. The SWAP model cannot fully quantify whether an actual conversion of prime farmland of statewide importance or unique farmland to nonagricultural uses would occur given the numerous factors, including individual decisions of agricultural producers that influence potential conversions. However, the model results were used as an indicator of the amount of prime, unique, and farmland of statewide importance that could be converted under each of the alternatives. Ultimately, under LSJR Alternative 3, impacts are significant and avoidable for impact AG-1.

Service providers were evaluated both quantitatively and qualitatively within a particular impact statement and between them. This is because we were trying to accommodate many different types of information to inform the analysis and because different service providers have different circumstances and may react to a reduction to surface water in different ways. For example, the extent to which service provider's surface water supplies would actually be reduced is a function of the mechanism by which they received the water, such as water rights or contracts. It is also influenced by existing policies, regulations, and the type of water they supply.

Some water supply contracts have provisions that could dictate when and how much surface water municipal service providers receive from irrigation districts. For example, contracts could require irrigation districts to supply the full contracted amount of surface water to the service provider at all times, including during dry periods or water restricted periods. However, other irrigation districts have policies in place that may require the curtailment of water supplies for municipal service providers during periods of service water reduction.

So the approach to analyzing service providers tries to take into account all of these different factors. Ultimately, impact SP-1 is considered to be significant and unavoidable under LSJR Alternative 3 because it is expected that the construction of new water supply facilities or waste water treatment facilities would be needed that could cause significant environmental effects.

There are a few more service provider impacts. These three impacts are about violation of water quality standards and changes in water supply associated with the exports. They were evaluated qualitatively with the results from the groundwater use analysis, the EDC increment analysis, and the export analysis informing them. Ultimately, SP-2A and 3 are less than significant, and 2B is significant and unavoidable.

There are a few common treatments about our results in general in the document. We have relatively few significant impacts in our LSJR Alternative 2 without adaptive implementation. Impacts to resources that are water supply dependent typically increase in severity with the increase on the percent of unimpaired flow. Adaptive implementation can either increase or reduce impacts, depending on the increase or the decrease in the percent of unimpaired flow under method one.

The results from the analytical tools were used to provide an understanding of the nature of the impacts associated with the LSJR alternatives and the relative magnitude of changes between the baseline and the alternatives. Here is a roll-up summary table of the different resources we just walked through, showing with and without adaptive implementation.

So a few additional considerations, the Sustainable Groundwater Management Act, or SGMA, is incorporated into the analysis in a few ways as it relates to groundwater and service providers. Under impact GW-1, SGMA is discussed as it relates to potential mitigation to groundwater resources. Since SGMA now requires that local agencies form groundwater GSAs by

June 30th, 2017, in the critically overdraft eastern San Joaquin, Merced, and Chowchilla subbasins, they must implement GSPs by January 2020.

These plans must include measurable objectives as well as milestones in increments of 5 years to achieve the sustainability goal in the basin within 20 years of the implementation of the plan. The sustainable level pumpings to be determined by the different agencies is unknown at this time and will depend on groundwater recharge, which could increase or decrease. In our cumulative discussion for groundwater resources and service providers, we identified that a cumulative impact would not result to these resources because physical effects to the existing subbasins would improve once groundwater use becomes sustainable.

However, for agricultural resources, we have a different story. SGMA was evaluated qualitatively for the cumulative impact analysis, which acknowledges that SGMA requires sustainable groundwater management that could result on limits on groundwater supply for irrigation water. Historically groundwater has been used as both direct irrigation and for surface water replacement, especially under drought conditions when surface water supplies are low. A reduced groundwater supply could result in a reduced number of acres that can be irrigated and could result in the conversion of agricultural land. Therefore, in our cumulative impact analysis, we do identify that the potential effect when combined with the effects of the LSJR alternatives would result in a significant cumulative impact.

Non-flow measures, the document analyzes ten non-flow measures qualitatively in Chapter 16. These are related to habitat restoration, fish passage improvements, and other measures related to predatory fish control and evasive aquatic vegetation control. They range from floodplain and riparian habitat restoration to implementing fish screens on unscreened diversions.

The non-flow measures could inform the body of scientific information potentially used to make adaptive implementation decisions. We recognize that not any one measure alone could fully inform the body of scientific information and a combination could occur. So we cannot predict the combination of measures that could occur. However, we disclose the types of impacts that are associated with these different measures.

A few words about the SDWQ Alternatives 2 and 3, the water quality of the Southern Delta under SDWQ Alternatives 2 and 3 would not result in a change to the general range of historic salinity in the Southern Delta.

This is because the program of implementation included in these alternatives does not call for a change to the Bureau of Reclamation's compliance requirements at Vernalis. The relationship between the salinity at Vernalis and the Southern Delta is not expected to change.

Because the compliance requirements at Vernalis are the same for the SDWQ alternatives, the water supply effects modeling for the LSJR alternatives include effects that would occur under all SDWQ alternatives. Because of this, the SDWQ alternatives are primarily evaluated based on exceedances in EC, the potential to result in new infrastructure to comply with potential regional board requirements, and also the salt tolerance for agricultural crops in the Southern Delta.

So over ten different analytical tools were used in the SED to help either form or provide results for the various impact analyses -- environmental impact analyses and economic effects analyses. Results of the tools were used quantitatively to evaluate resources such as aquatic biological resources. Results of the tools were used in combination with other information to evaluate resources such as service providers, and different results were used depending on the resource and how the analytical tool presented different information.

Thank you very much.

GITA KAPAHI: So with that, we will open it up to questions. If you could raise your hand, and as I see you, I will get you a microphone. There is one right there.

MAUREEN MARTIN: Good morning. My name is Maureen Martin, and I am from the Contra Costa Water District. And I was just curious about your export analysis, if you are planning on releasing the modeling tool you used to estimate changes in exports or if you have any kind of modeling verification that you could provide, you know, that shows the validity of how you approximated the change in exports.

ANNE HUBER: First let me --

Is this working? Yes.

First let me mention that the methods are described in Chapter 5 and also Appendix F.1, and the equations used to estimate the change in exports are included within the WSE results file, which I believe is publicly available.

MAUREEN MARTIN: I guess I was just wondering if you would also include -- if there is any evaluation -- since they are approximations and not necessarily being able to choose which -- anyway, in reality there are multiple competing objectives that are governing export operations at any time. So I was just wondering if you had any way to corroborate your approximations with any kind of other models, like CalSim or historical results, just so you are providing some context with those.

ANNE HUBER: Well, the approach was to use the regulation that was most likely to affect export restrictions, and that was based on, you know, logic as well as what -- as other types of modeling. Other modeling like -- well, I have been involved in multiple projects which we have estimated change in export based on actual flows and conditions in the Delta. And in some cases, it is fairly clear, like in May and April, exports are often limited to 1,500 CFS. So that is a fairly large control on exports.

And in other cases, the restrictions are -- there is a general pattern in which regulations are in control during particular months, but I agree that it is not always exactly the same.

LES GROBER: I just want to check your question. Is that about corroborating with other models -- or I mean, there is -- I think as you suggest, the operation of the project is complex, and there can be a number of things that can drive it. We have used just the basic requirements/regulations to programmatically get a sense of what the different level of exports would be. I'm sure they could come up with different assumptions, you know, but as Anne had said, the model constraints and results are posted in our -- the files that we have for that analysis.

GITA KAPAHI: Other questions? There you go. Okay.

CHRIS SHUTES: Chris Shutes with CSPA with a follow-up. So did you look at a variety of export operations and evaluate different -- different operations and the effects particularly on salinity based on those different export operations and what the differences would be? And second question, where more precisely in your appendices, which is rather large, can we find the output and the analysis of the exports?

LES GROBER: We did not do different scenarios for exports. It was just one, the single run since it was not part of the project, looking at the exports. There is going to be additional analyses that will be done as part of phase two where there would be proposals for changing conditions in the objectives in the Delta, but that is not part of this project.

NICOLE WILLIAMS: I think you also asked where in Appendix F.1, and we will look that up and get that to you.

CHARLEY BRUSH: Charley Brush with the Bay-Delta office. And I just had kind of a -- Les said earlier that flows -- I guess the diversions would be reduced from approximately 80 percent of San Joaquin flows to approximately 60 percent, leaving 40 percent as instream flows as an approximate ballpark.

And then in Nicole's presentation, there was some question about how this would impact groundwater pumping, and there is combined impacts of reduced surface water and also the unknown impacts of SGMA implementation. So I was wondering if in this combined analysis you see an increase in groundwater pumping or a reduction in groundwater pumping or if you haven't really answered that question.

So what do you think in the long term? Would there be -- of course, there are regional geographic differences. But in the, let's say, San Joaquin, Tuolumne, Stanislaus, and Merced River basins, do you expect an increase in groundwater pumping or a reduction in groundwater pumping?

LES GROBER: The short answer -- and then stick around for the rest of today when we show how we do that analysis. But the short answer is, yes, we expect that there would be an increase in groundwater pumping. Going to the first part of the question -- and hopefully I didn't confuse things in talking about these different percents. But the flow proposal is for keeping 30 to 50 percent of unimpaired flow, February through June, in the Merced, the Tuolumne, and the Stanislaus for the reasonable protection of fish and wildlife, with a starting point of 40 percent.

I think, as you said, if you do the math, that leaves 60 percent to continue to do what it is doing, being stored or directly diverted. That other number, 80 percent, that was just an illustration of just frequently how 80 percent, sometimes even more, of the water is diverted or stored during that time period for other purposes. When I say, "and more," that was something that we covered at the workshop last Monday. Sometimes in the single digits, it can be 5, 6 percent of the unimpaired flow currently in the instream February through June period. So I think you will get more answers to your questions about methods and numbers with regards to groundwater when we get into that session.

ANNE HUBER: And one other thing, I think your question was about SGMA and what we expected under SGMA. And as Nicole had mentioned, SGMA is considered qualitatively in the cumulative analysis section.

GITA KAPAHI: Other questions? Back there.

ART GODWIN: Hi. Art Godwin with the Turlock Irrigation District. On the water quality -- the surface water quality, did I understand you correctly that the way you analyzed it was if there was a change of more than a certain percentage of flow, then you would assume there was an impact of water quality?

ANNE HUBER: That is correct for the general -- for impact aqua three -- water quality three. The first two impact analyses focus on salinity, and the third one is more of a general assessment based on delusion effects. And in general, the three tributaries have a fairly high water quality, and it is unlikely that increasing the flow, as is expected under the alternatives, would cause problems.

GITA KAPAHI: And can you get a little closer to the microphone?

ANNE HUBER: Okay. Should I repeat that?

ART GODWIN: I'm fine. I heard it.

ANNE HUBER: Okay.

GITA KAPAHI: Any other questions? Should we take a break?

LES GROBER: We are actually a bit ahead of schedule, which is good because I think we have probably more depth in terms of groundwater. I would suggest perhaps a little bit early for a break, unless we want a five-minute break. I will tell you what, why don't we just take a very short break, a five-minute break, because we will get some other speakers up here to move into the groundwater session. So by -- the only accurate clock I see is that red one. 10:07? So let's just say 10:15, we will get started.

GITA KAPAHI: Thank you.

(Whereupon a break was taken.)

LES GROBER: Okay. We are going to get started again and now move into the groundwater use methodology and results. And we have been joined now in addition by Tim Nelson and Will Anderson, water resource control engineers.

TIM NELSON: Hello. My name is Tim Nelson, and I am a water resource control engineer here with the board. I have been here for about a year and a half after graduating from Davis with a master's in civil environmental engineering. And so today, I am going to present the groundwater assessment.

So the topics I am going to cover include an overview of the analysis and what was performed, a summary of the data used and the assumptions made as part of the analysis. I will go over the methods and calculations for determining groundwater pumping, and then I will cover a few rules.

So what is the logic behind our modeling? So based on the results of the WSE, we noted surface water diversions could be reduced as an effect of the potential unimpaired flow requirements. If possible, as we saw in the recent drought, water users would likely increase groundwater pumping to compensate for lost surface water supplies and avoid them in advance.

There are many ways to do this analysis, but we assumed that water users could replace any applied surface water shortage up to the maximum pumping capacity. And this maximum pumping capacity is based on the current infrastructure capacity, so the number and sizes of wells in each district. But in the future, it may be limited by the Sustainable Groundwater Management Act.

So the primary input for this analysis is the surface water diversions for each district determined in the WSE model. So the WSE gives us a total diversion for each tributary. This diversion is then postprocessed, as I will go over later. And we determine the applied surface water, which we use in our groundwater equation to determine the additional groundwater pumping.

Here is a map of our plan area. It includes four groundwater subbasins -- the Merced, Turlock, Modesto, and Eastern San Joaquin. All four of these basins are considered priority basins, and the Merced and Eastern San Joaquin subbasins are considered critically overdrafted. Overlying these subbasins are seven irrigation districts -- Merced; Turlock; Modesto; Oakdale; South San Joaquin; and the two CVP contracting districts, the Central San Joaquin Water Conservation District and Stockton East Water District.

So as part of this analysis, we are performing a district groundwater balance. So here we have a tributary, a generic district and its irrigated crops overlying one of the groundwater subbasins. So it begins with surface water diversions from a tributary into the district's distribution system from which there will be losses for evaporation, surface water returns to the tributary, and distribution system seepage.

Some of the districts may have municipal deliveries to make, but the majority of their surface water diversion will be used as applied surface water to irrigate crops. Now, if there is a shortage in applied surface water, we assume that the districts can pump groundwater up to the maximum capacity, and the total of applied surface water and groundwater will be used to satisfy crop consumptive use demands and account for seepage passed through as deep percolation.

So for this analysis, we made some key assumptions. The first is that groundwater pumping occurs at the farm gate and is only used to satisfy crop applied water demands. Of course, we assume that the districts can pump as much groundwater as needed up to the maximum pumping capacity. And for the two contracting districts -- the CVP contracting districts -- we only model a portion of their demands that they divert from the Stanislaus River, so about 155,000 acre-feet. And we assume that both districts can fully replace any shortage within this amount with groundwater.

So, of course, as part of the analysis, we want to use the best available information. For many of our terms, the agricultural water management plans served as a source. In addition, we also sent information request letters to each of the modeling irrigation districts, and based on their responses, we were able to improve our representations a lot.

Some of the parameters that we used these sources to estimate include district M&I deliveries, seepage from regulating reservoirs, minimum annual groundwater pumping, estimates of their maximum groundwater pumping capacity, distribution loss factors, and deep percolation factors. And I am going to get into all of these terms in just a little bit.

So now I want to go over the demand parameters, what they are, and I guess, a little bit of where they are from, and a little bit as well of how they are represented. So the first one is municipal and industry surface water deliveries. So WSE represents three municipal deliveries from the districts. The first is from the Modesto Irrigation District to the City of Modesto to reduce their reliance on groundwater, and this equals about 30,000 acre-feet per year and is assumed to be fully delivered each year.

The second is deliveries from SSJID through the Degroot water treatment plan to Manteca, Escalon, Lathrop, and Tracy were about 15.7 TAF per year, which is also assumed to be fully delivered each year. The final one represents SEWD municipal deliveries for about 10,000 acre-feet per year. Based on their contract, the 10,000 acre-feet of diversion from the Stanislaus is supposed to be used for municipal demand. But since OID and SSJID are senior to the CVP contracts, sometimes SEWD may not receive supplies from the Stanislaus. And in that case, it is assumed that any shortage in this delivery would be replaced with groundwater.

The WSE also represents three off-stream regulating reservoirs that some of the districts use to maintain water supply reliability. Now, each of these reservoirs is usually maintained at full capacity. But they are constantly losing water to seepage, and that needs to be replaced. The first one is Woodward

Reservoir for SSJID, and it loses about 29.5 TAF per year; Modesto Reservoir for Modesto, which loses about 31.2 TAF per year; and Turlock Reservoir, which loses 46.8 TAF per year. And as part of these estimates, we assume that these estimates also account for any distribution seepage losses that occur in the distribution system prior to the reservoirs themselves.

There is surface water returns, so any water such as operating spills or surface applied water runoff that returns to the tributaries, so if there is any water diverted by the district that returns to the river. And the estimates for spills and returns are from CalSim 2. Here is a time series of annual surface water returns for the irrigation districts from 1922 to 2003. We see that TID, which has the largest area of the districts, also has the largest returns, about 60,000 acre-feet in most years except in really dry periods when it significantly drops to about 20,000 acre-feet per year. And Merced ID has very little while Merced ID has very little return flows.

The Merced ID also has a sphere of influence demands that it delivers to. So the first one is Bear Creek in the Merced National Wildlife Refuge, which is required delivery as part of the district's FERC license for New Exchequer, and so they deliver about 15,000 acre-feet per year. There is the Steavenson entitlement, which is an adjudicated delivery to the Steavenson Irrigation District of 24,000 acre-feet per year.

In CalSim, deliveries to the El Nido Irrigation District are represented separately, and this is an area south of the Merced Irrigation District. But it was incorporated with the larger district in 2005. So for the groundwater analysis, it is actually incorporated with the district. And then finally other SOI demands, which represent voluntary water sales to the district of 16,000 acre-feet per year, and these are only delivered if the district has fully met all of its demands. And it is also assumed that any shortage from these demands, apart from El Nido because it is represented with the district, can be replaced with groundwater.

So distribution system losses are mostly seepage from district canals and ditches but also include some evaporation. So for this analysis, we represent the distribution losses as a percent of the total surface water deliveries apart from regulating reservoir losses and municipal deliveries, and this percent is calculated based on information in agricultural management plans. And so the distribution loss factor is equal to the distribution seepage plus the distribution evaporation, so our losses divided by deliveries for applied surface water, spills and returns, and for Merced, the SOI deliveries. And here is a table of the loss factors. So Merced irrigation has the largest of about 32 percent, and Modesto has the smallest of about 5 percent.

So deep percolation is represented similarly. So this is the portion of applied water that seeps past the root zone and back into the groundwater basin. So we have presented it as a percent of the consumptive use demand as being satisfied with the applied water. And this is also calculated based on the agricultural water management plans and so the factors -- the plan's estimate of deep percolation divided by the estimated consumptive use. And here is a similar table of factors. The CSJWCD WMP did not provide estimates for deep percolation so we assume that their deep percolation was the same as SEWD's.

So minimum groundwater pumping is any groundwater pumping performed regardless of year type or surface water availability despite areas that may not have access to the surface water distribution system. So here is a bar chart of each district's minimum groundwater pumping performed each year. TID has the largest at 80.6 TAF per year. The first three -- SSJID, OID, and Modesto -- these estimates are from their information response letters from 2015. Both TID and

Merced are from their agricultural water management plans.

The last demand term is the consumptive use of applied water, so pretty much the focus of the irrigation districts to supply irrigation water. And so this is the portion of applied water that supports crop growth through evapotranspiration. And as was described in the presentation last Monday as part of the WSE, the CUAW demands are based on the CalSim 2 demands. And so here is a time series of annual consumptive use demands for each district, 1922 to 2003, and we see it varies by year based on local weather conditions and local water availability.

So a large part of the groundwater analysis is based on how we use our surface water, how much of it is going to be delivered for applied water, and how much reaches the crops. So first I am going to go through how we take the WSE total tributary diversions and divide it up among the districts and how it reaches its end use.

So first I am going to describe it in words. So where more than one district diverts water from a tributary, it will assume that each of these districts will receive an equal percent of their crop surface water demand, which I will define in a minute. So in times of shortage, both districts received the same shortage relative to their demand after accounting for the minimum groundwater pumping.

On the Merced River, Merced ID makes 100 percent of the diversions, but some water is also passed through a sphere of influence demands. And for the two CVP contractors, they only receive water from the Stanislaus after SSJID and OID have made their diversions because those are senior districts.

I am about to go into a bunch of math. So first, I wanted to define some terms. So the total surface water available for diversion on each tributary -- and I define tributary terms with a subscript of "T." This is DIVT, total diversion, and this is the primary input from the WSE. For parameters that are specific to each district, I define them with a subscript "Z." And these include distribution loss factors, "DF"; deep percolation factors, "PF"; the crop COAW demand, "CDEM"; the crop surface water delivery, "CSW"; and the applied water demand, "AWDEM," which is equal to the crop demand times one for itself plus the deep percolation factor to account for any associated deep percolation.

And if you get lost during any of this map I am going to go through, please raise your hand or yell out. Are we good now? Okay.

So the first step is to take out any off-the-top demands. These are demands that we assume are fully satisfied in each year. So we start with our total tributary diversion, DFT, and we subtract out terms for reservoir losses, M&I deliveries, and return flows along with their associated distribution losses for each district on that tributary.

For Merced, we also subtract out deliveries to the Merced National Wildlife Refuge and to Steavenson along with distribution losses. After subtracting all of these terms, we end up with the total tributary diversion available for farm demands, so consumptive use and any deep percolation. So DIVFT is the farm diversion.

So these remaining diversions are used to satisfy district crop demands and any associated deep percolation distribution losses. Therefore, we can write it also as the farm diversion is equal to the sum for all districts on the tributary of the crop surface water delivery times one, plus the percolation factor times one, plus the distribution loss factor. So it is just the remaining demands that it can be delivered to.

What we want is the crop surface water delivery because this will tell us how much surface water is used as applied water in our groundwater calculations. So for the Tuolumne and Stanislaus, it is -- well, I guess, first, on the Merced, this equation is easy to solve for because there is only one district. So there is no summation, and there is only one unknown. But for the other two rivers, there is two districts. So we have two unknowns in the equation. So for those rivers, it is assumed that the diversions are divided between the districts so that both districts meet the same percentage of their crop surface water demand.

So crop surface water demand is the remaining crop demand after accounting for minimum groundwater pumping, so the portion that would be ideally satisfied with surface water. And so the crop surface water demand times this percent that we say is the same for both districts is known as XT and should equal our crop surface water delivery. The crop surface water demand is the COAW demand that remains after accounting for minimum groundwater pumping. And so we need to remove the minimum groundwater pumping from our consumptive use demand.

So it is easier to start this derivation by looking at the applied water. So the applied surface water demand is equal to the applied water demand minus minimum groundwater pumping. These applied water demands equal to a crop -- either crop surface water demand times one plus the percolation factor or the total crop demand times one plus the percolation factor. And so in this case, we want the crop surface water demand so we can rearrange, and we end up with the crop surface water demand is equal to the total crop demand minus the minimum groundwater pumping divided by one, plus the percolation factor.

So this -- so we want to know how much of the minimum groundwater pumping is actually used to satisfy crop demand. And so dividing by one plus the percolation factor will account for any deep percolation that would have occurred.

So now we have all of the estimates that we need to calculate our X of T, the percent of crop surface water demand met. So combining our equations, we get our total farm diversions on the tributary are equal to the crop surface water demand times our percent, multiplied by one plus the percolation factor, and times one plus the distribution loss factor for each district.

Now X of T, XT, is the same for both districts so it can be taken out of the summation. And since it is the only thing we don't know, we can rearrange. And we get our percent of crop surface met, which is the total farm diversions divided by the sum of crop surface water demand times one, plus the deep percolation factor times one, plus the distribution loss factor. So it is the sum over both districts on the tributary.

And now with X of T, we can plug it back into the equation for surface water delivery, and we have -- and we now know how our surface waters are -- how our surface water diversions are used to meet component demands. And this now leads into our groundwater calculation. We have the use of applied surface water and our minimum groundwater pumping. In times of surface water shortage, we want to know how much additional groundwater pumping we can use.

So this assumes that in times of surface water shortage, districts are going to increase groundwater pumping to compensate. And so the increased groundwater pumping here adds groundwater -- it should be Z. The additional groundwater pumped for the district is the minimum between any leftover demand after applying surface water and minimum groundwater pumping. It should be the applied water demand minus the applied surface water minus the minimum groundwater pumping, or the available pumping capacity, so the maximum groundwater pumping capacity minus the minimum groundwater pumping capacity.

So a high value of maximum groundwater pumping can reduce agricultural impacts, but it also increases the potential for groundwater impacts. So it is a balancing act. Now, for the analysis, we looked at two different maximum groundwater pumpings, one to represent 2009 infrastructure and one for 2014 infrastructure after the recent drought because a lot more wells have been drilled.

Before the 2009 scenario, we looked at it because it corresponds with the initial notice of preparation for the SED. We used irrigation district capacities based on 2012 AWPMs and information therein. And as mentioned before, the contracting districts we assumed could fully replace their Stanislaus River supply with groundwater.

For the 2014 scenario, we had asked the districts directly for current estimates of their groundwater pumping capabilities. So it takes into account wells drilled from 2013 to 2015. And in this scenario, SSJID, OID, Modesto, and Turlock capacities are based on their 2015 information request response letters. But for the impact determinations in the SED, we used the 2009 scenario results because the 2014 scenario is even more -- or is more unsustainable. And with SGMA, it doesn't seem likely for it to continue.

So here is a chart of the minimum groundwater pumping and the two estimates of the maximum pumping capacity. We see that for Modesto and Turlock, there was a large increase in groundwater capacity over this recent drought period to avoid unmet demands. For Merced, we did not get an estimate of their current groundwater pumping, but they already had such a high capacity that we assumed that they could already account for most of their loss -- any unmet demand with the 2009 infrastructure.

So now I will cover just a few results. So here we have a time series of total applied water for Merced Irrigation District. It is the black line broken down into the sources of how it is satisfied. So the purple bar down at the bottom is the minimum groundwater pumping, and it is virtually constant, the same for almost all years. Then the light blue section is the surface water deliveries. See, under baseline, they usually were fully satisfied with surface water. In a few of these drier years, in '77 and the early '90s, they had to increase the groundwater pumping, and so the additional groundwater pumping is the red section. And if they reach the capacity for groundwater pumping and there is an unmet demand, this is the white portion beneath the black line.

So comparing this with the same situation on our 40 percent unimpaired flow alternative, we see a large increase in groundwater pumping to replace surface water shortage but not a lot of increase in unmet demand or agricultural shortage because Merced has such a high groundwater pumping capacity.

So here is the annual average for all years and then by water year type for groundwater pumping over all of the irrigation districts. So we see that on average for all years, there is an increase of about 104,000 acre-feet per year in response to the 40 percent unimpaired flow objective, but most of this increase is coming in dry and critical years. Particularly, in dry years, as in critical years, they have already met their capacity under baseline a lot of times.

At the same time, there is also a decrease in annual groundwater recharge from the districts because there is more surface water shortage, and they reach their groundwater capacity more. There is more unmet demand, and so there is less deep percolation and at the same time, less surface water diversion and less distribution losses. So we see about 80,000 acre-feet of annual recharge across all of the districts, but most of it is coming in dry and critical years.

Finally, I want to take a look at the net input from the districts. So if you subtract the groundwater pumping from the groundwater recharge, you get the net input associated with the districts. So here we see under baseline, we have a relatively high net input to the groundwater subbasin, and as you increase your unimpaired flow objective to the right, you see they start to decrease as they have less recharge and are doing more groundwater pumping. But even under the 40 percent unimpaired flow objective, they still have a positive net input to the groundwater subbasin. So they are net contributors to groundwater storage.

And so for further information, please look at Chapter 9, the Groundwater Resource Analysis, and in Appendix G, which contains all of the modeling and assumptions used for the analysis. And both of these can be found on the Website. Thank you.

GITA KAPAHI: Thank you, Tim.

With that, we will open it up to questions. Can I get the microphone? Thank you.

UNIDENTIFIED SPEAKER: Thank you.

You mentioned that 2014 groundwater is not sustainable, and so that is why you used 2009. Does the board believe that 2009 is sustainable?

LES GROBER: That is a good question. The issue of sustainability, that is an important question. So I think the way to frame the 2009 versus 2014 is that 2014 is less sustainable. There is a lot that goes into the question of sustainability. In what we describe, even using the 2009 rates of groundwater pumping, there is an increase of groundwater pumping over the current condition, and we go into some discussion about those numbers and how it relates to the current rate of pumping in the area. But the question of sustainability is that big question that has to be answered by SGMA.

UNIDENTIFIED SPEAKER: And also, what is the planning horizon? Perhaps in the short time you can compensate for the loss of surface water by repumping more groundwater, but in the long run, that is very programmatic. So what is the planning horizon of this study?

LES GROBER: So as the introduction showed, the last major update of the plan was in 1995. We are updating it now, you know, 20 years later. So we are required to periodically update the water quality control plan. But it is that 10- or 20-year horizon over which it would be reevaluated and updated again.

So that is the reason we handled groundwater issues and SGMA in the plan, in that we expect based on the observation of what happened in the recent drought that there would be some level of increased groundwater pumping. We selected 2009 rather than 2014 for the reason that I said, that it is less unsustainable in general. SGMA is going to have to determine that sustainability.

But there will be other things that will likely be happening in the next few years, things like additional groundwater recharge, things like that, response to the program here. So a lot of that starts becoming quite speculative. So the short answer is the planning horizon is about 10, 20 years in terms of the frequency of the update of the water quality control plan.

UNIDENTIFIED SPEAKER: Thank you.

ART GODWIN: I am curious why you used CalSim for some of the input data and you used the ag water management plans for other input data. For instance, you had district spills, and that was from CalSim. But then you used the ag water management plan to develop other demand data within the district.

LES GROBER: Because in some ways, though, this is not the whole suite of models -- and I will let Tim add. The whole suite of models is not as limited of a dynamism. It is not a dynamic model in terms of surface groundwater interaction, but we are perturbing the system here with changes in surface water supply and things like that. So we relied upon the ag model plans rather to come up with a more targeted run that gets at answering the question in terms of surface water, groundwater response, and those such changes rather than CalSim.

ART GODWIN: So I am wondering why you used CalSim for some of the inputs and you used the ag water management plan for other inputs.

WILL ANDERSON: Art, that is a really -- you can see why that is a question. However, we used the spills in CalSim because that is what the WSE water balance -- the surface water balance is based on, and if we -- we basically keep those the same. But it doesn't alter the effect -- it doesn't have a lot of effect on the actual applied water calculation because the operational spills and returns are going back to the river. And so those are essentially a passthrough for the applied water component.

So it is -- it really doesn't -- it doesn't cause a mismatch, if you see what I am saying, because we are really concerned about the fate of surface water diversions that do not return to the river. If they return to the river, you could say, "Spills are X" or "Spills are Y." But the fact that they are going back to the river is consistent in WSE, and they are not part of the applied water, if that makes sense.

ART GODWIN: Yeah. And then I am not following Les' explanation earlier on why you didn't just stick with CalSim since CalSim already has surface water diversions, already has an ag demand component to it, has groundwater surface returns, et cetera.

WILL ANDERSON: Well, we could do that, but we really believe that the ag water management plans are a really good, updated, more recent source of data that is published by those who really know the water balance more recently than the most recent update to CalSim.

ART GODWIN: Then that goes back to my other question about, "Well, why did you use some of the ag water management plans and not the rest?" Because the management plans have spills in them as well. So just --

WILL ANDERSON: Because it is a passthrough.

ART GODWIN: Well, I know, but that doesn't answer why.

LES GROBER: We are trying to maintain some of the -- I mean, the backbone for the water supply effects is CalSim. So every time you, kind of, make a change, it has, you know, some other effect. So we made the adjustments to CalSim that actually improve the response, if you will, in terms of information that is provided by the ag water management plans in terms of what we expect in terms of responses of the districts to the reduced surface water supply and groundwater pumping.

But changing things like spills, which is kind of like, you know, a fundamental part of the CalSim construct would become a more difficult exercise, and as Will suggested, it doesn't change the results.

ART GODWIN: Well, it would change the results, wouldn't it, when you look at your --

GITA KAPAHI: Can you use the microphone?

ART GODWIN: Sorry. It would change your results, wouldn't it, for your equation for determining, for instance, the -- I don't know which equation it was but one of those factors. I don't recall which one, but it seems like -- because this is basically a water balance. You are looking at what got diverted, and you are subtracting losses and evaporation. And you are including the consumptive use of the crop. Somewhere in there, spills is -- are you using spills just to balance it out?

TIM NELSON: Like I said before, the spills are a passthrough. The only way that that enters this balance would be the fraction that is lost from the distribution system on that passthrough.

ART GODWIN: Okay. So it was the distribution?

TIM NELSON: Right. So that is going to be -- that amount is -- it is a fraction of a fraction. So if you are looking at what that difference is, it is going to be a relatively small difference in the scheme of things here. One of the other things -- I mean, it is a good topic, returns and spills, because one might ask, "Well, what happens if in response to this, people become more efficient and reduce their spills and return flows?"

And so we thought about that. Essentially, when we have it here as a passthrough, the same as CalSim, "Okay. Go ahead and reduce those operational spills. Then you will need to divert less in that operational regime." And so if it is just left in the stream, that doesn't change the hydrologic water balance, the WSE balance. So it is either going to be going through the stream or going through as a passthrough additional loss.

ART GODWIN: Right.

LES GROBER: And it doesn't change the water supply effect.

ART GODWIN: Right. But it does change what ends up at Vernalis.

LES GROBER: Well, no. I think that is what Will's explanation was because the requirement for the instream flow is at the confluence for each of the tributaries. So --

ART GODWIN: Right. But the spills don't necessarily happen at the confluence.

WILL ANDERSON: Right. It would be back in the stream.

AMY: Right. As a follow-up to Art's questions --

GITA KAPAHI: Can you please state your name? Thank you.

AMY: Amy -- okay. Thanks.

So just to clarify, is it only the spills, the returns, and the max and min pumping rates that are different from CalSim? Or I think I read somewhere that the consumptive use of applied water was also adjusted. Was that adjusted to the daily operations model?

WILL ANDERSON: No. Not to the daily operations model. The -- starting with the CalSim consumptive use demands, which is basically the crop ET demand, that is a time series -- a monthly time series that will change with regards to climate, lower needs, and wetter years with more precipitation. To translate from the COAW, or crop demand, to the diversion demand, you have to add up all of these components. All of these components are the distribution losses, reservoir losses, return spills, all of the things that would have to be diverted in order to get that crop demand met.

So the total surface demand is made up of those components based on the fractions from the ag water management plans for all of the things except for those operational spills. So that is where CalSim had the value of, "Okay. 30 percent deep percolation and 10 percent distribution losses." That is kind of their main assumption that they use in a few different places.

We have got better information than that. So we use the fractions that were published. Once you add all of that up to a total surface demand or diversion demand -- the point of diversion -- you can then look at the spectrum -- the demand curve when it is totally met, and we would have to adjust that then to what has been observed with diversions. By "observed," I mean you can look at what CalSim actually diverts when it meets full demand. You can look at what an operation meets at full demand. You can look at the ag water management plan diversion to meet total demand. And those are three kind of different views at the total demands.

We think that operations models are probably a really good representation of that over many years. CalSim is over the longest time span, but we are a little bit skeptical about, you know, where that exact level is because sometimes it can be based on older estimates. The ag water management plans are the most recent estimates but may only be for a couple of years. Though, with those three different views, we have to take the weight of all of that evidence and land on what is a total demand. And so that is why we adjusted the consumptive use demand that scales the total demand to the best available estimate of district demand.

AMY: So it is scaled to the agricultural water management plans and not CalSim?

WILL ANDERSON: For the most part, the scaling was done to the operations model representations of demands, since we have the operations models for each tributary.

AMY: Oh, okay. Thank you.

UNIDENTIFIED SPEAKER: You said you used the operations model for each tributary. Which operations models are those?

WILL ANDERSON: So for the Tuolumne, we have the Tuolumne FERC process operations model. For the Merced, we have the same from Merced ID. And also on the Stanislaus, there is the CalSim runs that were done by Steiner as part of the San Joaquin Tributaries Authority interm plan of operations reports, and those incorporate the 1988 agreement, total diversions, and so on.

So we really have to think long and hard about, "What does that mean to have the total diversions met and what that level is?" So in terms of getting feedback and comments on the values that we use, that is exactly what we are here to talk about and would expect to hear back on those numbers. And I would be happy to clarify, either now or through further correspondence, on those values and how these work.

UNIDENTIFIED SPEAKER: Just a general question, if I could. You had access to CalSim; you had access to the three tributary models. And yet, you developed a WSE model. So what was wrong with the other models?

WILL ANDERSON: Mainly --

UNIDENTIFIED SPEAKER: I am familiar with the Tuolumne model, and I know you can adjust flows, diversions, everything else you want to do with that model. And I am wondering why that didn't fit your purposes.

WILL ANDERSON: Well, one might use different tools for different evaluations. We found that putting it in the spreadsheet was the most flexible way to implement the instream flow alternatives and determine the amount of additional flow in the river and the effects of that.

UNIDENTIFIED SPEAKER: Well, I mean, the Tuolumne is a daily operations model, and you went with a monthly operations model and then disaggregated that to whatever for the temperature study. So just an observation. You don't have to answer it.

SUSAN BERK: Hi. My name is Susan Berk. I am a resource economist working for some of the irrigation districts in the region. Just switching gears a little bit, I do still want to talk about groundwater but not operations models. Quoting here from Appendix K, the water quality appendix, you state that the state water board must consider in establishing water quality objectives the need for developing housing within the region. So that is just from the water code.

And I am curious to know -- as an example, the population of Merced County as well as actually Stanislaus and San Joaquin are projected to continue to outpace the population growth in the state. They are expected to grow between 3 and 4 percent a year through 2050. Understanding that a lot of the municipal providers as well as the rural service providers as well as domestic wells require, you know, sustainable groundwater use for housing, I am wondering where in the SED you spoke to this issue about how additional groundwater pumping would affect the ability for the region to continue to develop housing at a pace that is needed.

LES GROBER: There is some discussion at that looking at the county plans in the cumulative impacts analysis.

SUSAN BERK: What was the result of that? I have been through the document, but I have to admit I haven't been through every single page of it. So what was the takeaway from that analysis?

LES GROBER: That there would be additional groundwater pressures and needs for groundwater surface water for developing -- accommodating population growth.

Anne --

ANNE HUBER: In addition, there is discussion in Chapter 13 about how municipalities would respond to a shortage in water and discussion about how there may be a need prior to full implementation of SGMA to increase well depths or pumping, if necessary.

SUSAN BERK: Okay. Because is it covered as a -- I didn't notice that there was an environmental justice section, but one of the things that does strike me about this is that the median household income is much lower in this area than it is throughout the state, and this is some of the last affordable housing in the state. So the impact is actually probably on disadvantaged communities in terms of how they would pay for those well depths, et cetera. Is there acknowledgment of the EJ?

LES GROBER: I just want to bring us back to the technical nature of this here. If you have policy comments, then I encourage you make those at the hearings.

SUSAN BERK: Well, technically the EJ is a -- should be a section of the document, right, the environmental document? It is okay.

ANNE HUBER: I just want to add that there is some discussion in Chapter 22 about disadvantaged communities.

VALERIE KINCAID: Thanks. Valerie Kincaid, San Joaquin Tributaries Authority. On slide 20, you begin to talk about the calculations for the groundwater analysis. I think the top of that slide says that the DIVT is from the WSE, and that is consistent with my reading of the document as well. But it is inconsistent with the earlier presentation that Nicole made, and there were, in the WSE, a number of lines pointing to the analyses in the document. And interestingly the only error that was missing in that was a WSE groundwater line arrow. So I guess my question is: Is the groundwater analysis based on the WSE model or not?

ANNE HUBER: I can answer that. Nicole's lines were direct links. So the WSE results were not directly used for groundwater analysis. Instead, they fed into the -- well, they were not used directly in Chapter 9. Instead the WSE results fed into the groundwater use analysis, which then fed into the Chapter 9 discussion.

VALERIE KINCAID: So they are the top -- I mean, the WSE inputs are the top line here, though, of the groundwater analysis; is that right?

ANNE HUBER: Yes. All we are saying is that the WSE results fed into the groundwater use analysis, which then fed into the discussion in Chapter 9.

VALERIE KINCAID: All right. I had questions about that slide when it came up. If this presentation is being circulated elsewhere, we might want to improve that. I think that is misleading in saying that the WSE doesn't actually drive the groundwater analysis and results, and I don't think that is the case.

So I have a second question. So on slide 26 -- there we go -- Tim did a very good job of walking through a lot of the inputs for the calculations. But one of the inputs that I think you all know I have a continuing curiosity about is the max groundwater input. And that wasn't walked through specifically. I am wondering if Tim could take some time. And I think the following slide tries to go into it, but I still have a lot of questions about not necessarily why you used 2009 versus 2014 data but why we are calling it a maximum groundwater number and how that max groundwater calculation was made.

TIM NELSON: The maximum groundwater pumping, it is just the, I guess, how much can they pump based on their infrastructure. So in that equation, they can't pump any more than that, even if they wanted to, to meet their demand.

VALERIE KINCAID: Are you saying it is a maximum capacity? Because my understanding from reading the SED is that is not the case. 626,000 acre-feet is the combined maximum total groundwater capacity pumping, and as you see in that chart, you are showing it in the mid-200s.

TIM NELSON: These are by district. The 626 is for all of the districts combined.

VALERIE KINCAID: Okay. But also in the document, there are times where max groundwater pumping doesn't equal the maximum capacity. Right? You have different years. You have above normal years and different years that drive that calculation. It doesn't seem like a static number. So I guess my question is: Are you saying the maximum groundwater number on slide 26 is a static number? And if it is, can you tell me where you got it?

TIM NELSON: It is a static number, and for 2009, it is from the 2012 AWMPs. And for 2014, it is from the district response letters, at least for the indicated districts. And --

VALERIE KINCAID: Do you have the -- and you don't have to provide them now because I wouldn't have them if I were you, but if you have the page numbers from where you got those in the AWMPs, that would be helpful.

TIM NELSON: They are in Appendix G, but I don't have it with me to give you --

WILL ANDERSON: Valerie, a month ago in Modesto, I showed you that Excel file --

VALERIE KINCAID: Right.

WILL ANDERSON: -- that has all of those referred out, and I think it might be useful for us to put them on a white paper, just so it is abundantly clear.

VALERIE KINCAID: It would be useful, and I appreciate that. I have gone through that, and I still, frankly, can't match up the data. And we have had other people who are much more technically savvy than me look at it, and we still can't match up the data. So we still have a lot of outstanding questions on that issue.

WILL ANDERSON: Your point is well taken.

LES GROBER: And I just want to make sure I understand on the question, you are saying you are not finding that -- though that is a hard number, that max pumping, you don't see that we are relying upon it up to that amount in years?

VALERIE KINCAID: I am actually not saying that it is a static number. So that was my first question. I understand that that was Tim's answer. But I have dug down a lot of this, and it is not a static number. So maybe that is not part of the problem.

And if it is a static number, my question is: Where are you getting an ag water management plan? We have looked for that, and I don't see that anywhere in our ag water management plans. So my only assumption can be that it is a calculation of some sort. That is an assumption of mine because I can't find it. And if it is a calculation, which I think it is because, like I said, there is different numbers for above normal, dry years, and different year types. So I guess I am not finding that in the ag water management plan, and I am wondering if there is a calculation behind what it is. And if there is not, where specifically it comes from.

LES GROBER: Okay. Thanks.

WILL ANDERSON: I am going to try and address that just one more time because I know it has been a source of confusion. When we show summary statistics by year type, we would say, you know, wet year, dry year, critically dry year. Those statistics are for -- it is a composite of however many years in this 82-year study, each of which has a unique value for the amount of applied water shortage and the amount of groundwater that is pumped additionally for that.

And so when you see that critically dry years may pump less than that capacity, it is because not all critically dry years use all of that capacity, but some do. And when you take the average of the critically dry years, it may provide a different number that you are expecting, if you think that the pumping would reach a maximum in all critically dry years.

BILL PARIS: Bill Paris from Modesto. Last week we talked about accretions and how those contributed to meeting some of the requirements. And they were assumptions that we talked about. I think 20 percent was what was in there. Has there been an analysis or evaluation of the potential relationship between -- potential impacts to groundwater depths and whether or not the streams would remain gaining or losing or in what percentages or how that might change? And if so, can you tell me where that might be?

ANNE HUBER: In Chapter 5 there is a discussion in the setting about the interaction between rivers and groundwater. It is not part of the groundwater use analysis partly because this analysis focuses on the main part of the groundwater budget that would be affected by the alternatives. So if groundwater pumping were to increase, there is some potential that there would be small increases in seepage from the rivers, which would, in a small, way help ameliorate groundwater impacts. But there was not a need to analyze that in detail in order to determine that there would be an impact.

The amount of water lost from the rivers is currently -- well, there are sections of rivers that are both gaining and losses. If groundwater were to drop over a long time, which is not expected due to SGMA, then seepage, like I indicated, could increase, but it would probably not have a large effect on flows.

BILL PARIS: Okay. But is that reflected in the document anywhere, or is that sort of your perception of things in response to the question?

ANNE HUBER: Well, like I said, there is the section in Chapter 5 that talks about the existing interaction between surface water and groundwater.
Sorry. I am incorrect. It is Chapter 9. I was just looking at -- yeah. So there is some uncertainty there, and I don't know that we have a large discussion on that.

BILL PARIS: Okay. And I understand that maybe today we are talking about groundwater. I guess, maybe, I should have asked this question last week, and if so, I apologize.

I am wondering if from the surface water perspective -- and, again, the assumptions regarding accretions -- if there should have been some analysis between these two, whether it was in the groundwater section or the surface water section. Has anyone looked at or considered whether or not -- and I don't know. I am just asking if anyone had looked at what impact that might have had.

TIM NELSON: We haven't published any analysis of that.

BILL PARIS: Okay. Thank you.

And if I may, I would like to ask a follow-up question. I apologize. I was talking to Amy back here when you had mentioned this, but Will, you had mentioned the use of the Tuolumne River daily operations model. Can you explain how the state board used that model, in what capacity?

WILL ANDERSON: The only way we used that was to have another independent view on what the total diversions might be, the duration of what those total diversions might be.

BILL PARIS: Sort of as a check on the accuracy of the other models that you were using and the results that you were getting?

WILL ANDERSON: Right. Just another independent use of the weight of evidence.

BILL PARIS: Thank you.

MAUREEN MARTIN: Hi. I'm Maureen Martin again from the Contra Costa Water District. Last Monday, I heard that you guys were evaluating some sensitivity studies in the WSE model related to maybe removing some of those adaptive management, the carryover storage, and flow shifting, things like that. So AO was wondering if we were going to -- I thought I remembered that those results might be presented. So if you could describe if those types of sensitivity analyses are going to be discussed today, and if they are, how they might affect this type of analysis, you know, removing some of those in any way or how it might trickle down into the other analyses that are dependent on the WSE.

LES GROBER: Sure. We were unable to get those sensitivity runs, so we are not going to be presenting those today.

MAUREEN MARTIN: Will they be available in the future?

LES GROBER: We will see. We have some capacity issues in doing all of this. We will see -- you know, a number of people have that question. We will see what we are able to do and keep people posted. Maybe we will add it as an add-on at one of the upcoming hearings or maybe we will just post something, but we don't have it today.

MIGUEL MATTEO: Miguel Matteo, Merced Irrigation District. So my first question, I guess as a piece of information from a technical standpoint, the baseline for Merced Irrigation District for groundwater pumping is off by 100,000 acre-feet. And I can explain why, if you guys want me to.

LES GROBER: Sure.

MIGUEL MATTEO: So the 100,000 acre-feet is based on acreage that does not take surface water altogether. So they are not in our books. So basically they are acreage within the Merced Irrigation District that are strictly on groundwater. If you want to see those numbers, you need to go to the 2015 ag water management plan, where we use a metric to be able to come up with a consumptive use on those. We have qualitatively discussed those in the 2012 ag water management plan, but we did not have numbers since groundwater was not under the jurisdiction of the district at the time.

LES GROBER: Thank you.

MIGUEL MATTEO: That is one. The other thing is just back to the depletion/accretion. When you analyzed the shortages on diversions, are we using the same software -- are we using the same water balance that has to do with groundwater with accretion and depletion, or are we using different assumptions?

WILL ANDERSON: It is essentially the same assumptions that are based on the ag water management plans components. But it does start with the CalSim time series of consumptive use of applied water because that represents the climatic pattern of wet and dry years -- wet and dry months to come up with the total demand. Is that clear at all? Does that answer your question?

MIGUEL MATTEO: Well, basically, are we using the same depletion number for the groundwater model that you are using and also for the river flows in meeting unimpaired flows at the confluence? Are these the same equations? Is this the same water balance, basically? Is it all tied together or not?

WILL ANDERSON: The groundwater balance is separate. It is entirely separate from the WSE water supply effects surface water hydrology. We use the same factors -- the same fractions, but the purpose of the WSE is to determine how much water is available to meet demands at a point of diversion. In the groundwater surface water use analysis, the purpose is to evaluate the fate of that diverted surface water and what additional water might need to be pumped, if that is clear.

MIGUEL MATTEO: Yeah. I can see why you are doing one exercise versus the other, but the question is: If I go to the WSE model and I went backwards to come up with the value for depletion, for example, or accretion and I went into the other model that you are working on for the shortages on demand on the districts and went backwards to come up with the accretion/depletions, am I going to get the same answers?

WILL ANDERSON: When I heard you say, "accretions" and "depletions" --

MIGUEL MATTEO: The river depletions.

WILL ANDERSON: -- I am thinking that we use the CalSim values for the -- these are local inflows and additional depletions or water that is not seen downstream. So that is separate from the groundwater use analysis, and they are the same values for each of all of the alternatives. So each alternative will be the same for accretions and depletions. And information on accretions would be one thing that would be welcome as a comment.

MIGUEL MATTEO: Okay. Thank you.

CHRIS SHUTES: Chris Shutes with CSPA. I was wondering if you could go back to slide 15 or 16 and describe a little bit more the definition and how you got to the deep percolation factor.

There you are.

And I am particularly curious why it is so different for the different districts.

TIM NELSON: Well, this is just based on their reported estimates of deep percolation and consumptive uses. I think these are the averages. And, I guess, I'm not really sure what goes into the numbers that we get from the agricultural water plans.

CHRIS SHUTES: Okay. Can you tell me, just simply definitionally, what is the deep percolation factor?

TIM NELSON: It is the percent of consumptive use that -- so if you have a crop demand, you know your crop demand. How much more water do you need to account for deep percolation? How much more water do you need to apply to the field to make sure that your crop is fully satisfied? And so that is a percent of that crop demand. So it is the extra water that you want to apply to make sure you have fully met your demands.

WILL ANDERSON: Let's turn that around because Tim is trying to figure out what the comparison of what the crop need is and translate that to what is needed at a point of diversion. I think definitionally the most fundamental way to look at it is to look at what has been published and observed as the on-field efficiency. That is how much of the applied water percolates through the root zone and into the groundwater. The other fraction would be consumptive use without the transpired water.

CHRIS SHUTES: Okay. And so the bigger the number here, the less efficient it is for crop use? In other words, you have to increase your diversions in order to meet your -- in order to produce your crops; is that correct? Or do I have it backwards?

TIM NELSON: That is essentially correct. I will just leave it at that.

CHRIS SHUTES: All right. But this doesn't reflect the actual percolation into a groundwater basin and tell you how much water is usable as groundwater at some future time; is that correct?

WILL ANDERSON: It is in the water balance, in the mass balance. It is what goes into the ground, yes. And it would be potentially usable in that balance. And the opposite would be what is pumped and removed from the ground. And these districts have long histories. They have many systems. They have many crops they are growing. And if you look at the individual reports, you can probably kind of view the numbers. They are published, and they are very clear. They are incredible sources of information, and so we are very pleased to be able to use them.

LES GROBER: These are good questions and observations, and it is kind of reflective of what we see here. And we are interested in receiving comments if anybody thinks the numbers are wrong and also why it is important that they are wrong. But this whole area has been doing this kind of conjunctive use because it is kind of leaky systems and a lot of water supply that isn't used for crop consumptive use. So it is something that we, you know, struggle with in trying to find the right mix here.

But I just want to point out that in the examples of the effects and what we are trying to get from this, it is a zero-sum game in that if you improve efficiencies or stop the leaky systems or things like that, you will lose less water in the moment, but you will also do less of the groundwater recharge, and the groundwater deficit goes up, if you will. So it is an interesting problem.

CHRIS SHUTES: Yes. I remember asking at a conference someone from DWR what the efficiency was of, say, flood irrigation as a groundwater recharge means or method, and the response I remember getting was that it was quite varied depending from place to place. But these numbers, at least for MID and TID, seem very high. So I am wondering if there is a distinction between what they need to produce their crops and what is eventually available in practice as usable groundwater. And then I also wondered about the statistics, and maybe I need to do some research on things.

UNIDENTIFIED SPEAKER: So just so I understand this, so this is saying, for instance, for TID that 46 percent of the applied water goes into deep percolation?

TIM NELSON: No. It is a consumptive use demand, the crop demand. So you need 46 percent more water than the crop demand. So you know how much your crop needs. So you need 46 percent more of that to account for deep percolation. If you want -- so that is looking at it from the demand side.

So if you want to look at it as how much -- you know your applied water and you want to know what percent of that becomes deep percolation, you could adjust this to become a supply side factor.

UNIDENTIFIED SPEAKER: So you could have an equation that says applied water is equal to consumptive use plus deep percolation?

TIM NELSON: Yes.

UNIDENTIFIED SPEAKER: Well, yeah. I was sort of including that with consumptive use, but yeah. There was another table that you showed, which is, I think, efficiencies or something -- distribution loss factors.

So this is showing that even though we have a leaky system, TID only loses 8 percent?

TIM NELSON: So they need to divert 8 percent more water over their demands to account for distribution losses.

LES GROBER: And that is downstream of, say, the off-stream reservoir?

TIM NELSON: Yes. So the off-stream reservoir, we assume that it accounts for any losses upstream of it.

UNIDENTIFIED SPEAKER: Right.

TARIQ KADIR: Tariq Kadir from the Department of Water Resources. Can you go back again to the deep percolation factor slide?

LES GROBER: Jason, can you just go to the slide, please?

TARIQ KADIR: Again, I think this has already been brought up, and maybe it has been answered. But your definition is the deep percolation factor represents seepage of applied water, and yet your equation is a function of the consumptive use. So my question is: When you talk about deep percolation as a function of the physical system, is that what is grown on them there? So if you have one crop and then you have another crop that is double the consumptive use of applied water, are we saying that deep percolation is actually increasing as a result of that?

TIM NELSON: Yeah. For each crop -- so if you have two crops, they both have a demand. You apply water for one of them. Some of that water is going to seep past through. So if you apply water to two crops, there will be twice as much water seeping through the pass-through zone, assuming both fields have the same, I guess, soil efficiency.

ANNE HUBER: And also, I am just thinking another part of it is these numbers are imperial. So it has -- the numbers from the ag water management plans have aggregated all of the crops. So this was a way to estimate total overall percolation.

TARIQ KADIR: So it seems then that you have a deep percolation factor that is really tied into what is being grown in that area as opposed to a factor that is representative of the physical system. What are the properties of the soil and filtration and the deep percolation part of it?

WILL ANDERSON: That would be all rolled together. It is a fraction of applied water that is not used by the crop. So it would be -- it would include all of those factors rolled together to what has been published. If you look at -- you know, I am looking at a TID plan now because the question was brought up. That 46 -- well, we have got 46 percent on the percolation side and 8 percent on the distribution side.

So actually for TID, they have got a much more complicated water balance. They have got -- their distribution system, they have a whole balance for that, and then for the field, they have a whole thing for that. And we have had to combine them and generalize it in, kind of, a simplified schematic here. And I am looking at as this is what has been evaluated and published as the fate of this applied water. So --

TARIQ KADIR: So not to belabor it for too long, so if you have two irrigation districts growing the same crop, they will have the same deep percolation factor?

WILL ANDERSON: No. They have got unique soils -- parcels. Essentially, it would be what has actually happened. So we are not assuming that a certain crop has a certain percolation. We are evaluating from water balances what has actually happened. That is the best, you know, view for each of these.

TARIQ KADIR: Thanks.

GITA KAPAHI: Any other questions? Okay. It appears that we are done with this particular topic. We are a little ahead of schedule. Do you want to take an hour or come back at 1 o'clock. An hour? Okay. With your agreement, we will take one hour and come back at a quarter to 1 o'clock. So 12:45. Yeah, 12:45, be back in this room, and we will resume. Thank you.

(Whereupon a lunch break was taken.)

GITA KAPAHI: We have lost a few in the audience, but we will resume with the afternoon portion of the second day of the technical workshop. The next topic is agricultural economic effects and the statewide agricultural production model, the SWAP model. Go ahead.

TIM NELSON: Hello again. So now I will cover the agricultural economic effects and the statewide agriculture production model, and I will be assisted by Josue Medallin-Azuara. So the topics that are going to be covered is an overview of the analysis, what was done; preparation of inputs for the SWAP model and how we run it --

Okay. You are not missing anything yet.

Okay. After the inputs, I will hand it off to Josue, who will give a description of the SWAP model and cover the modeling equations and assumptions that go into it. And finally, I will cover the results, the analysis.

So the modeling logic -- so given the unimpaired flow objectives, there will likely be more frequent agricultural water shortages as we showed from the ground water analysis and the WSE. With greater shortage, crop production could be lower in certain years, particularly during drier periods. Fallowing -- and with the greater shortage, there will be more fallowed acres, which will reduce the gross revenue. Although, some changes to pricing and cropping patterns may dampen the effect.

So I showed this slide in the previous presentation. So from WSE, we get our surface water diversions. We use that in our groundwater analysis and determine our groundwater pumping. And from both of those, we have the applied surface water and the applied groundwater, so our total applied water for agricultural use. This total applied water estimate is then used as the primary input to the statewide agricultural model, or SWAP. And from SWAP, we get estimates of -- we get the change in acreage that would result from this change in supply. We get the change in acreage that would result from the change in applied water between the alternatives, and we also get the change in revenue that would occur.

So in setting up the SWAP model -- so the analysis covers six areas, representing the seven irrigation districts, with the two CVP contracting districts -- S EWD and CSJWCD -- combined. We have 19 crop categories following the DWR classifications for the land and water use. The primary input provided to the SWAP is the annual estimates of total applied water over the modeling period; although, the district applied water demands are calibrated to 2010 levels using DWR DAU crop surveys for 2010.

So here is a map of the irrigation districts and the DAUs overlapping them. So SEWD and CFWCD are in DAU 182. SSJID is DAU 205. Modesto and Oakdale are DAU 206. Turlock is DAU 2008, and Merced is DAU 210. So we used the DWR DAU crop surveys to calibrate our applied water demand for each district. So the DWR surveys land and water uses within each county periodically to develop crop distribution estimates for each DAU, but they don't do this every year. Instead, between surveys they use agricultural commissioners' annual reports to update crop yields appropriate for subsequent water years until the next survey is done. And all of this information can be found on DW R's Website.

So here is an example of crop distribution for DAU 205 for SSJID in 2010. As you can see, they have a lot of almonds. About 46 percent of their total cropping area is considered almonds in the crop -- in DAU's cropping patterns. So we applied the cropping pattern to the total irrigated acres of the district, and we get these estimates from the agricultural water management plans.

So for SSJID, we have 59,000 acres of irrigated area. So we multiply the previous crop distribution by the 59,000 acres to get our total crop area for each crop. And so we have 27,000 acres of almonds and 8.3 of corn and so on.

Also from the DAU crop surveys, we get crop applied water rates for the -- I guess the water needed to grow that crop -- grow an acre of that crop. So this is a bar chart of different applied water rates for each crop. And the applied water rates are in acre-foot per acre. So for every acre, how many acre-feet would you need to grow? Or how many acre-feet would you need to grow one acre of the crop?

So for almonds, we require 3.5 acre-feet for every acre. Multiplying this by our total acreage, we get an applied water demand. And then for almonds -- and if you sum that up for all of the different crops, you will get a total applied water demand for the district in that year, so for SSJID about 190,000 acre-feet of demand.

So now I will hand it off to Josue, and he will cover the statewide agricultural production model.

JOSUE MEDALLIN-AZUARA: Hello. I am Josue Medallin. I am an associate research engineer for the UC Davis Center of Watershed Sciences, and I have worked with the SWAP model as a codeveloper for the past ten years with Professor Richard Howard and other colleagues. So I will present the SWAP model, a description, and how -- the mechanics that we follow to come up with the outputs from the model that we are applying these in.

So this is a map that shows the model that is applied to California. It covers about 90 percent of the irrigated crop areas in the state and employs something called positive mathematical programming, which lies between the adopted and unadopted modeling, which uses statistics. And we have, as Tim said, 19 crop categories for this area. However, we have 20 crop grows for the statewide operation of the model that is employed in many studies.

We use information from land, water, labor, supplies, production costs, crop prices, and use. These come from different various sources. Our primary source for land and water use, as Tim said, is the crop use surveys by DAU, by the Department of Water Resources. And we also use information from cost and return studies from the UC Davis corporate station. We have several years for that information. We use that for the 20 crop categories, and we use, also, information from the ag commissioner's report to corroborate the information from the Department of Water Resources or match the cropping patterns reported by the counties.

The model maximizes net returns to land and management. In other words, we assume that the farmers show a profit-maximizing behavior and will plant making their crop decisions based on the crops that have net returns. And one of the nice features of positive mathematical programming is that it calibrates to the values of land and water use among other inputs, another feature of that that is well-suited for policy analysis. We have conducted many applications in California and other places in -- sure -- California and other places in the United States -- Chile, Mexico, the Middle East, and other locations employed for the same sort of publications.

So it was developed in the 1990s. It was constantly updated, and we have, as I mentioned, studies on agricultural adaptation to water scarcity. It provides, as an output, cropping patterns of land and water use and calibrates exactly to a base dataset using, as I mentioned, the positive mathematical programming. So the framework employed has been applied for California, for the U.S., the Americas, and the Middle East as well. An application for the area was developed using information from land and water use provided by the team and the water boards based on DAU crop surveys for 2010.

So the technique of positive mathematical programming considers a multi-region and multi-crop model in which the production is constrained to land and water use. We use a functional form from production. It is called the constant elasticity of substitution production function. And what this functional form does is to limit the amount of substitution that can occur between factors. In other words, we cannot keep producing water for crops just by adding supplies. We have limits on the amount that one factor can substitute for the other one.

We also have a nonlinear cost function. So this is one of the features. It is called a PMP cost function. It is one of the features in which the model bases its calibration to the observed datasets, and it is a form to represent the profit-maximizing behavior of farmers. In other words, we assume that observations in the field or in the base dataset -- it is the smartest thing to do based on the economics and the institutional and physical constraints in a region.

So as variables we have X, and you will see some of the modeling equations of the model, which is input use. And we have inputs for land, water, labor, and supplies. We also have a set of parameters. There are many parameters, as you can imagine. One is "V" for price. Delta, gamma, and omega are parameters for cost functions. The beta is for a cost parameter in the constant elasticity of substitution production function. And that is from the -- those are the main parameters that you would see on the equations, but we can go back to them as needed.

So in conducting the calibration, we use a six-step procedure. We will start with a base dataset. In this information, it was information that was provided on land and water use. We employed cost information from the SWAP model of the federal study that was conducted just a few years ago, and we employed that as the base dataset. And then we calibrate -- we obtain a calibrated linear program, which is fixed proportions in the base dataset and obtain the multiplier on the constrained resources -- in this case, land. We use that multiplier to parameterize the CES and the PMP cost function, and then we obtain a fully calibrated model.

The PMP is parameterized by using little squares of elasticities that we have available for California based on various studies. Then we have demand calibration in the case of those prices. And lastly, we have a calibrated model that we can then use to test different policies including water shortages, changes in land restrictions, and other -- depending on the applications. So this is the six-step procedure that we follow.

So this is how the CES production function looks like. It is not as scary. It is just a function that limits the substitution that can occur. In other words, we cannot just grow a crop by adding more labor. We need water and other inputs that are more essential. And anything between that and fixed proportions, which is essentially what we keep -- for a scaling production, we keep adding the same of an input and everything behaves in the same way. So this type of function or form will allow us to go in-between, in which we can cover a sensible range of a substitution of all factors.

And the profit first -- the profit maximization problem looks like the one below in the first term. On the left, we have the constant elasticity of substitution production function, and we have an escape parameter there. And by the way, all of these are cited in the references of the report or the document. This comes in a paper by Howard and myself on 2012, but we have these derivations well-documented in the literature as well.

One of the things to observe in this equation is that the right-hand side is working with average costs. So this is before the PMP cost function is calibrated. So we assume on this one that the constant returns to scale. And then we have the three -- the betas. The cost share returns are obtained by using this equation. We essentially use average costs and observe amounts -- survey amounts of inputs to obtain the parameters. Plus some of these parameters use some of the multiplied properties of the station calibration.

The bottom term is the scale term, which is dividing the fields and the land by the -- by the production that we obtained that we observed in the scales. The one with a tilde on the top is observed values.

Another feature that we use in this model is an exponential PMP cost function. So this has very desirable properties in a cost function. It assumes that no cultivated land would still have a fixed cost -- a fixed margin of cost on production given some sort of input. So we have -- the original formulation in the model back in the '90s was programmatic, and over time, we changed this to the exponential cost function.

Okay. So the calibrated program -- the base data functions are combined into a final program without calibration constraints, and it can be used for policy simulations. And this is how the calibrated program looks like. This is the objective function. The first term is prices. And term B and the exclamation term there is the production function. By the way, this is in index G. I is for crop, and J is for an input, so land, water, supplies, and labor.

The second term is the PMP cost function. It is the exponential functional form, and that only goes on land. And the rest is cost on supplies. And lastly, it is cost of water depending on the region. The land constraint is the one below. We assume that crops grown in a region are limited by the amount of land that is available in the base dataset. In other words, we are limiting expansions. If we take out this constraint, it can work on the regional range, but it is out of the calibration base.

The water resources constraint would take two sources of water. In this case, surface water and groundwater and some over -- of both sources to obtain the total water applied. We also have constraints on crop stressors documented in the federal disability study, in which the rates of applied water cannot go after a certain ratio. We also have constraints on silage corn. And again, these are limits based on the federal disabilities study. And we also have a rate of rotation in perennials, and we assume a certain life depending on the chart type. In this study, we observe something above 90 percent. So that means that if the G of 3 is 25 -- 20, 25, or 30 years, we put that into the denominator there -- in the perennial life denominator, and we obtain a value of about 0.92, 0.94, depending on the crop type.

So other things that we look into is we conducted a qualitative analysis for forward-linked sectors. It is talking about various livestock. Forward linkage is quantifying or just considering the downstream effects to industry sectors from an industry change in the supply chain. In other words, how much one sector downstream changes as a result of the supply. So the way we did that was to look for silage results in the SWAP and results from the alfalfa pasture. And it also reviewed the influence of milk prices. We conducted all of these using reasonable information from the UC Davis recent drought studies, which I coauthored with Dr. Dan Sumner, director of the AIC center and also an expert on milk and other commodities.

So again, the inputs to the SWAP model will be constraints on perennials; constraints on silage; the crop stress limits; base input information from the rest of the team -- from the water supply model, WSE that we discussed this morning; groundwater use assessment; and prices, yields, silage constraints, and production costs provided from the federal disability version of the SWAP model.

What we do with this information is apply it on water -- the expected shortages on water in a time series of two years and to the constraint that you saw in the calibrated program to water. And with that, the model decides, based on the profit-maximizing behavior of farmers and the calibration of parameters, what is the crop that maximizes this net return to land and management. And with that, we take into account the amount of water available, the amount of land available -- which, in this case, does not change -- and we report crop patterns and revenues.

And from here, I will pass it to Tim, who will tell us about the agriculture and economic impacts.

TIM NELSON: All right. So here is a time series of an applied water shortage across all irrigation districts. So as was mentioned, applied water is the primary input into the swap model. So SWAP will take these shortages here, just comparing the baseline with the 40 percent alternative -- well, here is the applied water shortage averaged over all years. Under baseline, there is about 37,000 acre-feet of shortage, which increases to about 149,000 acre-feet in the 40 percent alternative, primarily in the critical years.

So SWAP will take the applied water estimates, account for all of the shortage, and it tells us how acreage will respond, what acres will be fallowed, and how many acres will be fallowed. So here is a time series of the annual irrigated area fallowed across all of the irrigation districts. It is pretty much the same pattern as the applied water. We see large spikes in the drier periods and almost nothing in the wetter periods.

So here is the average annual irrigated area by crop type across all of the districts. So the crops that are being reduced in the 40 percent alternative are alfalfa, a little bit of corn, field crops, and pasture. These relatively are the lower net revenue crops. If we look at this for critical years, we see that the fallowing increases to more than half the crop in field crops, pasture, and alfalfa, but most of the other crops don't really see much changes. Like almonds, there is a little bit of fallowing. Orchards don't have any, all of these higher net revenue crops.

Here is the average annual acreage fallowed by year type for all of the districts. Can you see under baseline there is about 6,000 acre-feet fallowed and under the 40 percent alternative, 29,000 acre-feet is fallowed? So the difference would be a 23,000 acre-feet increase in fallowing under the 40 percent alternative.

Primarily from critical years -- well, but then in wet years, there is pretty much no increase in fallowing. Above normal, there is a 5,000 acre-feet increase and below normal, 13,000 acre-feet. When you start getting to dry and critical years, you are going to start to see a lot more fallowing. So in dry years, there is an increase of 31,000 acre-feet -- or thousand acres. Sorry. In critical years, there is about 80,000 acres of additional fallowing.

So SWAP also estimates how much money -- how much revenue these acres are worth, how much revenue would be lost from this additional fallowing. So here is the time series of annual revenue lost by fallowing land across all of the districts. And once again, it is pretty much the same pattern as the acres fallowed. And you can average this by district -- or you could look at this by district, and you can see on average, the annual revenue lost by TID is $20 million. But this is looking at the entire time series, when some years they won't have any; some years they will lose more.

So when you look at the average for critical years, you see that the losses are a bit higher. TID loses about $66 million on average. And then if you look at the overall average revenue loss, there is about 36 -- about a $33 million increase in revenues lost, primarily from critical years and dry years. But the revenue lost, you have to take into account what the baseline revenue is. And so here is a bar chart of the average annual agricultural revenue across all districts. But -- so the actual total rather than the loss that we were just looking at.

So under baseline for all years, the average is about one and a half billion dollars. And for the 40 percent alternative, this decreases by about 40 million, as is shown. And in the critical years, the baseline is about 1.44 billion, which decreases to 1.32. So for further information, see Chapter 11, The Agricultural Resource Analysis or Impacts, and Chapter 20, The Economic Analysis, as well as Appendix G for modeling information, which are all on the Website.

GITA KAPAHI: Okay. Thank you. Now we will go to questions.

There is one right there, Sandra. Thank you.

SUSAN BERK: So Susan Berk again. I am a water resource economist working with several of the irrigation districts. I am curious to know your choice of the baseline. You estimate the baseline is about $1.5 billion, but I think that that just accounts for crop commodities, and it doesn't account for the animal commodities produced.

So in the annual county ag commissioner's reports, more than half of the commodity value produced every year in these three counties comes from dairies and cattle and chicken, which are dependent on -- Tim, as you said -- the lower-valued crops that fall out of production when you run SWAP.

So I am having a hard time thinking through how leaving animal commodities out of the analysis, particularly when you are impacting the feed crops, is an adequate representation of the potential impact to the SED. And, you know, I noticed even in the long-term average annual numbers, you are estimating that 17 percent of alfalfa, 10 percent of corn silage, and 27 percent of pasture comes out of production.

And I know that the SED has written that you can import those crops to feed animals, but I am a little bit concerned about, one, importing corn because it is a wet -- as you know, it is a wet corn so it is difficult to import. So I guess I will just leave it at that and ask you to, sort of, describe to me your thinking about not including the animal commodities.

JOSUE MEDALLIN-AZUARA: Sure. That is a really good question. I think, as I mentioned, we addressed that qualitatively based on the recent studies of drought conducted at the center for watershed sciences, which we coauthored with Dan Sumner. The rationale is that the decisions, especially for dairies, on production are mostly driven, even in drought, by economic conditions. In other words, by the price of milk.

And even if we look at the reports from the counties, a lot of the impacts that are reported for the dairy industry are based on low milk prices, more than on water shortages. Which of course, as you mentioned, a market for alfalfa exists in the state, and that is often important when there is a shortage from other areas of the state. The silage corn, from our experience, showed that corn has to be grown within a range of about 50 miles within a region. We did not see a large impact on silage, even in dry years, that can actually impact -- that will suggest that dairies will face issues.

Also the substitution between the feed crops for the dairies depend pretty much on the preferences of the farmer. So some farmers prefer to substitute with a little bit more of alfalfa or concentrate. Although we understand that is limited, we mostly modeled the average farming operation for the dairies rather than the individual farming for these issues.

SUSAN BERK: Thank you. If I could just follow up, what would you consider to be a large impact on corn silage that actually might have an impact on the amount of milk that cattlemen can produce -- or dairymen can produce?

JOSUE MEDALLIN-AZUARA: I think we see previous modeling impacts in dry years. If we can go back to the slide -- I mean, we have seen in the effect of recent droughts that that doesn't go down. It is the fluctuations in the model of cultivated alfalfa and corn that is mostly fallowed in the milk prices rather than the water shortages. We have in 2014 a pretty dry year, where the alfalfa numbers and the corn silage numbers were at a historic high because the milk prices were at a historic high. So as we said, in our recent drought study, we did not see an effect for that that would matter. But going to the individual crops, where is this slide -- here. I mean, in a number of years in corn we see relatively low declines in the total amount of silage. And again, to our knowledge, this radius of about 50 miles is still acceptable to have some transportation of silage.

SUSAN BERK: Thank you.

JEFF MICHAEL: Jeff Michael from the University of Pacific. A question, as we look forward in time, I noticed in some of the critical years, it was about half or more than half of some of these low-value crops that were fallowed. And as we look over the past couple of decades, we have seen this sort of baseline movement out of these low-value crops into these high-value crops all across the state and the valley, including in this area. And we also have SGMA being implemented over the next couple of decades.

So my question is: "Have you considered" -- I guess your baseline is based on 2010 crop values and looking forward and whether that buffer of low-value crops could be smaller in the future than it is today.

LES GROBER: No. We did not look at any changes in future cropping.

JEFF MICHAEL: The question is: Is the choice of the baseline year, 2010 I guess it was, that was the most recent available data?

JOSUE MEDALLIN-AZUARA: It is for -- Tim --

TIM NELSON: So we chose 2010 because that corresponds with the initial notice of preparation -- or a period of the notice of preparation. Even if there was more recent data, we did not use it.

JEFF MICHAEL: So it doesn't reflect more recent crop prices?

TIM NELSON: No.

DEBBIE LIEBERSBACH: Hi. Debbie Liebersbach with the Turlock Irrigation District. So in the agricultural impacts section, I think you indicated that you didn't include double-cropping in the analysis. Is it incorporated in the economic analysis?

JOSUE MEDALLIN-AZUARA: You mean, like, winter and summer crops? They are -- we are working in the SWAP model with irrigated crop areas, which account for multi-cropping in a way. Areas like the Salinas Valley in which they have two or three seasons, we have a slightly different model to account for that. But here we essentially work with the irrigated crop areas more than with the irrigated land areas. Does that make sense to you?

DEBBIE LIEBERSBACH: Well, I mean, a lot of times a lot of these forged crop acres will be double crops. So you will have corn/corn or, you know, silage/wheat.

JOSUE MEDALLIN-AZUARA: Right.

DEBBIE LIEBERSBACH: And, I mean, there is any number of combinations, but that should be accounted for in the analysis.

JOSUE MEDALLIN-AZUARA: Right. And I think we do. We have, as I mentioned, irrigated crop areas and irrigated land areas. So the difference between these two is the amount of multi-cropping.

UNIDENTIFIED SPEAKER: You mentioned that you modified the SWAP model to more adequately reflect the area of study. And presumably by region, you did the six regions representing the seven irrigation districts where you combined the CVP districts. What were the assumptions that you made about the ability of each district to transfer water from one crop to another crop?

JOSUE MEDALLIN-AZUARA: We assumed in the SWAP model deposits represented by the farmer in each district -- so we assumed internally a market for water that can occur within the district, which I think is a defensible assumption. Within the districts -- we do not assume transfers within the districts.

UNIDENTIFIED SPEAKER: So no interdistrict but intradistrict transfers. So some of the districts actually don't accommodate intradistrict transfers. You might want to know that for future use. They don't actually allow that kind of transfer.

JOSUE MEDALLIN-AZUARA: You mean, within the district?

UNIDENTIFIED SPEAKER: Within the district, that is right. Yeah. Some do, but some don't.

And also, while I have the microphone, where in the SED or in the spreadsheets that you have attached can I find the information on the SWAP input specifically yielded and the prices that were used for the various crops?

TIM NELSON: I don't believe -- those are parameters that are part of SWAP itself and not part of the input spreadsheets.

UNIDENTIFIED SPEAKER: Right. Is it possible to get those?

LES GROBER: It seems that it should be, yes.

UNIDENTIFIED SPEAKER: Okay. Thanks.

UNIDENTIFIED SPEAKER: I was just wondering what the error bars on this would be. It seems to me like we are estimating a minimum difference in revenue lost because we are optimizing whether or not the agricultural distribution of one crop to the next is optimum and has some practical constraint. So could it be that we are representing a minimum rather than the full range of what is possible?

JOSUE MEDALLIN-AZUARA: Well, we represent a range of 82 years of water availability, yearly. I'm not sure if you are asking about, "How does that vary?" I mean, the model calibrates exactly to a base dataset.

UNIDENTIFIED SPEAKER: Well, my question is: For each given year -- and pardon me if this is an uneducated question. But for each year, you are targeting and assuming that the business would respond to the optimization function and would operate ideally. But there are potentially another range of things they could do that aren't optimum.

JOSUE MEDALLIN-AZUARA: Well, the modeling assumption of something like SWAP is that the farming behavior is profit maximizing and that they are doing the smartest thing, which is what we observed. And we represent the average decisions in farming over a certain area. If a farming operation is losing money, then it wouldn't be farming for very long. So we assume that what is observed is making enough money. And you are right. There is many factors that occur around those terms.

UNIDENTIFIED SPEAKER: Okay. Thanks.

JOSUE MEDALLIN-AZUARA: You are welcome.

STEVE BOYD: Steve Boyd, Turlock Irrigation District. If I could follow up with Mr. Grober, would it be possible -- assuming it is possible to provide those, that we could expect to see them?

LES GROBER: I'm not sure. Did you ask when it would be possible to get that information?

STEVE BOYD: You said, "It seemed possible."

LES GROBER: Yes. I just looked at Josue. It seems like it is data that is available. So that is something that we will then --

STEVE BOYD: So you will provide that?

LES GROBER: There were some other requests also for other types of runs and information. So we will try to do that over the next couple of weeks, and we would send notice out, post it, and make it available.

STEVE BOYD: Thank you.

GITA KAPAHI: One more.

UNIDENTIFIED SPEAKER: So I saw in your -- in the information about the calibration -- or the constraints on SWAP that you had a deficit irrigation constraint of up to 85 percent. Did you then add or look at the change in yield, particularly, like, with fruit and nut trees from deficit irrigation?

There has been sort of a wealth of information written about the fact that yields would decline under deficit irrigation and that not just -- particularly for trees, not just in the year of the deficit irrigation. But there is a lag impact; also, there is a problem with the setting of fruits in the following year. Is that included anywhere in the model?

JOSUE MEDALLIN-AZUARA: We account for it to the extent that it is captured by the curvature of the production function.

UNIDENTIFIED SPEAKER: Okay.

JOSUE MEDALLIN-AZUARA: So if you put in less water, you will see a decline in yield. But it is based on the curvature of the production function.

UNIDENTIFIED SPEAKER: So if we got the prices and the yields for the baseline in SWAP, can we also get the SWAP output for how yield changes? In other words, part of the SWAP output is going to be that estimated yield.

JOSUE MEDALLIN-AZUARA: Yeah. I mean, we are providing that base yield, but I am not sure if I understand --

UNIDENTIFIED SPEAKER: So the baseline yield, say for almond trees as you said, that is available as is the price data. Now what I understand you to say is that the yields -- the effective yields in SWAP are also changing based on the curvature of the production function. So can we see that information also?

JOSUE MEDALLIN-AZUARA: It is part of more of the calibrated production function more than a physically based yield from a crop experiment.

UNIDENTIFIED SPEAKER: I'm sorry.

JOSUE MEDALLIN-AZUARA: There are crop experiments that shows what the relationship is between applied water and the yield.

UNIDENTIFIED SPEAKER: Right.

JOSUE MEDALLIN-AZUARA: Those are not a part of the calibration, if that is what you mean.

UNIDENTIFIED SPEAKER: Right. I understand that. And I also understand what you are saying about the fact that there is curvature to the production function. So effectively you are getting a reduction in yield as a consequence. So what I am asking for is that SWAP output. I would just like to be able to see that

SWAP output so that I could see how the yields are effectively changing. Is that information that could be made available?

LES GROBER: So is the answer the output files are available that are being requested? So we can add that to the list of things that we will make available.

UNIDENTIFIED SPEAKER: Okay. That would be great.

I have one more question since I have the mic. What was it that you said about forward linkages in the slide show? I'm sorry. I was actually taking notes on the previous slide, and when I looked up, it was gone. My understanding was that there weren't any forward linkages into the processing sector that were made in the SED.

JOSUE MEDALLIN-AZUARA: So what I am saying is that we -- by construction of the IMPLAN model, we look into what were linkages. And the forward linkages were assessed qualitatively.

UNIDENTIFIED SPEAKER: The forward linkages were what?

JOSUE MEDALLIN-AZUARA: Assessed qualitatively.

UNIDENTIFIED SPEAKER: Right. I think that the SED says that IMPLAN doesn't support doing forward linkages, but I would point you to some work that is being done out of Cornell with USDA money on farm hubs where they actually have a handbook out now about how to use IMPLAN to do forward linkages.

JOSUE MEDALLIN-AZUARA: Okay.

UNIDENTIFIED SPEAKER: In the demographic analysis that I have taken a look at for the area, my estimation is, like, 25 percent of the jobs or more are tied to either crop or animal production and/or processing because there is an enormously robust processing sector in the region.

So I am wondering if there would be impacts. I know anecdotically when you talk to the economic development directors in these areas, they will tell you that, you know, when the tomatoes go out of production, they lose jobs; right? Factories downsize. They reduce shifts. So, you know, the fact that we are not really looking at that full compliment of potential impacts -- particularly, again, I will, kind of, go back to the EJ area where we have, you know, very low incomes and minority populations. It is a little concerning that it hasn't been addressed fully in the SED.

LES GROBER: Please provide those comments.

UNIDENTIFIED SPEAKER: Okay.

GITA KAPAHI: So it appears that we have exhausted the comments on this particular subject and can now move on early to the next one.

TIM NELSON: All right. Now we will cover the regional economic effects and IMPLAN multipliers. So the topics I am going to cover is an overview of the regional economic analysis, and then Josue will give a description of the IMPLAN model and the derivation methods for the multipliers for regional economic and employment effects. Then I will go over some of the economic and employment results and describe the fiscal, or tax effects, of the analysis.

So what is the logic? Based on the results of SWAP, some agricultural acreage could go out of production in response reduced water availability. With less crop production, this means less revenue and fewer jobs in the agricultural industry. Because of the interconnection between every sector of the economy, other sectors may also see revenue and employment impacts related to the impacts in the agricultural industry.

And then with reduced economic activities in all of these sectors -- well, in the agricultural industry, this could reduce tax revenue for different levels of government. So from our -- from the WSE and the groundwater analysis, we knew our total applied water. With total applied water, we ran SWAP, and we determined our agricultural impacts, both in crop and revenue. With those agricultural industry revenue impacts, we can apply IMPLAN multipliers, impact analysis for planning to determine changes in the wider economy for both economics and employment.

So for this analysis -- for the regional economic impacts analysis, we expanded the modeling area to the entire three-county region of San Joaquin, Stanislaus, and Merced counties, as these regional economic impacts won't be just limited to the districts themselves. They will spread out to cities and the wider area.

So I will hand it off to Josue to describe the IMPLAN.

JOSUE MEDALLIN-AZUARA: Thank you.

As Tim said, we used the IMPLAN model that is based on the input/output analysis that was developed back in the 1950s. It was very commonly used. It helps raise the expenditures on a region's economy after an economic event has occurred. So it was developed by the MIG Corp. and is -- well, that is a typo. Sorry. It says, "Oregon," and "Washington."

But there is a database available for all of the United States at the county level and also at the state level. It provides direct and multiplier effects for employment, value added, crop revenues, and other taxing impacts.

So this is how an input/output matrix looks like. We have sectors, such as the ones modeled in the analysis. We have commodities, factors, institutions, enterprises. We have capital. And all of these words are included in an input such as an accounting matrix framework. So we trace expenditures among all of the sectors and then obtain what are the multiplier effects, which are illustrated here.

Essentially when we see a change, which is the first box, we see a direct effect. Then there are leakages to the economy as a result of those changes in expenses that directly -- that go out of the region. This is the case when we have an enterprise that is out of state where we have some imports. Then we have local purchases, which are the ones that have an effect on the local economy.

And when we see these changes in local purchases, we see purchases of commodities and services. And we also have an impact on labor. We provide salaries to employees of both directly affected sectors and sectors from which the primary impact occurs on. So we call the first -- the first kind we call "indirect effect," and the second kind we call "induced effects." And with some of those two, we have -- in the indirect effects, we have the total impacts, which is the sum of the three.

The notion of multipliers rests on the difference between the initial of an exogenous change, which is the final for a good, and the total effect of the change. And this backwards linkage that we were discussing previously is the tracking of those primary effects or the direct effect purchases backwards through the supply change. In other words, we account for what is the change for reducing or increasing agricultural activity on purchases of agricultural goods, such as fertilizers or services from crop advisors and other things.

And then we account for that in the indirect effects. The employees from the directly affected sectors and the indirectly affected sectors have demand commodities and services within the regional economy, and this is what we call the induced effects. And the sum of these three is the total effects that we report in our study.

For this study, the multipliers of IMPLAN were derived using county models. We also have three county models, which is the merger of the three counties in the area. Then we match the multipliers from the ten sectors -- the ten crop sectors that are defaulted in the

IMPLAN model with the 19 categories for the SED study. And then each -- in the three-county model, we capture more of the region's economy on an individual model, which captures leakages. So we used a three-county model, which seems more comprehensive and has some connection within the economies.

And these are the multipliers that we developed.

I will pass this to Tim.

And this is the match that we did for the crops in the IMPLAN and the crops in the SWAP model.

TIM NELSON: So this is the table of IMPLAN economic multipliers that we derived for IMPLAN. We see that the direct multipliers are all one because SWAP output is the direct economic effects. For indirect effects -- for grain there is -- for every dollar impact to the agriculture sector, there is the additional 59 cents of impact from indirect impacts, and then there is another 20 cents added for induced economic effects.

And the total multiplier would be -- for every dollar lost in the agricultural sector, $1.79 is lost in total. And then here is the same or -- the table of IMPLAN employment multipliers derived. And so the direct effect is not one -- so for every dollar lost -- or no. So for every million dollars lost in the agricultural industry, 11 -- for every million dollars lost in grain, about 12 jobs will be lost, which -- and then looking at the indirect and induced effects in total, about 18 jobs would be lost for a million dollar loss of revenue for grain -- or for grain crops.

So now I will go over a few results. So here is a time series of revenue losses for the 40 percent alternative relative to the baseline, so a change in our 40 percent alternative. We see that the largest loss in revenue comes in 1924 at about 350 million. So there is going to be a lot of -- there is going to be times when there is really big revenue changes in these wetter -- or in these drier periods, and then there will be times when there aren't a lot of changes in the wetter periods.

So looking at the same time series plot but as an exceedance plot, we see the one year that was $350 million worth of revenue change at zero percent, and then as you move up in exceedance percent you -- so at 10 percent exceedance, the revenue loss is greater than 200 million. At 20 percent exceedance, the revenue loss is greater than 150 million. We see that in about 50 percent of the years, there is no revenue loss, and 50 percent of years, there is some revenue loss.

Looking at the annual averages, we see overall about $64 million in additional losses, but with most of it coming in critical years, when there is an increase of about 211 on average -- 211 million. Looking at the overall impact, we see that the total sector output, including the direct and indirect and induced effects is about 2.5 billion. And so a change of 64 million is about 2.5 percent.

Now here is the time series of annual employment reduction for the 40 percent alternative relative to the baseline. So it is the same pattern as we saw for the economic effect, just with a different Y axis because the only difference was the multiplier used. So we see the same effect with the high impact jobs in these critical years and low impact in the wetter periods.

So looking at it as an exceedance, we see that the highest single year impact on jobs is about 2,500 in 1924. And in about 50 percent of years, there is no employment impact, and 50 percent of years, there is. On an annual average, about 433 jobs are lost under the 40 percent alternative, with critical years showing an average of 1,450 jobs lost. Looking at the total employment including all of the effects, there is about 18,600 jobs and so a reduction of 433, you would be out minus 2.3 percent.

Now I am going to quickly go over the fiscal analysis and its methods. So with a reduction in agricultural production, there may be tax revenue impacts. The federal and state governments would be insulated from regional impacts, as their total tax revenue is significantly larger than the contribution of a single county. But for county and municipal governments, they could experience greater impacts because their revenue base is so much smaller. Were there to be a significant impact from loss of tax revenue from these local governments, it could result in the impact to public services.

So for the fiscal analysis, we derived IMPLAN multipliers, much like in the first one. But this time we were developing the multipliers for each county, assuming a $1 million loss of revenue for agriculture and looking at, "What is the tax impact in IMPLAN?" The multipliers then were applied to all of the whole alternatives and baseline conditions to obtain estimated changes in tax revenue for the federal and lumped state and local governments, and for IMPLAN, the state and local government tax impact was lumped together. So this was separated based on the information in the county and local tax documents.

So here is a table of the tax revenue impact that would happen assuming a $1 million loss for the agricultural sector. Thus the -- these columns. So in total, the federal government would lose -- for San

Joaquin County, the government would lose about $154,000 for a million dollar loss in the agriculture industry, and the state would lose $61,000, and the local governments would lose about $44,000.

And then dividing these numbers by 1 million will give us our fiscal impact multiplier. So for every dollar lost in the agricultural sector, about 15 cents is lost for the federal government in San Joaquin County, and 6 cents is lost for the state, and 4.5 cents is lost for the local governments.

So summarizing the results, we see that the baseline tax revenue calculated using these multipliers and the baseline total revenue for the federal government looking at San Joaquin County is about $91 million, 36 for the state, and 26 million for the local governments. In the 40 percent alternative, there is a change of $1 million for the federal government, $400,000 for the state, and $300,000 for the local government. But if you look at the estimate of total annual tax revenue based on 2010 tax reports, you can see that the change in revenue is virtually zero percent compared to what was estimated for all three counties and all local governments.

So this analysis and further information can be found in Chapter 20, The Economic Analyses Summary, and Appendix G that describes the modeling methods. Thank you.

GITA KAPAHI: Thank you, same.

So we will open it up to questions.

ART GODWIN: Art Godwin. In looking at the unemployment impacts, did you consider that this region also already has one of the highest unemployment numbers in the area or in the state? Did you factor that into your analysis? In other words, did you look at the cumulative effects of taking more people off of the -- more people from not working?

LES GROBER: We just looked at the comparison, just showing a change from whatever the current is.

ART GODWIN: Assuming all of these numbers are true -- your unemployment, your economical impacts, your fiscal impacts -- is this something that the state board is willing to accept?

LES GROBER: Well, that is what we are here today about. Well, today, we are here about showing our work that formed the technical analysis. But it is that trade off between the flow proposal, Southern Delta salinity proposal and the effects that the board is going to have to consider. That is what makes this hard.

UNIDENTIFIED SPEAKER: Could I ask you to go back to slide 30? I think it was 30. It is hard to read the numbers from here.

TIM NELSON: There is only 27 slides.

UNIDENTIFIED SPEAKER: Okay. So it is not 30. It is any of the column charts that show any of the results -- labor or output -- by water year type. Yeah. That would probably work.

LES GROBER: Twenty would work.

Something with numbers or --

UNIDENTIFIED SPEAKER: They were there a minute ago. The column charts that you had where you are showing results by water year type.

TIM NELSON: This?

UNIDENTIFIED SPEAKER: Yeah. That will work just fine.

So clearly the biggest impact is in dry and critical years, as you have already said. When I read through the SED, one of the things I am struck by is because we are talking about just dry and critical year impacts, you report so many of the impacts by average annual years that we are sort of obfuscating the true impact of the SED.

I mean, although you report it here, which is great. So the information is available. But I can't help but feel like -- particularly here, like all years the impact is $64 million. When in reality, in dry and critical years, it is actually up to over $200 million, and those dry and critical years occurred two out of five years. So they are just under 40 percent of the time. So what we are talking about is a really big change in water supply reliability to the region. And I'm not sure how that has been captured in the SED. As an example, I would expect that the fiscal analysis would actually also include a change in land value. We all know that, you know, land value in the Central Valley is tied to the water supply reliability of the acreage.

So the fact that it hasn't been addressed anywhere is a little -- feels like a little bit of a gap to me, and I would just like to hear your comments on that.

LES GROBER: Well, you can provide that comment, but as you say, we do provide -- just because there is a lot of information here, we provide averages. But then we do provide -- as here in the documents, we show what occurs in critically dry years and dry years. So it is in there, but please provide the comment.

UNIDENTIFIED SPEAKER: What is the base year for the IMPLAN data used in the modeling?

JOSUE MEDALLIN-AZUARA: 2010.

UNIDENTIFIED SPEAKER: Okay. So it is the 2010 IMPLAN data, which is the same as the SWAP data? Did you ever look -- IMPLAN has DOS functions for agriculture in it, reduction functions, and so does SWAP. Have you ever compared them to see how well they compare in terms of, you know, net revenue and various input costs?

JOSUE MEDALLIN-AZUARA: We employed only the multipliers from the 2010, and we relied on the SWAP inputs for production functions.

UNIDENTIFIED SPEAKER: Right. So you didn't make any adjustments to the -- to recalibrate IMPLAN based on -- other than, sort of, what comes in the box from IMPLAN?

JOSUE MEDALLIN-AZUARA: We just checked the numbers of employment by county, and they seemed to align.

UNIDENTIFIED SPEAKER: So the overall production functions -- and I am just -- you know, the percentage of cost to labor margin from growing almonds or nuts, is there significant differences in SWAP and IMPLAN on that cost data at all, or have you not looked at it?

JOSUE MEDALLIN-AZUARA: We looked only at the production of the employment numbers. Yep. We looked at the employment numbers, and they aligned the county totals.

UNIDENTIFIED SPEAKER: So you compared the direct employment numbers or the -- yeah -- the -- I don't think you showed this table, but table G56 shows direct employment of 8,000. I am looking at Appendix G. Yeah. Right there. So that is the number that compares to the county employment data? I mean, it should. It is the same source.

JOSUE MEDALLIN-AZUARA: It is on the screen? Oh, sorry.

Yeah. That is based on direct employment for the area.

UNIDENTIFIED SPEAKER: So then this table says that for all three counties then, there are 18,600 jobs that are direct, indirect, or induced by agriculture in the three counties.

JOSUE MEDALLIN-AZUARA: That is what I got out of it.

UNIDENTIFIED SPEAKER: Do you compare that to the total employment in the county, including the ag services sector?

JOSUE MEDALLIN-AZUARA: No. That is not included there. The ag services is a presector and is usually double of that.

UNIDENTIFIED SPEAKER: It is usually what?

JOSUE MEDALLIN-AZUARA: The ag services sector, the contract labor, if that is what you mean, is not part of that direct employment and usually is accounted when we have drawn the impact on IMPLAN to obtain the multiplier on jobs.

UNIDENTIFIED SPEAKER: Do you know in the IMPLAN model how much of the ag services employment is being consumed locally? I mean, the 18,600 number looks a little low to me for total farm employment across the counties, and I am wondering how the ag service sector is being accounted for.

JOSUE MEDALLIN-AZUARA: We can get back to that. I don't have the number on me.

BILL PARIS: Hi. Bill Paris, Modesto. At the beginning of today, I know you guys foreshadowed a little bit some of the analysis that we were going to see regarding San Francisco. And I know -- or at least I think I know -- from looking at that appendix, there is an emphasis on a five- or maybe six-consecutive-year drop period and what that impact would be on San Francisco.

Certainly from an irrigation district perspective, you know, one of the things we are most concerned about is getting through the '28 through '32 or '87 to '92 droughts and looking at those in consecutive years and trying to ascertain the impacts of that particular period, not just the averages.

So I am wondering how we do that type of analysis for ag. And if so, where is it, and if not, can you comment on why not?

LES GROBER: We -- I think as we briefly put up at the last workshop, we showed how the numbers for consecutive years. They are actually the average over that drought of record. The '87 through '92 is similar to the critically dry years in terms of water supply effects. But beyond that, we didn't do any specific detailed analysis about the multi-drought year effects.

BILL PARIS: Okay. But we did those for San Francisco; is that right? I know we are going to get to that later. And if I am wrong, you can say, "No. You are wrong. Wait an hour, and we will get there."

LES GROBER: Well, we did, as you see in the appendix. And that is because those are the years that there is an effect in years like that. So it -- that was the rationale for doing it for those -- for the city and county of San Francisco because that is when the effect occurs. There is the available effect that we described with regards to effects on ag on all years. But you have posed the question -- or posed the comment before. And you can make that as a comment about, you know, consecutive dry years. But we have both the long-term economic effects showing the exceedance from 1922 to 2002 -- 2004, the CalSim period? Yeah. 2003. So it is encompassed in that analysis of the full record.

BILL PARIS: Okay. Thanks.

UNIDENTIFIED SPEAKER: I have another question. Earlier, I asked you about using 2010 as the more recent data, and I think the answer was it was the year that this proceeding started or something was filed. Was there something preventing you from using more recent agricultural data to run the models, or is that just the -- why aren't we updating it to more recent data on crops and employment and economic factors?

LES GROBER: Rather than focusing on the update -- I mean, the nature of all of these analyses are to do a comparative analysis. So, you know, that is just using a baseline year from which to compare the effects. But, I mean, your comment is noted, and you should make -- you know, make that comment, if you have continued concerns with regard to using other years. But the purpose is to show a change from a baseline condition.

VALERIE KINCAID: Valerie Kincaid, San Joaquin Tributaries Authority. Kind of thinking about this dry year impact or maybe the, kind of, feast-or-famine type results that we are looking at, did either the SWAP for crops or the IMPLAN for the employment look at or assess the increase in unreliability in either water for crops or job for employment?

I guess, by that I mean, you know, in some years you are going to have no jobs in the region or a massive decrease in jobs. I am assuming that model just assumed that in a wetter year, when the jobs came back online that those jobs would actually return and that there was no analysis of the fact that when you have an increased reliability of jobs or water that there would be kind of a lasting effect or that -- you won't be able to recover in wet years what you see disappear in dry years. Does that make sense?

LES GROBER: Yes. There was no other specific analysis. It was just showing the full time series and the effects. As shown for many of the metrics, it increases the times and the amplitude of some of those shortages and, therefore, some of the effects.

VALERIE KINCAID: For a permanent crop, if you take it -- if you have to fallow it or if it is fallowed for a number of years, at some point that crop obviously can't recover. Was there any -- was that considered in the modeling at all? Or if so, how? I mean, a row crop, you can obviously take it down and replant it. But at some point, trees die, and it is not you are just fallowing for a year or two. Did you consider when that happens and build that into the analysis?

LES GROBER: I don't believe that we -- I will look to Josue in terms of the cropping, but I don't think that we were losing permanent crops for any of this analysis. So it wasn't -- that was not something that occurred.

VALERIE KINCAID: But how do you know that? I mean, how do you know that you are not losing permanent crops?

LES GROBER: Well, in the analysis that was done in terms of the crop shifting that occurs, the water goes first to permanent crops. So it didn't have that effect.

VALERIE KINCAID: But in some years, you did have to reduce the number of permanent crops. I guess, I just --

LES GROBER: I think there was stress and maybe some reduced water availability, but there was no loss to have question.

VALERIE KINCAID: But that is my question exactly there is that, did you consider when a loss of water would turn into a loss of the crop? I mean, was that considered, or did you just assume that it would come back online? If you had to not water trees for a year or two, I am assuming the model just assumed the trees would come back.

LES GROBER: But you are stating something that I don't think we observed in our analysis. There was water available for permanent crops.

VALERIE KINCAID: So are you saying that the results didn't have any impact on permanent crops at all, zero impact?

LES GROBER: There was some reduction stress watering, but there was no full loss of permanent crops. And I am looking to Josue.

JOSUE MEDALLIN-AZUARA: Yeah. As covered in the previous segment, we have a constraint on perennials. That is that default -- the fallowing up to the stated rate of replacement of permanent crops. I mentioned that number being above 90 percent of the existing crops. For some of them, that is a reasonable adaptation given the recent drought, in which we see that some new plantings occurred. And that required less water or simply they are distressed.

LES GROBER: I am just looking at the chart from the previous segment, which we could pull back if you are interested.

VALERIE KINCAID: Sure.

LES GROBER: But it showed that almond, pistachio, orchard crops -- it was the same irrigation that occurred under the 40 percent alternative under baseline.

VALERIE KINCAID: So the results do show zero reduction to those permanent crops then?

LES GROBER: Very small reduction in critical years, but again, within the stress -- the stress watering.

VALERIE KINCAID: Okay. So just to wrap it up, you didn't look at whether that stress would retire those crops or otherwise affect a permanent crop, which needs to be watered on a yearly basis? It was just a -- I think what you were saying it was just such a small number.

LES GROBER: It was a small number that did not result in loss of the crop. There was just some stress on the crop, which, as I think Josue said earlier, also then gets rolled into some yield reduction, but there was no loss of the crop.

VALERIE KINCAID: Okay. So you did analyze whether the crop would be lost? I guess --

LES GROBER: Well, the first question is: "How did we analyze when the crop was lost?" And I think what I am just saying here is there was no crop loss because that is part of what the SWAP model does. The water was then directed towards orchard crops, vine crops, permanent crops.

VALERIE KINCAID: Right. I understand that. But let's say that the small amount of impact to permanent crops exists. And I guess my question is:

"Was there an analysis of whether that small impact just reduced production or whether it actually would reduce permanently the crop and it would die?" And that analysis isn't included because you didn't ever get that because you took the low-value crops off, and they are not permanent crops. I understand that. I guess I am just wondering if the model has that built in.

Let's hypothetically say that the impacts to permanent crops were greater than they are. When would the model indicate that those crops would die and not come back? Or I guess I am asking, would it?

LES GROBER: The limited water was not sufficient to result in loss of the crop -- loss of orchard crops. It was just some stress watering that resulted in reduced yield.

VALERIE KINCAID: Had the loss been greater, would this model tell you if there were permanent losses and that the crop would die? I guess that is my question.

LES GROBER: Now we are getting into a hypothetical, which is something that we didn't evaluate.

VALERIE KINCAID: Okay. So it is something that you didn't evaluate? Okay.

UNIDENTIFIED SPEAKER: I am going to follow up on that. There is some tables in the appendix for each irrigation district, table G4, 6, A, B, C, and so on. That and, you know, the dominant loss is indeed, you know, pasture and field crops. But there is a loss of acreage for almonds and pistachios reported. For instance, 183 acres for Alternative 3 for Turlock Irrigation District. Is there -- but you are saying it is stress irrigation yield loss, not acreage loss. Could you clarify the number in these tables?

JOSUE MEDALLIN-AZUARA: Acreage loss.

UNIDENTIFIED SPEAKER: So there is acreage loss?

JOSUE MEDALLIN-AZUARA: That --

LES GROBER: 0.5 percent --

JOSUE MEDALLIN-AZUARA: Of baring orchards.

LES GROBER: Could you say that percent again, Will?

WILL ANDERSON: It appears, according to the chart, that 183 acres is 0.5 percent of the almond and pistachio category.

UNIDENTIFIED SPEAKER: All right. So this is estimating a single year? I am trying to think about how this would work over a sequence of years. And you talked about the constraint that was in there. Would that suggest that somebody with an older orchard delayed replanting for a year or two, or is that permanent loss? How do I interpret that number?

JOSUE MEDALLIN-AZUARA: That is an average loss in the acreage of crops, such as almonds and pistachios.

UNIDENTIFIED SPEAKER: So is the average loss over all of the years --

JOSUE MEDALLIN-AZUARA: Over the 82 years.

UNIDENTIFIED SPEAKER: So it is an average loss over the 82 years? So some years it is higher; some years it is lower? And then it is averaged?

JOSUE MEDALLIN-AZUARA: There is an allowance for the amount of permanent crops that can go out. I think I went through that in the previous segment.

UNIDENTIFIED SPEAKER: Well, sir, could you please speak a little closer to the mic?

JOSUE MEDALLIN-AZUARA: Sure.

UNIDENTIFIED SPEAKER: Thank you.

JOSUE MEDALLIN-AZUARA: There is a stable rate of replacement of permanent crops, which is in the model, and that is, I think, 94 percent. And depending on the life of the orchard, there is rate changes for different crops. And what we take out of here is this is the average loss over the 82 years.

UNIDENTIFIED SPEAKER: So just to clarify that, there is one year in which there is 183 acres of almonds that were lost. It was in one of the tables that you were just talking about. Are we to interpret that to mean that 183 acres of almonds died in one year and then came back in the next year, or is that just 183 acres weren't really harvested but the trees didn't really die?

WILL ANDERSON: First, before Josue attempts to answer, that is an average annual acreage for the 82 years. So we have got to keep that in mind.

UNIDENTIFIED SPEAKER: Okay. Thanks.

JOSUE MEDALLIN-AZUARA: I mean, this model accounts for year -- taking into account the amount of water available, and that is calculated, what is the loss for that year.

UNIDENTIFIED SPEAKER: So if the trees died -- because I didn't quite hear the answer to my question. It was either the trees died or the trees didn't die -- they just didn't produce anything and they came back the next year. It was kind of one of those two things. I was asking about that.

JOSUE MEDALLIN-AZUARA: I don't understand the premise.

UNIDENTIFIED SPEAKER: Okay. Let's assume that the SWAP model in any one year estimates that 200 acres of trees come out of production. That is the information that is being reported. The question is: "Do we" -- I mean, I know that SWAP is a model, and it is just an annual model. And it is giving that farm response to that amount of water that is available in that year. And it is not a dynamic model. So it is not looking forward; right? It is not saying what is going to happen next year. But how should we interpret the loss of 200 acres of almonds? How should we interpret that as part of the SED output? If the 200 acres of almonds didn't have any production value but the trees were still there and in the following year the trees come back in, is that how we should interpret it? Or is it 200 acres of almonds dead and gone?

JOSUE MEDALLIN-AZUARA: I would think it is just 200 just gone on average, and there is no -- I don't have any other further interpretation of that.

UNIDENTIFIED SPEAKER: It is a running average?

JOSUE MEDALLIN-AZUARA: I think we are reporting an average of what we see as a reduction or what we think is a reduction in acres in an average year.

UNIDENTIFIED SPEAKER: Well, I am just giving a hypothetical here, but in my hypothetical, it was just a one-year deal. It was just the loss of 200 acres in one year. Do we interpret that to mean that the trees died in that one year or that there was not production revenue from those 200 acres of trees in that year and the trees came back the next year?

JOSUE MEDALLIN-AZUARA: It is no production in that year.

UNIDENTIFIED SPEAKER: No production in that year?

JOSUE MEDALLIN-AZUARA: Uh-huh.

UNIDENTIFIED SPEAKER: But it is not really assuming that the trees would die. I mean, because it would be a huge capital loss, if that is what we should interpret; right? I mean, it is $25,000 an acre. So even if it is only 183 acres on average, that is $5 million in farm capital that is gone. So we should just interpret it that the trees live through the hydrologic record here; it is just that the almond production falls?

JOSUE MEDALLIN-AZUARA: I'm sorry.

UNIDENTIFIED SPEAKER: I am just verifying that the trees aren't dying.

JOSUE MEDALLIN-AZUARA: We don't have production of 162 acres on average over the 82 years, indeed.

UNIDENTIFIED SPEAKER: Okay. Yeah. We couldn't really hear that.

JOSUE MEDALLIN-AZUARA: Okay. I will repeat it.

UNIDENTIFIED SPEAKER: Thank you.

JOSUE MEDALLIN-AZUARA: So in this table, what we are seeing is we see a loss in production of 162 acres over the 82-year time period model on average.

UNIDENTIFIED SPEAKER: Okay. Thank you.

GITA KAPAHI: Any more questions on this topic? Okay. So at this juncture, let's take a 15-minute break, resume at 2:45 on the back wall clock. Thank you.

(Whereupon a break was taken.)

GITA KAPAHI: If you want to all take your seats, we will begin in a second here, and the next part of the staff presentation is on the South Delta salinity.

Les and Tim --

LES GROBER: Welcome back. We are now going to cover Southern Delta salinity. Topics we are going to cover are the current and proposed Southern Delta Salinity Objectives; some of the key points of what is known as the "Hoffman report," a report done several years ago to determine what are the salinity levels that are sufficient to reasonably protect crops in the Southern Delta; some of the modeling that was done as it relates to the water supply effects model, and a summary of the antidegredation analysis with respect to salinity.

First covering -- so just so this can be a stand-alone, covering some of the same information we have done at the other workshops and hearing. The Southern Delta Salinity Objectives are seasonal. They vary from 0.7 millimhos per centimeter for the April through August period at the three interior stations and at the San Joaquin River at Vernalis and 1.0 millimhos per centimeter during the non-irrigation season. And this is based on the growing season and of salt sensitivities of alfalfa during the seasoning stage for the 1.0 and beans for the 0.7.

And there are four Southern Delta Salinity compliance locations. Three, as I said, are in the interior Southern Delta and one in the San Joaquin River at Vernalis just upstream to the inflow at the Delta. The proposed objectives are for year-round 1.0 millimhos, and the SI unit is correcting that now in the basin plan. 1.0 deciSiemens per centimeter and the three compliance locations in the Southern Delta are changed to channel segments.

So the first reach for Brandt Bridge -- rather than one location on the San Joaquin River on Brandt Bridge, it now includes a reach from the San Joaquin River at Vernalis to Brandt Bridge. And rather than just this single location from Old River to Middle River, the Middle River from Old River to Victoria Canal. And for the Tracy site, it is now Old River and Grantline Canal from the head of Old River to West Canal.

So this is intended to provide more representative salinities in the Southern Delta rather than measuring at a single location, looking at it in these reaches. So part of the program calls for the assessment of salinity at the reaches to see how it relates to the single station and the proposed reach area.

As part of the program implementation, the Department of Water Resources and Bureau of Reclamation would continue to operate ag barriers and to address their impacts on the state water project and the central valley project operations on the water levels and salinity locations. It would also continue to require the bureau to meet the 0.7 EC objective at Vernalis for April through August so as to provide a simulative capacity during the irrigation season in those downstream locations -- those downstream reaches.

So the other requirements include a comprehensive operations plan, which is intended to provide information actions on other things that can be done to control water levels and salinity in the Southern Delta, monitoring and reporting, and as I have mentioned a study to characterize the dynamics of the conditions in the Southern Delta and how it affects salinity conditions.

And a point to make -- and what you will see, because it is germane to the antidegredation analysis, is that the combined Southern Delta salinity and San Joaquin River flow objectives is a package. The San Joaquin

River flow objectives are expected to improve salinity conditions in the Southern Delta. So aside from that, there really is no change in the fiscal environment that is expected to happen as a result of the change of the salinity objectives.

I am now going to move to the Hoffman report. The main conclusions from that are the salinity in the Southern Delta in the current condition is suitable for agricultural crops, even with the variability that is there and even though we are not currently meeting at all times the 0.7 seasonal objective in the interior Southern Delta stations, and that all salt-sensitive crops of significance, including almonds, apricots, dry beans, and walnuts, they are all protected.

Also, the relatively high leaching fractions that are associated with irrigation efficiencies of 75 percent for furlough and border irrigation methods, they are predominant in the Southern Delta. And the information with that and with data from drains in the western part of the Southern Delta suggest that leaching fractions are between 21 percent and 27 percent with minimums ranging from 0.11 to 0.22. Even with higher more variable leaching fractions, however, there would be general protection of all crops in the Southern Delta.

So the major finding of the report is that salinity could be increased from up to 0.9 to 1.1 deciSiemens per meter and still be protective of all crops in the Southern Delta. That being said -- and this kind of brings us back to remarks that I have made with regard to both the flow objectives but applied to the salinity protection -- it is not about the absolute protection but the reasonable protection, so some excursions still. And if you have leaching fractions that are more variable over a certain area, it could lead to yield losses of up to about 5 percent during low rainfall years. That is important because during low rainfall years, you wouldn't have the additional leaching that happens with that fresh water.

So to demonstrate some of this information as it is presented in the Hoffman report, two different steady state models were run based on assumed water uptake of different amounts at different areas of the soil column and exponential rates. But in any case -- and also, on two different assumptions for precipitation -- with or without. Being without precipitation would result in generally higher salinities because you wouldn't have that benefit of leaching of salts that occurs during the irrigation season.

And the analysis was done on three crops -- bean, alfalfa, and almond. And just to give you a flavor of what the report showed, this is for alfalfa. And it shows a relationship between -- on the Y axis -- the relative yield of the crop compared to the irrigation water salinity, when you consider the two different steady state models -- the 40, 30, 20, 10, and the exponential.

And as you can see on this for the dashed line even with the minimum precipitation, when you expect to have the earlier effects -- the earliest results and least negative effects is that you start seeing yield reductions below 100 percent at approximately 1.3 deciSiemens per meter, and it is higher for the other models. And even at a leaching fraction of 0.10, you still have no yield reduction under the minimum precipitation model until you get to a salinity of higher than 1.0.

So that gives a flavor of what was presented in the Hoffman report. Again, it was done for other crops and with and without salinity and for those two different steady state models.

So with that, I am going to hand it over to Tim to talk about how we did the modeling for the program analysis of the salinity effects in the Southern Delta.

TIM NELSON: All right. So salinity at Vernalis as well as the increase in salinity at the downstream locations is estimated in the WSE based on three equations. So first, salinity at Vernalis is calculated based on CalSim 2's estimates of salinity over the 82-year period of record. So the adjusted Vernalis CalSim baseline salinity, or EC, times the ratio times the CalSim baseline flow to whatever the flow is in our base LSJR alternative. So we are just adjusting it by the ratio of flows.

So this assumes that CalSim is a reasonable approximation for Vernalis salinity, and it assumes that the salinity change is adversely proportional to the change in flow. So as an example of how this works, so if Vernalis' flow increases by 10 percent over the CalSim baseline flow, then the EC will go down by 10 percent. And if the flow is reduced by 10 percent, then the EC will increase by 10 percent. So that is how we get salinity at Vernalis.

For the downstream compliance locations, the increase in EC at those locations is estimated based on the Vernalis flow. So the EC increment -- that is what we are calling the increase in salinity between Vernalis and wherever the reach is -- so Tracy and Brandt Bridge and Union Island. So the EC increment can be described as the increase in salinity from Vernalis to that station due to additional salt introduced downstream at Vernalis.

And this assumes that there is a constant monthly load of salt downstream at Vernalis so that the EC increases would still be inversely related to the Vernalis flow.

So the EC increase from Vernalis to the Tracy Boulevard Bridge is equal to 300,000 divided by the San Joaquin River flow at Vernalis. So where did we get this equation? So if we look at -- so the plot here is of the increase in salinity from Vernalis to the Tracy Boulevard Bridge over different flows at Vernalis. And this data is from, I believe, 1985 to 2010 for the monthly average increase.

So if we look at -- so these lines here, the green line represents an imperial fit line of 100,000 divided by the flow at Vernalis. So what that says is that if the flow at Vernalis is 1 CFS, then EC would increase by 100,000 microSiemens per centimeter. Oh, 200. Sorry. The green line is 200,000 divided by the flow at Vernalis.

The red line similarly is a fit line of 400,000 divided by the flow at Vernalis. So what we were doing with these fit lines was trying to just somewhat approximate how the cloud of data points -- just how EC increases between Vernalis and these downstream locations as best we could. We chose a line in-between the green and red line for 300,000 divided by the flow at Vernalis.

Similarly at Brandt Bridge and Union Island, we looked at clouds of data points for increase in salinity for Vernalis compared to flow. And in trying to fit these lines to it, we decided to go with -- we determined that a fit line of 100,000 divided by the flow at Vernalis was the best approximation for both sets of data.

So just looking at some results for salinity over the 1990 to '95 period, we see -- first under baseline and then under the 40 percent alternative, there is a dashed line. We see significant decreases in the February through June period because of the increased flow. One thing to note here is '93, this was a very wet year, and we see that the EC under the 40 percent alternative is actually higher under baseline. This is because -- so the flow at Vernalis is lower than under baseline. So that is why we see an increase. And this is because there is reduced flood spills under our 40 percent alternative.

So similarly, we can look at the salinity at Brandt Bridge and Union Island, and we see that it slightly increases. And then looking at the Tracy Boulevard Bridge, there is a further increase.

Now I will hand it over to Les to go over the antidegradation.

LES GROBER: Just some remarks on the nature of this analysis, as those kind of scatter plots show for the interior Southern Delta stations, it is very difficult to find a correlation between Vernalis and those other stations. So flow is an important element. It is the location conditions that are really driving it to a very large extent.

That being said, the concept behind these relationships is that in general, the higher increases in flow will help to reduce salinity to some extent, not to get too bogged down into the absolute nature of it but just the general -- the relative effect of changes in flow on Southern Delta salinity. I think to call out, there is no change here in Southern Delta salinity happening from the proposed change in the Southern Delta Salinity Objectives. So the only effect and the only antidegredation analysis had to do with the effects of the San Joaquin River flow proposal.

So the conclusion of the antidegredation analysis is that the proposed change to the lower San Joaquin River Flow Objectives and the Southern Delta Salinity Objectives would not result in reduced water quality. We did this antidegredation analysis because raising the salinity objectives may appear to allow for a water quality degradation, but this analysis shows that it is actually just the opposite.

The principal change that could affect the water quality is the lower San Joaquin River flow with increased flows during the February through June period and no change or slight decreases in July through January. Some of that shifting in flow then can result -- you know, happen from changes in spill releases and things like that. And then based on those equations, you would see an effect on salinity.

So the results show that there is no change in water quality that is coming from the new salinity objectives. It maintains the current condition, but in fact the metric that we use for the antidegredation analysis is how would increasing salinity -- how would increasing flows in the San Joaquin River overall help with Southern Delta salinity and salinity at Vernalis. I think we have heard oftentimes that much of the problem associated with Southern Delta salinity is the reduction of fresh water flows on the San Joaquin River and flowing into the Southern Delta. So this actually cures some of that by increasing some of the high quality water that flows into the Southern Delta.

So that analysis has a series of charts. This is yet another exceedance chart showing the monthly average EC, the Southern Delta monitoring locations for irrigation months from 1995 to 2015. So the one that has the poorest water quality, one of the interior Southern Delta stations, that top line, the light blue is the Tracy Road Bridge.

And the other lines, the two that are clustered together, that is the Brandt Bridge and the Old River near Middle River, as you can see. That is the reason for using some of the same equations. They tend to have fairly similar water quality and are closer to the San Joaquin River, which is that lowermost line, which is the San Joaquin River at Vernalis, shown in pink. And shown there for reference is the current salinity objective of 0.7.

Here is the similar graphic that shows the same information -- but it is now for the non-irrigation season, for September through March -- and again, showing the three interior Southern Delta locations and Vernalis. The one that stands out again is the Tracy Boulevard Bridge, which has some of the highest numbers.

So the way we did the analysis is using those equations and to see, "Well, what happens if you shift the flows, that you have more of those February through June flows and have the other things that would occur in terms of flow effects and changes in Vernalis?" And this is a summary table that shows the annual average change in salinity, so that grand metric is showing overall, even though there is changes that will occur. And I will show you a chart that shows some of the variability. But in general the changes, as you would expect, at Vernalis is that you have an overall change in salinity at Vernalis because of the higher flows, and that is propagated through the three interior Southern Delta stations.

Let's look a little bit now at the seasonality of that effect. Because, again, flows change throughout the year. This is not to suggest that it is always an improvement. There can be some -- because there is some shifting in flow that is occurring here and resulting shifting in water quality, this is now showing an exceedance chart of the change of the monthly EC values for Vernalis based on unimpaired flows of 20 to 60 percent.

So those are changes from the baseline, and you can see where you have got the positive numbers, that is saying that there is an increase at certain times of the year. And those are generally associated with times when there might be reduced spills, reduced water flows in the San Joaquin River resulting in higher salinities associated with those lower flows. But those are more than offset by the percent of the time that you have on the right side where you have lower salinity at Vernalis.

And this is propagated through the system. So this is showing the combined Brandt Bridge and Old River near Middle River, showing the same pattern. You have some increases. You have -- most of the time during that February through June period when you are increasing flow, you have improvements in salinity. So it is a point to note with regard to Southern Delta salinity and providing reasonable protection of agricultural objectives. This is during the, kind of, salt-sensitive stage of many crops too, that February through June period.

So for germination -- and it is also providing -- if you don't have that higher rainfall, it is providing, during those early irrigations, the improved water quality that provides for the leaching of salts. And the pattern continues for the Old River at Tracy Boulevard. But again, it is the same with some increases on the left side but more than offset by the overall improvement in most of the months of the year.

So the conclusion is that the proposed salinity objective and the program implementation would not result in change in salinity conditions at the Southern Delta and that the proposed objectives would generally improve the salinity objectives -- improve salinity conditions.

And that is consistent with the Hoffman findings that the salinity under the -- and the current condition -- with new flow conditions is that the surface water appears suitable for all agricultural crops.

So this is pulling from information from another source, and more information on the salinity is available in Chapter 5. Most of this was pulled from the antidegredation analysis and some of the modeling that Tim had gone through and some of the equations are in the Appendices F1 and F2, and the Hoffman report that we referred to is in Appendix E, all on our website.

So with that, we can take questions.

MAUREEN MARTIN: Good afternoon. I am Maureen Martin from the Contra Costa Water District, and I understand the simple flow salinity relationship that you have used. But as Les mentioned, the relationship is quite weak for a lot of the stations. I was wondering if you guys could provide or if you have analyzed what, kind of, your leach squares -- like, kind of, an R square or fit for the relationships that you developed to the plotted data. Do you have that?

LES GROBER: Sorry. Those were not on the plot. I think it was actually pretty low because of the scatter there. We could provide that to you, but it was quite low. And maybe to make the -- because it is related to this question, you know, the complexity of coming up with a relationship is tied to lots of other things that happened in the Southern Delta. So it is a difficult thing to model. This was intended to just provide what one could expect, you know, in the gross average, you know, for the purposes of the analysis.

MAUREEN MARTIN: Exactly. And just to further that point, so when you are looking at the salinity change in the South Delta, I know you didn't evaluate changes in exports or changes in other local factors. Is there any efforts going to be made in the future, like maybe in phase two, to evaluate better relationships that incorporate more variables besides just the flow at Vernalis?

LES GROBER: I would say a qualified yes, but I wouldn't characterize it as so much better because this analysis was done to answer the questions of the changes that are being proposed here and the potential physical effects. For phase two, phase two is specifically going to be looking at the operations in the Delta and hydrodynamics of the Delta. So there, it would be more important to look at the effects of barrier operation, Delta cross-channel gates, and things like that, and export pumping rates, and all of those things because all of those things, in a very complicated way, affect salinity in the Delta.

MAUREEN MARTIN: And just one more question -- and I know you have already talked to me about the sensitivity studies not being available at this moment. But most of what I can tell from reviewing the salinity analysis and the antidegredation analysis is that more flow will be coming in on the San Joaquin pretty much all the time and under most circumstances, including in the fall months. And that is due in part to some of the flow shifting that is incorporated under the adaptive management. And so I was just wondering if you could or may consider reevaluating some of the changes in Delta salinity if you were to remove some of those adaptive management components or be able to do this analysis again without some of those adaptive management components included.

LES GROBER: So you are saying if there were no adaptive implementation or adaptive management element, would we redo the analysis?

MAUREEN MARTIN: No. I think that we talked about, you know, removing some -- in the WSE model, getting rid of some of those adaptive management provisions that have currently been included, like the carryover storage or the flow shifting -- and I don't know exactly what you are planning on doing.

But it is my understanding that if you were to say -- not include flow shifting as you currently modeled it, there is a potential for the flow to be reduced during the fall, let's say, maybe not below the baseline condition but certainly below what is currently being attributed in the alternatives. And so, you know, depending on how you implement it, there could be a reduction in flows and a corresponding increase in salinity potentially outside of the February through June window.

LES GROBER: And just to maybe restate the question because I think it is two part because there is the adaptive implementation, and then there is the carryover storage, that we have discussed, to provide that sensitivity. And I think I am hearing your request as well, this is another thing that you, and perhaps others, would be interested in seeing. What would be the effects if there was no carryover storage? Am I hearing that correctly?

MAUREEN MARTIN: Yeah. And we -- and I will provide written comments more to this. But as I understand it -- and I know you talked about the flow shifting quite a bit at the workshop last Monday. But requiring a perfect foresight and the ability to know what type of water year it will be in advance of really knowing -- so having the block of water and then the way the model -- if I understand as you look at it, you know, you take the block of water and then you are able to decide at this current month that you need to be able to shift water to the fall.

And so without that perfect foresight, you know, it seems to me that there is a real possibility there will be reduced flows in ways that haven't currently been modeled in other times outside of the February through June implementation of the flow objects. And so just to get a more complete range of the possibilities given the full range of potential adaptive management -- so say you won't know in advance or you won't be able to retain some of that water in storage to shift to it later. So from a Delta perspective, just to be able to have more of a bookend analysis. And if that is not possible, it is just a request.

LES GROBER: Well, it is a big question, but I just want to -- well, just as a reminder because the document in total has, you know, itself evaluated a range of 20 to 40 percent. And some, especially at those lower numbers, don't involve any flow shifting and don't have to. So that information is already in there. The one piece that is not in there, though -- it is part of the project because it is the carryover storage, so not a requirement per se. It is part of the project that is included in here because as had been discussed, for those of you that weren't part of that, it is a necessary element once you start hitting the reservoirs, or if you don't have some assumptions about that, then you start having, you know, big temperature effects if you try to maintain water supply and things like that.

So the short answer is that I think that the results that you are asking for in terms of if there were no adaptive implementation is already in there because we are looking at that range of 20 to 60 percent, and there is certainly no flow shifting at the 20 percent. What we don't have in there as a sensitivity is what if there were no carryover storage in that reservoir reoperation. We are going to try to get that information as it would affect temperature. I don't know that we would be able to spill it on through to show what the -- you know, it just shows how complicated things like that are. Because if you unravel that, then you start to -- you are changing some of the overall operations and flows.

But my short answer to that as well is that the document, by evaluating the 20 to 60 percent range, has evaluated -- you know, especially at the lower percent, the 30 percent which doesn't necessarily involve any of the flow shifting likely captures the full range of possible effects. And also the main take-home from all of these graphics is that in general, more flow will tend to provide higher water quality, and to the extent that you are at the lower end of flow requirements, it requires less shifting and time and any kind of reoperation so that it wouldn't change the other times of year.

But your comments and concerns are noted, and please provide them.

MAUREEN MARTIN: Okay. One last question -- and so just to clarify, you know, there are places in the Delta, particularly like Victoria Canal, where we have one of our intakes and other places where, you know, the mix of water -- where there is a mix of San Joaquin water and Sacramento water.

So relative to your baseline, I know that you just analyzed really just the flow at Vernalis, this EC relationship. But there are places where the dynamics are quite complex, and the EC on the Sacramento is much lower than the EC coming in from the San Joaquin. So in times, you know, when the percentage of water is increasing -- you know, if there is a shift basically in the amount of water there that is from the San Joaquin relative to what it may have been from the Sacramento, that would result in an increase in salinity. But since -- maybe we will get to that in phase two.

But one other question, just briefly, on the process and -- I noticed that the baseline is different than the no-project alternative, Alternative 1. So I was wondering if you could speak to -- and as I understand it, the no-project alternative is different in that it operates New Malones to achieve the salinity objectives, particularly at Tracy, all the time. So it is a pretty different, you know, salinity analysis than the other alternatives and than the baseline.

So I was wondering if you could speak to a little bit about the difference between the baseline and the significance of not choosing the no-project alternative in order to assess the changes in salinity.

LES GROBER: I would just make the comment that we didn't show the no-project here. But that actually -- it is germane to what a tough problem we have in this Southern Delta. It is that if you are trying to fix it just with additional flow, you know, for all times of the year to meet the current objectives, it takes a lot of water. So that is not something -- we didn't show those results because they were not particularly useful.

Did we even -- did we do the no -- do we have the no-project?

WILL ANDERSON: We have got a lot of description of the no-project alternative. But you are right. To meet the lower criteria on Tracy, it does require a lot of water. So the no-project alternative basically assigns that responsibility to the Bureau of Reclamation to release from New Malones. And in order to meet that standard, it basically drains New Malones quite a bit of the time. So it is not really considered a very feasible kind of alternative. But it does show, kind of, what would be required to meet that standard as opposed to the existing environment in 2009, which did include VAMP, and it did not include meeting those from New Malones.

MAUREEN MARTIN: Okay. And yeah. Just to clarify, I just wanted to know that not -- even though you are evaluating it as an alternative moving forward -- I mean, I think that when I read the baseline salinity analysis that was done -- because those plots show that salinity at the stations can be lower than they are at Vernalis, particularly at Brandt Bridge. And so your analysis automatically is assuming that it is going to be higher -- you know, that increment is always going to be an increase whereas you can clearly see on the plot sometimes it is decreasing.

So you are choosing the baseline rather than the no-project alternative. I would surmise that it is actually in reality somewhere closer to the middle of those two, where I'm sure you are not draining New Malones, and you know, we are not operating it like that. But fundamentally your baseline shows a higher EC than I think is actually observed there, and it is biased towards the higher side most of the time. So that will -- when we are evaluating the incremental change, you know, it will bias your analysis towards no change or less of a change that might actually be expected in reality.

So with that, I am done. Thank you.

LES GROBER: Thank you.

UNIDENTIFIED SPEAKER: Quick question, why was HEC5Q not used to evaluate salinity? As I understand it, it had the ability to compute salinity at multiple locations.

LES GROBER: For -- since we are not doing -- because of the complexity of all of the other assumptions in the Southern Delta, this was a sufficient tool to just sum up the relative changes that would occur in response to the increase or changes in the San Joaquin River flows.

UNIDENTIFIED SPEAKER: So just was HEC5Q evaluated, or was it just not simple enough to run? I really don't understand why it wasn't --

LES GROBER: Just we did not run it.

UNIDENTIFIED SPEAKER: Okay. Second question, just following in the same vein about quantifying the fit and the possible error in the relationships. Was it calibrated? Is there anywhere in the report that this calibration is described? Can you point me towards that?

LES GROBER: The calibration of what?

UNIDENTIFIED SPEAKER: The calibration of EC versus flow relationships that you are using to estimate salinity.

LES GROBER: Did we show any --

WILL ANDERSON: Well, you are seeing the curve fit there. I'd take note of the scale of the increment versus the scale of the ambient. If you think of it, ambient EC is around 0.4, 0.5, somewhere in that range that we are talking about, an increment of 0.1 at 3,000 CFS or 0.2 at 1,000 CFS. And there is a fiscal reason for that. We don't have any tighter statistics on the validity of that. But it is a physical --

UNIDENTIFIED SPEAKER: So if I were to look in the SED, I could find supporting documentation of, you know, what the numbers were, or would you be able to provide those?

WILL ANDERSON: At the data site, you mean?

UNIDENTIFIED SPEAKER: Yeah. The calibration data.

WILL ANDERSON: For this curve fit?

UNIDENTIFIED SPEAKER: Yes.

WILL ANDERSON: Okay. I'm sure we can dig that up.

UNIDENTIFIED SPEAKER: Last question, I notice the equation that you put up towards the beginning of the presentation multiplied CalSim EC times CalSim flow over the lower San Joaquin River alternative. Was that at Vernalis, first of all? And was there not a flow versus EC relationship developed for Vernalis? Because the way I understood that slide, it was just proportional to flow, and no other relationship was applied at Vernalis.

Yes, that slide.

WILL ANDERSON: Right. This is assuming a very high water quality in the tributaries.

UNIDENTIFIED SPEAKER: Okay. But later on, there was a description of EC at Vernalis. So there was data there, data of flow and salinity that a relationship could have been prepared instead of assuming one to one with flow.

WILL ANDERSON: Anne Huber would like to answer the question.

ANNE HUBER: Just on that one topic, the data -- I mean, you can make a plot that shows flow at Vernalis and EC at Vernalis. But that flow in the plot is flow that comes from, you know, all sources. And some of the higher flows are coming from the upper San Joaquin River, where as the in -- what we are doing is we are actually modifying the amount of fresh water that is coming in.

So using measured data is not, you know, a completely representative way of evaluating EC at Vernalis.

UNIDENTIFIED SPEAKER: So sorry to interrupt you. But why use that at Vernalis because you didn't trust the validity but then other locations further into the Delta, why were those relationships used there? I just don't understand. It is just a clarifying question.

LES GROBER: When you say, "other relationship used in the Delta," so the ones in the Delta were tied then to an incremental change in salinity at Vernalis.

UNIDENTIFIED SPEAKER: Okay. This first location --

LES GROBER: So the first step is just the Vernalis salinity based on the changes in flow. And it is just a simple analysis. But as Anne had said, using historical information in this case would not necessarily be appropriate either because this is a big change in terms of where the flow is coming from, when it is coming. But then after determining the adjusted Vernalis EC based on the change in flow based on the CalSim baseline, if you will, then that is used to estimate, "Well, how would you expect the higher flows at Vernalis to affect salinity at the other stations?"

UNIDENTIFIED SPEAKER: So incrementally as you, you know, move away from Vernalis, it becomes okay to use the historical relationships because you are looking at it on an incremental basis.

LES GROBER: That is what we did in the analysis.

UNIDENTIFIED SPEAKER: Okay. Thanks.

UNIDENTIFIED SPEAKER: So I have got just a clarifying question. Can you go to the second to the last slide, I think, the conclusions?

So the first bullet point says that, "The proposal in the objectives and program implementation will not result in changed salinity conditions in the Southern Delta." But then this next point says, "Proposed flow objectives would generally improve salinity conditions in the Southern Delta."

Can you explain -- I may just not be following it -- how those two things coincide?

LES GROBER: The proposed salinity objectives will have no fiscal effect because we are just basically changing the objectives to comport with what the current condition is.

UNIDENTIFIED SPEAKER: Which includes exceedances of what the current condition is?

LES GROBER: Yes. Yes.

UNIDENTIFIED SPEAKER: Okay.

LES GROBER: So there is not going to be any physical change that occurs as a result of that change in the salinity objectives or the program implementation of the objectives. But the San Joaquin River flow element of the proposal will change flows and will have an effect on the salinity in the Southern Delta. And as we have analyzed in the programmatic analysis, it will be generally an improvement in the conditions or lowering of salinity, which is a good question, which is -- again, there is many -- there is always another model and another way of doing an analysis.

But because of what the principal change is and the principal effect, we kept it the same just in recognition of the physical system in that if you are increasing the quantity of water that is coming from the highest quality waters in the watershed, you are going to certainly be improving the water quality at Vernalis, and to the extent that Vernalis affects those other stations, it will improve salinity at those interior stations.

That being said, there are many other factors that affect salinity in the Southern Delta, and we didn't get into the details of that analysis because none of that is changing.

ANNA BRATHWAITE: Hi. This is Anna Brathwaite with Modesto Irrigation District. If we could turn to slide 15 super quick, I just wanted to clarify an issue. And maybe just to restate what has already been said, EC is simply an inverse relationship to the volume of flow, and that is the salinity impact.

TIM NELSON: At Vernalis the EC is calculated as the inverse -- it is inversely proportional to the flow.

ANNA BRATHWAITE: That was just the formula that was being discussed prior; right?

Great. So if you move on to slides 25 and 26, when you are going through potential exceedances. So I remember hearing at the prior technical workshop that flow shifting is involved in every single alternative; is that correct?

LES GROBER: Well, actually, no. At the lower flows, there was no flow shifting that had to be added. I think it only needed to start to be added at 35; correct? Yeah. So at 30 percent, there is no flow shifting because there is adequate water to achieve the increased February through June flows, and it didn't have any temperature effects any other time of year.

ANNA BRATHWAITE: And the flow shifting was part of the 40, 50, and 60 percent analyses then; right?

LES GROBER: That is correct.

ANNA BRATHWAITE: Okay. So if I am looking at this chart, does this show the exceedances with the flow shifting already built in? Does that make sense?

WILL ANDERSON: Yes. The answer is yes at 40 percent and above.

ANNA BRATHWAITE: The flow shifting is already built into this?

WILL ANDERSON: Right.

LES GROBER: Well, some portion of flow shifting but though not -- say at the 40 percent, they require some flow shifting, a small increment of that to prevent the temperature effects but not the full flow shifting that is allowed at 40 percent up to 10 percent of that amount, though, shifting it to the fall. Because that is covered by looking at the 50 percent alternative.

ANNA BRATHWAITE: Okay. And that takes you outside the February through June time period, though.

LES GROBER: That is correct.

ANNA BRATHWAITE: Okay. And then maybe just one last question. I believe it is the next slide. There is a title that speaks to relative to baseline. Maybe one more slide forward. Oh, no. Maybe two back then. Did you pass it? Okay. Well, I will hold that last question until I get a better handle on what slide it came from. Thank you.

MAUREEN MARTIN: Hi. It is Maureen again from the Contra Costa Water District, and I have just one more question. And it is really just your thoughts on the CalSim EC relationship at Vernalis remaining unchanged. And so one -- and it is really just a question. I haven't looked at any data or anything like that. Is there a possibility that given you have modeled that there will be an increase in groundwater usage throughout the basin, that there may be an increase in EC that is seen at Vernalis as a result of the change in the surface groundwater dynamics and that the relationship that has currently been used in CalSim might change?

LES GROBER: We didn't look at any changes in the relationship.

MAUREEN MARTIN: I know you didn't. I was just wondering if you thought that that was a reasonable assumption or that there was a possibility, even a qualitative way that that relationship may change in the future given the change in surface water/groundwater use that you have anticipated. So if you use more groundwater, groundwater is more saline.

LES GROBER: That is an interesting question, but it is not something that we had analyzed. And again at the level of the analysis that we are doing here that we are looking at, you know, as many people know, there is lots of sources of extremely poor water quality in the basin. I think what you are suggesting would be a refinement if you had now some in-between source of groundwater, but we didn't look at that.

ANNE HUBER: I think it would be pretty complicated because you might be using more groundwater and to the extent that would run out, that might increase salinity a little bit. There would also be an issue of if there is actually less land in production, then runoff might be reduced, which would help water quality. There are multiple factors.

MAUREEN MARTIN: Okay. Thank you.

JEFF MICHAEL: Hi. Jeff Michael from the University of Pacific. I had a question about that first bullet point and the conclusion. I was a little confused by it.

All right. So changing a subjective would not result in a change in salinity conditions in the Southern Delta, but you also talked about how you haven't analyzed all of those other factors that can affect salinity in the Southern Delta. So how can you make that conclusion if you haven't evaluated all of these other effects -- local sources, CVP -- and how they might be affected by this change?

LES GROBER: There is lots of different projects and things going on in the Delta. So we didn't analyze the possible effects of all of those things except for in our cumulative impact analysis where we acknowledged that there is going to be other things that could have effects on salinity in the Southern Delta. But we didn't do any quantitative modeling to try to assess them.

JEFF MICHAEL: So what is the justification for the first bullet point? I guess I am not understanding how you reached that conclusion.

LES GROBER: So we are proposing salinity objectives. So changing the salinity objective in the Southern Delta from 0.7 to 1.0 year-round, with the admonitions component of continuing to require the Bureau of Reclamation to meet the 0.7 at Vernalis doesn't change the current condition. So that can't be affecting the salinity conditions in the Southern Delta.

JEFF MICHAEL: So the current objectives don't constrain any of these other sources in any way? Would moving this allow them to do anything differently?

LES GROBER: You know, there has been difficulty in obtaining the current salinity objectives in the Southern Delta. So this isn't going to provide an opportunity or a chance for any changed condition.

UNIDENTIFIED SPEAKER: I had a question about the Hoffman report and those yield curves. Leaching fraction is something that I have heard discussed a lot. And if you look at the mathematics, there is a critical assumption there. I have heard people say that leaching fractions in the Delta are much lower than what you have assumed here.

And I was wondering, in preparing this report, did your staff go out and collect data about leaching fractions at all?

LES GROBER: No.

UNIDENTIFIED SPEAKER: Why not?

LES GROBER: We were doing a programmatic analysis, and the report that was done recognizes that there could be a range of leaching fractions. In fact, some information was provided to us showing that some work subsequent the Hoffman report shows leaching fractions can be in some areas lower. Though, that information also shows that yields aren't necessarily affected.

So the report is showing -- is based on information that was available at the time but also makes conclusions with regard to how the information can be used. And even if you had somewhat different leaching fractions -- and as those charts show -- you could start encouraging on some yield reductions if you had higher leaching fractions. But -- and this speaks to the program goal is to provide objectives that are not absolutely protective of all crops at all times but reasonably protective. And the conclusion of the Hoffman report shows that year-round 1.0 achieves that.

GITA KAPAHI: Looks like we have exhausted questions on this one.

LES GROBER: Then we are 20 minutes ahead.

GITA KAPAHI: We are ahead, which is okay. So let's move on then to the next section, which is part six, city and county of San Francisco effects.

WILL ANDERSON: Good afternoon. Will Anderson, water resource control engineer at the division of water rights. This afternoon, I am going to speak with you about the effects of the project on the city and county of San Francisco, particularly with regard to water diverted from the Tuolumne River. And on my left is Tom Wegge from TCW Economics. He is going to assist to talk about the economic effects of the potential changes in water supply, but I am going to first address how we did it.

So the question is what is the potential and likely effects of the project on the city and county of San Francisco with regard to water diverted from the

Tuolumne River? First we need to talk about the Tuolumne River in context of water rights. I am going to go through the method of this analysis, the potential project effects on the CCFS New Don Pedro Reservoir water bank and the accounting there, calculations that were required to determine the amount of replacement water that might be needed, the potential actions to meet the water supply demand. And like I said, Tom is going to jump in on the economic analysis.

So here is an old project diagram of the watershed. We see Hetch Hetchy in the upper watershed and Yosemite National Park. Don Pedro Reservoir is more in the middle, and the Turlock and Modesto Irrigation Districts are down in the lower part of the watershed.

So these irrigation districts have pre-1914 water rights, and essentially when Hetch Hetchy was built, the Raker Act was an act of congress that delineated the water rights -- at least to the regard of what is being diverted and stored -- at Hetch Hetchy and how that leaves a certain entitlement to the senior water rights of the districts.

In 1966, upon the construction of -- or the planning for the New Don Pedro project, the districts and the city and county of San Francisco got together. And they had a series of these agreements prior regarding when they would -- how they could operate the projects to allow flows from Hetch Hetchy at certain times of the year, et cetera.

The fourth agreement established a water bank in the new reservoir and the accounting of that water bank. In Article 8, it describes that the accounting of this water bank, it is a provision that the accounting would change to apportion the burdening of future flow requirements -- instream flow requirements and mentioned, at the time, the Federal Power Administration.

Now, we call it the Federal Energy Regulatory Commission. So anticipating new FERC flow requirements on the Tuolumne were to be apportioned 51.7 percent to the city. And so that is apportioning the burden of the increased flow requirements, 51.7 percent, to the account of the water bank. And I am going to attempt to describe to you and clarify how that works and how we accounted for the changes of the project.

So the Raker Act require, just in the simplest perspective, the city and county of San Francisco is required to bypass 250 -- 300 CFS or the entire natural flow of the Tuolumne River, if the flow is less than that amount. And that is the district senior entitlement. From April 15th to June 13th, the peak snowmelt period, the city and county of San Francisco must bypass 4,066

CFS.

So here is what that looks like in a wet year -- well, following a dry year. So in the lower part of the graph, this is the natural streamflow of the Tuolumne, and we see the 2,350 CFS level. So for most of the year, the CSF would have to bypass that amount and would be otherwise able to divert and store anything above that amount. And in that peak snowmelt period, you can see that we didn't really get much of that in '92, but in '93, there is kind of a more substantial amount.

So the essence of the water banking relies on additional water from the wet years to be stored in Don Pedro. In '92, there was only 68,000 acre-feet in that Raker Act category, and we will show an example of that six-year drought period and the fact that the water bank was drawn down.

So the sources of data for this analysis are the CCSF Tuolumne River flow accounting that we reference as PUC form P-173. It covers basically daily operations for the Hetch Hetchy project and the Tuolumne River and also provides a baseline accounting for the water bank. We have also used the WSE model, which will provide an amount of what is the increased flow requirement in the Tuolumne River for the 20 percent, 40 percent, and 60 percent unimpaired flow alternatives. And we also account for the need for flood releases based on the reoperation in the WSE model.

The water credit account modeling is not super sophisticated. It is a basic addition and subtraction. The current balance cannot exceed 570 acre-feet, except for if there is permitted encroachment into the flood control -- or the top of conservation storage. We start at the previous day's balance. Whatever comes in credits to that account. Whatever is a Raker Act entitlement is removed from that account, and the evaporation is assigned equally. Flood spills are assigned proportional to the net credit balance, and the accounting for the increased FERC flows are an additional debit in the amount of 51.7 percent of what the increased flow requirement is.

So essentially, this allows the districts and the city and county to -- well, the city and county to use some water at times when it is more convenient to divert to Hetch Hetchy Reservoir and allow for the peak flows that are -- on the Raker Act side could be diverted by the city and county to go down to Don Pedro Reservoir and then balance that account.

At this time, are there any clarifying questions about how that works?

Mr. Godwin --

Oh, maybe wait on the microphone.

ART GODWIN: Some of your numbers are a little wrong. Backing up, you had 2,350 CFS and 4,066. The Raker Act has 4,000, not 4,066. Here on this slide, you have 4,066 and 2,416.

WILL ANDERSON: Well, I will have to definitely check into that. There is a little bit of a difference in what -- there is additional agreements as to the original Raker Act. So thank you for pointing that out.

ART GODWIN: Correct. You need to get to the bottom of that.

WILL ANDERSON: We will certainly get to the bottom of that.

So what we have done is taken the baseline accounting from the PSE from 173 and compared that to -- based on WSE what we think is the baseline credit balance. We see in the years 1988 to '92 that our calculated baseline that we have calculated that the bank has drawn down below zero. And the fourth agreement doesn't allow for that. It says that it must not go below zero. So essentially there is a meet and confer-type clause. And so what happens between the city and the districts is a contractual relationship.

But when we go into the impacts of the projects, we have to interpret what could plausibly happen, and we are going to look at the bookends of what could happen and how much water is acquired to keep a positive credit balance, essentially.

So we have got two scenarios that we have evaluated because we haven't been able to determine from the record specifically how to interpret the fourth agreement with regards to additional instream flow requirements.

Scenario one would require reallocation of storage credits only if there is a positive credit balance. So this reallocation of credits is the term in the fourth agreement essentially assigning an additional burden to the city and county.

Scenario two really indicates storage credits, even if there is a negative balance. And so that basically is if the balance is zero, we are evaluating what the additional water cost is, that number continues to go up, even if there is no Raker Act water available.

So scenario one -- so the city and county is responsible for 51.7 percent of increased requirements when the account is positive. And so we see in the six-year drought period of '87 to '92 that baseline is the upper line, the blue line. We saw the baseline plot earlier. It goes below zero a couple times and just barely in water year 1988, a little more so in '89, '90, '91, and it gets back above zero after that. And so this is saying when the account is less than zero, we are not accruing additional responsibility for increased flow requirements.

So that is just the zero line, the dotted red point I wanted to show just so you are clear, when the account is below zero. It continues to accrue debits based on operations. We assume that the Hetch Hetchy diversion will operate the same and that amount of water will continue to be available. But there would be a burden, and there would be -- there is a contractual cost certainly there. It only accrues the increased flow required debits in scenario two.

So scenario two, we do see that that draws the account far more negative in the 20 percent, 40 percent, and 60 percent unimpaired flow requirements. So basically, we can account for the six-year drought period, '87 through '92, as the largest drought in the period that we have data available for, which is this 21-year period covered by the PUC form 173 that describes the operations for the Hetch Hetchy and the accountings of the water bank.

So we can evaluate that in baseline there is a supplement needed. So basically in the drought, there is a need to confer under the fourth agreement and come up with the responsibility for how to make up for what is the supplement that is needed to keep the account above zero. In the 40 percent alternatives, we can see that for that six-year period, the average is about 45,000 acre-feet. That is for scenario one.

And then scenario two, we have got a six-year average of 137,000 acre-feet. If we average that over a longer period, such as if this is an event that could be reasonably planned for, we can look at a longer term average, and that lowers those numbers respectively to 12.8 and 39.2 thousand acre-feet per year for the 21-year average.

We also observe, if we look at the 60 percent alternative here, there is a couple of other years that would be of concern, but we are going to stay focused on the 40 percent for the six-year drought and for the general proposal at 40 percent.

Now I am going to pass it over to Tom Wegge to talk about the economic analysis.

TOM WEGGE: Good afternoon. There is nothing like having an economist in the late afternoon to inject a little energy into the room at this time. My name is Tom Wegge. I am a resource economist at TCW Economics. I am going to be presenting our analysis -- do you hear that -- of potential effects of the proposed project and alternatives that was conducted for the Substitute Environmental Document. These right here.

So the presentation topics that I am going to be covering, first the SFPUC water district profile. For those of you that aren't as familiar with the district, this information is sort of the institutional context that helps, I think, to understand how the district operates and why the analysis was done the way it was.

Then I will move into an overview of the economic analysis. From that point, there is sort of three steps in the process of our analysis. First being estimating water supply costs. Then following up from that, looking at potential ratepayer effects, and then lastly, looking at estimated regional economic impacts in the Bay Area, where service is provided by the San Francisco Public Utilities Commission.

Just as far as a little background on the SFPUC water district, the city and county of San Francisco through this district owns and operates a regional water system providing service to approximately 2.6 million residents in the four-county area. It is also the retail water supplier in the city and county of San Francisco. It provides water to 27 wholesale providers and water companies within the three counties of Alameda, San Mateo, and Santa Clara counties.

The overall capacity of the district's water system is about 265 million gallons per day or 296,000 acre-feet on average. Approximately 85 percent of the water comes from the Tuolumne River watershed through the district's Hetch Hetchy project. And the other 15 percent comes from combined Alameda and peninsula watersheds.

During the drought periods, sometimes the water provided by the Hetch Hetchy project can actually account for more than 93 percent of the district's total water. The individual water agencies rely on the district's supplies to varying extents, and water use by customer class varies widely among the wholesale agencies. This information is shown in the SED document at the table identified -- in the table identified here.

About 59 percent of the water is delivered to residential customers, 21 percent to commercial and industrial, 11 percent to government and other users, and 9 percent to dedicated irrigation users.

Okay. Now I am going to present a little information about the -- how the economic analysis was conducted. The -- in hopes that a profile of the district will help to understand how some of the divisions were made and how we did this analysis.

This flowchart here presents the sequence of steps that we went through for the analysis. The -- as far as assumptions, there were, sort of, two key overarching assumptions that were made, the first being that the San Francisco PUC would purchase water to offset water shortages during extended drought periods.

The second overarching assumption is that SFPUC would pass the additional cost on to its retail customers. These -- particularly the first overarching assumption here is important in that we are assuming that the water would be replaced and that the district would pay to replace that water. And the reason why this is important is other analyses in which shortages of water to the district were looked at, such as in the relicensing study -- the hydroelectrical relicensing studies in New Don Pedro, a different assumption was made that rather than replacing the water, a rationing would occur. And that assumption does have different implications for the analysis.

So with these assumptions, we estimated what the additional water supply cost would be, and then based on that, we looked at how those additional costs would affect ratepayers with the general conclusion that there would be a decrease in discretionary income of water customers and net income of proprietors and that this would result in -- as far as the retail customers to

SFPUC -- a temporary rate change.

And in the case of their wholesale customer, which it is mentioned that there are 27 wholesale agencies that they provide water to, that would translate into higher wholesale water rates that would be passed on to their customers in terms of temporary rates or charges.

And then the last component of your analysis looked at potential changes in the regional economic impacts. This included changes in economic output within the four-county Bay Area region, decreases in jobs, and some -- although we didn't look at other effects, there are some other effects that will include -- like fiscal effects -- revenue generated for public agencies.

So the first step that was mentioned was to estimate the water supply cost associated with the shortages that the district would experience under different scenarios and assumptions. As economists always say, we need to have assumptions for just about everything. And with an analysis this complex, there certainly had to be a number of them.

So to the step of estimating water supply costs, we assume that the water demands during severe drought periods, such as the six-year extended drought period that Will was mentioning before from 1987 to 1992, that those shortages would be offset by purchases of water from irrigation districts. For example, MID and TID.

We assumed that the water purchase price for this water would be on average $1,000 per acre-foot. We assumed that there would be no other cost to the district, such as costs to hold, treat, or distribute the water from the Hetch Hetchy system. And lastly, that O&M cost to obtain water from that system would not vary on the amount of water delivered annually.

As mentioned, we did assume for purposes of our analysis that water transfers from irrigation districts would be the source of water to meet the shortage to the district -- to the SFPUC. However, we did look at, in the SED, some alternatives to this. The two primary ones were evaluating potential in-Delta diversions. This was looked at, as indicated on this slide, by SFPUC in a 2007 study. These are some of the capital costs and O&M costs associated with that, but as mentioned, for our analysis, we used water transfer as the mechanism for replacement water. The second major source was looking at water supply desalinization projects. And, again, some information is included in the SED related to that.

The -- this particular slide identifies the water supply costs on both a short term -- this slide is on a short-term basis. By "short term," I mean during the extended drought period, which as mentioned was the 1987 to 1992 period. So this shows the required water transfer under scenario one and scenario two as it relates to the water bank account and how that would be operated.

Under scenario one, the water -- the average water transfer amount would be 14,000 to 30,000 acre-feet for the 20 percent, 40 percent, and 60 percent flow alternatives at $1,000 an acre-foot. The math is pretty straightforward here. It would incur a cost of $14 to $30 million per year to acquire that water supply. Under scenario two in the short term, the water transfer needs are 35 to 208 thousand acre-feet per year, and the associated costs with that range from 35 million to 208 million.

The next slide here looks at this cost over the longer period of time. As Will had mentioned, the analysis of the water supply effects was -- there was 21 years of data on SFPUC operations. So this extended drought of six years was part of this 21-year period. And so the longer period is represented by the 21 years in the period of record. Because the longer period of time has 21 years as opposed to six years for estimating costs, the -- the annual average transfers and annual average costs are reduced under scenario one from 4 to 9 million per year and under scenario two, from 10 to 71 million dollars a year.

And I would just like to point out at this point that while this analysis focuses on the costs to the SFPUC for replacing water and the revenue, or the costs -- it provided an estimate of these costs, you need to keep in mind that although these are costs to the city and county of San Francisco, they also represent a transfer of revenue from the city and county of San Francisco to the agricultural districts and the growers where it assumes that that is where the water would be transferred to. So there is two sides of this equation, both a cost and a potential revenue enhancement.

The next slide here shows the annual costs averaged over a longer period of time. This focuses on the boxed information here. It is the costs associated with the Alternative 3, the 40 percent unimpaired flow. As previously shown, the cost would range from 8 million to 34 million dollars per year.

Now the water supply costs, as that flowchart indicated earlier, those costs then become costs that are passed on to the ratepayers within the four-county Bay Area. And this next component looked at how these ratepayer effects might occur. A couple of key assumptions here that we use for baseline purposes, in the combined SFPUC, you see water enterprise and Hetch Hetchy water budgets. They are separated for the SFPUC for the fiscal year of 2013-2014, and that total budget was $483 million.

The second key budget for the ratepayer analysis is that the budgetary cost increase that we looked at was to include the water supply cost to this baseline condition -- budgetary condition, and we assumed that there would be a proportional rate increase within terms of the district's retail and wholesale water rates.

This slide just steps through three main -- or walks through three main steps for the ratepayer analysis. We first estimated the baseline water budget. Second, we used the estimates of water supply replacement costs for determining the change in the baseline annual water budget. And then the third step was to estimate the annual percent change from the baseline water budget and use that as a basis for approximating the annual effect on customer rates.

This slide actually shows the calculations. The first step is to determine the total baseline budget, which is the 483 million that I previously mentioned. The second step is to determine what the short-term water supply costs do to the budget and then the long-term water supply costs. And then the third step is to estimate what the percent change is in the budget. And then both the short term and the long term are used to approximate what the change would be to ratepayers.

So during the six-year drought, under scenario one, what we show is that the percent change in the subject represents from about 3 percent under the 20 percent alternative. Under the 40 percent alternative -- unimpaired flow alternative, it is a 5.6 percent increase. And then the 60 percent flow alternative, we estimate a little over 6 percent.

This just highlights the changes specific to the 40 percent unimpaired flow alternative. Over the longer 21-year period, the full extent of data that we had, which based on work that Will looked at, seemed to be fairly representative in terms of water year type to a longer historical period. So we felt that using this 21-year period to determine what the average cost would be was appropriate. And the annual change in ratepayer effects is reduced from essentially 2 percent to 6 percent to, in this case, less than 1 percent to about 2 percent under Alternative 4.

This slide presents the same information but on -- for scenario two. Again, it is showing the effects across the alternatives in terms of the percent change in potential ratepayer effects. In the short term, that range is 7.2 percent under Alternative 2 to 43 percent under Alternative 4. In the probably more realistic, reasonable, long-term period, which is the 21-year slice of years, the increase in ratepayer effects would be about 2 percent to about 15 percent. Again, this box here highlights the values associated with the Alternative 3, 40 percent, unimpaired flow.

Okay. The last component of our analysis was to look at the regional economic impacts, just a quick overview. To do this, what we are trying to do is estimate, "Were the analyzed impacts on the Bay Area regional economy from purchasing replacement water supplies?" It should be noted that the analysis that we did here was broken out by the four counties, and then what I am going to be presenting is just for the four-county region as a whole. But the analysis actually shows the effects within each of these counties.

So the water supply costs were further broken out by water district, customer type, and county. We evaluated how different customer types would likely respond to higher water rates and then developed modeling assumptions for that analysis. And then we used -- similar to what was done for the agricultural economic analysis, we used IMPLAN to estimate both the county level and region-wide effects as measured by economic output and jobs based on expected changes in the demand for goods and services in the region.

The key assumptions relate to the different types of water categories or client/customer categories. Again, discretionary income was assumed to be reduced as a result of higher water costs to the various groups. I won't go through each of these, but we broke customers out into households, commercial, industrial, government, and dedicated water users and developed appropriate assumptions for IMPLAN modeling.

This next slide shows the results of the IMPLAN analysis. This slide focuses on scenario one. I have highlighted the effects with the effects of the 40 percent unimpaired flow alternative. What we are showing in terms of changes in economic output are -- and these are annual changes -- an estimated $31 million under scenario one, which represents about 0.05 percent of the total economic output in the economic region. And in terms of jobs, we estimated a loss of about 226 jobs, which is less than 0.1 percent of the total jobs in the region.

This slide shows the similar effects but under scenario two. As Will had defined it, the effects become larger under scenario two because of the bigger hits that the water districts would incur. This highlights the

$140 million annual loss in economic output and about 1,000 jobs annually within the four-county region.

Now, we also -- as I mentioned, we used the $1,000 per-acre-foot price for purposes of estimating water supply costs to the district. This was based on a review of the literature as well as an investigation of the prices used in recent water transfers. Because of the uncertainty of this price, we felt that doing a sensitivity analysis, at least as it related to the regional economic impacts, was appropriate. And so we looked at what those effects on economic output and jobs were -- or would be under assumptions of $500 an acre-foot water and then $2,000 an acre-foot water. And so this first slide shows the effect on output, and then the next and last slide shows the effect of the sensitivity analysis on total jobs.

So with that, I will --

GITA KAPAHI: Open it up to questions.

TOM WEGGE: -- turn it over to questions.

GITA KAPAHI: Okay.

WILL ANDERSON: First, I would just like to clarify for Mr. Godwin's original pointing out that there was inconsistencies in the numbers in the slides, there is another -- I don't have the fourth agreement right in front of me right now, but there is an additional amount of what looks like 66,000 acre-feet that is added in the fourth agreement. So that is -- excuse me, 66 CFS. You are correct, sir. That is what is in the calculations, and I apologize for the inconsistency in the slides there.

MATT MOSES: Hi. Matt Moses. I am with SFPUC Regional Water System. Thanks for walking through what is not such a simple analysis. Don't sell it too short.

I have a question about the basis for scenario one. As I understand, you used a historical water bank account balance over the 20-or-so-year period that you evaluated. And can you describe again -- maybe with more detail -- what happens in scenario one, specifically when the bank account goes to zero?

WILL ANDERSON: Right. As I'm sure you are aware, in the fourth agreement, it has a provision that the account shall not go negative. And in the case that it would be heading that way or that would -- the numbers would add up that way, there is a clause in Article 8 that the city and the districts would need to find a solution to that, whether it be arbitration or some other agreement.

So specifically in the analysis, what we are saying is that the increased burden of the flow requirement would not continue to accrue at the point that the balance is going negative. And that is -- you could consider that, kind of, a lower limit. But scenario two is where that continues to accrue no matter what. And essentially, kind of, the thought behind that is that we don't know exactly how the parties would tend to sort this out, but the increased flow requirement causes the balance to be zero more often. So that is a dilemma.

We can see what the high-end items limit of the costs, if that were determined to be the interpretation of that. And scenario one is an attempt to have a lower end cost of -- in the course of operations when that -- when the water is available under the account that the city would bear that burden at 51 percent. And we see that when the account is negative.

It is going that way primarily because -- and I am going to go back to the -- I will move back to this slide here. So if you have successive dry years where essentially there is minimal flow that is accruing to the bank account, then that would cause that dilemma. I don't know if that helps answer the question. Because if you have -- it is difficult to accrue an obligation based on something you don't have. The contract can say it is so, but that would certainly be something to resolve.

UNIDENTIFIED SPEAKER: (Microphone error.)

WILL ANDERSON: So this evaluation is -- to answer the second part first, no, we didn't feed that cost back into the model because we are assuming that there is some resolution to the issue of the water bank, whether that be bypass flows, which is not a primary assumption of the analysis. But in the wider view, that is the obligation, if the flows would need to be bypassed, or some other arrangement.

So in the case that flows would be bypassed, then the district entitlements would be kept whole in that case, and that would be a water shortage, as is seen in droughts in baseline -- in the severe drought.

LES GROBER: Could you restate your question? I think what you are asking is: Did we fold this back into -- and how would it change the water supply effects in the basin?

And the short answer is "no" and that these would not be additive effects. So depending on how this shortage is revived, it wouldn't be an additional water supply effect. It would be either here or in the valley floor, in the basin.

UNIDENTIFIED SPEAKER: (Microphone error.)

UNIDENTIFIED SPEAKER: Test.

TOM WEGGE: I understand the assumption you made for the economic analysis about purchasing water, but then did you look at -- did you run that back through the water supply effects analysis to see what the effects are to the districts of transferring 120,000 acre-feet of water to San Francisco?

UNIDENTIFIED SPEAKER: No, we did not.

LES GROBER: There would be only -- the water supply effect, that is not an additive effect. So when we come up with the mean annual in terms of obtaining the instream flows, it would not be an additional water supply impact, say, over the 290,000 acre-feet on average per year, correct.

WILL ANDERSON: If they did in fact transfer and sell the water --

LES GROBER: Then they would have the water supply effect that was described, so the 290,000 on average. It wouldn't increase it by transferring that water.

UNIDENTIFIED SPEAKER: So it would just be replacing the water that they were shorted, that they otherwise would have received?

ANNA BRATHWAITE: Hi. This is Anna Brathwaite from the Modesto Irrigation District. It sounded like you had three different options to choose from to mitigate the water supply impact. It could be water transfer, building new treatment or storage facilities, and then building a desal plant it sounded like were the three options.

And I was just -- I have a follow-up question. But maybe, first, why did you choose the water transfer between the three of those projects, especially since the service provider's significant and unavoidable impacts were due to construction from water treatment or other waterworks? So I thought maybe the more protective standard would be to acknowledge that and apply those same principals to San Francisco. But I thought maybe you could explain to me, kind of, why the change.

LES GROBER: When you say, "the change," I mean, we looked at all -- as you said, all three of those. But here -- the focus here is if you were to do it through the transfers, which that is something that has happened in the past but not of this magnitude. We focused on that because it is something that is more -- you know, everything was in place to achieve all of that. So it would just be changing hands for them to achieve the transfers.

ANNA BRATHWAITE: Okay. And so -- okay. And so just maybe you could explain the thinking. So I would have thought with the larger rate base, larger revenue stream, easier access to capital, that if you were proposing construction projects for smaller agencies that you would also look and take the more protective view of the environmental analysis and look at the potential construction projects.

TOM WEGGE: Well, I mean, we considered all of the options, but we felt that the most reasonable assumption, given the existing infrastructure, the history of having transfers, the fact that the district -- the SFPUC -- has identified transfers between MID and TID and their water supply plan, that based on those factors and the fact that, like I said, the infrastructure was in place, that seemed like the most reasonable assumption for purposes of analysis.

ANNA BRATHWAITE: Okay. Thank you. And I just note that you also cited to the SFPUC plans for the reasonable assumption of the construction projects, but thank you.

NICOLE WILLIAMS: This is Nicole Williams with ICF, and maybe I can just add to Tom's answer. It is that those two types of construction projects -- or would-be construction projects are identified in the document. We just didn't necessarily do a regional economic analysis on them. So we identified the costs and the information related to operation and maintenance that had been identified to give a price point, but the regional economic analysis was really coming from the water transfer side.

VALERIE KINCAID: Valerie Kincaid from the San Joaquin Tributaries. I have two questions. On page 21, there were a list of assumptions, which are really helpful and explained the inputs and how the analysis was driven. Can you explain how those assumptions were developed?

TOM WEGGE: The first assumption, I think we just talked about, that -- you know, with various options available, including in-Delta diversions and desalinization and other potential water supply sources, we felt that purchasing water from irrigation districts -- again, just for purposes of analysis -- was a reasonable assumption to make, and the cost that we assumed was based on a review of the literature and what seemed like a reasonable price. And then we did the sensitivity analysis.

VALERIE KINCAID: Did you develop those as a consultant, or were those inputs given to you before you ran your economic analysis?

WILL ANDERSON: I don't know. Tom needs to answer that. I will say that the record includes examples of the city pursuing such sales and don't in fact note the details of what has actually occurred in the past but that it would certainly be something that would be possible. And in terms of prices, the drought has seen all different kinds of pricing, and we have got a lot of substantial information to say what the prices might be for such a transfer. And we have also looked at the sensitivity of that.

And to answer that for Tom --

VALERIE KINCAID: It looks like it was staff generated.

WILL ANDERSON: Yes.

VALERIE KINCAID: Okay. Was there any analysis about whether the water was actually available? So in those drought years, it looked like you ran the numbers of how much water would have to be purchased. Did you look to see if the water was actually available for purchase and what inches per acre-foot that would bring the districts down to delivering to their own customers?

LES GROBER: That is included in the water supply effects for what would occur with those shortages, as we have shown in the earlier segments in terms of the effects and the plan area on the districts. So there is no other specific additional analysis -- when you say, "water availability," it would just be -- that would be -- then the full shortage would be borne by the districts and those others in the watershed.

VALERIE KINCAID: Okay. So this analysis took into account -- because it is built off the WSE -- is that what you are saying, that it took into account the reservoir storage operations, too? You would be able to transfer this amount of water and keep the carryover that is assumed in the WSE model? You would physically be able to do that?

WILL ANDERSON: So I think it might help to clarify Mr. Godwin's original question to say that the PUC-173 operations as the baseline are the diversions at the Hetch Hetchy that did happen. So assuming that these continued to happen in the alternatives, that water is at that point not included in our analysis, but the city and county will continue to receive their supply. That is pretty much the base assumption there.

And as to inflows to the reservoir, they are not seen in Don Pedro, simply the credit account that we are evaluating after that point. So the amount of water in the reservoir that the districts see would be as a result of the alternatives, if that makes sense.

VALERIE KINCAID: Yeah. Just a layperson's sort of follow-up to that. So because this is already included, you wouldn't see any reservoir fluctuation from this assumed transfer; is that what you are saying?

WILL ANDERSON: No, I am not saying that.

VALERIE KINCAID: Thanks.

UNIDENTIFIED SPEAKER: Does it work this time? Yes. Thanks for your earlier clarification on the scenario one assumptions. It sounds like you came up with some assumptions to set low estimates for what the cost to the San Francisco system might be. So unless I am wrong about that, I will just leave that alone for right now.

I think it is important to note that the water bank account is something that is actively operated by the San Francisco water system. And so in your post-processing of the historical account balance, you are debiting in scenario two from the operations that were conducted to try to maintain water supply for delivery to the service area in the Hetch Hetchy. What we do with the water bank account is make sure that we will be able to divert water into the Hetch Hetchy and the San Francisco regional service area when we need it, including in the dry times of the year.

So if the water bank account balance were at zero more often, it could lead the San Francisco regional water system in trying to plan ahead and maintain future M&I supply reliability. It could lead the system to ration deliveries more often. Did you consider the effects of additional water supply rationing by the system in response to contributions to the instream flows?

LES GROBER: No. I was looking to Nicole -- or I think the answer is no. Okay. No.

UNIDENTIFIED SPEAKER: So thank you. I understand the answer. I would propose that including additional water supply rationing could set your high bar regarding costs to the San Francisco water system higher. And if you could, respond to that.

LES GROBER: Provide that comment. Thank you.

CHRIS SHUTES: Hi. Chris Shutes with CSPA. Did you consider transfers from any other sources other than the districts of Turlock and Modesto?

LES GROBER: No.

CHRIS SHUTES: Would that have an economic impact that would be different if it came from the north of the Delta, for instance?

LES GROBER: Well, the reason for no is because it is within the system -- the plumbing is all there using the current water bank -- the current facilities. So we didn't look at other sources; is that correct?

CHRIS SHUTES: Did you consider the likelihood of future additional infrastructure construction by the city and BOSQUA as part of the regional drought planning?

LES GROBER: No.

CHRIS SHUTES: And is the reason you didn't consider in-Delta conversions strictly because of the additional treatment costs and conveyance costs once water got to the Bay Area -- or once water got to the point of diversion?

LES GROBER: Nicole --

NICOLE WILLIAMS: All right. So I will have to look back -- I'm sorry. But the in-Delta diversion, that may have actually been included in our document -- and I will have to double-check where -- a cost associated with a water transfer that might have come outside of the irrigation districts. But I will have to check the document and get back to you.

CHRIS SHUTES: All right. Thank you. I would just point out that it appears that the city is on a trajectory to construct some of these facilities, and that might be a more reasonable -- or another reasonable approach and would likely be less expensive than desal.

UNIDENTIFIED SPEAKER: I should have asked this earlier regarding South Delta salinity and the assumptions about exports from the South Delta, and Chris just reminded me to ask it now. We talked this morning about how the possibility of export pumping from the South Delta could change in response to changes to inflows on the San Joaquin. Was any consideration given in the Delta water quality change analysis to the effects of changes in export pumping? And then you can see where I am going with this. If you were to look at San Francisco making diversions from the Delta, what effect would that have?

LES GROBER: We didn't look at any changes with regard to those types of active changes and export pumping.

UNIDENTIFIED SPEAKER: Okay. Thanks.

BILL PARIS: Bill Paris, Modesto. I may be very dense. So I apologize, but I am going to ask the same question for the fourth or fifth time. But I want to get to this question of additive and what has been wrapped back around or what has been included.

Last week -- and please bear with me. I may get the numbers wrong, but hopefully you will get the gist of what I am saying. Last week we put up a chart at the last technical workshop, and I think it said during critical years the average reduction was 38 percent. That may not be right, but hopefully that will recall the information that was provided.

If I am understanding right, is that number sort of a generic number that is sort of a basin-wide 38 percent reduction, not to each and every entity, but that is just sort of a mathematical equation result? Is that a fair way to say it?

LES GROBER: Yeah. That is the average over the entire affected area.

BILL PARIS: Okay.

Under what we are talking about today, though, if the districts went ahead with the water sale, scenario one or scenario two would have a larger individual reduction during those dry and critical years than 38 percent; is that fair? That would be absorbing San Francisco's share of that; is that accurate?

LES GROBER: Yeah. Not an additive effect but there would be perhaps --

BILL PARIS: Understood.

LES GROBER: Yeah.

BILL PARIS: Okay. So I think what a lot of us are asking is: "Has that element been wrapped back around, say, through SWAP and IMPLAN at any point?"

LES GROBER: To show the reduced effect that it might have -- not a reduced but what the effect would be. No. There hasn't been any kind of mix and match of scenarios where -- in the scenario where there is that transfer that occurs so you have the water supply effect translated to the area. No, that was not done.

BILL PARIS: Okay. Can I ask why that wasn't -- oh, go ahead. I'm sorry.

ANNE HUBER: I am just thinking -- oops. Let me --

WILL ANDERSON: Anne Huber from ICF.

ANNE HUBER: I don't know if it was clear in the way the analysis was done, but the full shortage was assigned to agriculture, for the purpose of assessing agricultural impacts. And so in that sense, the effect of MID and TID giving water to CCSF is accounted for in the analysis. If some of the CCFS water were to -- if CCFS were shorted, then the agricultural impact would be less than what was modeled. I don't know if that was --

BILL PARIS: That is very helpful. I did not realize that. Thank you.

WILL ANDERSON: If that is the case, then the water has to be bypassed, which is more so than in the baseline. They have found some other alternative supply.

BILL PARIS: Okay. Thanks. I am going to hand this over to Art.

ART GODWIN: So in the WSE that we learned last week, you made no assumptions of San Francisco. So you just had an inflow number into Don Pedro based on CalSim; right?

WILL ANDERSON: That is correct.

ART GODWIN: Okay.

ANNA BRATHWAITE: This is Anna from Modesto Irrigation District. So just to confirm, that same point is true for all of the service providers in the WSE analysis? Was there ever a time that you looked at the impacts to irrigation and M&I supply at the same time?

LES GROBER: This seems to be a recurring question/thought/theme. The importance of the mean annual water supply effect of the 293,000 acre-feet a year varies by year. That is the total maximum water supply effect over all impact areas and all uses. It can then be moderated, as we are shown, by doing some groundwater pumping. Although, that then just translates some of the effects into groundwater.

But as Anna just said, there is not an additional city and county of San Francisco effect. To the extent that there is a shortage in San Francisco, it reduces the ag effect in the valley. So it is a zero-sum game. So there is no additional effect on drinking water or municipal or anything else. The total is 293. The nature of the analysis is to show, "Well, what is the effect of that?" And also as Anna said, it puts all of that on the ag water supply, but there could be differences in where that shows up.

ANNA BRATHWAITE: I have to admit, I didn't find that a helpful answer. So maybe it is just something to think about. I am just trying to understand if there was ever an impact analysis that looked at the same time that water was missing from any municipality and the irrigation at the same time.

And again, if it is the same answer as last time, then perhaps state that, and then we will move on. But I am just not finding your answer helpful. There is a specific citation in the revised SED that says that municipal supply is not reviewed at the same time as the agricultural water impacts for groundwater. So I am just trying to resolve that one statement in Chapter 9 with, kind of, what we are discussing here.

LES GROBER: I'm sorry. What is that statement? Can you say that again?

ANNA BRATHWAITE: Sure. That the groundwater impact analysis did not look -- no. It was that the municipal supply was presumed to be fully met. That was the gist of it. And quite frankly -- now might be a good time to actually find the citation. I have it somewhere.

ANNE HUBER: Is it ringing a bell? It is through that, for agriculture and groundwater, the assumption was that the full shortage would affect just agriculture? I mean, those two analyses were linked. However, in Chapter 13, Service Providers, there is a discussion of what might happen if municipalities experienced a reduction.

That approach let us, sort of, estimate the maximum possible agricultural effect. Yet, in Chapter 13, there was a qualitative discussion of what happened if municipalities experienced a reduction. And it was -- it would be hard to model with certainty because it is unclear to what extent municipalities would experience a shortage. Although CCSF was modeled quantitatively, the other municipalities were qualitative.

ANNA BRATHWAITE: That was helpful. So the service providers locally were not modeled. That was purely qualitative, the assumptions about the impacts. But San Francisco was modeled, and that was quantitative. And that is a difference.

ANNE HUBER: Yes, that is correct. Because it was easier to model CCSF in a quantitative manner because there are known rules about water banking.

ANNA BRATHWAITE: Gotcha. And so maybe just, kind of, something to -- we will put it in our comment. But, you know, for those of us trying to analyze the document, it would be very helpful if you could treat like-entities a little more alike. So MID is looking at various service providers, both local and a bit further away. And it looks like you are choosing the less expensive, less environmentally protective analysis for San Francisco citing ease of facilities.

And I would say that all of those same factors exist for our local service providers. And so to the extent that you have identified water transfers as a less expensive, more efficient means to look at the analysis, I would just encourage you to perhaps treat them a little more alike in your analysis.

LES GROBER: It is not just because it was simple, but it is also a water supply for a large metropolitan area, the single largest population that is served almost exclusively by surface water of the project area. So there is that recognition as well.

ANNA BRATHWAITE: Thanks for acknowledging it.

UNIDENTIFIED SPEAKER: I don't want to quibble too much over terminology, but I would like to suggest that San Francisco's operations were not actually modeled in that historical account balance of the water bank. It was actually just decremented by the amount of flow estimated to be contributed to the new flow standard.

To my earlier point, in operating to the proposed flow regime in a scenario where San Francisco is contributing, San Francisco would reoperate the reservoir system to retain more carryover storage in the Hetch Hetchy, which is our water supply reservoir, so that we would be able to make it through extended dry periods. We would do that by making the contributions a lot like what you have estimated in the scenario two calculation and also by rationing our supplies to the service area to make sure that we could get through periods of multiple dry years.

LES GROBER: And I am curious, would you be doing that to reduce the costs?

UNIDENTIFIED SPEAKER: We would be doing that to ensure a consistent water supply for the service area, a reduced but not failing water supply. So like I said, quibbling over terminology, maybe we were treated more equally than you proposed.

UNIDENTIFIED SPEAKER: I am just curious why you made the decision to model the district separately from San Francisco. Why didn't you look at the entire watershed?

LES GROBER: I'm sorry. "Look at the entire watershed"?

UNIDENTIFIED SPEAKER: Yeah. San Francisco and the districts together, why wasn't that analysis done? Instead you did the districts over here, and then you did this whole separate appendix for San Francisco.

LES GROBER: Well, not to lose sight of this is supposed to be a programmatic analysis of things that could happen. But we can't know exactly where the water supply costs and where the water supply effects will lie.

So that starts becoming a very difficult problem to answer. We have already -- in response to comments from the last round, we have made more assumptions about replacing water supply with groundwater pumping.

Each time one makes such an additional analysis, there is a greater likelihood that someone will say, "Well, no. It is going to actually be something else." So this is our best effort to show a series of, "This is a thing that could happen, recognizing that any of a number of other things could also happen." But that is why the comments will be useful to say, "Well, no. No. It is actually this other thing that would happen, and it would be a very different effect. And here are the reasons."

But we tried to bracket what could be the possible effects without doing an even more exhaustive analysis by coming up with one possible outcome, as it seems to be you are suggesting.

UNIDENTIFIED SPEAKER: No. I am not suggesting one possible outcome. What I am suggesting is -- I mean, the watershed -- San Francisco and the districts operate their projects cooperatively, and yet you treat them as totally separate. I mean, Hetch Hetchy could be in an entirely different watershed for all you know. End of comment.

CHRIS SHUTES: Chris Shutes with CSPA. Well, in defense of board staff on that one, in the last round of the SED, people assumed that there was only one way to operate and to divide responsibility, and therefore, the economic impacts were shifted enormously to the Bay Area. And that was used by some parties to suggest that the whole scheme was unworkable and unreasonable.

So while I think that it might have been a good idea to look at additional alternatives -- and we suggested some in a couple of comment letters in the interim -- I think do think that it is a good thing that at least one alternative, operational or resolution, was considered. And I think there are more. But one of the games that I have confronted for a long time is the idea that there is nothing that we can do because it is all going to get transferred economically to San Francisco, and there just has to be an answer to that loop.

LES GROBER: Thank you. It seems we are moving more into comments. So I suggest we have reached the end of our workshop.

GITA KAPAHI: So again, if there are things that need to be followed up on, there are cards at the back of the room. Check off the subject matter, and put your contact information. Give those cards to staff, please. There are additional -- not technical workshops but board workshops coming up. The next one is --

LES GROBER: Yes. We have -- coming up this Friday, we have the second day of hearing in Stockton, and that is followed by Merced on the following Monday and Modesto next Tuesday. And then the final day of hearing will be January 3rd back here. And the comment period closes January 17th.

GITA KAPAHI: Thank you. So thank you all for your attention today. And I understand that the presentations will be posted in the next few days; correct, Katie? Thank you.

(End of recording.)

I, AMANDA L. JOHNSON, CSR No. 13922, do hereby declare as follows:

That pursuant to the request of Shelly McLean, I did transcribe video files as requested by Shelly McLean.

I declare under the penalty of perjury that the foregoing is transcribed as true and correct to the best of my ability.

DATED at Modesto, California, this ___________ day of ___________________, 2016.

____

Amanda L. Johnson

EXHIBIT 6

CALIFORNIA
Water Boards

Fact Sheet

November 2016 Statewide Conservation Data

November Conservation Summary

November 2016 marks the 18th month since the state's 400-plus urban water suppliers were directed to be in compliance with the emergency conservation standards that followed the Governor's April 1, 2015, Executive Order. The State Water Board has been requiring water delivery information from urban water suppliers for 30 consecutive months, following the historic July 2014 board action to adopt emergency water conservation regulation.

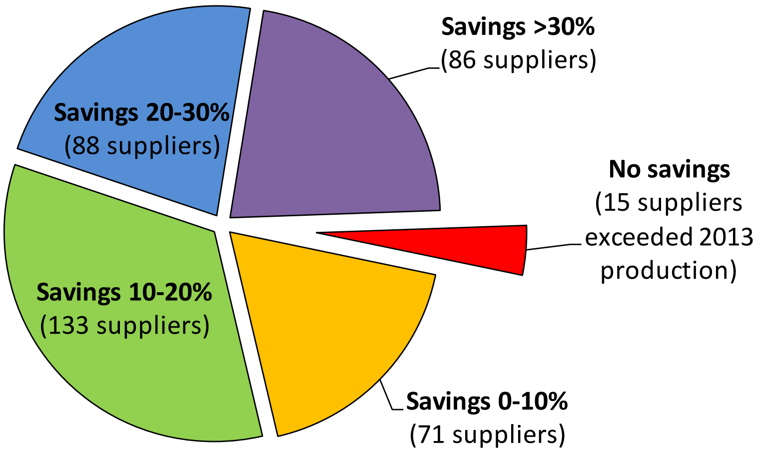
On May 18, following the Governor's May 9 Executive Order, the Board adopted a statewide water conservation approach that replaces the prior percentage reduction-based water conservation standard with a localized "stress test" approach that mandates urban water suppliers act now to ensure at least a three-year supply of water to their customers under drought conditions. This fact sheet summarizes the results for November 2016 and illustrates the progress made since June 2015 when urban water suppliers were first required to comply with state-mandated conservation standards. Current conservation summary data are posted here**.** Stress test results are here.

In November 2016 the monthly water savings were 18.8 percent compared to November of 2013 potable water production. In November of 2015 the savings were 20.2 percent. Since June 2015, Californians have saved nearly 765 billion gallons (2,347,125 acre-feet), which equates to an 18-month cumulative savings of 22.6 percent. Based on the estimate that the average person uses 0.2 acre-feet of water per year, this savings is enough to supply 11.7 million Californians with water for one-year; approximately the combined population of San Diego, Orange, San Bernardino, Alameda, and Sacramento counties, or more than 30 percent of the state's population.

The data from November 2016 continue to show a mixed picture of performance by agencies across the state, with many continuing to conserve significantly and other showing a trend of declining conservation. Average percent water savings in eight out of ten hydrologic regions increased over conservation levels in October 2016, and conservation levels in five hydrologic regions – North Coast, North Lahontan, Sacramento River, San Francisco Bay, and Central Coast, were greater than in November 2015. The increase over the water savings achieved in November 2015 could be due to wet conditions in November 2016, and turning off outdoor irrigation, which is both appropriate and required by the regulation. Where conservation levels dropped compared to last year, the decline may be due to one or more of multiple factors, including low precipitation, a reduction in conservation messaging, less restrictive irrigation rules, or additional irrigation to establish new landscapes.

Breakdown of Water Savings

The chart below shows the number of suppliers achieving various levels of water savings in November 2016 compared to the same month in 2013, which serves as a baseline for water conservation. Thirty four percent of suppliers reporting in November 2016 achieved water savings between 10 and 20 percent compared to the same month in 2013; these suppliers serve more than 14.5 million people. Forty four percent of suppliers, serving more than 13.2 million Californians, reported water savings of 20 percent or more. Fifteen suppliers reported water production exceeding the November 2013 volume.



- Sixty six out of 86 suppliers that reported water savings greater than 30 percent in November 2016, also increased water savings over what they saved in November 2015. Among suppliers that saved more than 30 percent in November 2016, and increased water savings by 10 percent or more over the conservation in 2015 are: Patterson, Olivehurst Public Utility District, San Juan Water District, Ripon, Galt, Del Oro Water Company, Lemoore, Redding, Sonoma, Windsor, Millbrae, Tustin, and Goleta Water District.
- There are additional examples of efforts that resulted in yet more savings this year compared to November 2015 savings, such as Whittier, Morro Bay, Ventura County Waterworks District No 1, San Buenaventura, Sacramento Suburban Water District, West Valley Water District, and Tahoe City Public Utilities District.
- On the other hand, there are examples of suppliers with conservation performance dropping compared to November 2015, and with average R-GPCD exceeding 230 gallons, such as Santa Fe Irrigation District, Los Angeles County Public Works Waterworks District 29 (Malibu), Vaughn Water Company, and Valley Water Company.
- Among those saving more than 20 percent in November 2016, 155 suppliers passed their stress test and are not required by the emergency regulation to reduce total potable water production from their 2013 production. These suppliers include East Bay Municipal Utilities District, Alameda County Water District, Los Angeles County Public Works Waterworks District 40 (Antelope Valley), Contra Costa Water District, Stockton, Sacramento Suburban Water District, California Water Service Company Stockton, Escondido, California Water Service Company Mid-Peninsula, Vallejo, Santa Clara, San

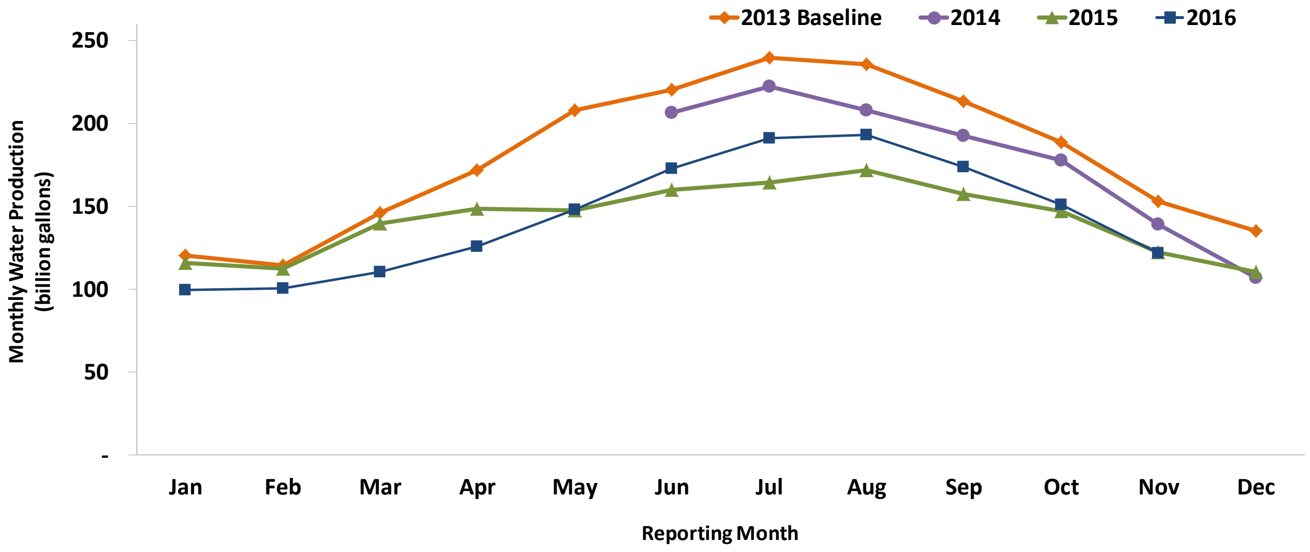
Jose, Downey, Clovis, Fairfield, Santa Maria, California-American Water Company Los Angeles District, and Santa Monica.

- Several suppliers among the 71 that reported water savings below 10 percent in November 2016 had achieved water conservation above 20 percent in November 2015. Among formerly high water savers but conserving less than 10 percent this year were Rubio Canyon Land and Water Association, Rancho California Water District, Riverside Highland Water Company, and Coalinga.

In looking at the data, percentage savings alone do not tell a complete story of conservation achievement. Suppliers with already low R-GPCD use are taking more significant efforts to save water with small percentage reductions than big users of water for whom it easier to save water, particularly on outdoor ornamental landscapes. Despite less than 10 percent water savings in November 2016, examples of communities with low R-GPCD and already significant conservation and efficiency achievements include San Diego, Irvine Ranch Water District, Sweetwater Authority, Park Water Company, California-American Water Company San Diego District, Compton, Golden State Water Company Florence Graham, Paramount, Estero Municipal Improvement District, and Eureka.

Statewide Water Production Trends

The graph below shows the statewide trends in water production from June 2014 through November 2016.



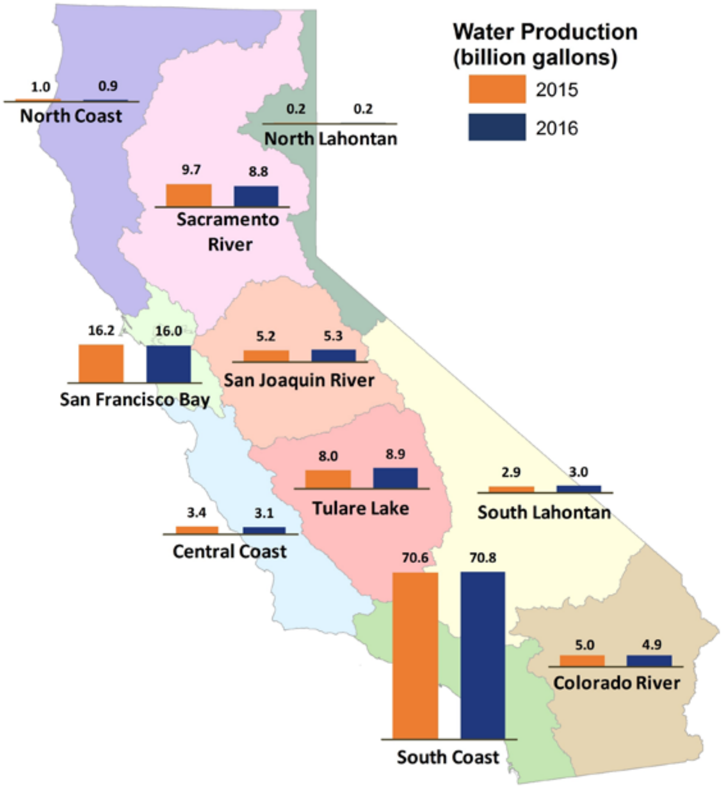
Statewide Water Conservation Results
Water Production June 2014 - November 2016 (Billion Gallons)

CALIFORNIA Water Boards

Fact Sheet

Water Savings by Hydrologic Region June 2015 to November 2016

Hydrologic Region	Jun 15	Jul 15	Aug 15	Sep 15	Oct 15	Nov 15	Dec 15	Jan 16	Feb 16	Mar 16	Apr 16	May 16	Jun 16	Jul 16	Aug 16	Sep 16	Oct 16	Nov 16
Central Coast	30.6%	31.9%	28.1%	26.9%	24.1%	27.3%	24.7%	19.2%	20.7%	30.4%	29.0%	31.5%	24.7%	26.4%	25.4%	24.9%	26.8%	27.9%
Colorado River	25.2%	34.0%	24.7%	17.4%	24.4%	21.3%	10.8%	28.5%	18.0%	17.6%	30.2%	29.3%	23.8%	23.7%	15.1%	7.2%	11.1%	20.8%
North Coast	16.0%	32.5%	19.7%	20.0%	16.8%	18.0%	20.3%	19.5%	14.4%	13.6%	27.7%	29.5%	8.9%	23.5%	15.5%	11.7%	21.8%	24.0%
North Lahontan	29.8%	32.4%	25.0%	16.2%	10.0%	12.9%	18.8%	27.7%	23.2%	18.4%	30.7%	42.7%	19.5%	13.9%	10.6%	7.6%	16.4%	16.6%
Sacramento River	36.3%	37.4%	34.5%	28.2%	25.5%	31.3%	24.6%	13.4%	20.6%	36.6%	30.4%	35.4%	23.4%	23.6%	18.7%	15.5%	30.7%	35.5%
San Francisco Bay	32.3%	32.3%	30.5%	25.3%	23.3%	26.8%	23.5%	13.2%	18.1%	25.1%	28.8%	30.9%	22.5%	22.4%	21.1%	17.9%	26.0%	27.5%
San Joaquin River	33.4%	34.7%	30.0%	26.7%	26.7%	31.1%	20.2%	15.4%	17.1%	35.2%	32.7%	34.3%	24.7%	24.3%	19.7%	19.2%	26.2%	29.3%
South Coast	22.9%	28.2%	23.7%	26.7%	20.6%	14.1%	15.9%	17.9%	6.9%	20.9%	22.8%	24.2%	19.9%	17.0%	15.3%	19.4%	15.6%	12.2%
South Lahontan	31.1%	35.9%	29.3%	25.8%	22.9%	18.8%	5.0%	18.4%	13.1%	27.8%	27.5%	25.3%	24.0%	17.0%	23.5%	13.4%	17.5%	15.2%
Tulare Lake	29.4%	32.2%	28.0%	25.9%	22.1%	28.3%	21.7%	15.8%	17.2%	27.0%	30.1%	31.1%	24.2%	22.7%	18.6%	18.9%	15.5%	18.2%
Statewide	**27.5%**	**31.3%**	**27.0%**	**26.2%**	**22.2%**	**20.2%**	**18.2%**	**17.2%**	**11.9%**	**24.3%**	**26.1%**	**28.1%**	**21.7%**	**20.1%**	**17.6%**	**18.2%**	**19.6%**	**18.8%**



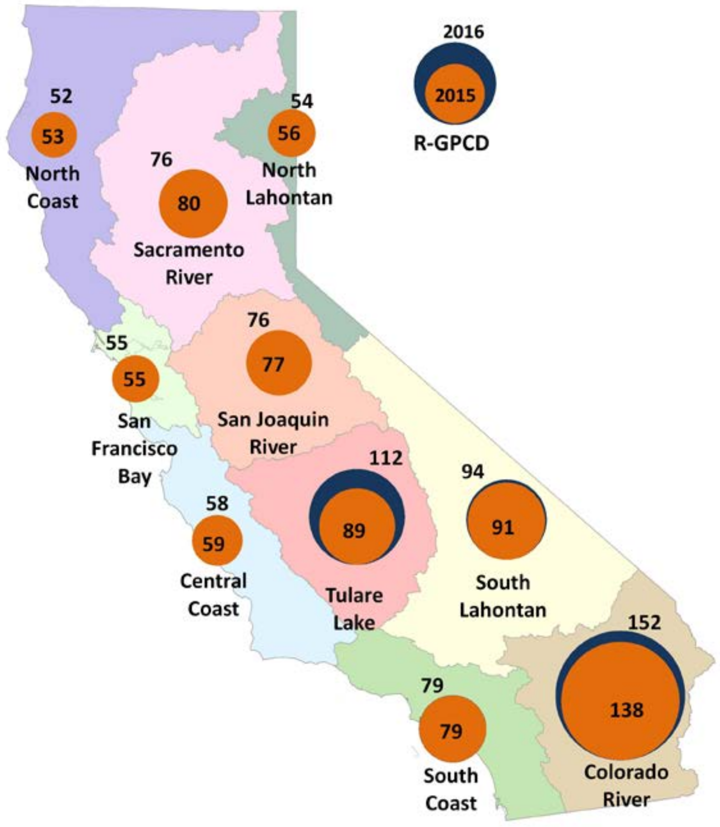
Water production by hydrologic region (in billions of gallons) for November 2016* (blue bars) compared to November 2015 (orange bars).

*Preliminary water production for November 2016, as 16 suppliers have not reported by December 20, 2016 when data were downloaded for analysis.

November 2016 savings by hydrologic region ranged from 12.2 percent to 35.5 percent. In November 2016, eight hydrologic regions reported higher percentage of water saved than in October 2016. Five hydrologic regions reported greater monthly savings in November 2016 than November 2015.

R-GPCD by Hydrologic Region June 2015 to November 2016

Hydrologic Region	Jun 15	Jul 15	Aug 15	Sep 15	Oct 15	Nov 15	Dec 15	Jan 16	Feb 16	Mar 16	Apr 16	May 16	Jun 16	Jul 16	Aug 16	Sep 16	Oct 16	Nov 16
Central Coast	75.9	76.2	76.4	76.2	70.5	59.5	53.3	49.1	53.2	52.2	62.9	70.7	80.4	82.6	80.0	79.3	70.0	58.1
Colorado River	169.9	153.8	171.8	161.9	132.0	138.4	111.3	93.0	105.5	110.2	127.2	141.5	169.9	179.5	195.8	181.6	161.3	151.6
North Coast	78.7	73.5	75.7	73.3	70.7	53.4	52.5	50.1	52.3	52.0	55.3	62.4	85.8	82.8	81.6	82.3	68.8	51.6
North Lahontan	115.2	113.5	117.7	113.4	81.4	56.2	61.6	57.9	54.7	54.0	57.7	78.5	133.8	142.8	127.6	128.1	77.1	54.5
Sacramento River	137.1	152.8	147.3	141.6	117.9	80.5	68.5	68.1	66.4	68.5	92.3	121.0	163.3	186.8	178.2	160.5	108.1	75.6
San Francisco Bay	70.0	72.0	72.3	72.2	67.4	55.1	51.0	49.5	51.1	50.9	57.4	65.9	79.3	81.3	82.0	79.8	65.1	54.6
San Joaquin River	127.2	130.7	131.5	123.4	102.5	76.8	66.7	61.6	67.0	67.1	84.3	107.5	138.1	150.0	149.5	130.8	103.2	75.7
South Coast	91.4	88.6	94.8	89.3	83.6	78.5	70.4	62.4	71.6	68.1	77.0	81.6	94.4	101.5	103.4	96.5	87.2	78.8
South Lahontan	133.3	131.3	148.3	129.7	107.1	90.6	73.9	68.0	69.3	78.1	98.5	116.4	145.4	160.9	149.2	146.4	109.0	94.1
Tulare Lake	154.9	162.5	164.0	150.2	124.4	88.8	76.8	69.7	70.6	79.3	99.3	128.2	167.0	190.4	187.6	176.0	143.5	112.2
Statewide	**98.1**	**98.1**	**102.2**	**96.9**	**87.2**	**75.6**	**67.2**	**61.1**	**67.2**	**66.0**	**77.0**	**86.9**	**105.0**	**113.5**	**113.7**	**106.4**	**89.8**	**76.6**



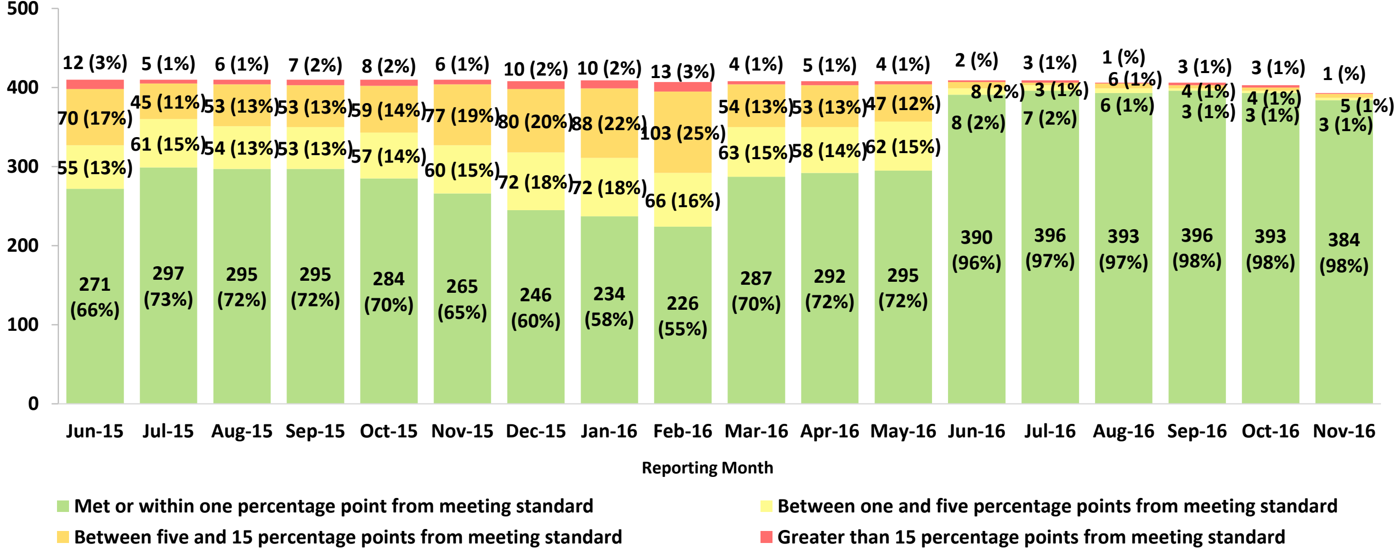
Residential Gallons per Capita per day (R-GPCD) for November 2016 (blue circles) compared to November 2015 (orange circles).

As stated above, The table provides the average monthly R-GPCD for June 2015 through November 2016, by hydrologic region. The average statewide R-GPCD for November 2016 was 76.6. Average hydrologic region R-GPCDs for November 2016 range from 52 to 152, with six hydrologic regions reporting lower R-GPCDs in November 2016 than they did in November 2015. All ten hydrologic regions had the average R-GPCD in November 2016 lower than in 2013.

Compliance

The stress-test based regulation that went into effect in June 2016 resulted in many suppliers having a zero percent conservation mandate, and nearly all of those suppliers are in compliance by having water production levels below 2013 levels (the baseline year for the emergency regulation). Information about the Board's compliance actions is located here

With 393 water supplier reports submitted for November, 384 suppliers (98 percent) met or were within one percentage point of their conservation standard; three suppliers (1 percent) were between one and five percentage points of meeting their conservation standard; five suppliers (1 percent) were between five and 15 percentage points of meeting their conservation standard, and one supplier was more than 15 percentage points from their conservation standard.


Conservation Standard Compliance June 2015 to November 2016*

* Includes suppliers under alternative compliance orders. Alternate compliance orders do not substitute for individual conservation standards, however, suppliers meeting the terms of their alternate compliance orders are not priorities for enforcement.

Caring for Trees While Conserving Water

Saving trees is important for cooling city streets and public safety, and watering them is essential and requires some care. That is why the Save Our Water campaign has partnered with California ReLeaf to provide residents with tips on how to maintain trees while reducing outdoor water use. Information is available at: www.saveourwater.com/trees.

Rebate Programs for Turf Removal and Toilet Replacement

Inefficient toilets and turf grass use large volumes of water, and present opportunities for significant water savings. Rebates are now available at: http://saveourwaterrebates.com/.

CALIFORNIA
Water Boards

Fact Sheet

Background

In his April 1, 2015 Executive Order, in light of three unusually dry years, including the worst snowpack in 500 years, Gov. Edmund G. Brown Jr. mandated a 25 percent water use reduction by users of urban water supplies across California. In May 2015, the State Water Board adopted an emergency regulation requiring a 25 percent reduction in overall potable urban water use statewide from June 2015 through February 2016 compared with 2013. The board implemented tiered conservation requirements, ranging from 8 percent to 32 percent, so that areas that had reduced their per capita water use over the years had lower targets than those areas using more water per person.

On Feb. 2, 2016, based on Gov. Brown's November 2015 Executive Order, the State Water Board approved an updated and extended emergency regulation. The extended regulation responded to calls for continuing the conservation structure that had spurred such dramatic savings while providing greater consideration of some factors that influence water use: climate, population growth and significant investments in new local, drought-resilient water supplies such as wastewater reuse and desalination.

On May 9, 2016, Governor Edmund G. Brown Jr. issued Executive Order B-37-16, requiring the Board to adjust its emergency water conservation regulation through the end of January 2017 in recognition of improved urban water supply conditions across the state and, separately, take action to make some of the requirements of the regulation permanent. The Board adopted the revised regulation on May 18. June was the first month under the revised regulation.

Since June 2014, the State Water Board has been tracking water conservation for each of the state's larger urban water suppliers (those with more than 3,000 connections) on a monthly basis. Compliance with individual water supplier conservation requirements is based on cumulative savings. Cumulative tracking means that conservation savings will be added together from one month to the next and compared to the amount of water used during the same months in 2013.

California has been dealing with the effects of an unprecedented drought. To learn about all the actions the state has taken to manage our water system and cope with the impacts of the drought, visit Drought.CA.Gov. Every Californian should take steps to conserve water. Find out how at SaveOurWater.com. While saving water, it is important to properly water trees. Find out how at www.saveourwater.com/trees. In addition to many effective local programs, state-funded turf removal and toilet replacement rebates are also available. Information and rebate applications can be found at: www.saveourwaterrebates.com/.

(This fact sheet was last updated Jan. 3, 2017)

EXHIBIT 7

UNITED STATES OF AMERICA
FEDERAL ENERGY REGULATORY COMMISSION

Turlock Irrigation District
and
Modesto Irrigation District

Project No. 2299

AFFIDAVIT OF ANSON B. MORAN

I, Anson B. Moran, do hereby declare as follows:

1. I am General Manager of the Public Utilities Commission for the City and County of San Francisco, and have been so employed since December, 1993. Prior to my appointment to this position, I was General Manager of the Hetch Hetchy Water and Power Department since 1988. Prior to that position, I was Assistant General Manager, Finance for the San Francisco Public Utilities Commission. I Joined the Public Utilities Commission in 1980.

2. I serve on the Boards of the California Water Education Foundation and California Municipal Utilities Association, and am currently Chairman of the California Urban Water Agencies. I have a Bachelor of Science in Electrical Engineering from Worcester Polytechnic Institute and a Master of Arts in Urban Studies from Occidental College.

3. I am responsible for the actions of the Hetch Hetchy Water and Power Department and San Francisco Water Department which supply water to a population of approximately 2.3 million people within the counties of Tuolumne, Alameda, Santa Clara, San Mateo, and San Francisco.

4. In this affidavit, I address the subject of the planning and operation the City's water facilities during drought.

Specifically, I address the basis of the procedures the City used to determine the rationing that was implemented during the recent drought, and which are incorporated in the City's water supply planning studies.

5. The City's "operation rule" was developed during the course of the recent 1987-1992 drought. Never before had such a sustained drought been experienced by the City. The onset of the drought really began in 1986, the point in time when the City's reservoirs were last filled, and continued until June, 1993 when the City's reservoirs finally refilled to full capacity. This drought spanned approximately 7 years.

6. Water deliveries to City customers at the time the drought began amounted to approximately 293 million gallons per day (MGD)(328,000 acre-feet per year). During the 1987-1992 period the City received from Tuolumne River runoff an average of only 151,500 acre-feet per year, and from local Bay area water sources approximately 20,700 acre-feet per year. The deficit between water supplies and water demands during the drought became readily apparent as the drought progressed, requiring an extreme dependence on Tuolumne River reservoir storage to partially close the gap.

7. The City proceeded with operations at the onset of the drought in accordance with procedures based on the experience of many years of historical operation, including the knowledge of previous drought events such as had occurred in 1976-1977. The operation of the City's facilities in accordance with rules based only on historical data proved to be a mistake.

8. The City learned the painful lesson as to the adverse impacts that are caused by not planning for a drought worse than any experienced to date. This lesson was driven home when the hydrology of the Tuolumne River and the City's operations through 1990 and early 1991 had created a situation where a 45 percent rationing program among City customers was initiated - a level of rationing that was found to be intolerable and not achievable.

9. The City and its customers implemented numerous drought-related and long-term water conservation programs to lessen water demand, with water demand ultimately being reduced by approximately 30 percent as compared to pre-drought deliveries. The City also purchased water from other entities to narrow the gap between supplies and demands. These actions along with a fortuitous storm during the spring of 1991 allowed the City to regain control of its system and efforts moved forward to better plan for the reliability of the City's water deliveries.

10. Significant questions regarding how the City would operate its water system had to be addressed. Several of these questions were as follows:

- How much water should the City maintain in storage in one year to assure water deliveries during the next year?
- To what level and for what duration can the City expect its customers to reduce water use?
- How long a period should the City expect the drought to continue?
- During the drought period, what water supplies (e.g., inflow to City reservoirs) should be expected to occur?

The answers to these fundamental questions are intertwined, and result in the operation rule that the City now uses to guide City water delivery operations.

11. However, underlying the answers to these questions is an appreciation of the risk that is inherent in operating to any rule. In the case of the City's water deliveries, risk is the product of the probability (frequency) of water shortages and the consequences of those shortages.

12. The frequency of potential shortages is forecasted with modeling tools that integrate assumptions for each of the above questions.

13. The consequences of shortages include economic, socio-economic, environmental, and personal (human) impacts.

14. What makes San Francisco's situation unusual is the consequence of being wrong in our forecast. Because of our entitlement structure, and limited conveyance and treatment capacity, an additional, unforecasted year of drought could literally result in empty reservoirs, no entitlements, and little or no alternate source of water. We could have no water to serve our 2.3 million customers.

15. In the spring of 1991 these consequences achieve a sobering clarity. I became acutely aware of the physical constraints of the City's water conveyance, treatment and delivery facilities; the availability of, and limitations to movement of supplemental emergency water supplies into the City's system; and the uncertainty as to when the drought would finally end. Due to the extremely limited conveyance and treatment capacity system to

bring other emergency sources of water to the City, the City must rely on storage in the Tuolumne River basin to ride out droughts. The City just does not have other sources to call on during drought, such as turning on pumps. In addition, I had first-hand information as to the direct and indirect adverse impacts that were occurring to the City's customers as the result of water shortages.

16. Situated within the drought, I weighed all the above factors and supported the operation rule that is currently used by the City in practice, and incorporated in the planning studies submitted to FERC. That plan was tested as it was developed and is the direct product of real, on-the-line decision making. When considering all the factors associated with the City's entitlements to water, its physical system, and the dire consequences of just being wrong in the forecasting of the length of drought that may hit the City, I can not agree with any comment that the City's operation rule is overly conservative.

I declare under penalty of perjury that the foregoing is true and correct.

Date: Jan 26, '94

Anson B. Moran

EXHIBIT 8

Budget Workshop

BOARD MEETING

MAY 26, 2016

Alameda County Water District

Agenda

- Who, What, Where
- Drought Impact
- Budget Review
- Capital Improvement Program (CIP) Review
- Financial Forecasting
- Customer Usage Analysis
- Drought Surcharge/Ordinance
- Next Steps

A Few Words and the BIG Picture

- Commitment to Customer Service
  - Water supply, Water Quality, Reasonable Price
- Drought Impact
- Water Rates
- Other Ongoing and Future Challenges
- Commitment to Transparency
- Financial Practices

Who We Are

Mission Statement

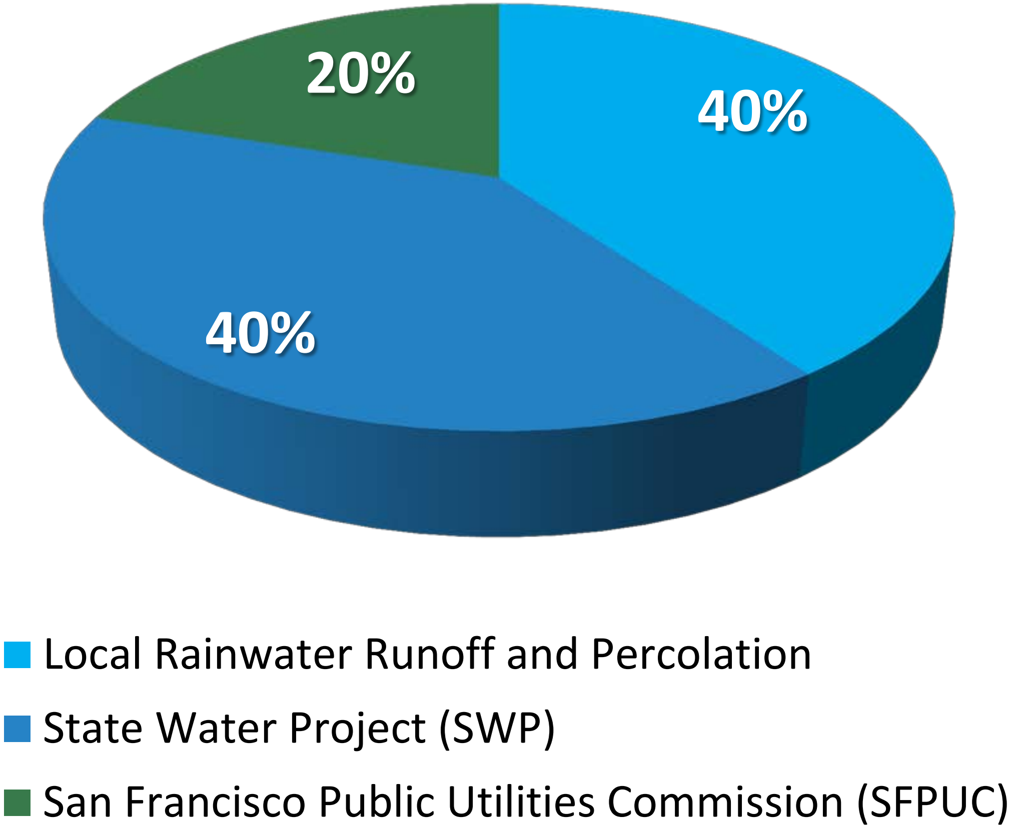
It is the mission of the District to provide a reliable supply of high quality water at a reasonable price to our customers. To fulfill this mission, the District will:

- Provide prompt, courteous, and responsive customer service.
- Ensure that sound, responsible financial management practices are observed in the conduct of district business.
- Plan, design, and operate district facilities efficiently, effectively, and safely, bearing in mind our responsibility to be a good neighbor and a good steward of the environment.
- Promote ethical behavior in the conduct of district affairs and facilitate the public's involvement in the planning and development of district policy.
- Recruit and retain a qualified, productive workforce and maintain a workplace environment where diversity and excellence are valued and where creativity, teamwork, and open communication are actively encouraged.

Who We Are

- Established in 1913
  - County Water District Law: Water Code §30000 et seq.
- Service Area: Cities of Fremont, Newark, and Union City
  - Population: 344,000
  - Connections: 82,000
- Special District – Form of Local Government
- Elected Board: 5 Directors
- Personnel: 230 Authorized FTEs
- Credit Ratings
  - Standard & Poor’s: AAA
  - Moody’s: Aa2

Water Supply Sources – Average Year



Niles Cone Groundwater Basin

Peralta-Tyson Blending Facility

- Groundwater from pumped wells is blended with water from SFPUC Hetch-Hetchy
- Capacity: 50 MGD

Newark Desalination Facility

- Desalination of brackish groundwater
- Capacity: 12.5 MGD
- Constructed in 2003
- Expanded in 2009

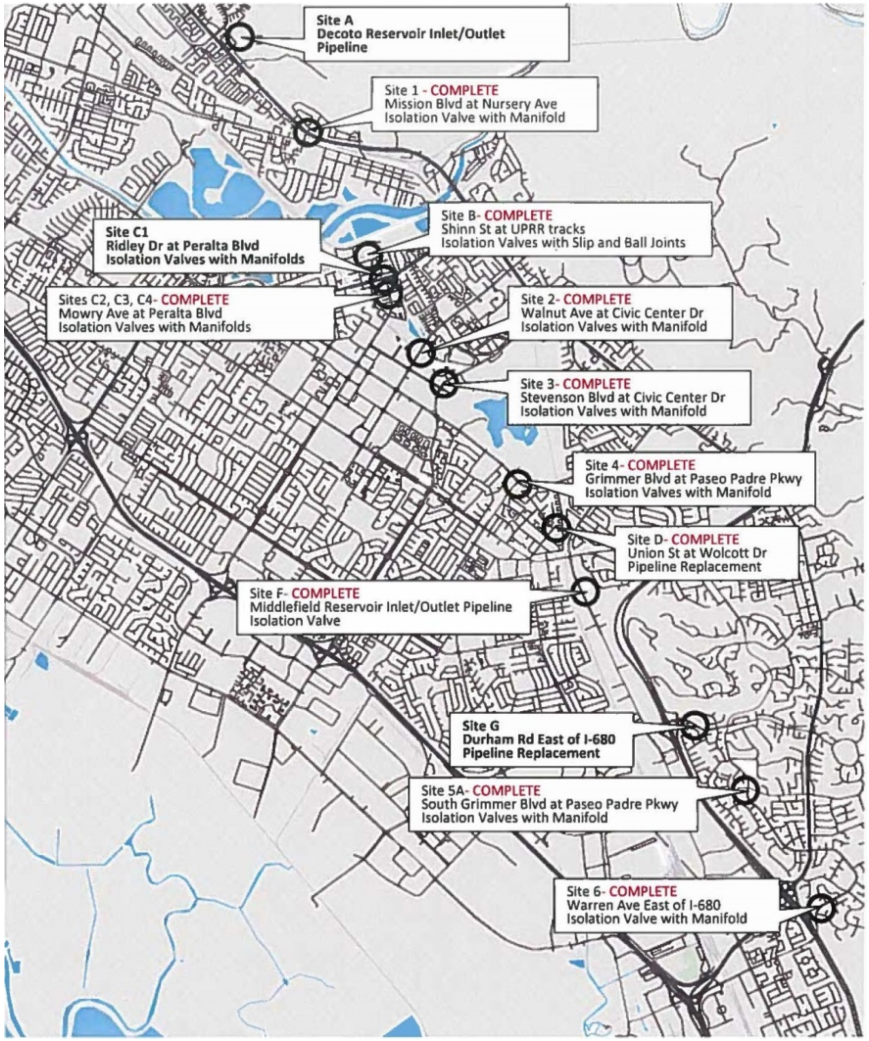
Mission San Jose Treatment Plant (TP1)

- Constructed: 1975
- Upgraded: 2004
- **Decommissioned: 2015**
- 4 MGD Capacity

Water Treatment Plant No. 2 (TP2)

- Constructed: 1992
- Upgraded: 2014
- Capacity: 26 MGD
- Ozone Generation

~900 Miles of Water Mains



What We Do

What We Do
(Responsibilities)

Ensure a Reliable, High Quality, Water Supply

- Maximize water supply reliability through the optimization of multiple sources of supply
- Consistently meet or surpass all State and Federal drinking water regulations
- Protect and manage the Niles Cone Groundwater Basin
- Comply with all environmental regulations, including the Endangered Species Act
- Attract and retain highly qualified employees to operate and maintain complex system

Provide Excellent Customer Service, including Conservation Assistance and Education

Ensure District Financial Sustainability and Resiliency

- Use lower cost water supplies as much as possible
- Improve productivity and efficiency
- Maintain reasonable rates (lower half of major Bay Area water providers)
- Maintain AAA bond rating

Maintain Capital Infrastructure

- Identify, prioritize and successfully complete highest priority CIP Projects
- Seismically improve critical infrastructure

Where We Are

Where We Are - District Overall
(Accomplishments)

Improved Water Supply as a result of Operational Adjustments and Strategic Partnerships

Maintained High Level of Water Service Reliability and Water Quality

Addressing Financial Challenges due to the Drought and Low Water Demands

- Multiple Financial Board Workshops

Maintaining and Improving Critical Infrastructure

- Completing Most Essential Highest Priority Capital Projects Due to Financial Challenges
- Planned Seismic Improvements Implemented

Productivity and Efficiency

- Reorganization Complete – increased synergies
- Organizational Assessment / benchmarking with other agencies
- Implementation of New Technology
  - Sharepoint Rollout
  - CityWorks Implementation

Where We Are - Office of the General Manager
(Accomplishments)

Improved transparency and accountability to the customers of the District through a comprehensive revision of the Board Rules

Maximize productivity and efficiency

- Ongoing organizational assessment of the District's Departments
- Maintaining current staffing levels in challenging environment
- Consolidating several Management/Supervisor positions
- Continued focus on staff development

Increased community and media relations activities

Strategically worked with other organizations to benefit ACWD's ratepayers

- ACWA – Pursuing legislation to facilitate Low Income Assistance programs
- CUWA – Opposing proposed Public Goods Charge
- BAWAC – Bay Area Regional Reliability (BARR) Project

Where We Are - Operations
(Accomplishments)

Met or surpassed all primary drinking water regulations 100% of the time

- Completed triennial Lead & Copper Tap Sampling program
- Performed over 30,000 water quality analyses

Environmental Stewardship – Complied with all Federal, State and local regulations

Developed asset management programs to ensure equipment, facility, and distribution system reliability

Conducted NIMS/SEMS ICS emergency response training w/ DMD staff

- Collaborated with USD to repair sinkhole on Alvarado Blvd, UC

Operational efficiencies and cost savings

- Decommissioned San Jose Treatment Plant #1 ($4.0M)
- Maximized use of Newark Desalination Plant ($2.3M annually)
- WTP2 treatment process and power optimization ($500K annually)
- Interagency bulk buying of water treatment chemicals ($400K to date)

Where We Are - Engineering and Technology Svcs
(Accomplishments)

Information Technology

- Video recording and online-posting regular Board Meetings
- Cityworks (new GIS-based work order system)
- Sharepoint (enterprise collaboration/document platform)
- Alternate Disaster Recovery (DR) site at WTP2

Project Engineering

- Large Diameter Hayward Fault Seismic Retrofit Project
- Rubber Dam #1 Replacement following vandalism
- Appian Tank Project and Pipeline Seismic Upgrades

Development Services

- Improvement plans, Agreements, Permits– meeting target completion dates
- Processed over 306 customer job orders for over 114 customer projects

Where We Are - Water Resources
(Accomplishments)

Implemented Planning and Conservation Programs

- Met extraordinary demand for conservation programs during water shortage emergency
- Completed draft Urban Water Management Plan
- Submitted Concept Paper for the Lake Del Valle Storage Expansion Project

Managed Water Supplies and Protected Watershed

- Placed newly-replaced Rubber Dam 1 into full operation
- Optimized imported water supply sources during the drought
- Responded to water quality threats in watershed

Managed and Protected the Groundwater Basin

- Completed draft Salt and Nutrient Management Plan
- Completed Niles Cone Saltwater Intrusion grant project
- Submitted a SGMA Basin Boundary Modification Request

Where We Are - Finance
(Accomplishments)

Customer Service and Meter Reading

- Developed stronger cash internal controls and billing system audits in Customer Service.
- Review of AMI future and improvements in Meter Reading
- Developed Customer Assistance Program alternatives

Procurement and Contracts

- Improved business processes

Budgets and Financial Analysis

- Conducted multiple finance workshops for Board
- Insight Budget software milestone of training managers to use software

Accounting and Treasury

- Received a clean audit. Maintaining AAA status.
- JDE implementation and new chart of accounts is stabilizing. Better, faster, quicker reporting
- Business processes improved for more efficiency, less redundancy and writing Standard Operating Procedures

Where We Are Going

Where We Are Going - District
(Challenges)

Maintaining Financial Health

- Debt Service Coverage, Bond Requirements
- Income Statement Bottom Line, AAA Status
- Fixed Operating Costs are 70% of all Operating Costs
- Staff working on efficiencies and cost savings
- Identify and apply for grant funding

Drought Impacts

- Reduced Water Consumption
- Reduced Rate Revenue
- Deferral of capital projects
- Governor's Executive Orders and State Board's Emergency Regulations

Infrastructure Replacement and Seismic Improvements

- Reservoir Structural Improvements (Roofs, etc.): ~ $28M
- Main Replacement and Seismic Improvement Program (MRSUP): ~$10 M/yr

Groundwater Basin Issues

- City of Hayward attempting to leverage SGMA to redefine ACWD's boundaries
- SGMA Implementation

Where We Are Going - District
(Challenges)

Water Supply Reliability

- Vallecitos Channel Improvements: ~$1M - $7M
- Kaiser Pond Embankment Improvements $ ~300K - $1.6M
- Rock Pond Pipeline ~$900K

Regulatory – Comply with Endangered Species Act

- Fish Ladder and Fish Screen Projects: ~$38M (anticipated reimbursement of ~$8M from ACFC)
- Environmental Stewardship – Implement new State NPDES Drinking Water System Discharge Permit

Ongoing Statewide Drought

- Maintain conservation efforts with conservation assistance program, and community outreach

SFPUC Rate Increases

- 9.3% for FY 2016/17 - ~$2.2 million
- Effective increase of 127% over last six years
- Projected increase of 47% over next five years

Regional and Local Water Supply Projects

- Optimize water supply sources
- Joint Recycled Water Evaluation with Union Sanitary District

Where We Are Going - District

(Challenges)

District Productivity and Efficiency

- Implementation of SharePoint collaboration platform
- Advanced Metering Infrastructure (AMI) Pilot Planning Study
- Continue implementation of asset management programs for Facilities and Distribution System
- Continue process improvements related to new development
- CyberSecurity, Disaster Recovery, Telephone System Improvements

CalPERS and OPEB Liabilities

- Continued funding of Annual Required Contribution (ARC)
- Accelerated payment plan delayed to FY 2021/2022
- CalPERS Employer Contribution Rate increased 15% over last five years
- CalPERS Employer Contribution Rate projected to increase 24% over next five years

Staffing Levels and Staff Development

- Employee attrition, internal reorganizations, and retirements: 17 recruitments YTD
- Koff and Associates Organizational Assessment Study scheduled to be completed by June 30, 2016
- Participate and maintain involvement in BAYWORK, a regional collaborative of water and wastewater agencies working together to ensure workforce reliability and succession planning

Where We Are Going - District
(Challenges)

Emergency Response and Security

- Expand emergency preparedness and response training District-wide
- Evaluate District security measures to develop new strategic security improvement plan

Water Quality

- Continue providing high quality water to our customers

Transparency

- Begin posting Board Meeting videos on District's website
- Improve website information and reporting

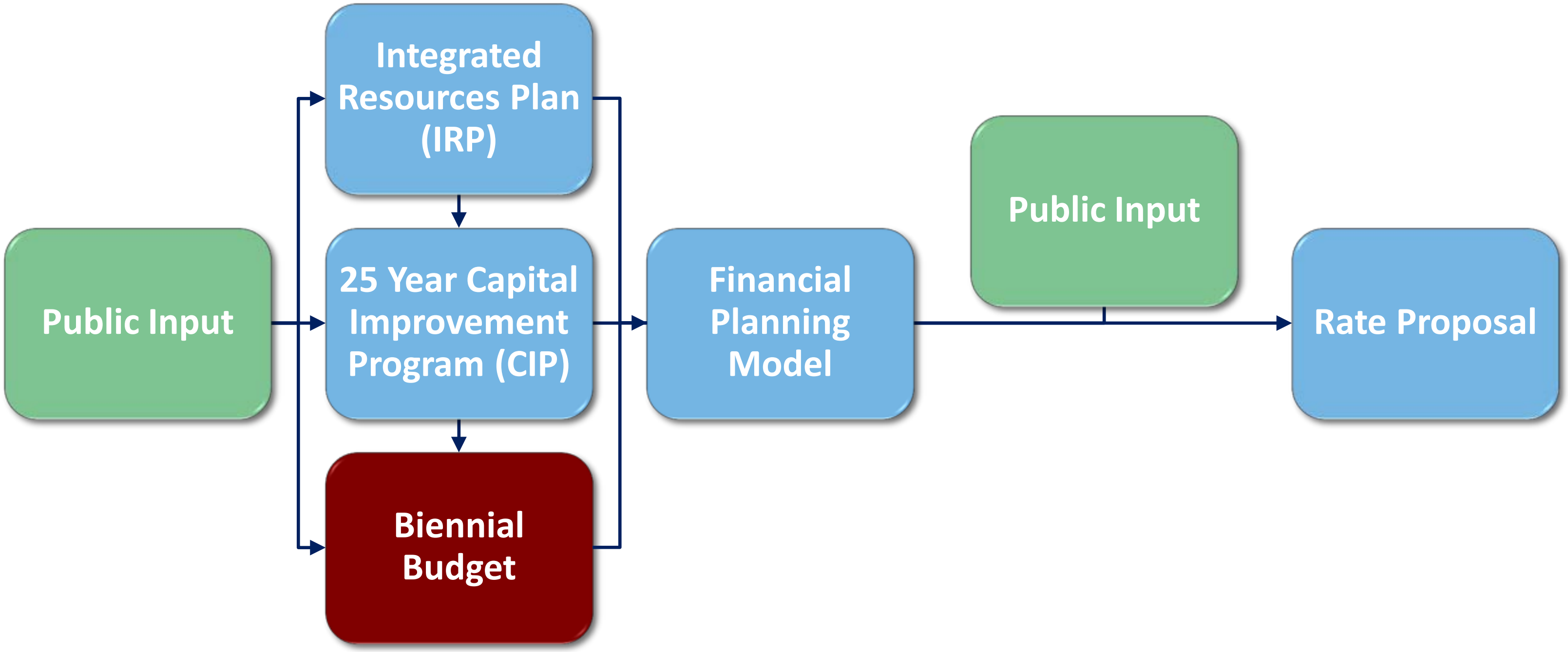
Community and media relations

- Conduct several public meetings on various topics of interest
- Conduct public tours of key District facilities

Potential Major Initiatives for Future Board Consideration

- Projected Costs not included in Budget/Financial Planning Model (ACWD Share)
  - California Water Fix (Studies: $200K/Project: $120M)
  - Los Vaqueros (Studies: $100K)
  - LVE w/ Trans-Bethany pipeline: ($267M)
  - Lake Del Valle (Studies: $100K-$200K)
  - Sites Reservoir (Studies & “Down Payment”: $600K-$1.8M)
  - Bay Desalination: $323M-$464M

District Financial Planning Process



Public Input

Integrated Resources Plan (IRP)

25 Year Capital Improvement Program (CIP)

Biennial Budget

Financial Planning Model

Public Input

Rate Proposal

Drought Impact

Drought Timeline

January 17, 2014

- Governor declares drought State of Emergency
- ACWD issues request for 20% voluntary reduction

March 13, 2014

- ACWD adopts Declaration of Water Shortage Emergency and Water Use Ordinance to achieve 20% reduction service area-wide

July 17, 2014

- ACWD adopts Drought Surcharge

April 1, 2015

- Governor directs State Water Resources Control Board to implement 25% statewide mandatory water reductions

May 5, 2015

- State Water Resources Control Board adopts conservation standards; ACWD assigned a conservation standard of 16%

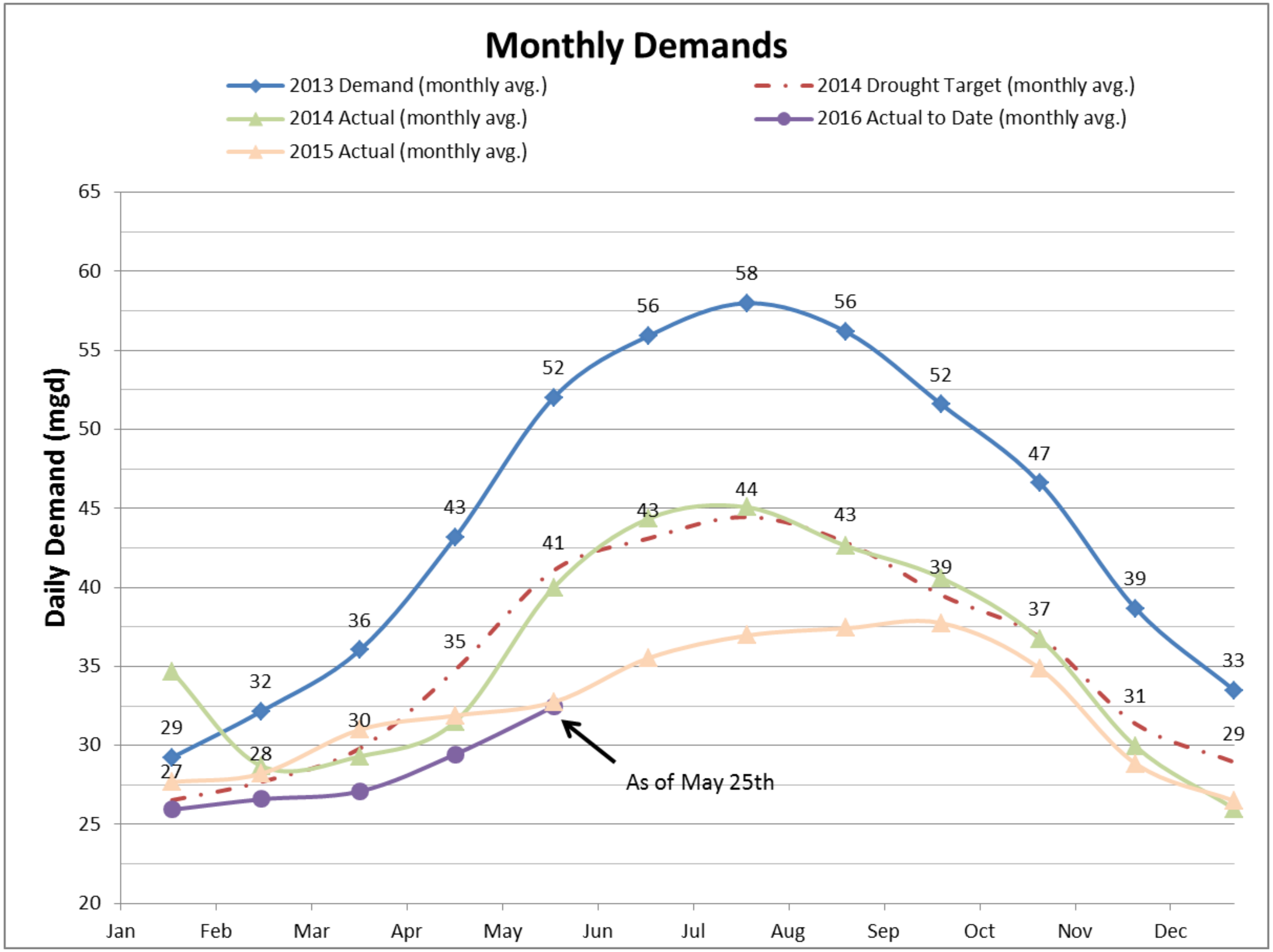
May 9, 2016

- Governor issues Executive Order B-37-16, “Making Water Conservation A California Way of Life”
- Governor directs State Water Resources Control Board to adjust emergency water conservation regulations

May 18, 2016

- State Water Resources Control Board adopts self-certification of supply reliability

Drought Impact (Production Demand)



Drought Impact (Consumption)

	FY 2013/14 Actual	FY 2014/15 Actual	% Variance Prior FY	FY 2015/16 Estimate	% Variance Prior FY	% Variance Cumulative
Residential Single Family	9,426,499	7,225,175	-23.4%	6,178,857	-14.5%	-34.5%
Residential Multi-Family	3,534,663	3,117,916	-11.8%	2,955,414	-5.2%	-16.4%
Residential Landscape	703,862	473,510	-32.7%	352,409	-25.6%	-49.9%
Total Residential	**13,665,024**	**10,816,601**	**-20.8%**	**9,486,680**	**-12.3%**	**-30.6%**
Business	2,072,443	2,019,549	-2.6%	1,903,010	-5.8%	-8.2%
Business Landscape	693,195	382,507	-44.8%	283,953	-25.8%	-59.0%
Industrial	1,012,568	970,957	-4.1%	928,700	-4.4%	-8.3%
Industrial Landscape	486,804	370,171	-24.0%	266,515	-28.0%	-45.3%
Others (e.g., Cities, Churches)	775,132	569,210	-26.6%	442,300	-22.3%	-42.9%
Others Landscape	510,725	364,583	-28.6%	291,546	-20.0%	-42.9%
Total Non-Residential	**5,550,867**	**4,676,977**	**-15.7%**	**4,116,024**	**-12.0%**	**-25.8%**
Wells Agriculture	218	117	-46.1%	231	97.0%	6.1%
Wells Industrial & Joint Use	1,237	1,224	-1.1%	1,473	20.3%	19.1%
Wells Municipal	612	671	9.7%	622	-7.3%	1.7%
Total Wells	**2,066**	**2,012**	**-2.6%**	**2,326**	**15.6%**	**12.5%**
Hydrant	101,622	90,263	-11.2%	105,916	17.3%	4.2%
Total Billed Demand	**19,319,580**	**15,585,854**	**-19.3%**	**13,710,945**	**-12.0%**	**-29.0%**

Drought Impact (Rate Revenue)

	FY 2013/14 Actual	FY 2014/15 Actual	% Variance Prior FY	FY 2015/16 Estimate	% Variance Prior FY	% Variance Cumulative
Service Charges						
Residential	15,040,914	17,045,024	13.3%	22,268,762	30.6%	48.1%
Business	1,521,311	1,738,333	14.3%	2,378,733	36.8%	56.4%
Industrial	807,187	955,482	18.4%	1,306,418	36.7%	61.8%
Others (e.g., Cities, Churches)	840,073	959,069	14.2%	1,227,276	28.0%	46.1%
Hydrant	234,180	305,312	30.4%	349,452	14.5%	49.2%
Total Service Charges	**18,443,665**	**21,003,219**	**13.9%**	**27,530,642**	**31.1%**	**49.3%**
Commodity Rates						
Residential	41,744,388	33,303,016	-20.2%	30,982,478	-7.0%	-25.8%
Business	8,749,502	7,886,517	-9.9%	7,897,171	0.1%	-9.7%
Industrial	4,714,438	4,386,092	-7.0%	3,795,485	-13.5%	-19.5%
Others (e.g., Cities, Churches)	4,102,981	3,133,057	-23.6%	2,724,031	-13.1%	-33.6%
Wells	335,679	376,540	12.2%	479,958	27.5%	43.0%
Hydrant	309,286	215,763	-30.2%	362,019	67.8%	17.0%
Total Commodity Charges	**59,956,274**	**49,300,986**	**-17.8%**	**46,241,142**	**-6.2%**	**-22.9%**
Drought Surcharge	**-**	**5,576,657**		**5,655,094**	**1.4%**	
		-		-		
Total Rate Revenue	**78,399,940**	**75,880,862**	**-3.2%**	**79,426,878**	**4.7%**	**1.3%**

Drought Impact – Consumption and Revenue

	FY 2013/14 Actual	FY 2014/15 Actual	FY 2015/16 Estimate	Cumulative
Consumption (CCF)	19,319,580	15,585,854	13,710,945	
Consumption Reduction Compared to FY 2013/14		(3,733,726)	(5,608,635)	**(9,342,361)**
Commodity Rate Impact ($3.373/CCF)		($12,593,858)	($18,917,926)	**($31,511,784)**
Drought Surcharge		$5,576,657	$5,655,094	**$11,231,751**
Net Commodity Rate Impact				**($20,280,033)**
TP1 Decommission Savings (One-Time)			$3,936,600	$3,936,600
TP1 Decommission Savings (Ongoing)			$300,000	$300,000/yr

Budget Review

Budget Comparison

	FY 2014/15	FY 2015/16			FY 2016/17			
	Actual	Amended Budget	Estimated Actual	% Variance	Adopted Budget	Proposed Budget	% Variance	FY17 Prop FY 16 Est % Variance
BEGINNING CASH BALANCE	**$127,842,294**	**$115,844,100**	**$120,606,074**		**$104,504,700**	**$109,202,321**		
REVENUES								
Water Revenue	74,573,457	86,162,100	74,632,429	-13.4%	93,222,200	79,638,669	-14.6%	6.7%
Drought Surcharge	5,576,657	6,900,000	5,655,000	-18.0%	6,900,000	-	-100.0%	-100.0%
Ground Water Revenue	334,181	447,600	429,423	-4.1%	485,300	467,212	-3.7%	8.8%
Proceeds From Taxation	9,535,109	9,243,100	8,790,100	-4.9%	8,921,300	8,921,300	0.0%	1.5%
Interest Revenue	634,868	948,400	1,149,042	21.2%	889,100	1,016,839	14.4%	-11.5%
Facilities Connection Charges	1,937,104	2,019,000	4,375,177	116.7%	2,038,000	4,657,037	128.5%	6.4%
Other Revenue	1,021,219	2,938,700	1,332,756	-54.6%	2,513,100	4,646,150	84.9%	248.6%
Customer Jobs	4,950,705	2,472,000	2,800,000	13.3%	634,900	4,176,000	557.7%	49.1%
TOTAL REVENUES	**98,563,300**	**111,130,900**	**99,163,927**	**-10.8%**	**115,603,900**	**103,523,207**	**-10.5%**	**4.4%**
EXPENSES								
Source of Supply	30,405,945	36,792,700	33,512,817	-8.9%	35,761,200	38,474,351	7.6%	14.8%
Pumping	1,813,654	1,368,600	1,618,554	18.3%	1,420,400	1,420,387	0.0%	-12.2%
Water Treatment	14,949,323	16,790,300	14,232,695	-15.2%	17,244,100	15,711,059	-8.9%	10.4%
Transmission & Distribution	13,157,609	15,697,800	15,609,209	-0.6%	16,947,200	18,124,018	6.9%	16.1%
Customer Accounts	1,472,611	1,753,600	1,500,000	-14.5%	1,620,900	1,620,938	0.0%	8.1%
Administrative & General	37,553,506	37,850,900	38,468,895	1.6%	39,277,200	38,641,606	-1.6%	0.4%
Expenses Credit - Overhead	(24,882,076)	(25,523,900)	(23,793,821)	-6.8%	(26,233,500)	(27,605,373)	5.2%	16.0%
Expense Projects	2,020,358	1,869,200	814,000	-56.5%	313,700	1,503,390	379.2%	84.7%
TOTAL OPERATING EXPENSES	**76,490,930**	**86,599,200**	**81,962,349**	**-5.4%**	**86,351,200**	**87,890,376**	**1.8%**	**7.2%**
Capital Projects - GF	5,808,437	4,798,300	4,335,632	-9.6%	5,615,900	11,294,542	101.1%	160.5%
Capital Projects - Bond	11,843,167	17,436,300	11,909,108	-31.7%	11,156,700	5,119,088	-54.1%	-57.0%
Capital Projects - FIF	2,895,240	4,983,400	3,179,460	-36.2%	1,681,000	3,693,570	119.7%	16.2%
Customer Jobs	3,762,312	2,471,900	2,800,000	13.3%	2,513,100	4,176,000	66.2%	49.1%
Debt Service	4,999,434	6,381,200	6,381,131	0.0%	6,386,400	6,386,406	0.0%	0.1%
TOTAL NON-OPERATING EXPENSES	**29,308,590**	**36,071,100**	**28,605,331**	**-20.7%**	**27,353,100**	**30,669,606**	**12.1%**	**7.2%**
TOTAL EXPENSES	**105,799,520**	**122,670,300**	**110,567,680**	**-9.9%**	**113,704,300**	**118,559,982**	**4.3%**	**7.2%**
NET of REVENUES & EXPENSES	**(7,236,220)**	**(11,539,400)**	**(11,403,753)**		**1,899,600**	**(15,036,775)**		
ENDING CASH BALANCE	**$120,606,074**	**$104,304,700**	**$109,202,321**		**$106,404,300**	**$ 94,165,546**		

Reserves/Financial Indicators

	FY 2014/15	FY 2015/16		FY 2016/17		
	Actual	Amended Budget	Estimated Actual	Adopted Budget	Proposed Budget	Benchmark
General Fund						
Debt Service	$ 2,874,298	$ 2,860,634	$ 2,860,634	$ 2,860,634	$ 2,860,634	$ 3,000,000
Self-Insurance	1,745,200	-	-	-	-	-
Management Retirement Bonus	-	1,753,000	1,753,000	1,745,200	1,753,000	2,000,000
Emergency/Rate Stabilization	10,000,000	10,000,000	10,000,000	10,000,000	10,000,000	10,000,000
Operations & Maintenance and Capital	55,270,043	59,496,666	54,240,961	60,969,066	43,000,910	37,000,000
2015 Revenue Bond Fund	17,028,196	63,700	5,119,088	-	-	-
TOTAL GENERAL FUND RESERVES	**86,917,737**	**74,174,000**	**73,973,683**	**75,574,900**	**57,614,544**	**52,000,000**
FACILITIES IMPROVEMENT FUND RESERVES	33,688,337	30,130,700	35,228,639	30,829,400	36,551,004	30,130,700
TOTAL RESERVES	**$120,606,074**	**$104,304,700**	**$109,202,322**	**$106,404,300**	**$ 94,165,548**	**$82,130,700**

Debt Service Coverage	**4.41**	**3.37**	**2.58**	**4.09**	**2.03**	**1.5 - 3.0**
Debt Ratio	**0.17**	**0.18**	**0.17**	**0.18**	**0.17**	**0.2 - 0.4**
Current Ratio	**6.58**	**7.00**	**6.58**	**7.00**	**6.58**	**2.0 - 2.5**

Budget Comparison– Revenues

	FY 2015/16			FY 2016/17			
	Amended Budget	Estimated Actuals	% Variance	Amended Budget	Proposed Budget	% Variance	FY17 Prop FY16 Est % Variance
REVENUES							
Water Revenue	$ 86,162,100	$ 74,632,429	-13.4%	$ 93,222,200	$ 79,638,669	-14.6%	6.7%
Drought Surcharge	$ 6,900,000	$ 5,655,000	-18.0%	$ 6,900,000	$ -	-100.0%	-100.0%
Ground Water Revenue	447,600	429,423	-4.1%	485,300	467,212	-3.7%	8.8%
Proceeds From Taxation	9,243,100	8,790,100	-4.9%	8,921,300	8,921,300	0.0%	1.5%
Interest Revenue	948,400	1,149,042	21.2%	889,100	1,016,839	14.4%	-11.5%
Facilities Connection Charges	2,019,000	4,375,177	116.7%	2,038,000	4,657,037	128.5%	6.4%
Other Revenue	2,938,700	1,332,756	-54.6%	2,513,100	4,646,150	84.9%	248.6%
Customer Jobs	2,472,000	2,800,000	13.3%	634,900	4,176,000	557.7%	49.1%
TOTAL REVENUES	**111,130,900**	**99,163,927**	**-10.8%**	**115,603,900**	**103,523,207**	**-10.5%**	**4.4%**

Budget Comparison – Expenses (Cost Centers)

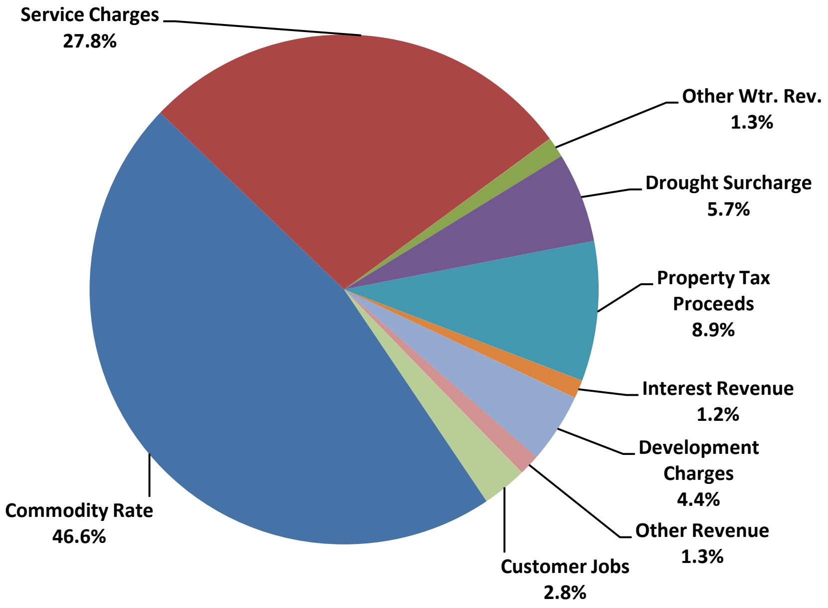
	FY 2015/16			FY 2016/17			
	Amended Budget	Estimated Actuals	% Variance	Amended Budget	Proposed Budget	% Variance	FY17 Prop FY16 Est % Variance
EXPENSES							
Source of Supply	36,792,700	33,512,817	-8.9%	35,761,200	38,474,351	7.6%	14.8%
Pumping	1,368,600	1,618,554	18.3%	1,420,400	1,420,387	0.0%	-12.2%
Water Treatment	16,790,300	14,232,695	-15.2%	17,244,100	15,711,059	-8.9%	10.4%
Transmission & Distribution	15,697,800	15,609,209	-0.6%	16,947,200	18,124,018	6.9%	16.1%
Customer Accounts	1,753,600	1,500,000	-14.5%	1,620,900	1,620,938	0.0%	8.1%
Administrative & General	37,850,900	38,468,895	1.6%	39,277,200	38,641,606	-1.6%	0.4%
Expense Transfer - Overhead	(25,523,900)	(23,793,821)	-6.8%	(26,233,500)	(27,605,373)	5.2%	16.0%
Expense Projects	1,869,200	814,000	-56.5%	313,700	1,503,390	379.2%	84.7%
TOTAL OPERATING EXPENSES	**86,599,200**	**81,962,349**	**-5.4%**	**86,351,200**	**87,890,376**	**1.8%**	**7.2%**
Capital Projects - GF	4,798,300	4,335,632	-9.6%	5,615,900	11,294,542	101.1%	160.5%
Capital Projects - Bond	17,436,300	11,909,108	-31.7%	11,156,700	5,119,088	-54.1%	-57.0%
Capital Projects - FIF	4,983,400	3,179,460	-36.2%	1,681,000	3,693,570	119.7%	16.2%
Customer Jobs	2,471,900	2,800,000	13.3%	2,513,100	4,176,000	66.2%	49.1%
Debt Service	6,381,200	6,381,131	0.0%	6,386,400	6,386,406	0.0%	0.1%
TOTAL EXPENSES	**$122,670,300**	**$110,567,680**	**-9.9%**	**$113,704,300**	**$118,559,982**	**4.3%**	**7.2%**

Budget Comparison– Expenses (Cost Elements)

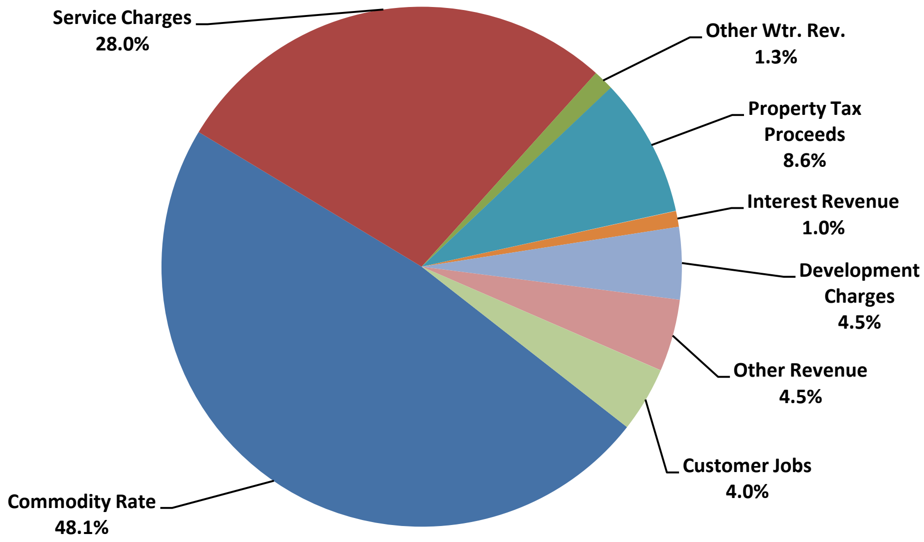
	FY 2015/16			FY 2016/17			
	Amended Budget	Estimated Actual	% Variance	Adopted Budget	Proposed Budget	% Variance	FY17 Prop FY16 Est '% Variance
Labor							
Operating	$ 24,936,352	$ 24,347,065	-2.4%	$ 26,267,749	$ 25,888,559	-1.4%	6.3%
Capital	2,223,200	1,590,607	-28.5%	2,012,100	1,872,005	-7.0%	17.7%
Customer Jobs	586,400	664,234	13.3%	593,700	937,800	58.0%	41.2%
Total Labor	**27,745,952**	**26,601,906**	**-4.1%**	**28,873,549**	**28,698,364**	**-0.6%**	**7.9%**
Purchased Water	27,792,582	25,307,217	-8.9%	26,349,105	29,062,269	10.3%	14.8%
Employee Benefits	14,679,900	14,672,774	0.0%	15,933,310	15,643,310	-1.8%	6.6%
OPEB	4,079,000	4,079,100	0.0%	4,211,000	4,211,000	0.0%	3.2%
Other Expenses							
Operating	15,111,366	13,556,193	-10.3%	13,590,036	13,085,238	-3.7%	-3.5%
Capital	24,994,800	17,833,593	-28.7%	16,441,500	18,235,195	10.9%	2.3%
Customer Jobs	1,885,500	2,135,766	13.3%	1,919,400	3,238,200	68.7%	51.6%
Total Other Expenses	**41,991,666**	**33,525,552**	**-20.2%**	**31,950,936**	**34,558,633**	**8.2%**	**3.1%**
Debt Service	6,381,200	6,381,131	0.0%	6,386,400	6,386,406	0.0%	0.1%
Total Expenses	**$122,670,300**	**$110,567,680**	**-9.9%**	**$113,704,300**	**$118,559,982**	**4.3%**	**7.2%**

Revenues

FY 2015/16 Estimated Actual



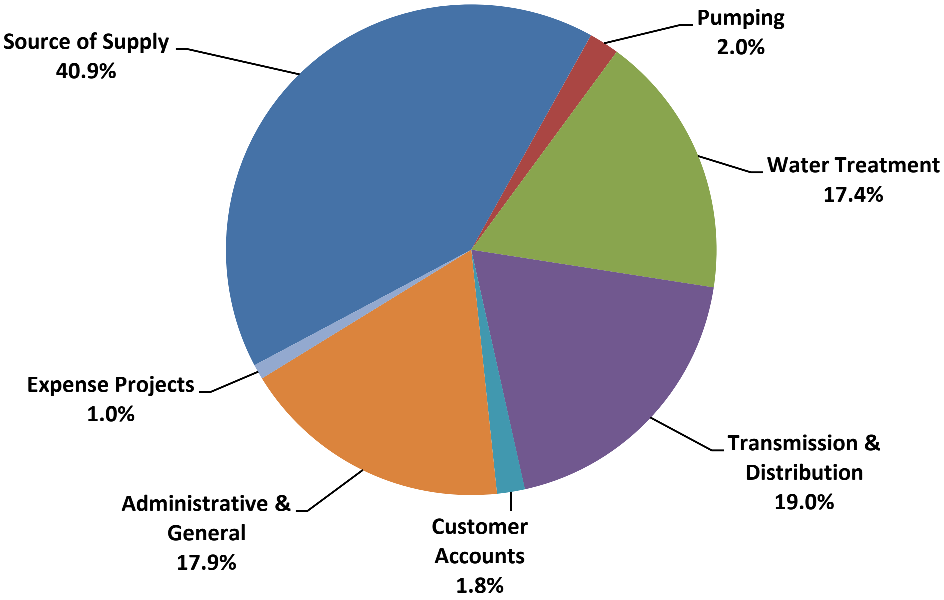
FY 2016/17 Proposed Budget

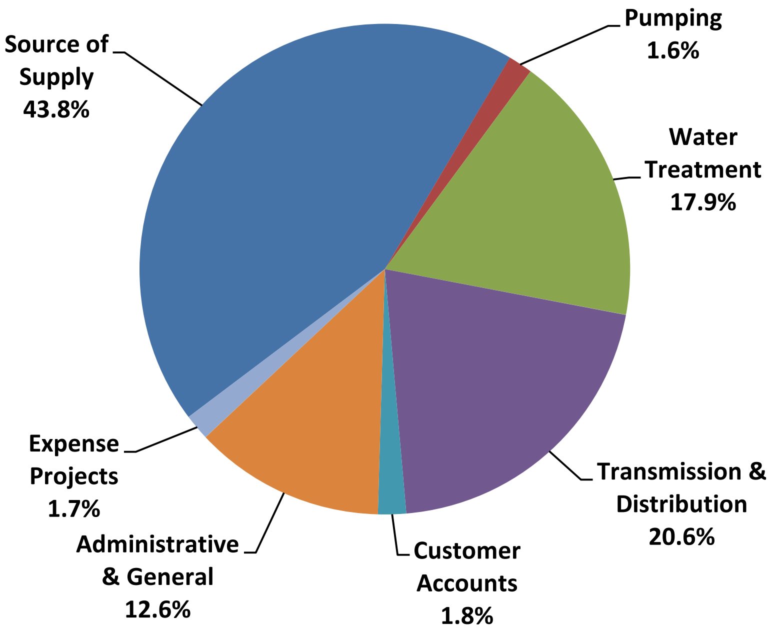


Revenues

	FY 2015/16			FY 2016/17			
	Amended Budget	Estimated Actual	% Variance	Adopted Budget	Proposed Budget	% Variance	FY17 Prop FY16 Est % Variance
Commodity Rate	$ 58,098,000	$ 46,241,142	-20.4%	$ 62,745,900	$ 49,790,136	-20.6%	7.7%
Service Charges	27,192,700	27,530,642	1.2%	29,597,800	28,984,531	-2.1%	5.3%
Other Wtr. Rev.	1,319,000	1,290,068	-2.2%	1,363,800	1,331,214	-2.4%	3.2%
Drought Surcharge	6,900,000	5,655,000	-18.0%	6,900,000	-		-100.0%
Property Tax Proceeds	9,243,100	8,790,100	-4.9%	8,921,300	8,921,300	0.0%	1.5%
Interest Revenue	948,400	1,149,042	21.2%	889,100	1,016,839	14.4%	-11.5%
Development Charges	2,019,000	4,375,177	116.7%	2,038,000	4,657,037	128.5%	6.4%
Other Revenue	2,938,700	1,332,756	-54.6%	634,900	4,646,150	631.8%	248.6%
Customer Jobs	2,472,000	2,800,000	13.3%	2,513,100	4,176,000	66.2%	49.1%
	$111,130,900	**$ 99,163,927**	**-10.8%**	**$115,603,900**	**$103,523,207**	**-10.5%**	**4.4%**

Operating Expenses


FY 2015/16 Estimated Actual


FY 2016/17 Proposed Budget

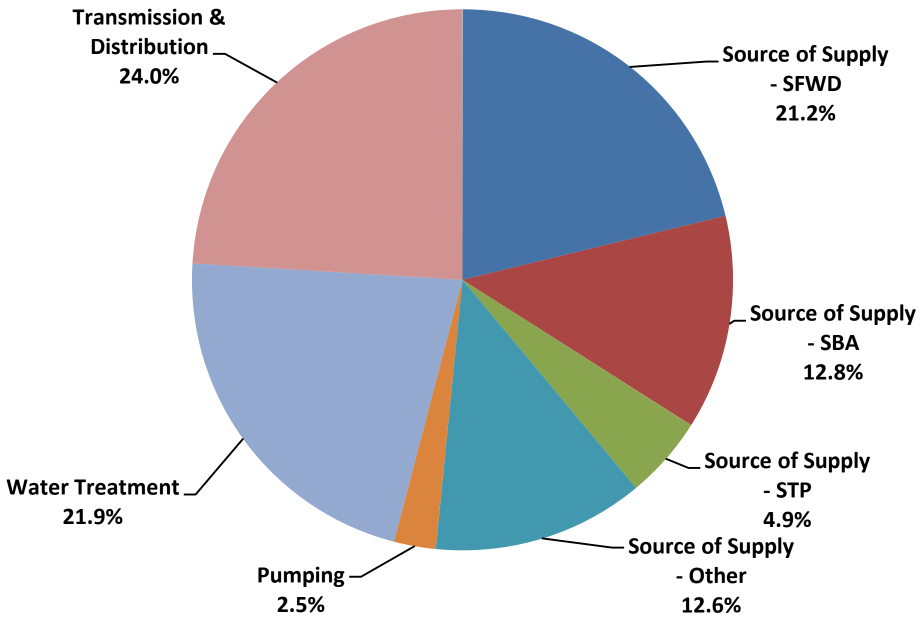
Operating Expenses

	FY 2015/16			FY 2016/17			
	Amended Budget	Estimated Actual	% Variance	Adopted Budget	Proposed Budget	% Variance	FY17 Prop FY16 Est % Variance
Source of Supply	$ 36,792,700	$ 33,512,817	-8.9%	$ 35,761,200	$ 38,474,351	7.6%	14.8%
Pumping	1,368,600	1,618,554	18.3%	1,420,400	1,420,387	0.0%	-12.2%
Water Treatment	16,790,300	14,232,695	-15.2%	17,244,100	15,711,059	-8.9%	10.4%
Transmission & Distribution	15,697,800	15,609,209	-0.6%	16,947,200	18,124,018	6.9%	16.1%
Customer Accounts	1,753,600	1,500,000	-14.5%	1,620,900	1,620,938	0.0%	8.1%
Administration & General	12,327,000	14,675,074	19.0%	13,043,700	11,036,233	-15.4%	-24.8%
Expense Projects	1,869,200	814,000	-56.5%	313,700	1,503,390	379.2%	84.7%
	$ 86,599,200	**$ 81,962,349**	**-5.4%**	**$ 86,351,200**	**$ 87,890,376**	**1.8%**	**7.2%**

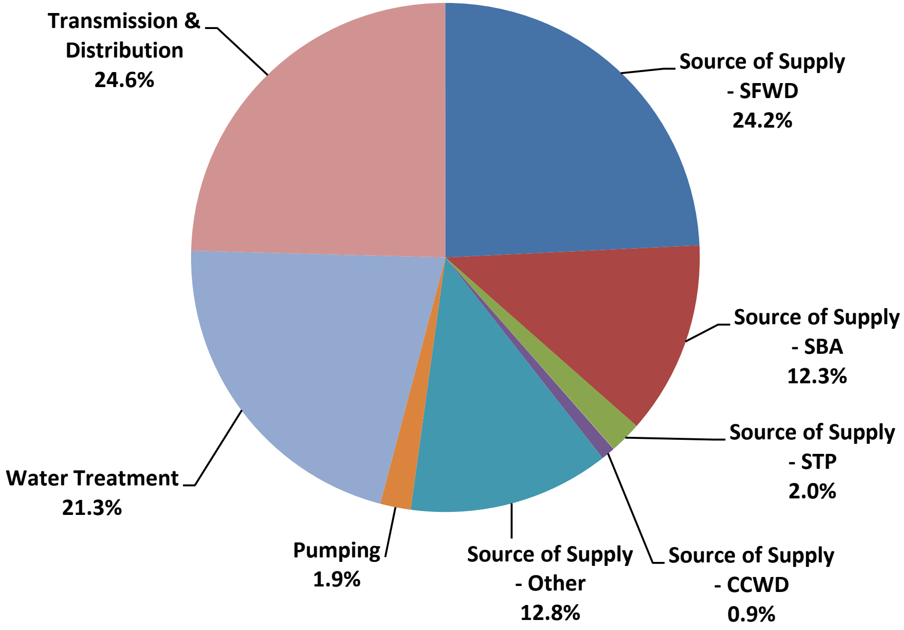
	FY 2015/16			FY 2016/17			
	Amended Budget	Estimated Actual	% Variance	Adopted Budget	Proposed Budget	% Variance	FY17 Prop FY16 Est % Variance
Labor	$ 24,936,352	$ 24,347,065	-2.4%	$ 26,267,749	$ 25,888,559	-1.4%	6.3%
Fringe & Overhead	21,773,887	19,735,108	-9.4%	22,905,848	22,547,723	-1.6%	14.3%
Purchased Water	27,792,582	25,307,217	-8.9%	26,349,105	29,062,269	10.3%	14.8%
Other	12,096,379	12,572,959	3.9%	10,828,498	10,391,825	-4.0%	-17.3%
	$ 86,599,200	**$ 81,962,349**	**-5.4%**	**$ 86,351,200**	**$ 87,890,376**	**1.8%**	**7.2%**

Operation and Maintenance

FY 2015/16 Estimated Actual



FY 2016/17 Proposed Budget

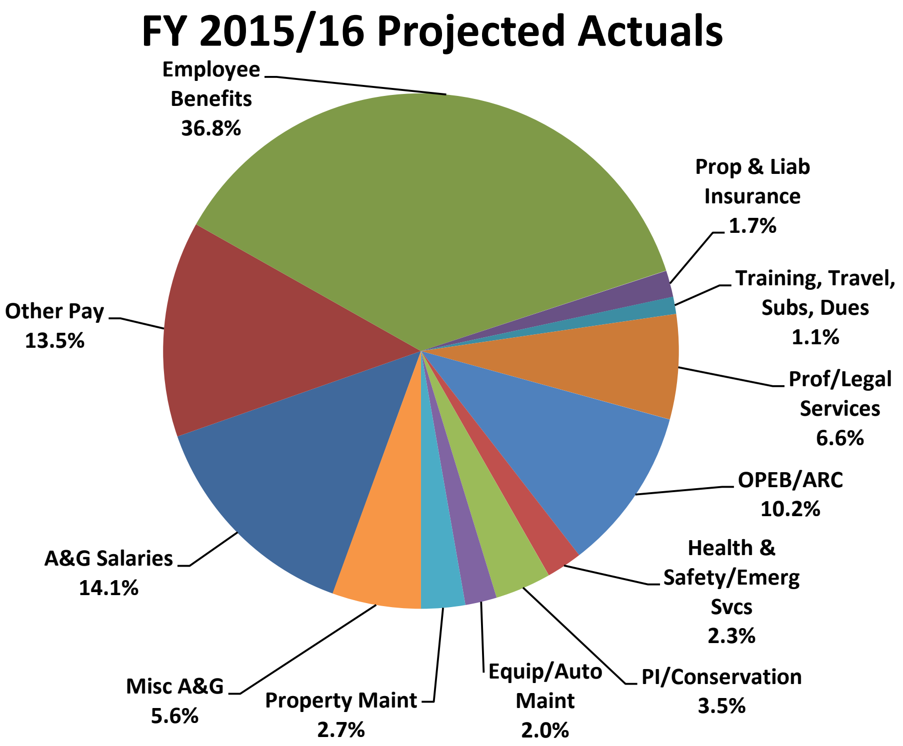


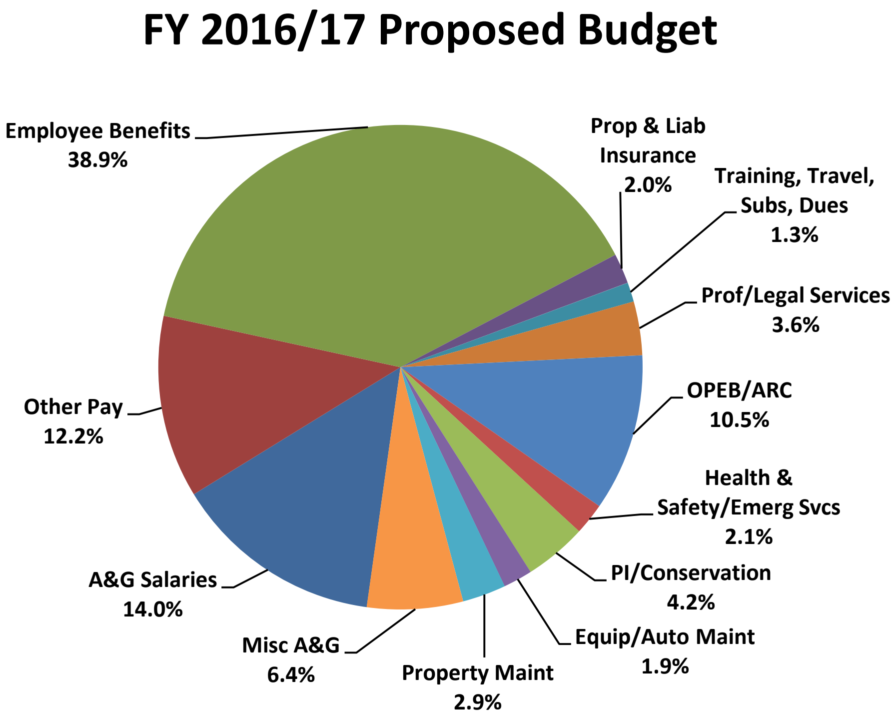
Operation and Maintenance

	FY 2015/16			FY 2016/17			
	Amended Budget	Estimated Actual	% Variance	Adopted Budget	Proposed Budget	% Variance	FY17 Prop FY16 Est % Variance
Source of Supply - SFWD	$ 15,601,636	$ 13,776,271	-11.7%	$ 15,678,207	$ 17,863,700	13.9%	29.7%
Source of Supply - SBA	8,326,406	8,326,406	0.0%	7,711,278	9,038,569	17.2%	8.6%
Source of Supply - STP	3,204,540	3,204,540	0.0%	2,959,620	1,500,000	-49.3%	-53.2%
Source of Supply-CCWD	660,000	-	-100.0%	-	660,000		
Source of Supply-Other	9,000,118	8,205,600	-8.8%	9,412,095	9,412,082	0.0%	14.7%
Pumping	1,368,600	1,618,554	18.3%	1,420,400	1,420,387	0.0%	-12.2%
Water Treatment	16,790,300	14,232,695	-15.2%	17,244,100	15,711,059	-8.9%	10.4%
Transmission & Distribution	15,697,800	15,609,209	-0.6%	16,947,200	18,124,018	6.9%	16.1%
	$ 70,649,400	**$ 64,973,275**	**-8.0%**	**$ 71,372,900**	**$ 73,729,815**	**3.3%**	**13.5%**

	FY 2015/16			FY 2016/17			
	Amended Budget	Estimated Actual	% Variance	Adopted Budget	Proposed Budget	% Variance	FY17 Prop FY16 Est % Variance
Labor	$ 11,895,647	$ 10,876,436	-8.6%	$ 12,695,071	$ 12,475,977	-1.7%	14.7%
Fringe & Overhead	21,412,165	19,577,585	-8.6%	22,851,128	22,456,759	-1.7%	14.7%
Purchased Water	27,792,582	25,307,217	-8.9%	26,349,105	29,062,269	10.3%	14.8%
Other	9,549,006	9,212,037	-3.5%	9,477,596	9,734,810	2.7%	5.7%
	$ 70,649,400	**$ 64,973,275**	**-8.0%**	**$ 71,372,900**	**$ 73,729,815**	**3.3%**	**13.5%**

Administrative and General





Administrative and General

	FY 2015/16			FY 2016/17			
	Amended Budget	Estimated Actual	% Variance	Adopted Budget	Proposed Budget	% Variance	FY17 Prop FY16 Est % Variance
A&G Salaries	$ 5,126,678	$ 5,612,000	9.5%	$ 5,470,271	$ 5,622,481	2.8%	0.2%
A&G Other Pay	4,929,040	5,400,000	9.6%	5,186,790	4,891,669	-5.7%	-9.4%
Employee Benefits	14,679,900	14,672,774	0.0%	15,933,310	15,643,310	-1.8%	6.6%
Property & Liability Insurance	784,458	661,605	-15.7%	804,070	804,070	0.0%	21.5%
Election Expense	-	-	0.0%	265,000	265,000	0.0%	
Education & Training	181,850	145,000	-20.3%	175,000	168,000	-4.0%	15.9%
Travel, Subscrip, Dues	344,435	291,000	-15.5%	356,650	349,650	-2.0%	20.2%
Office Supplies	109,350	95,000	-13.1%	114,350	114,350	0.0%	20.4%
Postage	240,620	240,620	0.0%	265,620	265,620	0.0%	10.4%
Telephone	138,150	123,150	-10.9%	139,150	139,150	0.0%	13.0%
Small Tools/Supplies	235,950	220,000	-6.8%	235,850	235,850	0.0%	7.2%
Legal Services	1,000,000	1,600,000	60.0%	700,000	700,000	0.0%	-56.3%
Professional Services	1,072,850	1,022,353	-4.7%	771,780	743,780	-3.6%	-27.2%
OPEB/ARC	4,079,000	4,079,100	0.0%	4,211,000	4,211,000	0.0%	3.2%
Information Technology	1,312,155	1,088,132	-17.1%	1,308,000	1,177,500	-10.0%	8.2%
Health & Safety/Emergency Svcs	933,419	900,000	-3.6%	910,316	849,995	-6.6%	-5.6%
Public Information/Conservation	1,848,561	1,400,000	-24.3%	1,674,315	1,674,315	0.0%	19.6%
Equipment/Auto Maintenance	753,557	789,717	4.8%	780,897	780,897	0.0%	-1.1%
Property Maintenance	1,189,972	1,096,162	-7.9%	1,088,680	1,163,680	6.9%	6.2%
Other A&G	328,300	448,812	36.7%	245,200	372,700	52.0%	-17.0%
	39,288,245	**39,885,425**	**1.5%**	**40,636,249**	**40,173,017**	**-1.1%**	**0.7%**
Expense Credit Equipment	(1,437,300)	(1,416,530)	-1.4%	(1,359,000)	(1,531,411)	12.7%	8.1%
Expense Credit Overhead	(25,523,900)	(23,793,821)	-6.8%	(26,233,500)	(27,605,373)	5.2%	16.0%
	$ 12,327,045	**$ 14,675,074**	**19.0%**	**$ 13,043,749**	**$ 11,036,233**	**-15.4%**	**-24.8%**

Labor

	FY 2015/16			FY 2016/17			
	Amended Budget	Estimated Actual	% Variance	Adopted Budget	Proposed Budget	% Variance	FY17 Prop FY16 Est '% Variance
Operating							
General Fund							
Source of Supply	$ 2,440,346	$ 2,175,407	-10.9%	$ 2,607,418	$ 2,607,418	0.0%	19.9%
Pumping	165,763	231,576	39.7%	170,281	170,281	0.0%	-26.5%
Water Treatment	4,591,608	3,836,558	-16.4%	4,774,875	4,133,327	-13.4%	7.7%
Transmission & Distribution	4,697,930	4,632,895	-1.4%	5,142,497	5,564,951	8.2%	20.1%
Customer Accounts	1,275,388	1,090,925	-14.5%	1,315,138	1,315,138	0.0%	20.6%
Administration	5,126,678	5,612,000	9.5%	5,470,271	5,622,481	2.8%	0.2%
Vacation, Sick Leave, Etc.	4,976,226	5,414,989	8.8%	5,236,561	4,941,440	-5.6%	-8.7%
General	1,461,456	1,265,202	-13.4%	1,520,308	1,482,987	-2.5%	17.2%
Expense Projects	200,957	87,513	-56.5%	30,400	50,536	66.2%	-42.3%
Total Operating Labor Expenses	**24,936,352**	**24,347,065**	**-2.4%**	**26,267,749**	**25,888,559**	**-1.4%**	**6.3%**
Capital							
General Fund	1,859,500	1,358,563	-26.9%	1,847,900	1,562,964	-15.4%	15.0%
Facilities Improvement Fund	363,700	232,044	-36.2%	164,200	309,042	88.2%	33.2%
Total Capital Labor Expenses	**2,223,200**	**1,590,607**	**-28.5%**	**2,012,100**	**1,872,005**	**-7.0%**	**17.7%**
Customer Jobs	586,400	664,234	13.3%	593,700	937,800	58.0%	41.2%
Total Labor Expenses	**$ 27,745,952**	**$ 26,601,906**	**-4.1%**	**$ 28,873,549**	**$ 28,698,364**	**-0.6%**	**7.9%**

Employee Benefits

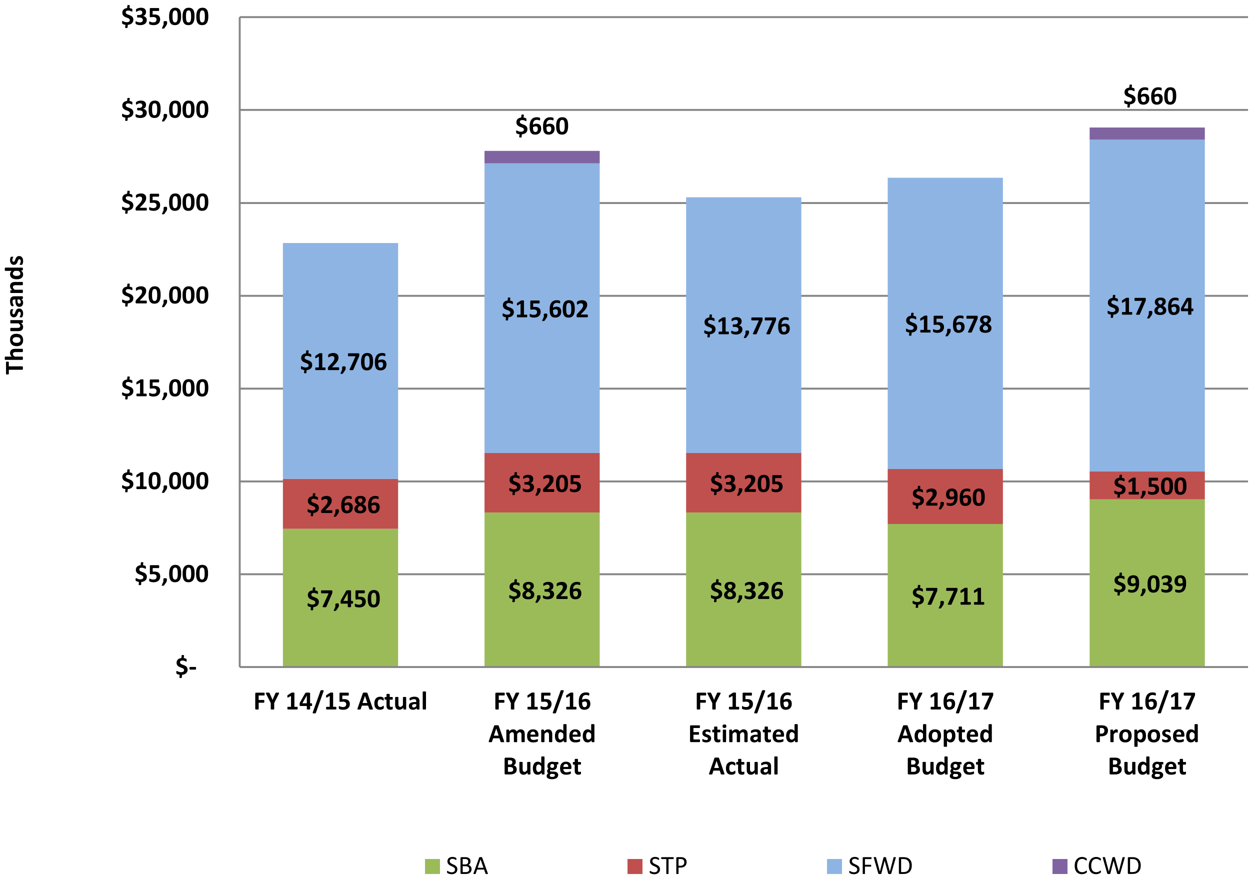
	FY 2015/16			FY 2016/17			
	Amended Budget	Estimated Actual	% Variance	Adopted Budget	Proposed Budget	% Variance	FY17 Prop FY16 Est '% Variance
PERS Employer Percent	$ 6,955,000	$ 6,780,000	-2.5%	$ 7,759,700	$ 7,584,700	-2.3%	11.9%
PERS EE Portion Paid by ACWD	359,700	315,000	-12.4%	375,300	375,300	0.0%	19.1%
Deferred Comp Contribution	61,000	80,000	31.1%	61,000	61,000	0.0%	-23.8%
Social Security	13,800	5,500	-60.1%	14,800	14,800	0.0%	169.1%
Medical - Cafeteria Flex Benefit	5,074,700	4,975,000	-2.0%	5,458,400	5,233,400	-4.1%	5.2%
Medicare	394,700	405,000	2.6%	411,300	411,300	0.0%	1.6%
AD&D	6,400	6,400	0.0%	6,700	6,700	0.0%	4.7%
Life Insurance	59,500	62,000	4.2%	61,700	61,700	0.0%	-0.5%
Dental	470,900	450,000	-4.4%	485,000	485,000	0.0%	7.8%
Vision	66,300	65,000	-2.0%	68,300	68,300	0.0%	5.1%
Employee Assistance Program	7,000	7,000	0.0%	7,000	7,000	0.0%	0.0%
Short Term Disability	59,900	59,900	0.0%	61,400	61,400	0.0%	2.5%
LTD/Wage Continuation	108,500	108,500	0.0%	111,210	111,210	0.0%	2.5%
Unemployment Insurance	13,000	20,000	53.8%	13,000	13,000	0.0%	-35.0%
Workers' Comp	980,000	1,180,000	20.4%	989,000	1,099,000	11.1%	-6.9%
Misc Other Benefits	-	105,000		-	-		-100.0%
MCP Allowance	49,500	48,474	-2.1%	49,500	49,500	0.0%	2.1%
	$ 14,679,900	**$ 14,672,774**	**0.0%**	**$ 15,933,310**	**$ 15,643,310**	-1.8%	6.6%
OPEB/ARC	**$ 4,079,000**	**$ 4,079,100**	**0.0%**	**$ 4,211,000**	**$ 4,211,000**	**0.0%**	**3.2%**

FTEs and Retirements

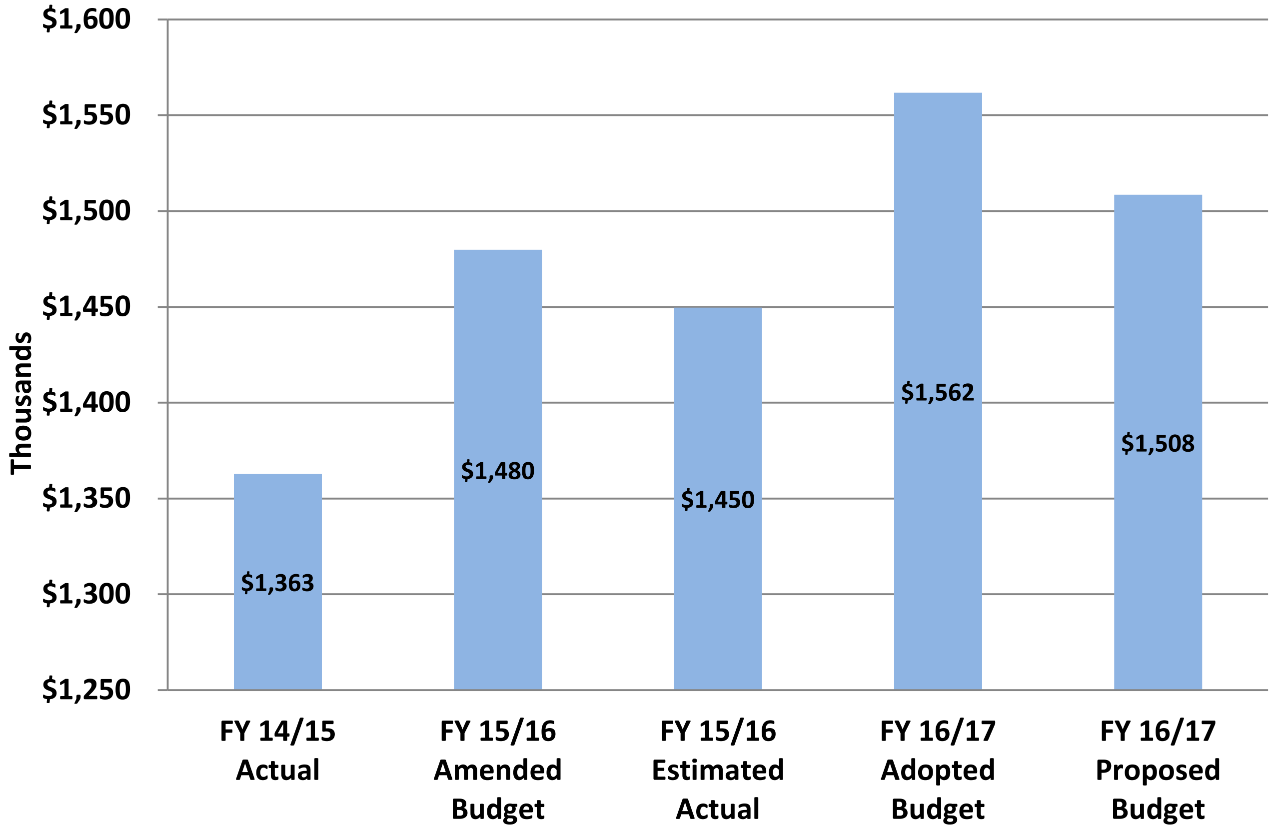
	FY 2012/13 Actual	FY 2013/14 Actual	FY 2014/15 Actual	FY 2015/16 YTD	FY 2016/17 Proposed Budget
Autorized Positions	233	238	238	230	230
Vacancies	23	19	27	16	

	CY 2012 Actual	CY 2013 Actual	CY 2014 Actual	CY 2015 Actual	CY 2016 YTD
Retirements	17	5	8	11	5

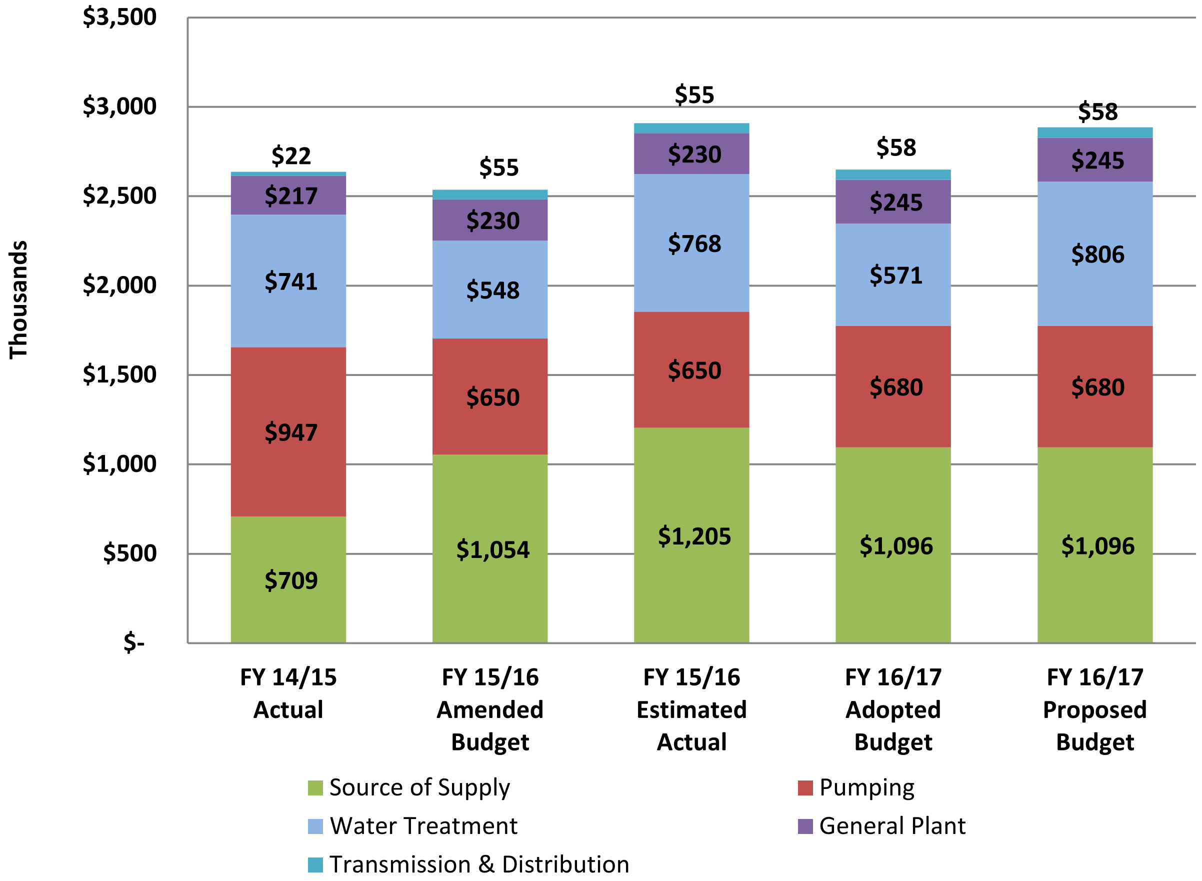
Purchased Water



Chemicals


$1,600
$1,550
$1,500
$1,450
$1,400
$1,350
$1,300
$1,250
Thousands
$1,363
$1,480
$1,450
$1,562
$1,508
FY 14/15 Actual
FY 15/16 Amended Budget
FY 15/16 Estimated Actual
FY 16/17 Adopted Budget
FY 16/17 Proposed Budget

Purchased Power



Debt Service

	FY 14/15	FY 15/16		FY 16/17	
	Actual	Amended Budget	Estimated Actual	Adopted Budget	Proposed Budget
Debt Service:					
2009 Refunding Revenue Bonds	$ 2,868,100	$ 2,863,200	$ 2,863,200	$ 2,866,800	$ 2,866,800
2012 Revenue Bonds	1,890,900	1,893,300	1,893,300	1,892,700	1,892,700
2015 Revenue Bonds	240,400	1,624,700	1,624,700	1,626,900	1,626,900
	$ 4,999,400	**$ 6,381,200**	**$ 6,381,200**	**$ 6,386,400**	**$ 6,386,400**
Outstanding Principal:					
2009 Refunding Revenue Bonds	$ 13,050,000	$ 10,595,000	$ 10,595,000	$ 8,070,000	$ 8,070,000
2012 Revenue Bonds	44,495,000	44,230,000	44,230,000	43,955,000	43,955,000
2015 Revenue Bonds	27,810,000	27,355,000	27,355,000	26,875,000	26,875,000
	$ 85,355,000	**$ 82,180,000**	**$ 82,180,000**	**$ 78,900,000**	**$ 78,900,000**

Capital Expenditures

	FY 14/15	FY 15/16		FY 16/17	
	Actual	Amended Budget	Estimated Actual	Adopted Budget	Proposed Budget
Capital Projects - GF	$ 5,808,437	$ 4,798,300	$ 4,335,632	$ 5,615,900	$ 11,294,542
Capital Projects - Bond	11,843,167	17,436,300	11,909,108	11,156,700	5,119,088
Total General Fund Capital	**17,651,604**	**22,234,600**	**16,244,740**	**16,772,600**	**16,413,630**
Capital Expenditures-FIF	2,895,240	4,983,400	3,179,460	1,681,000	3,693,570
Customer Jobs	3,762,312	2,471,900	2,800,000	2,513,100	4,176,000
		-	-		
Total Capital Expenditures	**$24,309,156**	**$ 29,689,900**	**$ 22,224,200**	**$20,966,700**	**$ 24,283,200**

Major initiatives: Water Supply Reliability Concepts

District is currently considering a number of water supply reliability concepts

Estimated ACWD share expenses for FY 2016/17 (unbudgeted):

- WaterFix Studies - $200,000
- Los Vaqueros Studies - $100,000
- Lake Del Valle studies - $100,000-$200,000
- Sites Reservoir Studies & ‘down payment’ - $600,000 to $1.8M *(for 10 to 30 TAF participation)*

Total FY 16/17 Cost to continue all options: ~$1.0M to $2.3M

Proposed FY 2016/17 budget includes:

- $80,000 for Planning Studies – Intended for Desalination
- $660,000 for the ELV pilot exchange project

Major initiatives: Water Supply Reliability Concepts

Proposed CIP includes $116M in FY 2035/36 for a Recycled Water or Alternative Concept(s)

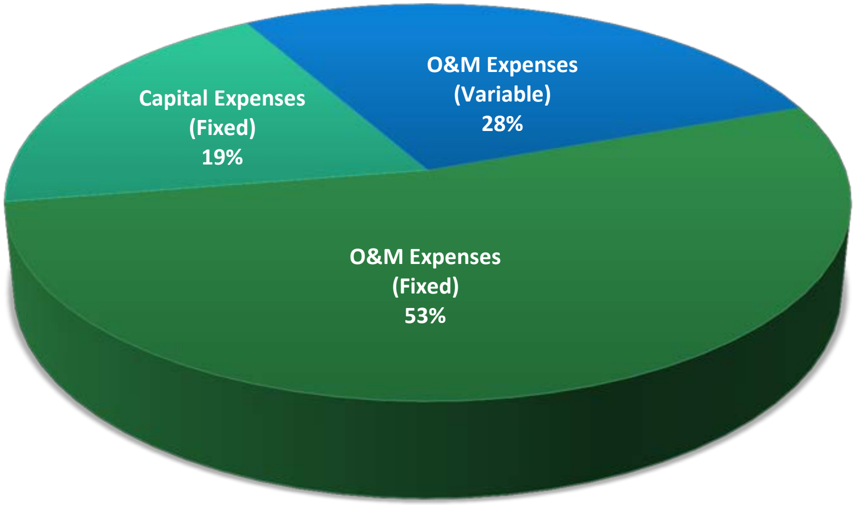
Current Concepts being evaluated (ACWD Share Estimates):

- WaterFix : $120M
- LVE w/Trans.-Bethany pipeline: $267M *(no water included)*
- Bay Desalination: $323M - $464M
- Recycled Water / Indirect Potable Reuse (IPR)
  - 2,500 AF/yr. of non-potable Recycled Water: $143M
  - 4,500 AF/yr. of potable reuse: $70.1M (cap only)
  - Recycled Water Fill Station: $300K-$2.0M

Water System Costs vs. Revenue

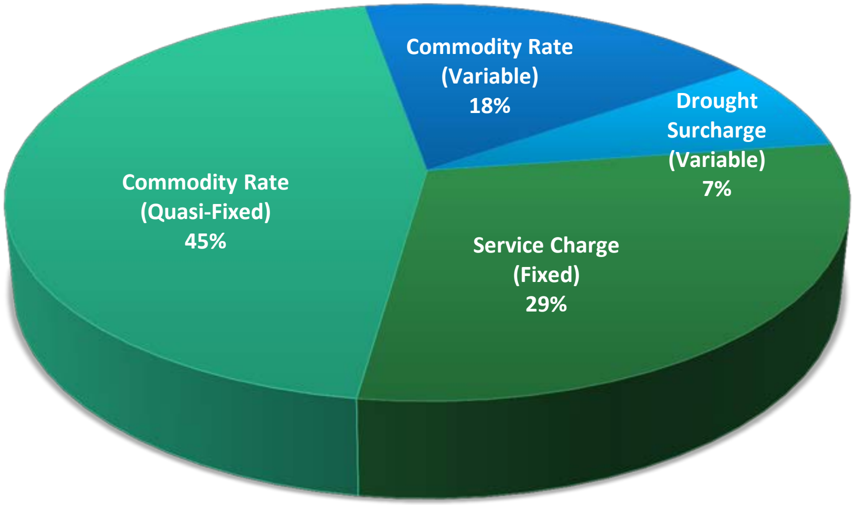
Water System Costs

(FY 15/16 Adopted Budget)



Water Rate Revenue

(Projected Billed Indoor Demand: 24.5 MGD)



Fixed Costs = 19% + 53% = 72%

Variable = 28%

Fixed Revenues = 29%

Fixed + Quasi-Fixed = 29% + 45% = 74%

Variable = 18% + 7% = 25%

Quasi-fixed = commodity rev for stable indoor consumption only

Capital Improvement Program (CIP) Review

Financial Forecasting

Customer Usage Analysis

Drought Surcharge/Ordinance

Drought Emergency Regulations

Extended Through January 2017

End-User Requirements Remain

Conservation Standard Self-Certification

- Due June 22, 2016
- Assume next 3 years' precipitation are same as 2013-2015
- Assume demand is average of 2013 and 2014
- Conservation standard is shortfall in the 3rd year

ACWD's Preliminary Conservation Standard

Water Shortage Emergency Ordinance

Section 1, Declaration of a Water Shortage Emergency

Section 2, Purpose and Authority

Section 3, Effect of Ordinance

Section 4, Water Use Limitations

Section 5, Water Use Guidelines

Section 6, Application Procedure for Exceptions

Section 7, Exemption from CEQA

Section 8, Severability

Section 9, Publication and Posting of Ordinance

Drought Surcharge

Conditions for rescinding surcharge:

- Governor rescinds drought state of emergency declaration;
- State Board rescinds statewide drought emergency regulations; and
- Board rescinds water shortage emergency Ordinance.

Next Steps

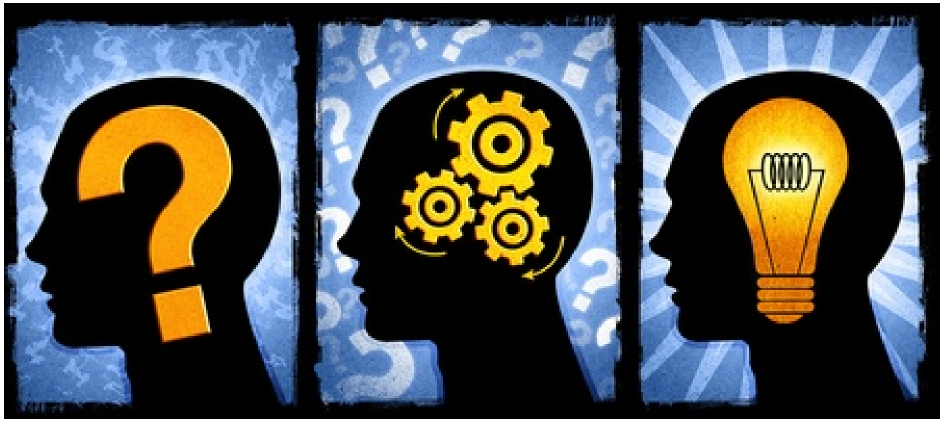
June 9 Board of Directors

- Evaluate Drought Surcharge/Ordinance

June 30 Budget Workshop

- Adopt FY 2016/17 Midcycle Budget Adjustments
- Adopt 25 Year Capital Improvement Program (CIP)

Discussion



Capital Improvement Program

MAY 26, 2016

BOARD MEETING

Outline

Capital Budget – Mid-cycle Revisions

CIP Overview

Cost Reduction Scenarios

Discussion and Feedback

Capital Budget

MID-CYCLE REVISIONS

Mid-Cycle Yr2 Proposed Budget ***($1000s)***

Category	2016 (Adopted)	2017 (Adopted)	2016 (Estimated)	2017 (Proposed)
Capital Jobs	24,769	16,366	19,419	20,586
Extraordinary Expense	1,869	314	814	1,503
2-Yr Total	$43,317		$42,322	
Customer Jobs	2,472	2,513	2,800	4,176
TOTALS	29,110	19,192	23,033	26,265
2-Yr Total	$48,302		$49,298	

Capital Projects with greatest FY increase

	Increase	Reason
Customer Jobs	$1,663,000	Higher Development Activity
Main Relocation for SF BDPL 3&4	$1,535,000	FY Payments/ Outside Agency
Cayenta Software	$695,000	FY Payments/ Staffing
Iron Horse Lane Main Replacement	$645,000	Scope & Schedule Adjustment
RD #1 Fish Ladder	$539,000	Schedule Adjustment
WTP2 PLC Replacement	$525,000	Acceleration for work efficiency
Washington Blvd Main Replacement	$429,000	Scope & Schedule Adjustment
Fault Crossings – Hose Procurement	$380,000	FY Payments/ Staffing
RD1 Fabric Replacement	$376,000	FY Payments/ Contractor
HQ Office Project	$342,000	FY Payments/ Staffing
Appian Tank	$308,000	FY Payments/ Contractor
CIP Software	$300,000	FY Payments/ Staffing

Summary of Changes

	Impact on Budget Year
New Projects	$210,000
Accelerated Project	$525,000
FY Payments/ Outside Agency	$1,916,000
Scope & Cost Changes	$1,228,000
Higher Development Activity (Customer Jobs)	$1,663,000
FY Payments/ Contractor	$684,000
FY Payments/ Staffing availability *(Eng 1.7M; IT 1.4M; Ops 0.4M)*	$3,466,000
Revised Schedule (Fish Passage Program)	$494,000
Delayed for Grant Funding	$200,000
Cost savings and reductions	($1,378,000)
Defer Project	($1,935,000)
TOTAL	$7,073,000

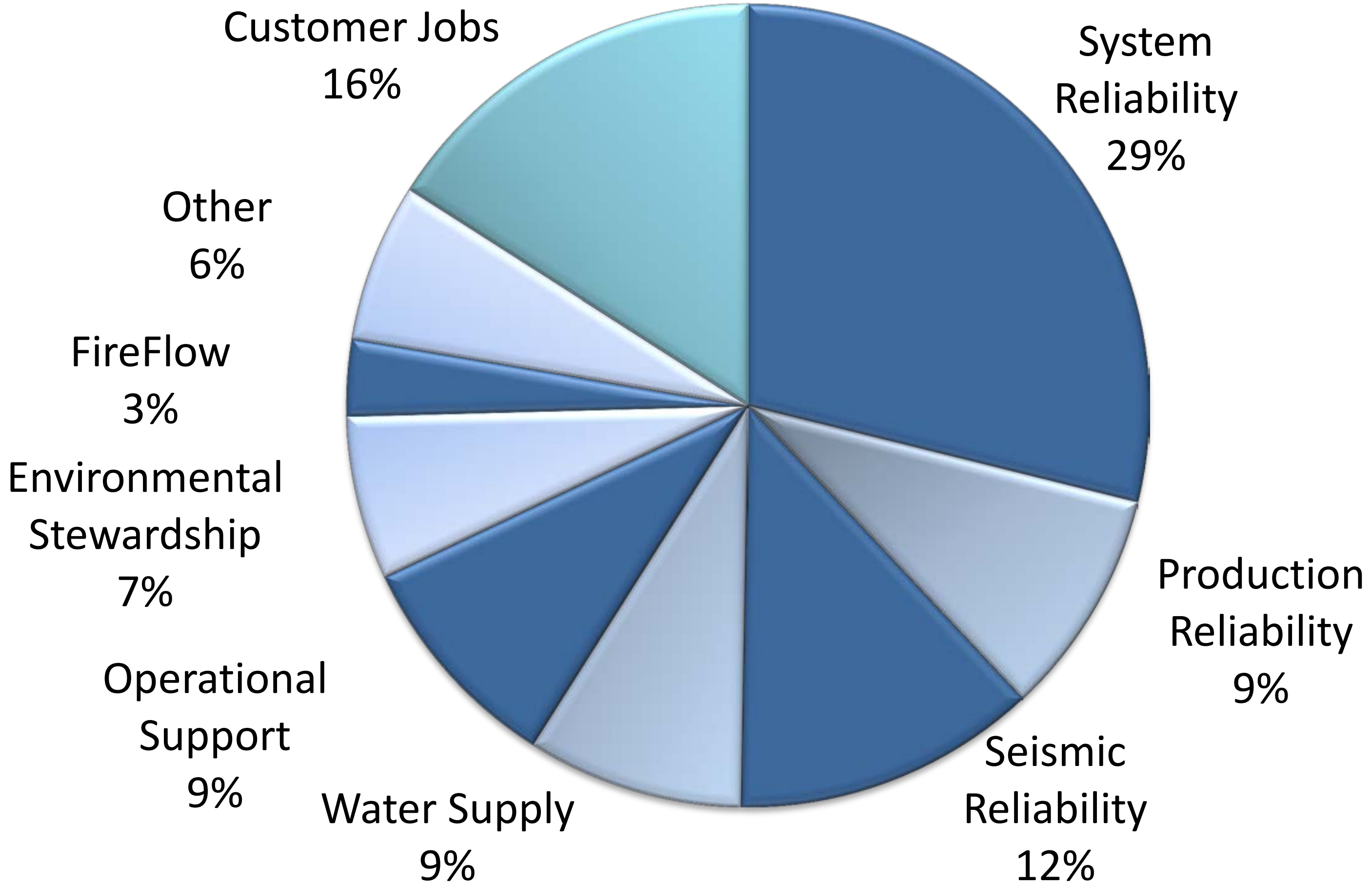
Major Projects (highest cost)

Customer Jobs		$4,176,000
Main Relocation for SF BDPL 3&4	*	$1,535,000
SL Emergency Replacement Program		$1,295,000
Membranes for Newark Desalination Facility		$1,234,000
Washington Blvd Main Replacement	*	$1,084,000
Avalon Site Slope Stability		$1,008,300
Blending Facility Radio / Niles Repeater	*	$974,800
Middlefield Inlet/ Outlet Pipeline Seismic Upgrade	*	$987,000
WTP2 PLC Replacement	*	$913,500
Cayenta Software	**	$744,600
RD1 Fish Ladder	*	$739,000

** Bond Funded;   ** Extraordinary Expense*

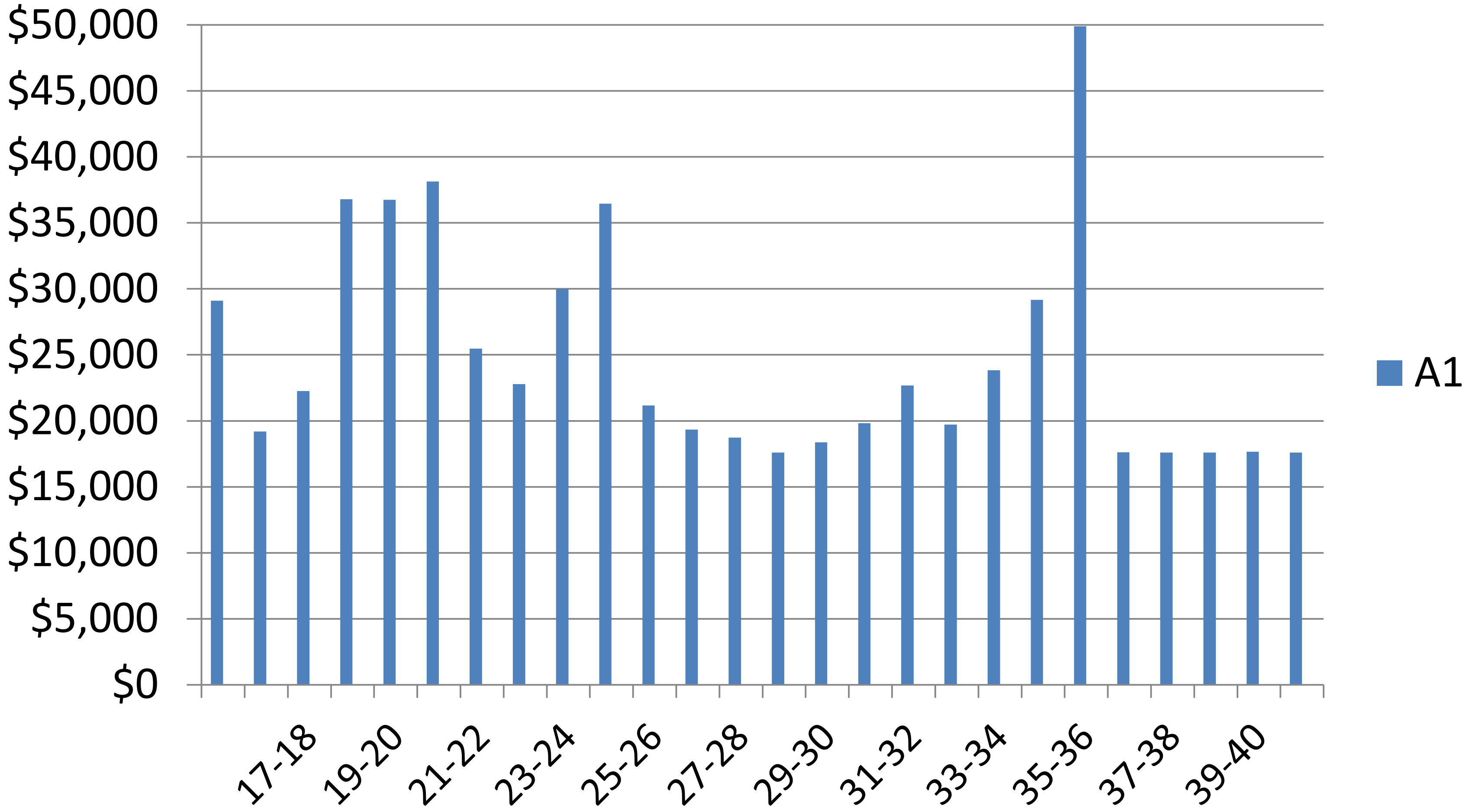
Proposed Yr2 Expenditures by Category

Total Cost $26,265,000



CIP Overview

Prior Adopted (Revised) CIP A1



Mid-Cycle Changes to the CIP

Escalation *(+3% to future years)*

Cost adjustments *("pencil sharpening")*

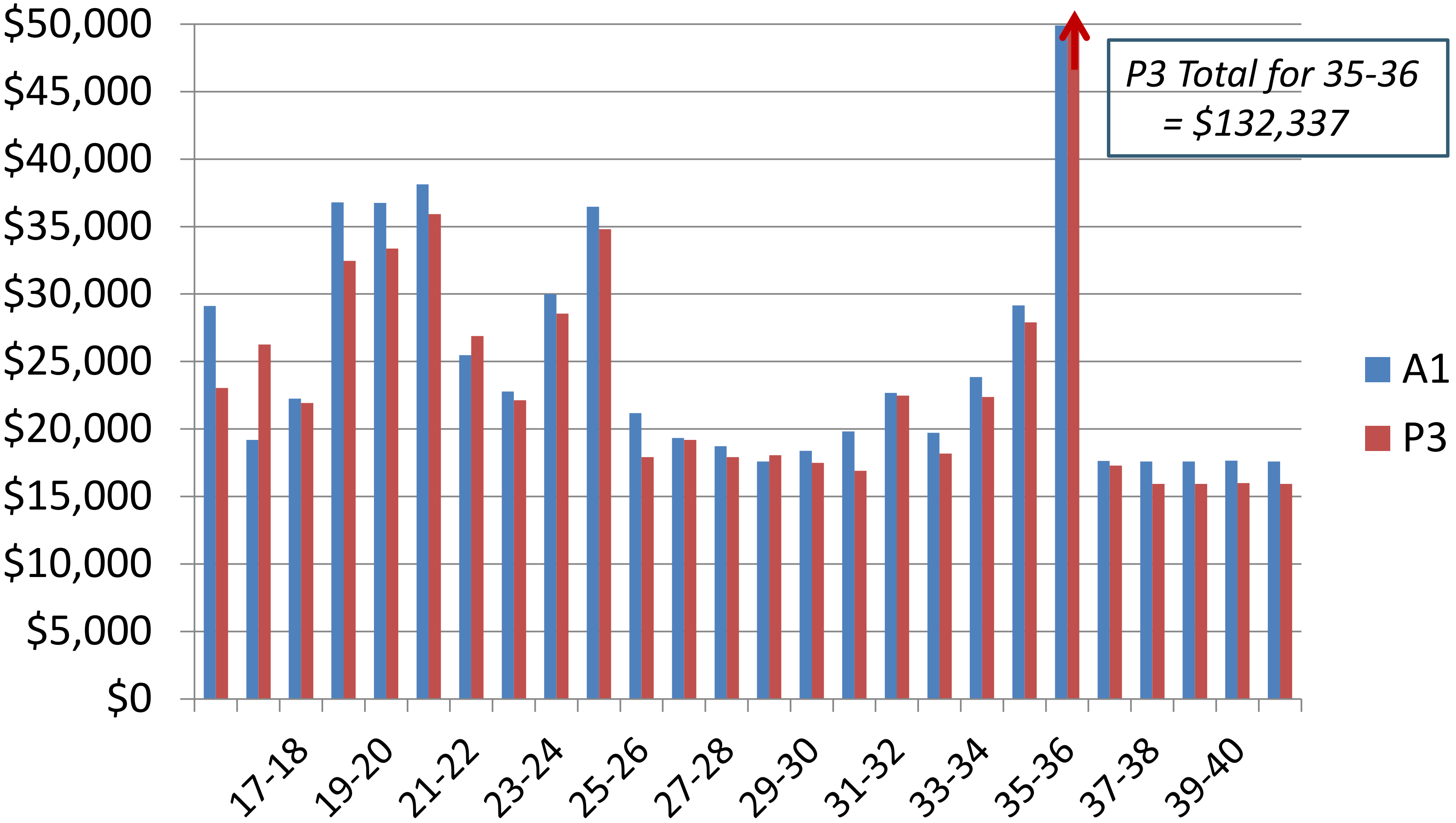
Schedule Adjustments

Adjusted recurring costs *(to historical amounts)*

Total CIP Program Reductions:

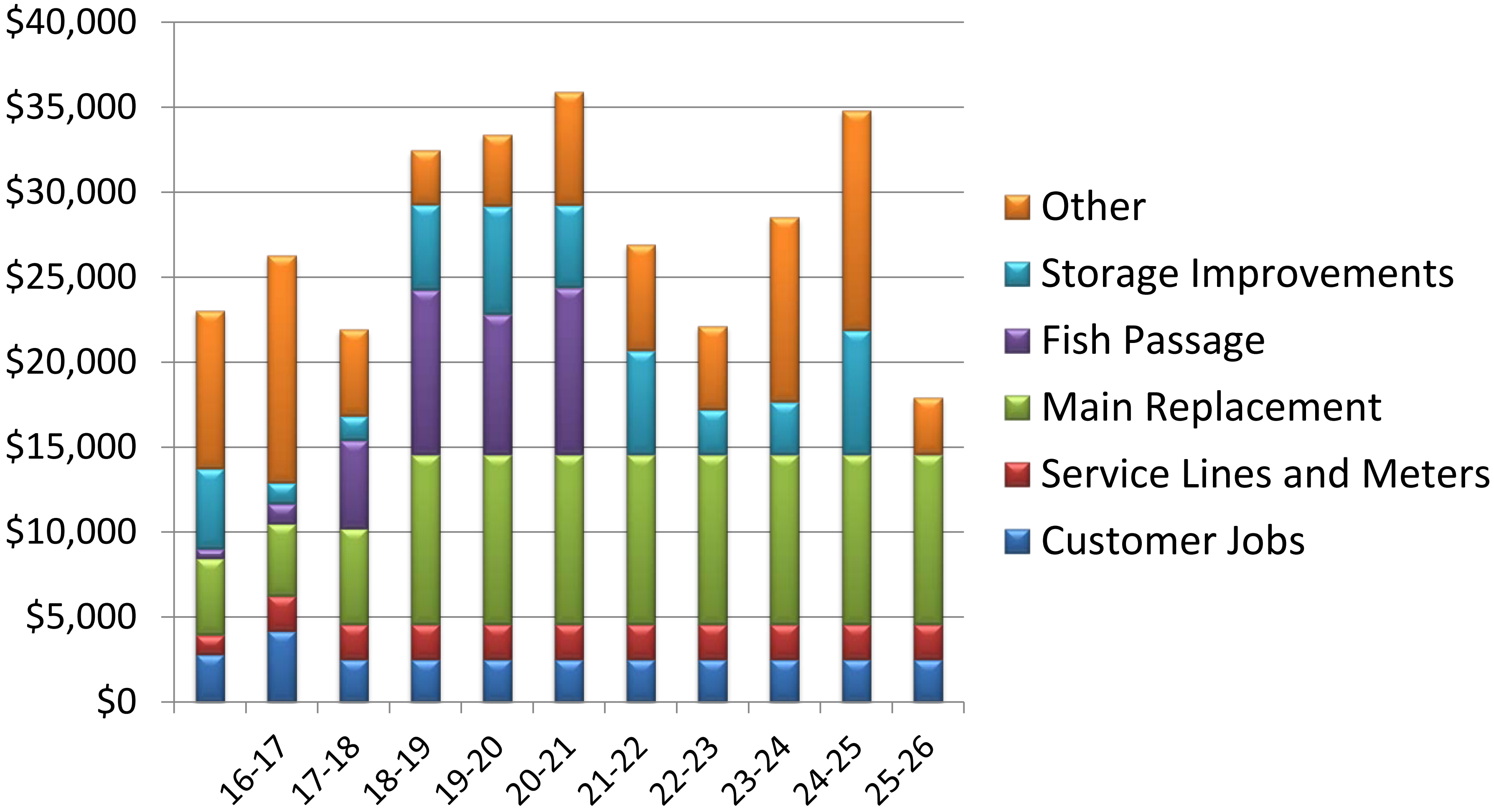
- **6 years:** **$11.9M** *(GF portion only)*
- **10 years:** **$15.3M** *(GF portion only)*

Proposed CIP – version P3



P3 Total for 35-36
= $132,337

Proposed 10-Year Expenditures by Program



CIP Reduction Scenarios

CIP Reduction Scenarios

Staff developed multiple scenarios to cut and defer additional costs *will show 4 levels*

Building on reductions already in CIP “P3”

Per FPM, focus on next 5 years (through FY 20/21)

Objectives:

- Minimize impacts on reserves *(minimize rate pressure)*
- Minimize consequences of cuts/deferrals

Each scenario builds on the prior

Targeting “GF” reductions, *total cost reduction is greater (GF+FIF)*

Seeking feedback regarding the Board’s priorities (and acceptable cuts/deferrals)

Level 1: ~$6M GF Capital Reduction *(S14)*

Consequences
Alameda Creek Fish Passage Completion - CY 2022
Continued Deferrals of Facility Decommissioning
Higher Maintenance Costs, Avalon

Level 1 Deferrals	
Alameda Creek Fish Passage, Schedule	-$3,448,000
Decommissioning of Facilities	-$1,348,000
Avalon Tank Site Slope Stability	-$803,000

Net 5Yr GF Reduction -$5,525

Level 2: ~$21M GF Capital Reduction *(S15)*

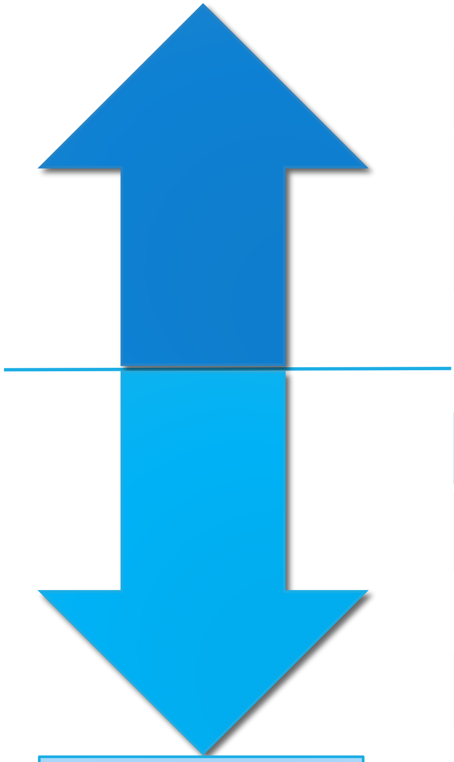
Consequences – Level 2
Alameda Creek Fish Passage Completion - CY 2022
Continued Deferrals of Facility Decommissioning
Higher Maintenance Costs, Avalon
Near Term Reduction to Water Main Replacements
Deferred Seismic Improvements to Alameda, Decoto Reservoirs

Level 2 Cuts & Deferrals	
Alameda Creek Fish Passage, Schedule	-$3,448,000
Decommissioning of Facilities	-$1,348,000
Avalon Tank Site Slope Stability	-$803,000
Main Replacement Program ($6,7,8,10M)	-$11,387,000
Seismic Upgrade of Reservoir Structures	-$13,887,000

Net 5Yr GF Reduction -$21,029

Level 3: ~$24M GF Capital Reduction *(S17)*

Consequences – Level 3
Alameda Creek Fish Passage Completion - CY 2022
Continued Deferrals of Facility Decommissioning
Higher Maintenance Costs, Avalon
Near Term Reduction to Water Main Replacements
Deferred Seismic Improvements to Alameda, Decoto Reservoirs
Deferred AMI, Recharge Diversion & Dist. WQ Improvements



Net 5Yr GF Reduction -$24,070

Level 3 Cuts & Deferrals	
Alameda Creek Fish Passage, Schedule	-$3,448,000
Decommissioning of Facilities	-$1,348,000
Avalon Tank Site Slope Stability	-$803,000
Main Replacement Program ($6,7,8,10M)	-$11,387,000
Seismic Upgrade of Reservoir Structures	-$13,887,000
Facilities Improvements/Initiatives	-$3,033,000

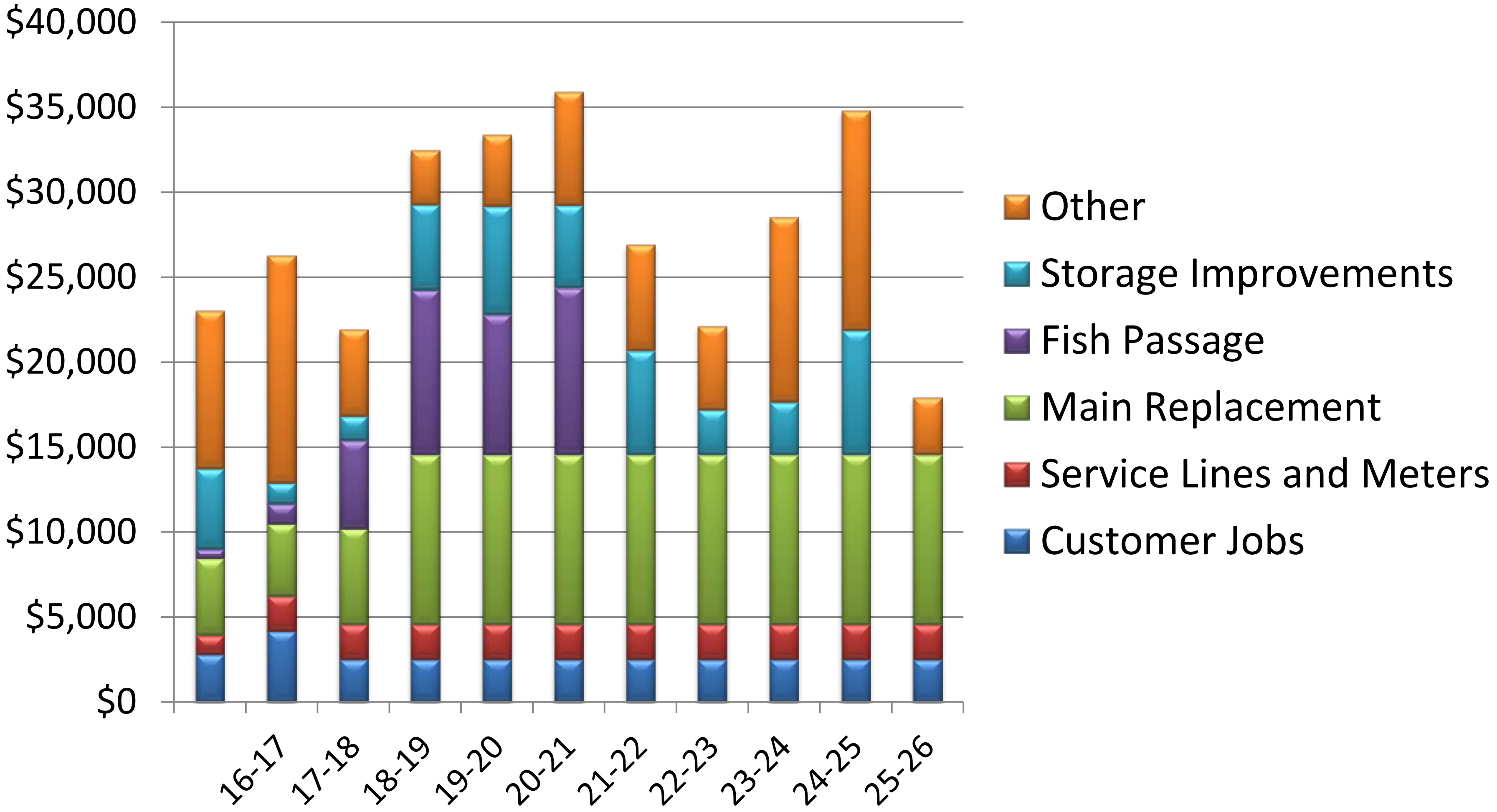
Level 4: ~$31M GF Capital Reduction *(S16)*

Consequences – Level 4
Alameda Creek Fish Passage Completion - CY 2023
Continued Deferrals of Facility Decommissioning
Higher Maintenance Costs, Avalon
Greater Near Term Reductions to Water Main Replacements
Greater Deferrals to Alameda, Decoto Reservoir Seismic

Level 4 Cuts & Deferrals	
Alameda Creek Fisheries, 1 additional year	-$11,583,000
Decommissioning of Facilities	-$1,348,000
Major Maintenance Projects	-$803,000
Main Replacement Program ($4,6,8,10M)	-$14,387,000
Seismic Upgrade of Reservoir Structures	-$14,388,000

Net 5Yr GF Reduction
-$31,037*

Proposed 10-Year Expenditures by Program



Discussion and Feedback

Level	Scenario	Reductions	GF 5-Yr Reductions (from P3)
Level 1	S14	Adjusted Fish Program + Defer Facility Decommissioning + Defer Avalon Slope Stability	$5.5M
Level 2	S15	Level 1 + Delay of Main Repl. ($6,7,8,10M) + Defer Reservoir Seismic Upgrade (1yr & 6yr)	$21.0M
Level 3	S17	Level 2 + Defer AMI + Rock Pond, Whitfield WQ	$24.0M
Level 4	S16	Level 2 + Longer Delay of Main Repl. ($4,6,8,10M) + Greater Deferral of Reservoir Seismic Upgrades + Deferral of Fish Program 1 *additional* year	$31.0M

END OF PRESENTATION

Financial Workshop #5 (Customer Usage Analysis)

BOARD MEETING

MAY 26, 2016

ACWD
Alameda County Water District

RAFTELIS
FINANCIAL CONSULTANTS, INC.

Agenda

Review Tiered Rate Discussion

Implementation Path Discussion

Drought Usage Analysis

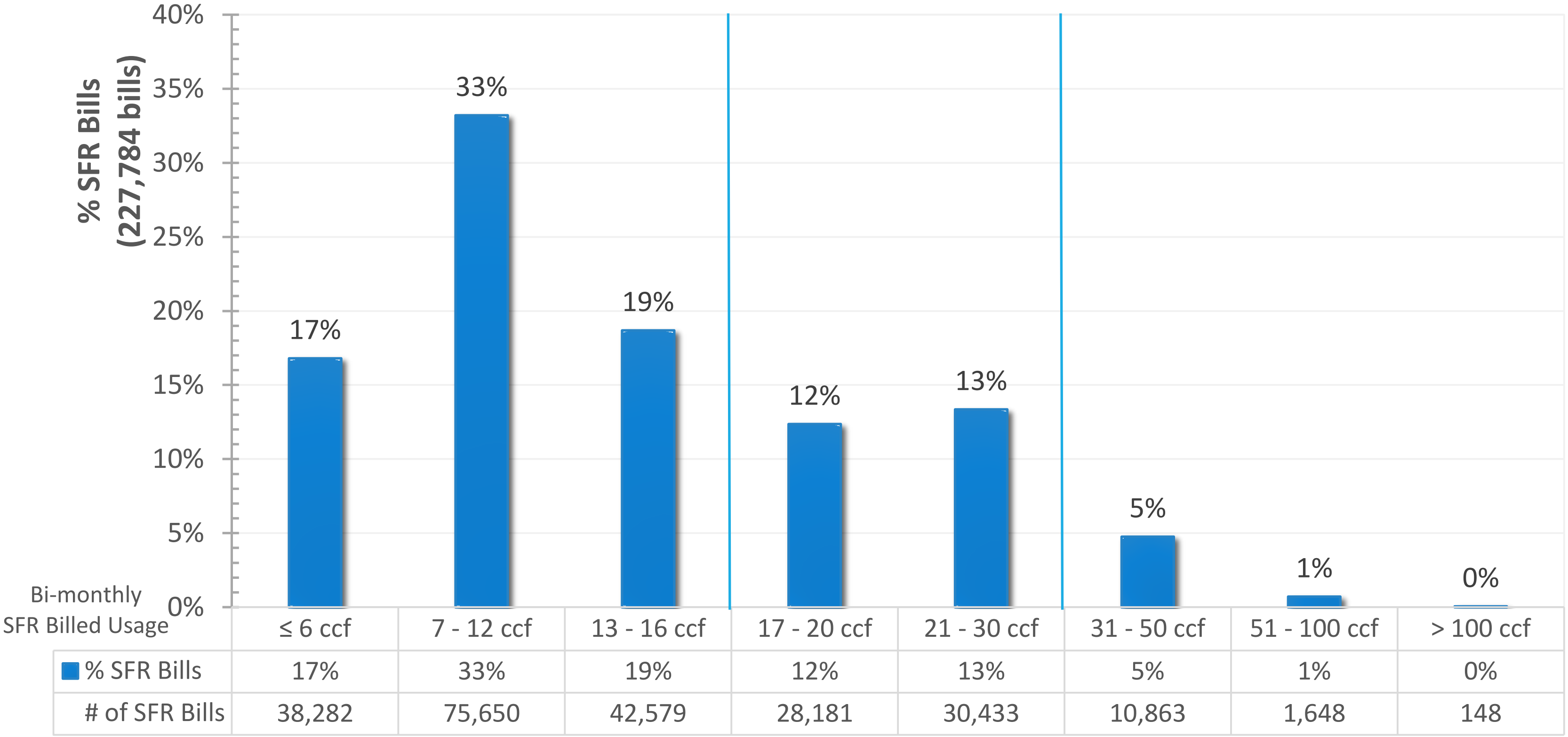
Potential Tier Definition

Rationale for tier definition

	Current DSC Tiers	Potential Tier Widths	Bases
Tier 1	0 – 16 ccf	0 – 12 ccf	2015 Winter Average Usage = 12 ccf
Tier 2	17 – 30 ccf	13 – 20 ccf	2015 Summer Average Usage = 17 ccf 75th – 80th Percentile Usage = 19 – 21 ccf
Tier 3	Above 30 ccf	Above 20 ccf	

SFR Bill Frequency

CY 2015 Consumption for ¾ Inch Meters



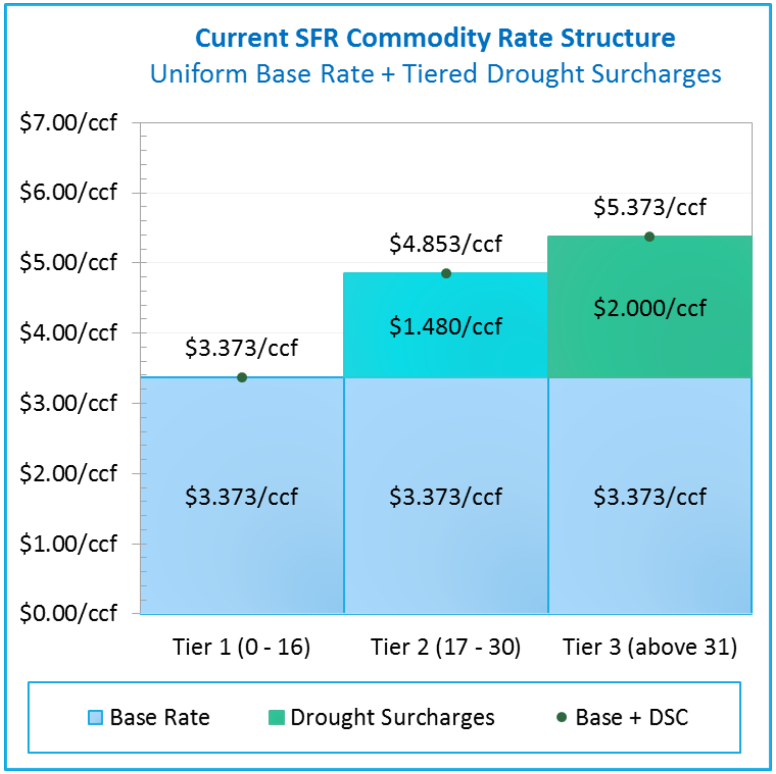
Bi-monthly SFR Billed Usage	≤ 6 ccf	7 - 12 ccf	13 - 16 ccf	17 - 20 ccf	21 - 30 ccf	31 - 50 ccf	51 - 100 ccf	> 100 ccf
🟦 % SFR Bills	17%	33%	19%	12%	13%	5%	1%	0%
# of SFR Bills	38,282	75,650	42,579	28,181	30,433	10,863	1,648	148

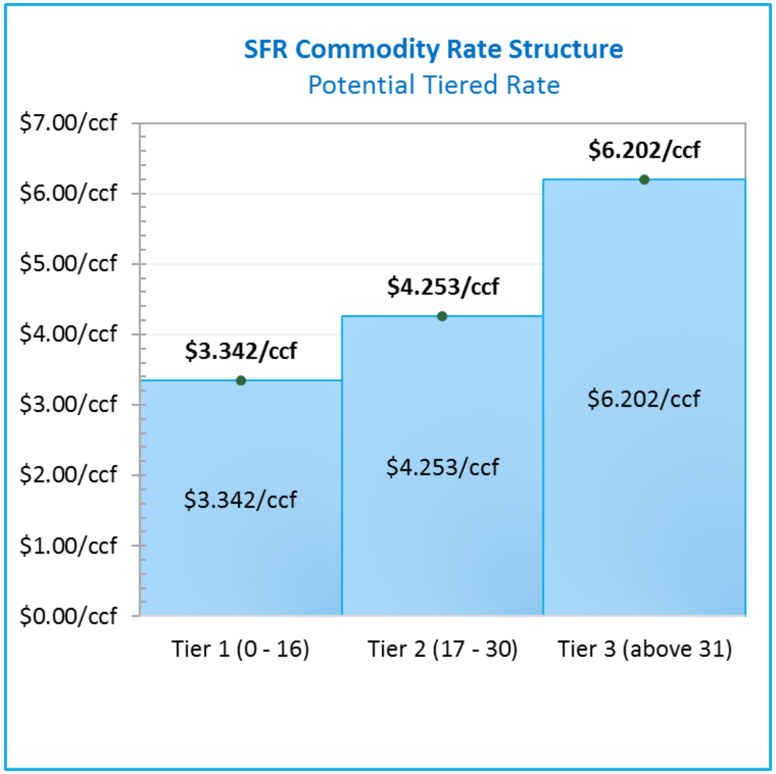
Preliminary SFR Commodity Tiered Rates

Single Family	Projected Demand (ccf)	Water Supply	Delivery Base	Peaking	Conservation	Revenue Offsets	Potential Tiered Rates	Current w/ DSC
Tier 1	4,650,919	$0.536	$2.600	$0.725	$0.000	-$0.519	**$3.342/ccf**	$3.373/ccf
Tier 2	1,242,394	$0.536	$2.600	$0.918	$0.199	$0.000	**$4.253/ccf**	$4.853/ccf
Tier 3	850,687	$2.162	$2.600	$1.241	$0.199	$0.000	**$6.202/ccf**	$5.373/ccf

Potential Implementation Paths

Path 1: Current w/ DSC → Tiered (Illustrative)

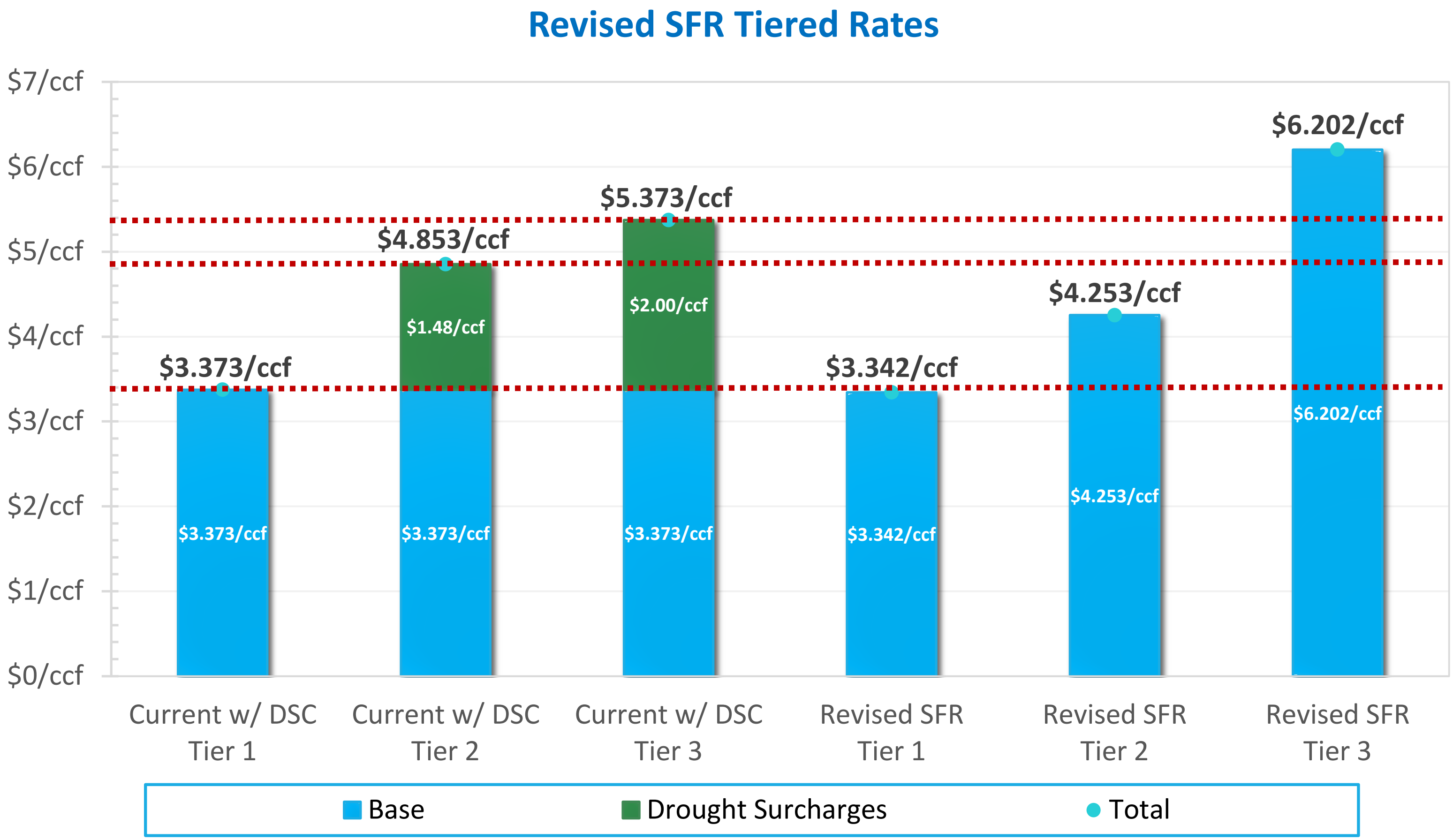




Current

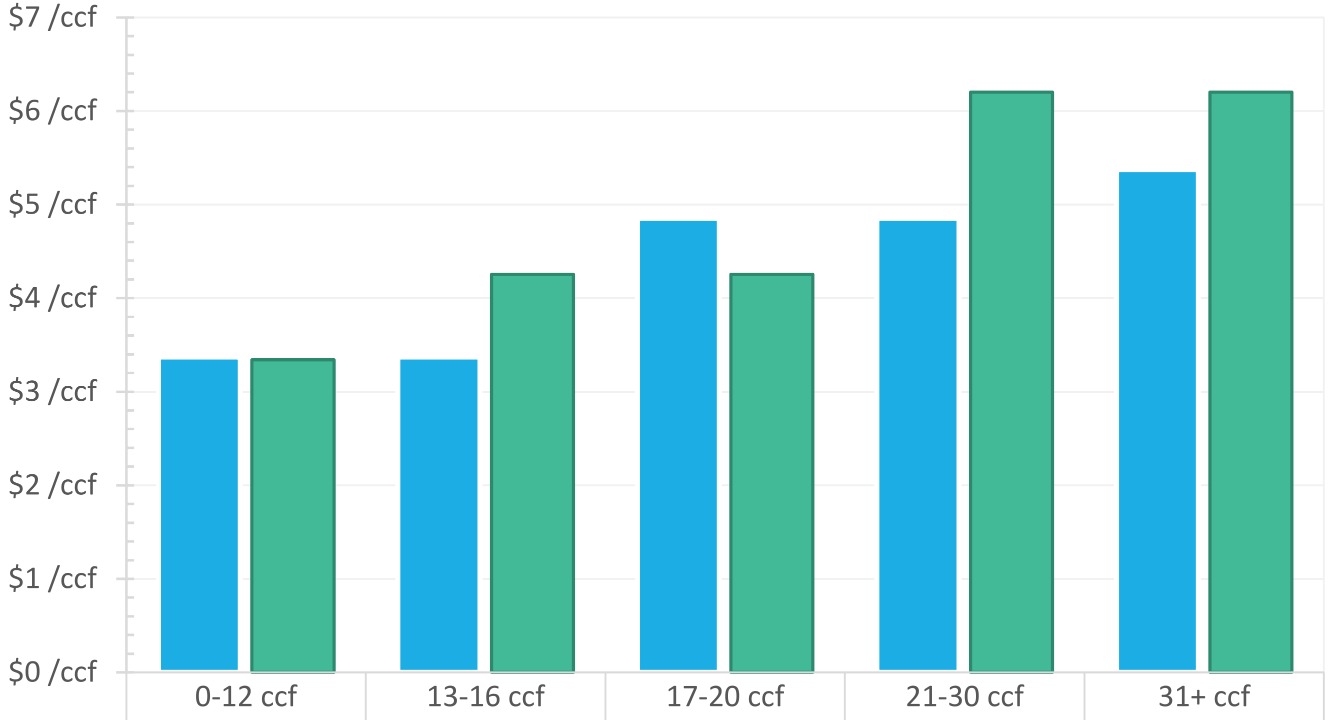
Tiered Rates

Preliminary Rate Comparisons



Preliminary Rate Comparison

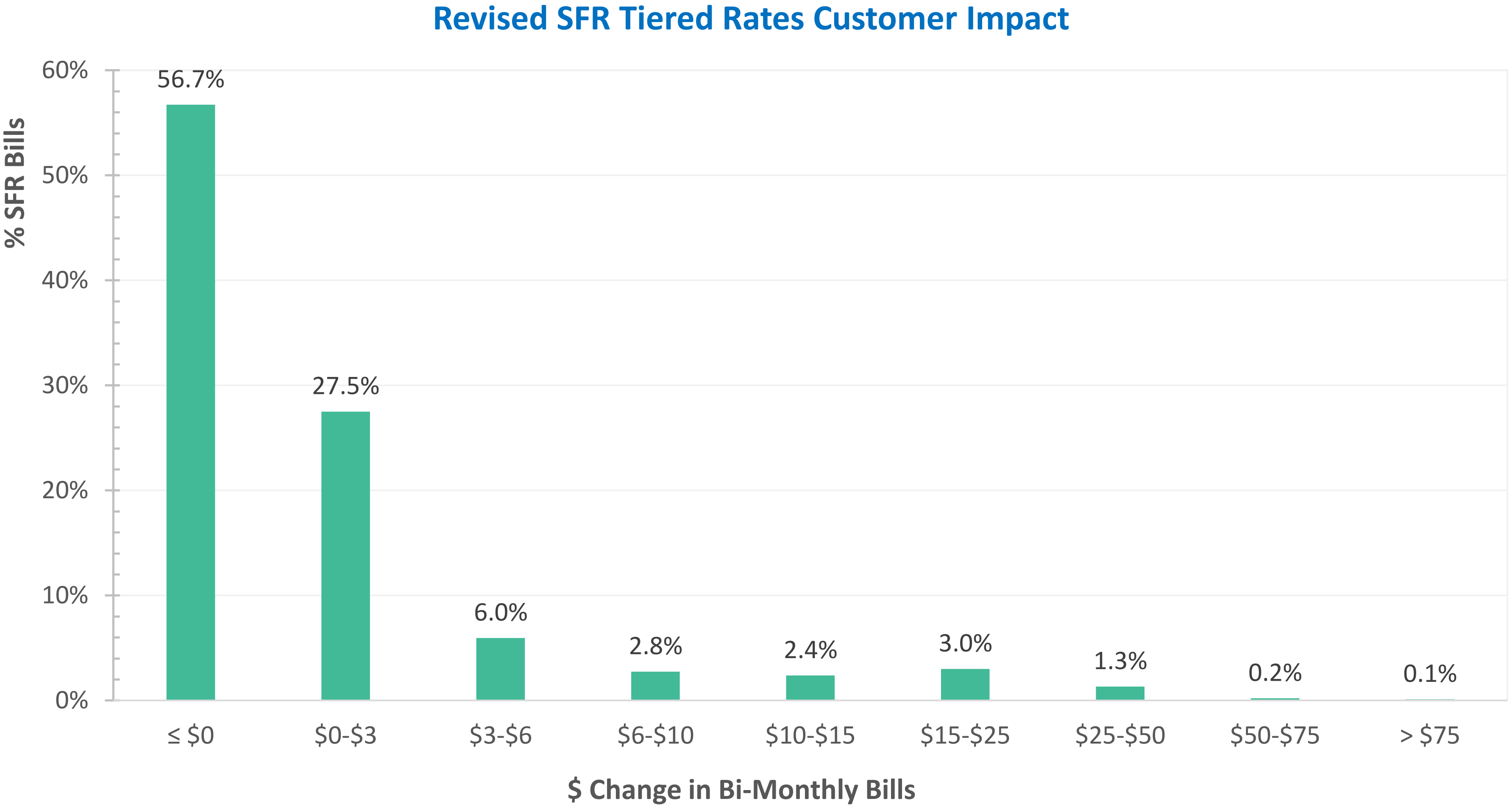
Revised SFR Tiered Rates



	0-12 ccf	13-16 ccf	17-20 ccf	21-30 ccf	31+ ccf
🟦 Current w/ DSC	$3.373/ccf	$3.373/ccf	$4.853/ccf	$4.853/ccf	$5.373/ccf
🟩 Revised Tiered Rates	$3.342/ccf	$4.253/ccf	$4.253/ccf	$6.202/ccf	$6.202/ccf

Preliminary Customer Impact Analysis

Potential Tiered Rates, Eliminated DSC, Revised Cost of Service Based on 2015 Consumption and Blended SFPUC Marginal WS Costs

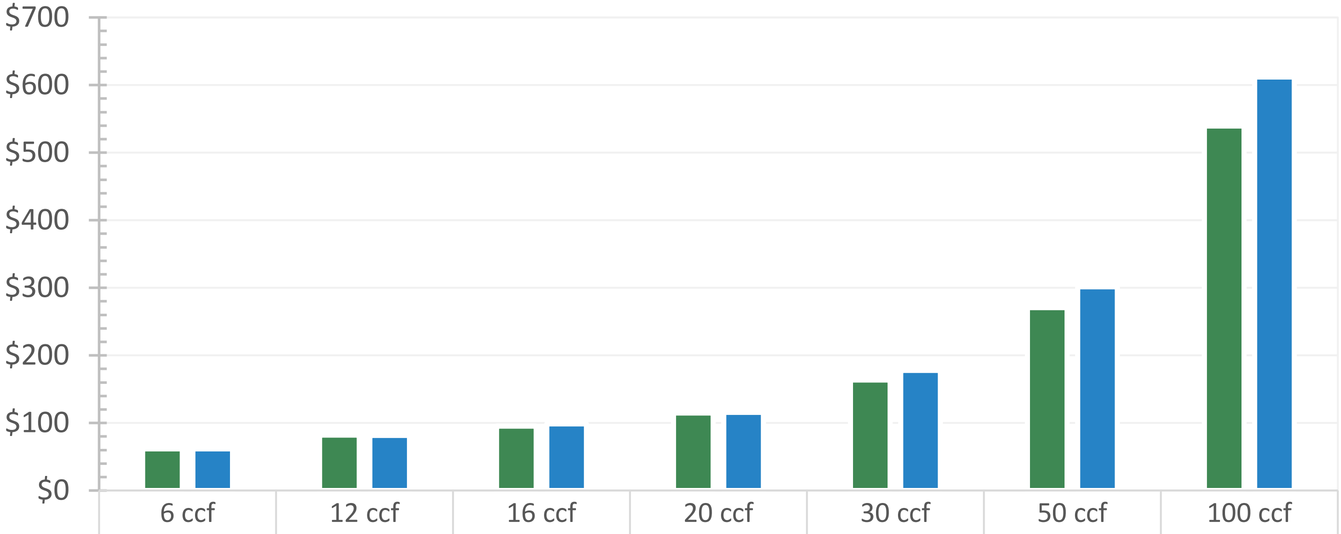


Preliminary Bill Impact Analysis

Current Bills with DSC → Bills with Potential Tiered Rates

Sample SFR Bills with Potential Tiered Rates

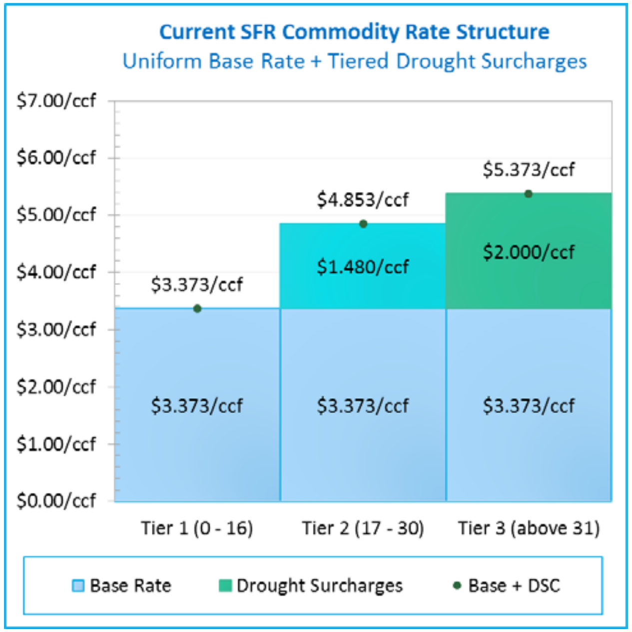
¾ inch Meters

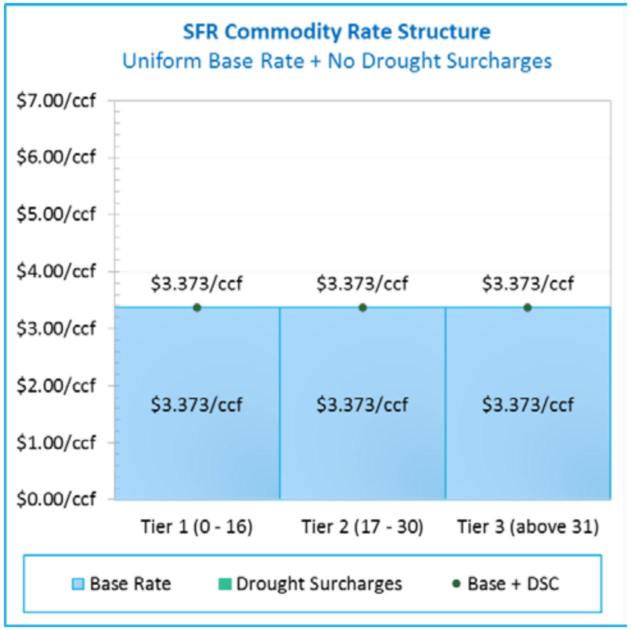


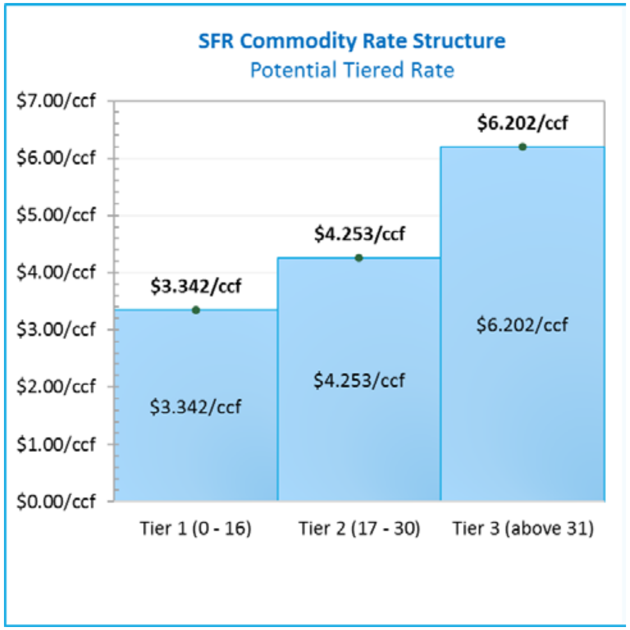
	6 ccf	12 ccf	16 ccf	20 ccf	30 ccf	50 ccf	100 ccf
🟩 Current Bills w/ DSC	$61.78	$82.02	$95.51	$114.92	$163.45	$270.91	$539.56
🟦 Potential Tiered Bills	$61.59	$81.64	$98.66	$115.67	$177.69	$301.73	$611.83
$ Impact	-$0.19	-$0.38	$3.15	$0.75	$14.24	$30.82	$72.27
% Impact	-0.3%	-0.5%	3.3%	0.7%	8.7%	11.4%	13.4%
# of SFR Bills	38,282	75,650	42,579	28,181	30,433	10,863	1,648

Potential Implementation Paths

Path 2: Current w/ DSC → Uniform No DSC → Tiered (Illustrative)


Current SFR Commodity Rate Structure
Uniform Base Rate + Tiered Drought Surcharges


SFR Commodity Rate Structure
Uniform Base Rate + No Drought Surcharges


SFR Commodity Rate Structure
Potential Tiered Rate

Current

Uniform w/o DSC

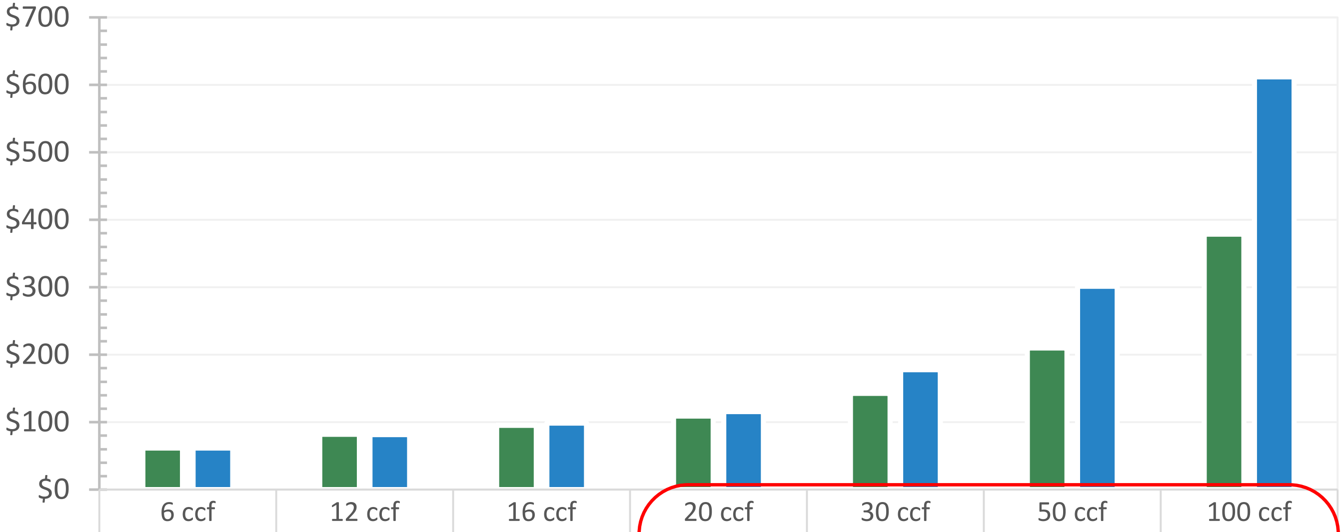
Tiered Rates

Preliminary Bill Impact Analysis

Current Bills without DSC → Bills with Potential Tiered Rates

Sample SFR Bills with Revised Tiered Rates

¾ inch Meters



	6 ccf	12 ccf	16 ccf	20 ccf	30 ccf	50 ccf	100 ccf
🟩 Current Bills w/o DSC	$61.78	$82.02	$95.51	$109.00	$142.73	$210.19	$378.84
🟦 Potential Tiered Bills	$61.59	$81.64	$98.66	$115.67	$177.69	$301.73	$611.83
$ Impact	-$0.19	-$0.38	$3.15	$6.67	$34.96	$91.54	$232.99
% Impact	-0.3%	-0.5%	3.3%	6.1%	24.5%	43.6%	61.5%
# of SFR Bills	38,282	75,650	42,579	28,181	30,433	10,863	1,648

Drought Usage Analysis Study Period

“Normal” Period:

- May-June to Nov-Dec 2013

Drought Period:

- May-June to Nov-Dec 2015

Bi-Monthly Usage Reduction

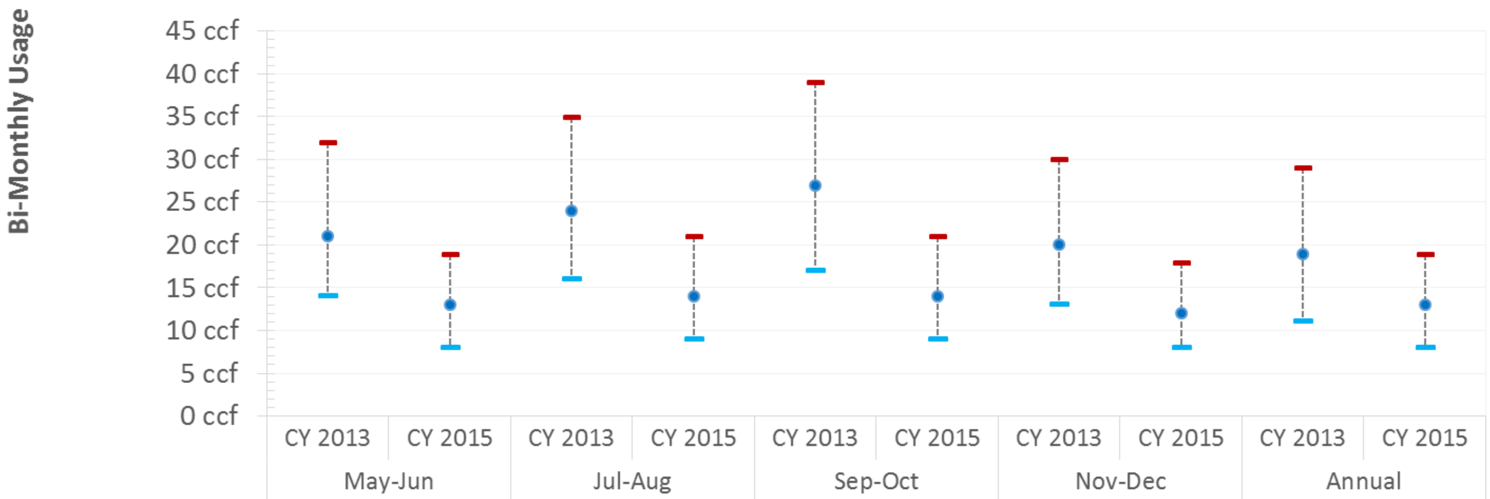
	2013	2015	Reduction	% Reduction
May - Jun	9,298 AF	4,998 AF	-4,300 AF	-46.2%
Jul - Aug	6,098 AF	5,440 AF	-658 AF	-10.8%
Sep - Oct	5,432 AF	5,448 AF	16 AF	0.3%
Nov - Dec	6,359 AF	6,276 AF	-83 AF	-1.3%
Total	**27,188 AF**	**22,163 AF**	**-5,025 AF**	**-18.5%**

Total Usage Reduction

	2013	2015	Reduction	% Reduction
Single Family	13,405 AF	9,993 AF	-3,411 AF	-25.4%
Multi Family	5,119 AF	4,654 AF	-465 AF	-9.1%
Commercial	4,594 AF	4,480 AF	-114 AF	-2.5%
Landscape	2,953 AF	2,108 AF	-845 AF	-28.6%
Others	1,117 AF	928 AF	-189 AF	-16.9%
Total	**27,188 AF**	**22,163 AF**	**-5,025 AF**	**-18.5%**

Single Family Bi-Monthly Usage Profile

Single Family Usage Profile Trends



	CY 2013	CY 2015	CY 2013	CY 2015	CY 2013	CY 2015	CY 2013	CY 2015	CY 2013	CY 2015
	May-Jun		Jul-Aug		Sep-Oct		Nov-Dec		Annual	
● Median	21 ccf	13 ccf	24 ccf	14 ccf	27 ccf	14 ccf	20 ccf	12 ccf	19 ccf	13 ccf
▬ Low - 25th Percentile	14 ccf	8 ccf	16 ccf	9 ccf	17 ccf	9 ccf	13 ccf	8 ccf	11 ccf	8 ccf
▬ High - 75th Percentile	32 ccf	19 ccf	35 ccf	21 ccf	39 ccf	21 ccf	30 ccf	18 ccf	29 ccf	19 ccf

Single Family Bi-Monthly Usage Profile

	2013	2015
Average	23 ccf	15 ccf
Median	19 ccf	13 ccf
25th Percentile	11 ccf	8 ccf
75th Percentile	29 ccf	19 ccf

Proposed Tier Width Definition:
Tier 1 = 0 to 12
Tier 2 = 13 to 20
Tier 3 = 21 +

Customer Response and Proposed Tier Definition

Proposed tier definition is consistent with customer response to the drought

Almost half the bills will be in Tier 1

Over 75 percent of the customers will be in Tiers 1 and 2

Rates developed are based on 2015 water consumption

- Assist with revenue stability in uncertain times

Discussion

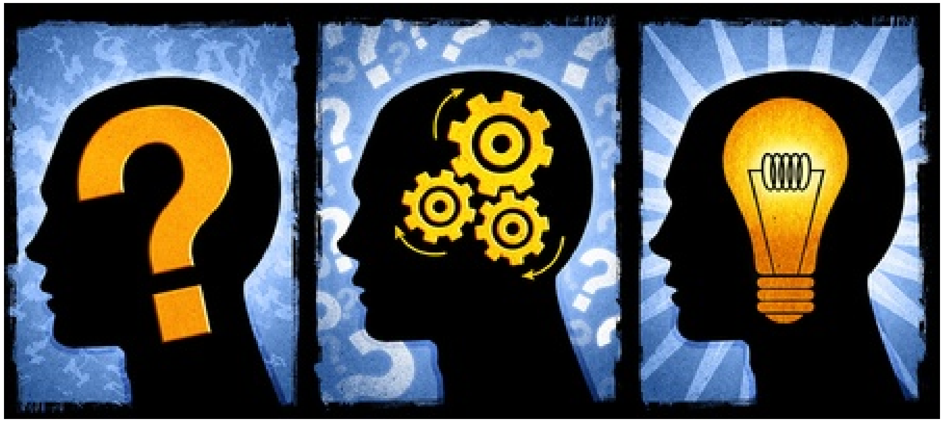


EXHIBIT 9

United States

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        - Pharmaceuticals and Biotechnology
        - Real Estate
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            - Legal
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            - Maritime Transportation
            - Rail Transportation
            - Road Transportation
        - Utilities
        - Forestry and Wood Industry
- Arts and Culture
    - Art
    - Books and Literature
    - Entertainment
        - Cinema
        - Media
            - Radio and Television
        - Music
- Lifestyle and Leisure
    - Automotive
    - Home and Garden
    - Fashion and Luxury

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Food
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  - Football (Australian)
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  Gameday Guide: LA Galaxy vs. Portland Timbers | March 12, 2017

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CITY OF MILLBRAE, CA

01/30/2017 | News release | Distributed by Public on 01/30/2017 12:27

Millbrae Residents Learn About Risks of 60 Year Water System

Last week, the Millbrae City Council, staff from the Public Works Department, and community members joined for the first Millbrae Water Infrastructure Study Session. During the open meeting, Millbrae Public Works Director Ray Chan spoke about the state of the City's water system and challenges the department is facing in trying to maintain it.

'We have a 60-year-old water system. Most water infrastructure has a typical useful life of 50 years,' said Chan. 'We are spending more than 40% of our funds on operations, maintenance and emergency repairs. This kind of emergency response is not sustainable and we need to start planning to gradually replace the system.'

Millbrae's water system was primarily built in the 1950's and 1960's. Deficiencies in the system became apparent in 2013 when seven water mains broke at the same time, causing thousands of Millbrae residents to temporarily go without water until public works crews were able to repair the broken pipes.

'When a water main breaks, we are obligated to fix it within 24 hours. For many of our emergency repairs, they are only temporary fixes. A complete replacement would take weeks. It's unreasonable to ask residents to go without water to their homes for that long,' said Chan in response to a question from a Millbrae resident. 'A planned replacement schedule is more appropriate for the system, as it allows continued water service to be provided.'

Millbrae's 75 miles of pipes provide clean water to 23,000 customers. Because of continual responses to breaks in the system and increased wholesale water costs, the City's budget for long-term capital improvements has shrunk by more than 60% over the past 7 years.

'The major problem we are facing is the San Francisco Public Utilities Commission (SFPUC) has raised our wholesale water rates by 176%. Since we haven't passed those increases on to our customers, we have significantly less funding to do permanent main replacements,' said Chan.

The San Francisco Public Utilities Commission (SFPUC) provides Millbrae with 100% of its water from a variety of regional sources, including Hetch Hetchy. In 2012, in order to address long needed attention to its own infrastructure backlogs and ensure reliable water sourcing, the SFPUC began a $900 million infrastructure upgrade to the Hetch Hetchy Reservoir.

Since then, in order to finance those improvements, the SFPUC has progressively increased its wholesale water rates for Millbrae and other cities in the Bay Area. Instead of passing these rate increases on to residents, Millbrae's water utility is paying for these increases by deferring needed capital improvements.

In 2009, Millbrae used only 30% of its budget to pay for water from the SFPUC, leaving 70% of customer revenues to fund operations, maintenance and capital improvements. Today, it spends more than 50% for water purchases, even taking into account decreases in annual water usage, leaving fewer dollars for proactive capital improvements and system replacements.

'We need to shift from continual emergency repairs to preventative maintenance,' said Chan. 'Public Works recommends replacing 2% of the City's water pipelines each year over a 50-year period. This replacement rate can be increased to 4% or more, but the 2% rate reduces financial stress on the City and would lower the impacts of street construction interruptions on residents and businesses.'

At the City Council's direction, the Public Works Department will host two more study sessions in the near future to review system repair options and funding needs. Times, dates and locations of those will be announced as they become available.

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Back

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EXHIBIT 10

MOODY'S
INVESTORS SERVICE

Rating Action: Moody's assigns Aa3 to San Francisco Public Utilities Commission (CA) Water Revenue Bonds

Global Credit Research - 27 Sep 2016

New York, September 27, 2016 -- Issue: Water Revenue Bonds, 2016 Series AB 2016 Sub-Series A Bonds (Refunding); Rating: Aa3; Rating Type: Underlying LT; Sale Amount: $728,815,000; Expected Sale Date: 10/06/2016; Rating Description: Revenue: Government Enterprise;

Issue: Water Revenue Bonds, 2016 Series AB 2016 Sub-Series B Bonds (Refunding); Rating: Aa3; Rating Type: Underlying LT; Sale Amount: $127,875,000; Expected Sale Date: 10/06/2016; Rating Description: Revenue: Government Enterprise;

Issue: Water Revenue Bonds, 2016 Series C (Federally Taxable); Rating: Aa3; Rating Type: Underlying LT; Sale Amount: $282,465,000; Expected Sale Date: 11/07/2016; Rating Description: Revenue: Government Enterprise;

Summary Rating Rationale

Moody's Investors Service has assigned an Aa3 rating to the San Francisco Public Utilities Commission (SFPUC or PUC) Water Revenue Bonds Refunding Bonds, 2016 Series AB, Sub-Series A and B. We have also assigned an Aa3 to the Taxable Water Revenue Bonds, 2016 Series C. The A, B and C Series bond have an expected par value of $728.8 million, $127.8 million, and $282.4 million respectively. The SFPUC's $4.3 billion debt parity debt is rated Aa3.

The rating reflects the SFPUC's exceptionally large and diverse service area that includes a strong customer base. The SFPUC's credit profile also benefits from a healthy level of stored water supply that helps maintain the reliability of the system's water delivery despite the drought. The rating also incorporates the SFPUC's strong liquidity position, which is included in the solid level of debt service coverage on an indenture basis, though coverage on a current basis is weak. SFPUC also has an unusually high level of debt which is a credit weakness resulting from a large and ambitious capital plan to seismically update facilities.

Rating Outlook

The stable outlook reflects our expectation that the SFPUC will continue maintain healthy liquidity and solid debt service coverage as per the indenture. Coverage by current year revenues will remain below average but will not present a material credit weakness as the utility will continue to implement rate increases, offsetting the revenue impact of weakened water demand.

Factors that Could Lead to an Upgrade

Stronger sustained coverage on indenture and current basis

Significant reduction of debt load

Stabilized demand and reduction of drought pressures

Factors that Could Lead to a Downgrade

Material weakening of debt service coverage

Significant diminishment of liquidity

Sustained deterioration of stored water supply

Legal Security

The SFPUC has irrevocably pledged the revenues of the water enterprise. These revenues consist of water enterprise revenue net of operations and maintenance expenses.

Use of Proceeds

Proceeds from the 2016 A and B bonds will be used to various series of outstanding revenue bonds. Proceeds from the Series C taxable bonds will be used to refund the outstanding taxable commercial paper and finance $15 million in capital projects.

Obligor Profile

The SFPUC serves approximately 2.3 million people including residents of the City of San Francisco. Nearly 70% of the SFPUC's customers live outside of the city and receive water from the SFPUC's wholesale contractors. Half of the SFPUC's 27 wholesale customers receive 100% of their water from the SFPUC, which helps to bring an element of stability and predictability to water sales revenue.

Methodology

The principal methodology used in this rating was US Municipal Utility Revenue Debt published in December 2014. Please see the Ratings Methodologies page on www.moodys.com for a copy of this methodology.

Regulatory Disclosures

For ratings issued on a program, series or category/class of debt, this announcement provides certain regulatory disclosures in relation to each rating of a subsequently issued bond or note of the same series or category/class of debt or pursuant to a program for which the ratings are derived exclusively from existing ratings in accordance with Moody's rating practices. For ratings issued on a support provider, this announcement provides certain regulatory disclosures in relation to the credit rating action on the support provider and in relation to each particular credit rating action for securities that derive their credit ratings from the support provider's credit rating. For provisional ratings, this announcement provides certain regulatory disclosures in relation to the provisional rating assigned, and in relation to a definitive rating that may be assigned subsequent to the final issuance of the debt, in each case where the transaction structure and terms have not changed prior to the assignment of the definitive rating in a manner that would have affected the rating. For further information please see the ratings tab on the issuer/entity page for the respective issuer on www.moodys.com.

Regulatory disclosures contained in this press release apply to the credit rating and, if applicable, the related rating outlook or rating review.

Please see www.moodys.com for any updates on changes to the lead rating analyst and to the Moody's legal entity that has issued the rating.

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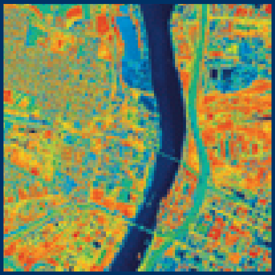
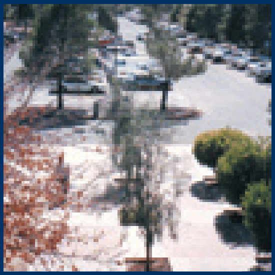
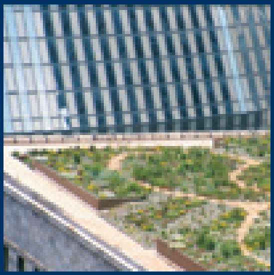
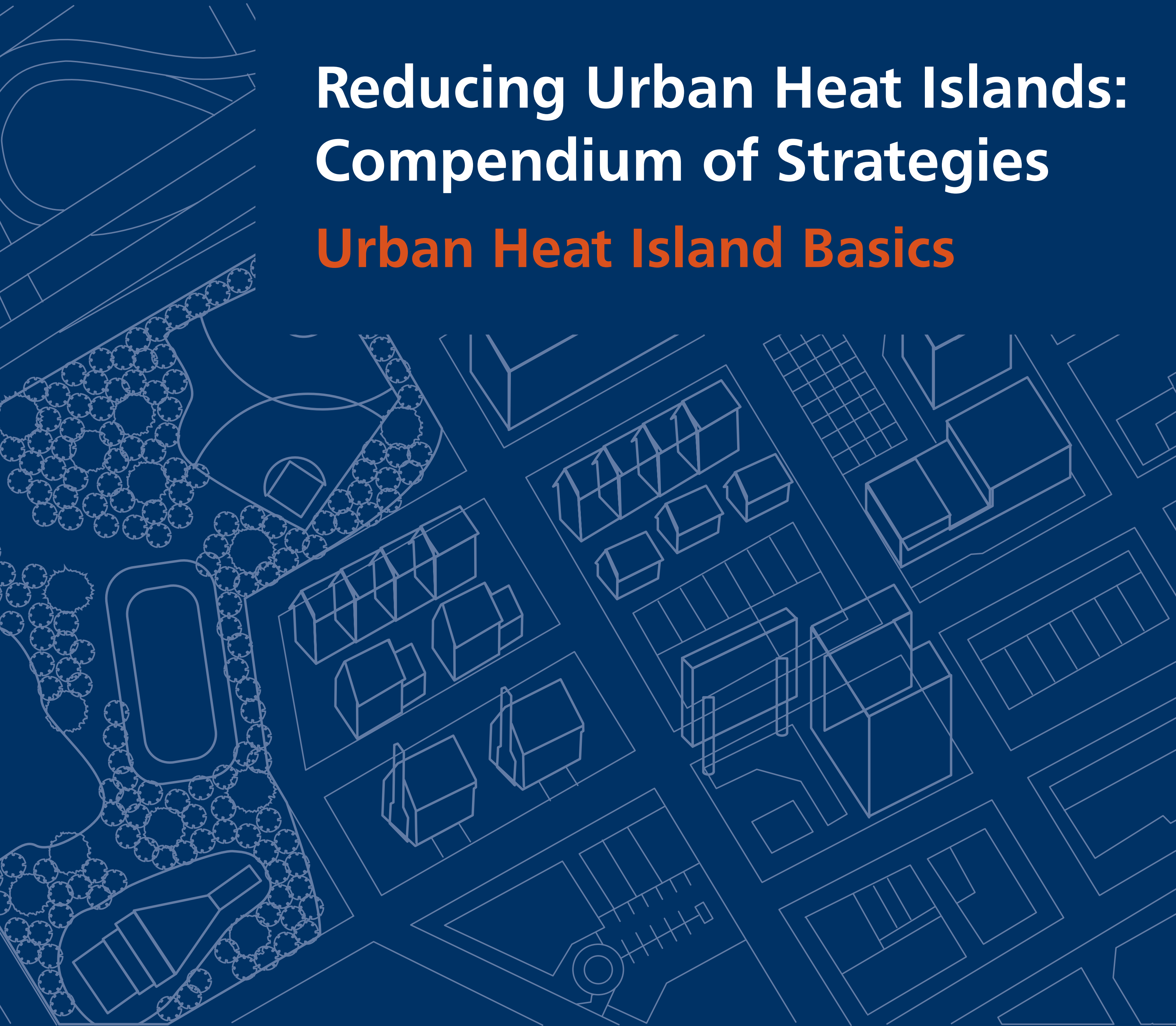
EXHIBIT 11



Reducing Urban Heat Islands: Compendium of Strategies

Urban Heat Island Basics



Acknowledgements

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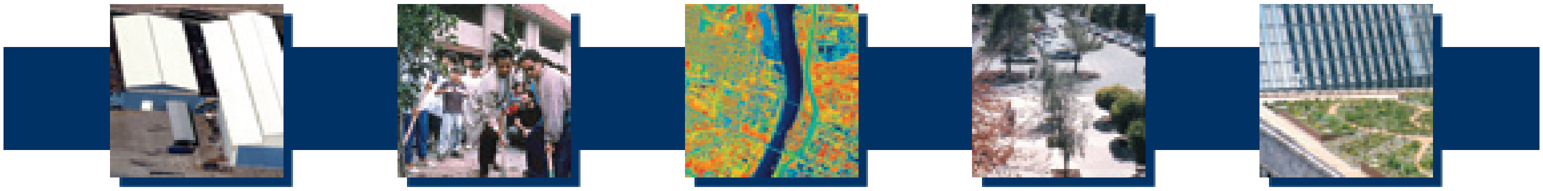

Urban Heat Island Basics

As urban areas develop, changes occur in the landscape. Buildings, roads, and other infrastructure replace open land and vegetation. Surfaces that were once permeable and moist generally become impermeable and dry.* This development leads to the formation of urban heat islands—the phenomenon whereby urban regions experience warmer temperatures than their rural surroundings.

This chapter provides an overview of different types of urban heat islands, methods for identifying them, and factors that contribute to their development. It introduces key concepts that are important to understanding and mitigating this phenomenon, as well as additional sources of information. It discusses:

- General features of urban heat islands
- Surface versus atmospheric heat islands
- Causes of urban heat island formation
- Urban heat island impacts on energy consumption, environmental quality, and human health
- Resources for further information.

1. What Are Urban Heat Islands?

Many urban and suburban areas experience elevated temperatures compared to their outlying rural surroundings; this difference in temperature is what constitutes an urban heat island. The annual mean air temperature of a city with one million or more people can be 1.8 to 5.4°F (1 to 3°C) warmer than its surroundings,[1] and on a clear, calm night, this temperature difference can be as much as 22°F (12°C).[2] Even smaller cities and towns will produce heat islands, though the effect often decreases as city size decreases.[3]

This chapter focuses on *surface* and *atmospheric* urban heat islands. These two heat island types differ in the ways they are formed, the techniques used to identify and measure them, their impacts, and to some degree, the methods available to mitigate them. Table 1 summarizes the basic characteristics of each type of heat island. These features are described in more detail in the following sections of this chapter.

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* This change in landscape may differ in regions such as deserts, where moisture may increase in urban areas if development introduces grass lawns and other irrigated vegetation.

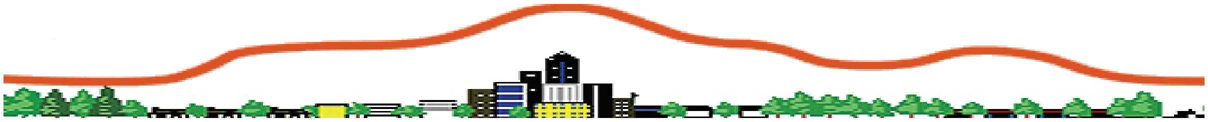


Table 1: Basic Characteristics of Surface and Atmospheric Urban Heat Islands (UHIs)[4]

Feature	Surface UHI	Atmospheric UHI
Temporal Development	• Present at all times of the day and night • Most intense during the day and in the summer	• May be small or non-existent during the day • Most intense at night or predawn and in the winter
Peak Intensity (Most intense UHI conditions)	• More spatial and temporal variation: ▪ Day: 18 to 27°F (10 to 15°C) ▪ Night: 9 to 18°F (5 to 10°C)	• Less variation: ▪ Day: -1.8 to 5.4°F (-1 to 3°C) ▪ Night: 12.6 to 21.6°F (7 to 12°C)
Typical Identification Method	• Indirect measurement: ▪ Remote sensing	• Direct measurement: ▪ Fixed weather stations ▪ Mobile traverses
Typical Depiction	• Thermal image	• Isotherm map • Temperature graph

1.1 Surface Urban Heat Islands

On a hot, sunny summer day, the sun can heat dry, exposed urban surfaces, like roofs and pavement, to temperatures 50 to 90°F (27 to 50°C) hotter than the air,[5] while shaded or moist surfaces—often in more rural surroundings—remain close to air temperatures. Surface urban heat islands are typically present day and night, but tend to be strongest during the day when the sun is shining.

On average, the difference in daytime surface temperatures between developed and rural areas is 18 to 27°F (10 to 15°C); the difference in nighttime surface temperatures is typically smaller, at 9 to 18°F (5 to 10°C).[6]

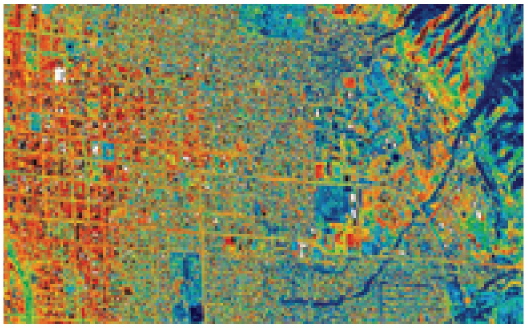
The magnitude of surface urban heat islands varies with seasons, due to changes in the sun's intensity as well as ground cover and weather. As a result of such variation, surface urban heat islands are typically largest in the summer.[7]

How Weather Influences Urban Heat Islands

Summertime urban heat islands are most intense when the sky is clear and winds are calm. Heavy cloud cover blocks solar radiation, reducing daytime warming in cities. Strong winds increase atmospheric mixing, lowering the urban-rural temperature difference. This document, *Reducing Urban Heat Islands: Compendium of Strategies,* focuses on mitigating summertime heat islands through strategies that have maximum impact under clear, calm conditions.

To identify urban heat islands, scientists use direct and indirect methods, numerical modeling, and estimates based on empirical models. Researchers often use remote sensing, an indirect measurement technique, to estimate surface temperatures. They use the data collected to produce thermal images, such as that shown in Figure 1.

Figure 1: Thermal Image Depicting a Surface Urban Heat Island



NASA/Marshall Space Flight Center

This image, taken from an aircraft, depicts a midday surface urban heat island in Salt Lake City, Utah, on July 13, 1998. White areas are around 160°F (70°C), while dark blue areas are near 85°F (30°C). Note the warmer urban surface temperatures (left side of image) and cooler surfaces in the neighboring foothills (on the right).

1.2 Atmospheric Urban Heat Islands

Warmer air in urban areas compared to cooler air in nearby rural surroundings defines atmospheric urban heat islands. Experts often divide these heat islands into two different types:

- **Canopy layer urban heat islands** exist in the layer of air where people live, from the ground to below the tops of trees and roofs.
- **Boundary layer urban heat islands** start from the rooftop and treetop level and extend up to the point where urban landscapes no longer influence the atmosphere. This region typically extends no more than one mile (1.5 km) from the surface.[8]

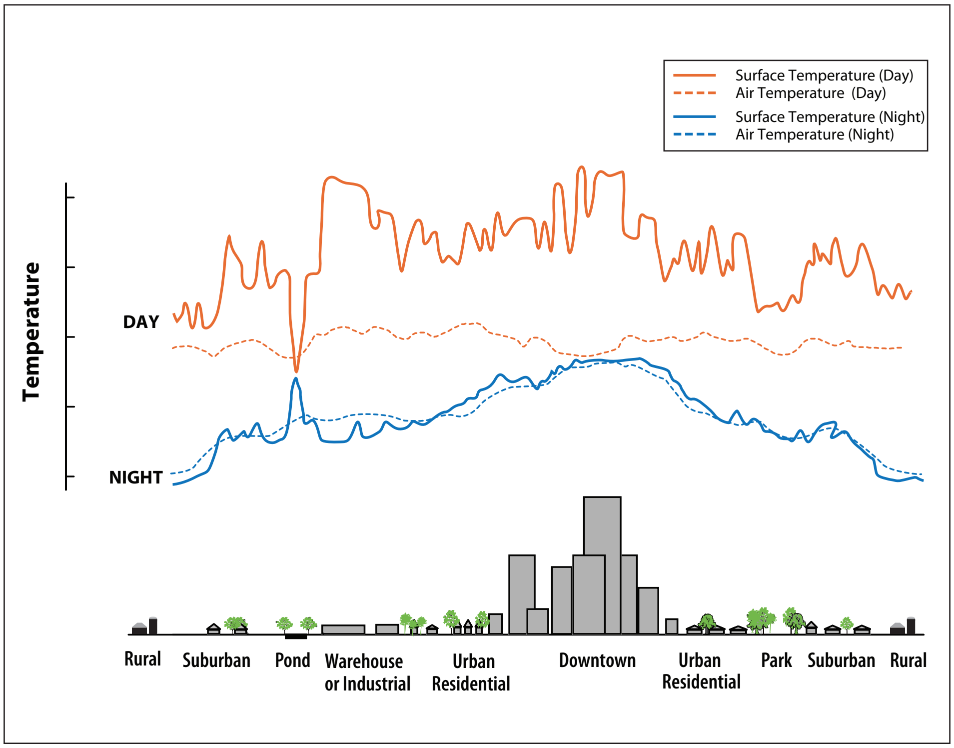
Canopy layer urban heat islands are the most commonly observed of the two types and are often the ones referred to in discussions of urban heat islands. For this reason, this chapter and compendium use the more general term *atmospheric urban heat islands* to refer to canopy layer urban heat islands.

Atmospheric urban heat islands are often weak during the late morning and throughout the day and become more pronounced after sunset due to the slow release of heat from urban infrastructure. The timing of this peak, however, depends on the properties of urban and rural surfaces, the season, and prevailing weather conditions.

Surface and Air Temperatures: How Are They Related?

Surface temperatures have an indirect, but significant, influence on air temperatures, especially in the canopy layer, which is closest to the surface. For example, parks and vegetated areas, which typically have cooler surface temperatures, contribute to cooler air temperatures. Dense, built-up areas, on the other hand, typically lead to warmer air temperatures. Because air mixes within the atmosphere, though, the relationship between surface and air temperatures is not constant, and air temperatures typically vary less than surface temperatures across an area (see Figure 2).

Figure 2: Variations of Surface and Atmospheric Temperatures



Modified from Voogt, 2000

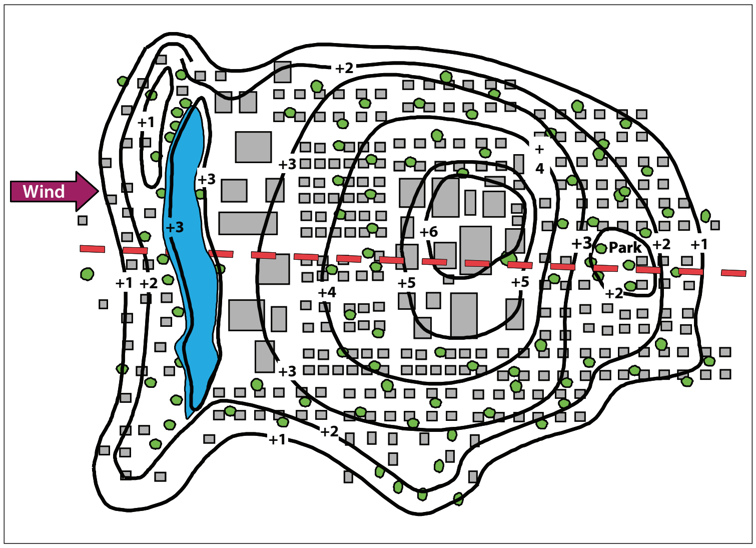
Surface and atmospheric temperatures vary over different land use areas. Surface temperatures vary more than air temperatures during the day, but they both are fairly similar at night. The dip and spike in surface temperatures over the pond show how water maintains a fairly constant temperature day and night, due to its high heat capacity.

* Note: The temperatures displayed above do not represent absolute temperature values or any one particular measured heat island. Temperatures will fluctuate based on factors such as seasons, weather conditions, sun intensity, and ground cover.

Atmospheric heat islands vary much less in intensity than surface heat islands. On an annual mean basis, air temperatures in large cities might be 1.8 to 5.4°F (1 to 3°C) warmer than those of their rural surroundings.[9]

Researchers typically measure air temperatures through a dense network of sampling points from fixed stations or mobile traverses, which are both direct measurement methods. Figure 3 illustrates a conceptual isotherm map that depicts an atmospheric urban heat island. The center of the figure, which is the hottest area, is the urban core. A simple graph of temperature differences, as shown in Figure 4, is another way to show the results.

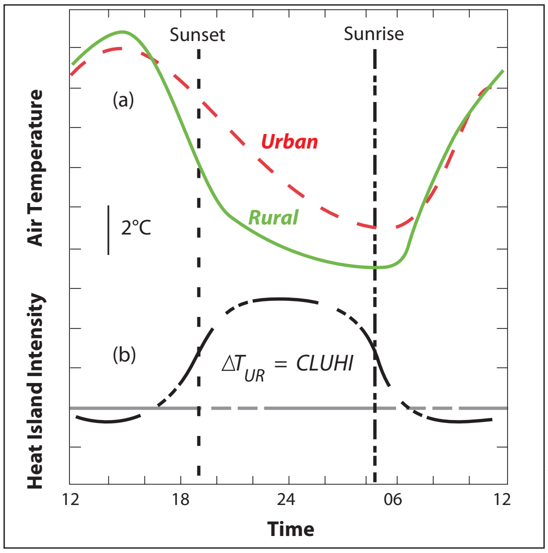
Figure 3: Isotherm Map Depicting an Atmospheric Nighttime Urban Heat Island



Modified from Voogt, 2000

This conceptual map with overlaid isotherms (lines of equal air temperature) exhibits a fully developed nighttime atmospheric urban heat island. The dotted red line indicates a traverse along which measurements are taken.

Figure 4: Conceptual Drawing of the Diurnal Evolution of the Urban Heat Island during Calm and Clear Conditions



Modified from Oke, 1982, and Runnalls and Oke, 2000

Atmospheric urban heat islands primarily result from different cooling rates between urban areas and their surrounding rural or non-urban surroundings (section (a) of Figure 5). The differential cooling rates are most pronounced on clear and calm nights and days when rural areas can cool more quickly than urban areas. The heat island intensity (section (b)) typically grows from mid- to late afternoon to a maximum a few hours after sunset. In some cases, a heat island might not reach peak intensity until after sunrise.

Urban Heat Islands, Climate Change, and Global Warming

Urban heat islands refer to the elevated temperatures in developed areas compared to more rural surroundings. Urban heat islands are caused by development and the changes in radiative and thermal properties of urban infrastructure as well as the impacts buildings can have on the local micro-climate—for example tall buildings can slow the rate at which cities cool off at night. Heat islands are influenced by a city's geographic location and by local weather patterns, and their intensity changes on a daily and seasonal basis.

The warming that results from urban heat islands over small areas such as cities is an example of local climate change. Local climate changes resulting from urban heat islands fundamentally differ from global climate changes in that their effects are limited to the local scale and decrease with distance from their source. Global climate changes, such as those caused by increases in the sun's intensity or greenhouse gas concentrations, are not locally or regionally confined.

Climate change, broadly speaking, refers to any significant change in measures of climate (such as temperature, precipitation, or wind) lasting for an extended period (decades or longer). Climate change may result from:

- Natural factors, such as changes in the sun's intensity or slow changes in the Earth's orbit around the sun
- Natural processes within the climate system (e.g. changes in ocean circulation)
- Human activities that change the atmosphere's composition (e.g. burning fossil fuels) and the land surface (e.g. deforestation, reforestation, or urbanization).

The term climate change is often used interchangeably with the term global warming, but according to the National Academy of Sciences, "the phrase 'climate change' is growing in preferred use to 'global warming' because it helps convey that there are [other] changes in addition to rising temperatures."

Global warming is an average increase in the temperature of the atmosphere near the Earth's surface and in the lowest layer of the atmosphere, which can contribute to changes in global climate patterns. Global warming can occur from a variety of causes, both natural and human induced. In common usage, "global warming" often refers to the warming that can occur as a result of increased emissions of greenhouse gases from human activities. Global warming can be considered part of global climate change along with changes in precipitation, sea level, etc.

The impacts from urban heat islands and global climate change (or global warming) are often similar. For example, some communities may experience longer growing seasons due to either or both phenomena. Urban heat islands and global climate change can both also increase energy demand, particularly summertime air conditioning demand, and associated air pollution and greenhouse gas emissions, depending on the electric system power fuel mix.

Strategies to reduce urban heat islands—the focus of this document, *Reducing Urban Heat Islands: Compendium of Strategies*—produce multiple benefits including lowering surface and air temperatures, energy demand, air pollution and greenhouse gas emissions. Thus, advancing measures to mitigate urban heat islands also helps to address global climate change.

For more information on global warming see EPA's Climate Change website, <www.epa.gov/climatechange>.

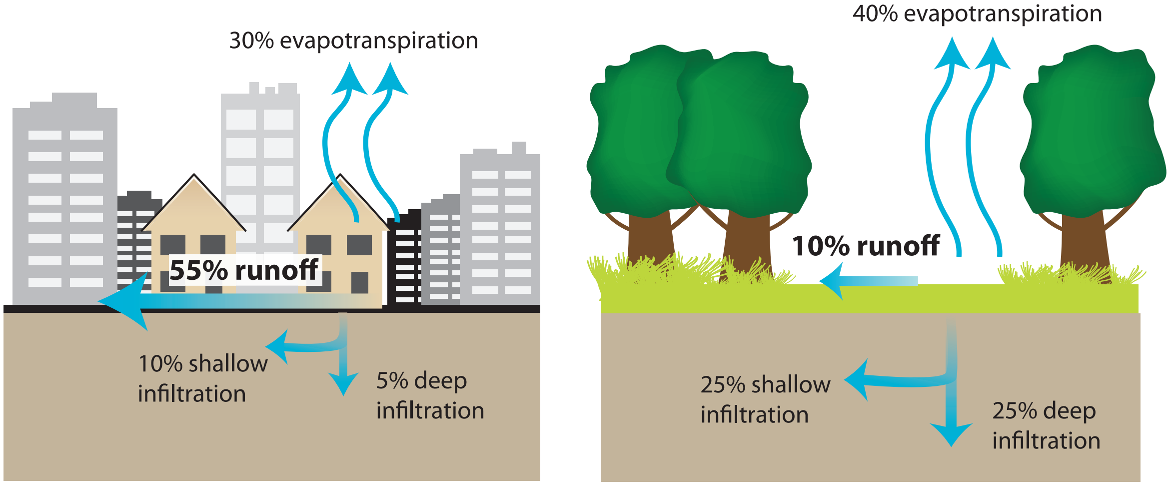
2. How Do Urban Heat Islands Form?

While many factors contribute to urban heat island formation (see Table 2), this chapter focuses on vegetative cover and surface properties because communities can directly address these factors with available technologies. See the "Trees and Vegetation," "Green Roofs," "Cool Roofs," and "Cool Pavement" chapters for detailed information on these strategies.

2.1 Reduced Vegetation in Urban Areas

In rural areas, vegetation and open land typically dominate the landscape. Trees and vegetation provide shade, which helps lower surface temperatures. They also help reduce air temperatures through a process called evapotranspiration, in which plants release water to the surrounding air, dissipating ambient heat. In contrast, urban areas are characterized by dry, impervious surfaces, such as conventional roofs, sidewalks, roads, and parking lots. As cities develop, more vegetation is lost, and more surfaces are paved or covered with buildings. The change in ground cover results in less shade and moisture to keep urban areas cool. Built up areas evaporate less water (see Figure 5), which contributes to elevated surface and air temperatures.

Figure 5: Impervious Surfaces and Reduced Evapotranspiration



Modified from the Federal Interagency Stream Restoration Working Group (FISRWG)

Highly developed urban areas (right), which are characterized by 75%-100% impervious surfaces, have less surface moisture available for evapotranspiration than natural ground cover, which has less than 10% impervious cover (left). This characteristic contributes to higher surface and air temperatures in urban areas.

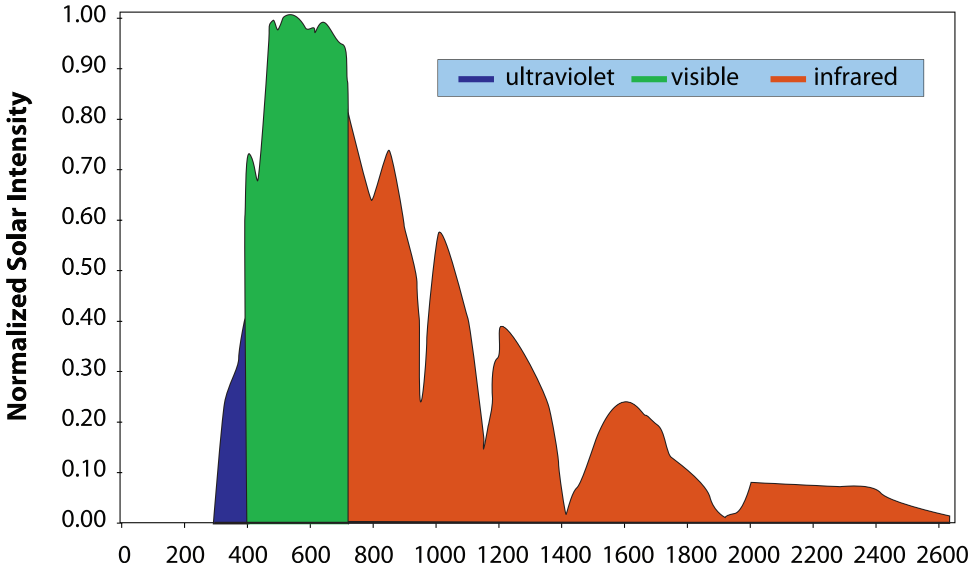
2.2 Properties of Urban Materials

Properties of urban materials, in particular solar reflectance, thermal emissivity, and heat capacity, also influence urban heat island development, as they determine how the sun's energy is reflected, emitted, and absorbed.

Figure 6 shows the typical solar energy that reaches the Earth's surface on a clear summer day. Solar energy is composed of ultraviolet (UV) rays, visible light, and infrared energy, each reaching the Earth in different percentages: five percent of solar energy is in the UV spectrum, including the type of rays responsible for sunburn; 43 percent of solar energy is visible light, in colors ranging from violet to red; and the remaining 52 percent of solar energy is infrared, felt as heat. Energy in all of these wavelengths contributes to urban heat island formation.

Solar reflectance, or albedo, is the percentage of solar energy reflected by a surface. Much of the sun's energy is found in the visible wavelengths (see Figure 6); thus, solar reflectance is correlated with a material's color. Darker surfaces tend to have lower solar reflectance values than lighter surfaces. Researchers are studying and developing cool colored materials, though, that use specially engineered pigments that reflect well in the infrared wavelengths. These products can be dark in color but have a solar reflectance close to that of a white or light-colored material. (See the "Cool Roofs" chapter for further discussion of cool colored roof products.)

Figure 6: Solar Energy versus Wavelength Reaching Earth's Surface



Solar energy intensity varies over wavelengths from about 250 to 2500 nanometers.

Urban areas typically have surface materials, such as roofing and paving, which have a lower albedo than those in rural settings. As a result, built up communities generally reflect less and absorb more of the sun's energy. This absorbed heat increases surface temperatures and contributes to the formation of surface and atmospheric urban heat islands.

Although solar reflectance is the main determinant of a material's surface temperature, thermal emittance, or emissivity, also plays a role. Thermal emittance is a measure of a surface's ability to shed heat, or emit long-wave (infrared) radiation. All things equal, surfaces with high emittance values will stay cooler, because they will release heat more readily. Most construction materials, with the exception of metal, have high thermal emittance values. Thus, this property is mainly of interest to those installing cool roofs, which can be metallic. See the "Cool Roofs" chapter of the compendium for more information.

Another important property that influences heat island development is a material's heat capacity, which refers to its ability to store heat. Many building materials, such as steel and stone, have higher heat capacities than rural materials, such as dry soil and sand. As a result, cities are typically more effective at storing the sun's energy as heat within their infrastructure. Downtown metropolitan areas can absorb and store twice the amount of heat compared to their rural surroundings during the daytime.[10]

Radiative and Thermal Properties—Cool Roofs and Cool Pavements

Albedo and emissivity are considered "radiative properties." Heat capacity, on the other hand, is one of several "thermal properties" a material can possess. For thin materials like roofing, which is typically placed over insulation, reflectance and emittance are the main properties to consider, as the heat capacity of a well insulated roof is low. For pavements, which are thicker than roofing products and are placed on top of the ground, which has its own set of thermal characteristics, designers and researchers need to consider a more complex set of factors that include radiative and thermal properties—such as heat capacity, thermal conductivity, and density.

2.3 Urban Geometry

An additional factor that influences urban heat island development, particularly at night, is urban geometry, which refers to the dimensions and spacing of buildings within a city. Urban geometry influences wind flow, energy absorption, and a given surface's ability to emit long-wave radiation back to space. In developed areas, surfaces and structures are often at least partially obstructed by objects, such as neighboring buildings, and become large thermal masses that cannot release their heat very readily because of these obstructions. Especially at night, the air above urban centers is typically warmer than air over rural areas. Nighttime atmospheric heat islands can have serious health implications for urban residents during heat waves (see textbox in Section 3.3, "Factors in Heat-Related Illnesses and Death.")

Researchers often focus on an aspect of urban geometry called urban canyons, which can be illustrated by a relatively narrow street lined by tall buildings. During the day, urban canyons can have competing effects. On the one hand, tall buildings can create shade, reducing surface and air temperatures. On the other, when sunlight reaches surfaces in the canyon, the sun's energy is reflected and absorbed by building walls, which further lowers the city's overall albedo—the net reflectance from surface albedo plus urban geometry—and can increase temperatures.[11] At night, urban canyons generally impede cooling, as buildings and structures can obstruct the heat that is being released from urban infrastructure.

Table 2: Factors that Create Urban Heat Islands

Factors Communities are Focusing On
• Reduced vegetation in urban regions: Reduces the natural cooling effect from shade and evapotranspiration. • Properties of urban materials: Contribute to absorption of solar energy, causing surfaces, and the air above them, to be warmer in urban areas than those in rural surroundings.
Future Factors to Consider
• Urban geometry: The height and spacing of buildings affects the amount of radiation received and emitted by urban infrastructure. • Anthropogenic heat emissions: Contribute additional warmth to the air.*
Additional Factors
• Weather: Certain conditions, such as clear skies and calm winds, can foster urban heat island formation. • Geographic location: Proximity to large water bodies and mountainous terrain can influence local wind patterns and urban heat island formation.

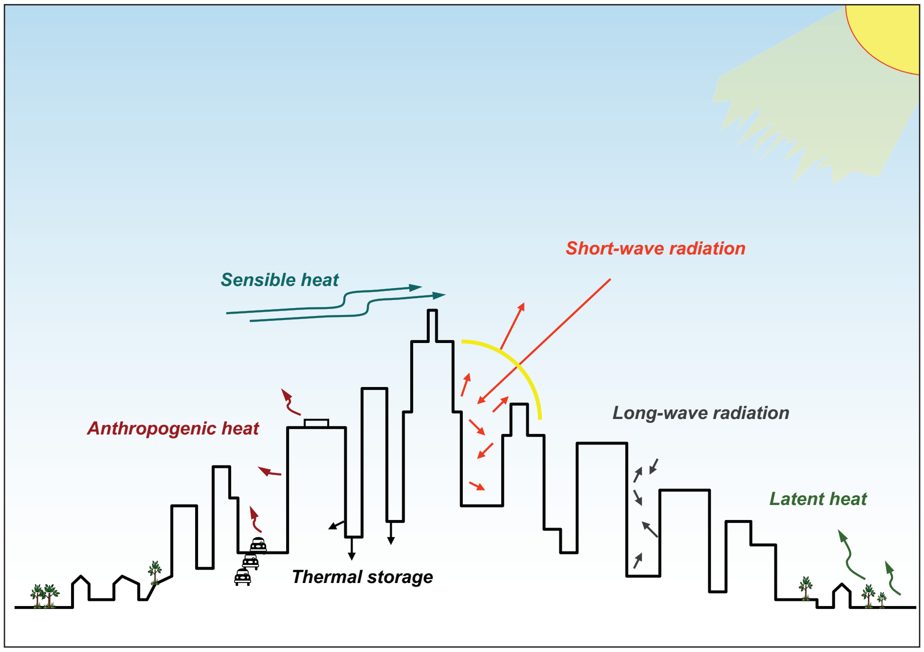
* Although communities currently can lower anthropogenic heat emissions through energy efficiency technologies in the building and vehicle sectors, this compendium focuses on modifying vegetative cover and surface properties of urban materials, as they have long been regarded as urban heat island reduction strategies. An emerging body of literature on the role waste heat plays in urban heat island formation, though, may lead communities to focus on anthropogenic heat in the near future.

The Urban Surface Energy Budget

An energy budget provides an equation that quantifies the balance of incoming and outgoing energy flows, or fluxes (see Figure 7). The surface energy budgets of urban areas and their more rural surroundings will differ because of differences in land cover, surface characteristics, and level of human activity. Such differences can affect the generation and transfer of heat, which can lead to different surface and air temperatures in urban versus rural areas. Various elements of the budget include:

- **Short-wave radiation** is ultraviolet, visible light, and near-infrared radiation from the sun that reaches the Earth (see Figure 6). This energy is a key driver of urban heat islands. Urban surfaces, compared to vegetation and other natural ground cover, reflect less radiation back to the atmosphere. They instead absorb and store more of it, which raises the area's temperature.
- **Thermal storage** increases in cities in part due to the lower solar reflectance of urban surfaces, but it is also influenced by the thermal properties of construction materials and urban geometry. Urban geometry can cause some short-wave radiation—particularly within an urban canyon—to be reflected on nearby surfaces, such as building walls, where it is absorbed rather than escaping into the atmosphere.

Figure 7: Urban Surface Energy Budget



Adapted from David Sailor

Continued on next page

The Urban Surface Energy Budget (continued)

- Similarly, urban geometry can impede the release of **long-wave, or infrared, radiation** into the atmosphere. When buildings or other objects absorb incoming short-wave radiation, they can re-radiate that energy as long-wave energy, or heat. However, at night, due to the dense infrastructure in some developed areas that have low sky view factors (see section 2.3), urban areas cannot easily release long-wave radiation to the cooler, open sky, and this trapped heat contributes to the urban heat island.
- Evapotranspiration describes the transfer of **latent heat,** what we feel as humidity, from the Earth's surface to the air via evaporating water. Urban areas tend to have less evapotranspiration relative to natural landscapes, because cities retain little moisture. This reduced moisture in built up areas leads to dry, impervious urban infrastructure reaching very high surface temperatures, which contribute to higher air temperatures.*
- Convection describes the transfer of **sensible heat,** what we feel as temperature, between the surface and air when there is a difference in temperature between them. High urban surface temperatures warm the air above, which then circulates upwards via convection.
- **Anthropogenic heat** refers to the heat generated by cars, air conditioners, industrial facilities, and a variety of other manmade sources, which contributes to the urban energy budget, particularly in the winter.

* This change in landscape may differ in regions such as deserts, where moisture may increase in urban areas if development introduces grass lawns and other irrigated vegetation.

The effects of urban geometry on urban heat islands are often described through the "sky view factor" (SVF), which is the visible area of the sky from a given point on a surface. For example, an open parking lot or field that has few obstructions would have a large SVF value (closer to 1). Conversely, an urban canyon in a downtown area that is surrounded by closely spaced, tall buildings, would have a low SVF value (closer to zero), as there would only be a small visible area of the sky.

2.4 Anthropogenic Heat

Anthropogenic heat contributes to atmospheric heat islands and refers to heat produced by human activities. It can come from a variety of sources and is estimated by totaling all the energy used for heating and cooling, running appliances, transportation, and industrial processes. Anthropogenic heat varies by urban activity and infrastructure, with more energy-intensive buildings and transportation producing more heat.[12] Anthropogenic heat typically is not a concern in rural areas and during the summer. In the winter, though, and year round in dense, urban areas, anthropogenic heat can significantly contribute to heat island formation.

2.5 Additional Factors

Weather and location strongly influence urban heat island formation. While communities have little control over these factors, residents can benefit from understanding the role they play.

- **Weather.** Two primary weather characteristics affect urban heat island development: wind and cloud cover. In general, urban heat islands form during periods of calm winds and clear skies, because these conditions maximize the amount of solar energy reaching urban surfaces and minimize the amount of heat that can be convected away. Conversely, strong winds and cloud cover suppress urban heat islands.
- **Geographic location.** Climate and topography, which are in part determined by a city's geographic location, influence urban heat island formation. For example, large bodies of water moderate temperatures and can generate winds that convect heat away from cities. Nearby mountain ranges can either block wind from reaching a city, or create wind patterns that pass through a city. Local terrain has a greater significance for heat island formation when larger-scale effects, such as prevailing wind patterns, are relatively weak.

3. Why Do We Care about Urban Heat Islands?

Elevated temperatures from urban heat islands, particularly during the summer, can affect a community's environment and quality of life. While some heat island impacts seem positive, such as lengthening the plant-growing season, most impacts are negative and include:

- Increased energy consumption
- Elevated emissions of air pollutants and greenhouse gases
- Compromised human health and comfort
- Impaired water quality.

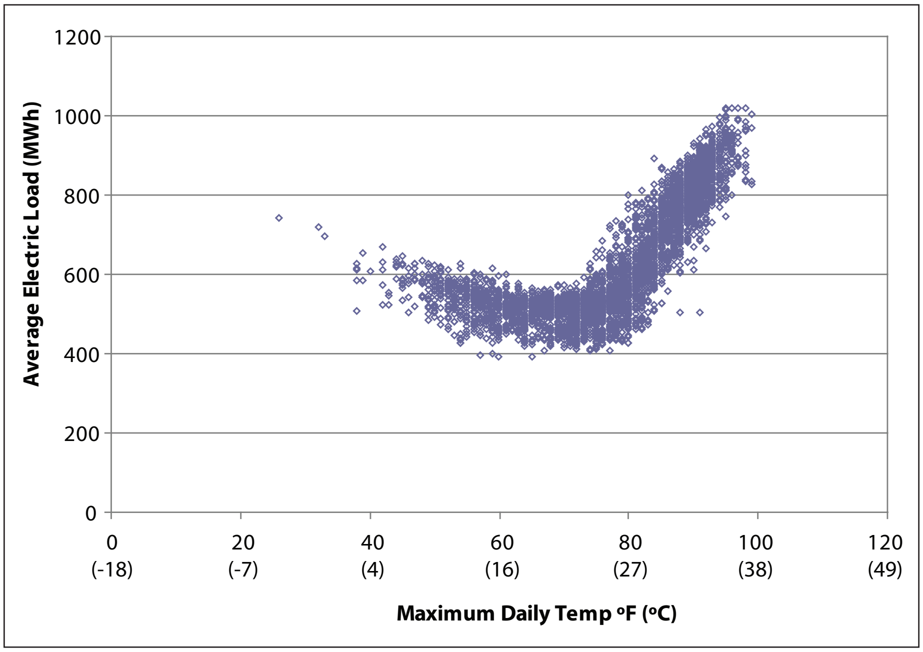
Wintertime Benefits of Urban Heat Islands

Communities may benefit from the wintertime warming effect of urban heat islands. Warmer temperatures can reduce heating energy needs and help to melt snow and ice on roads. Fortunately, urban heat island mitigation strategies—for example, trees and vegetation and green roofs—generally provide year-round benefits, or their winter penalty, such as that from cool roofs, is much smaller than their summertime benefits.

3.1 Energy Consumption

Elevated summertime temperatures in cities increase energy demand for cooling and add pressure to the electricity grid during peak periods of demand, which generally occur on hot, summer weekday afternoons, when offices and homes are running cooling systems, lights, and appliances (see Figure 8). This peak urban electric demand increases 1.5 to 2 percent for every 1°F (0.6°C) increase in summertime temperature. Steadily increasing downtown temperatures over the last several decades mean that 5 to 10 percent of community-wide demand for electricity is used to compensate for the heat island effect.[13] During extreme heat events, which are exacerbated by urban heat islands, the resulting demand for cooling can overload systems and require a utility to institute controlled, rolling brownouts or blackouts to avoid power outages.

Figure 8: Increasing Power Loads with Temperature Increases[14]



Sailor, 2006, with data courtesy of Entergy

As shown in this example from New Orleans, electrical load can increase steadily once temperatures begin to exceed about 68 to 77°F (20 to 25°C). Other areas of the country show similar demand curves as temperature increases.

3.2 Air Quality and Greenhouse Gases

As discussed in Section 3.1, higher temperatures can increases energy demand, which generally causes higher levels of air pollution and greenhouse gas emissions. Currently, most electricity in the United States is produced from combusting fossil fuel. Thus, pollutants from most power plants include sulfur dioxide (SO_2), nitrogen oxides (NO_x), particulate matter (PM), carbon monoxide (CO), and mercury (Hg). These pollutants are harmful to human health and contribute to complex air quality problems such as acid rain. Further, fossil-fuel-powered plants emit greenhouse gases, particularly carbon dioxide (CO_2), which contribute to global climate change.

In addition to increases in air emissions, elevated air temperatures increase the rate of ground-level ozone formation, which is produced when NO_x and volatile organic compounds (VOCs) react in the presence of sunlight. If all other variables are equal—such as the level of precursor emissions or wind speed and direction—ground-level ozone emissions will be higher in sunnier and hotter weather.

3.3 Human Health and Comfort

Increased daytime surface temperatures, reduced nighttime cooling, and higher air pollution levels associated with urban heat islands can affect human health by contributing to general discomfort, respiratory difficulties, heat cramps and exhaustion, non-fatal heat stroke, and heat-related mortality.

Urban heat islands can also exacerbate the impact of heat waves, which are periods of abnormally hot, and often humid, weather. Sensitive populations, such as children, older adults, and those with existing health conditions, are at particular risk from these events. For example, in 1995, a mid-July heat wave in the Midwest caused more than 1,000 deaths.[15] While it is rare for a

Factors in Heat-Related Illnesses and Death

Low income elderly people who live in row homes are at a particular risk for heat-related health incidents. Living on the upper floor of a typical row home, with a dark roof, brick construction, and windows on only two sides, could contribute to the risk of heat-related illness or death during heat waves, as temperatures in these homes can be extreme.[16] These homes often lack air conditioning, especially in areas unaccustomed to high temperatures. Further, even when air conditioning is available, residents may not use it for fear of high utility bills.

Social isolation and physical health also contribute to one's vulnerability. Elderly people, especially, may not have family or friends nearby, may not report to work regularly, and may lack neighbors who can check on them, leaving them stranded during extreme heat events. The elderly may also fail to hear news or other warnings of impending heat waves and recommendations on how to cope. Finally, their bodies may be less able to handle heat stress.

The lack of nighttime relief in air temperatures is strongly correlated with increased mortality during heat waves. Some studies suggest that these oppressive nighttime temperatures may be more significant than high maximum daytime temperatures.[17]

For more information on heat-related health incidents and ways to respond, see the EPA Excessive Heat Events Guidebook <www.epa.gov/hiri/about/pdf/EHEguide_final.pdf>

heat wave to be so destructive, heat-related mortality is not uncommon. The Centers for Disease Control estimates that from 1979 to 1999, excessive heat exposure contributed to more than 8,000 premature deaths in the United States.[18] This figure exceeds the number of mortalities resulting from hurricanes, lightning, tornadoes, floods, and earthquakes combined.

3.4 Water Quality

Surface urban heat islands degrade water quality, mainly by thermal pollution. Pavement and rooftop surfaces that reach temperatures 50 to 90°F (27 to 50°C) higher than air temperatures transfer this excess heat to stormwater. Field measurements from one study showed that runoff from urban areas was about 20-30°F (11-17°C) hotter than runoff from a nearby rural area on summer days when pavement temperatures at midday were 20-35°F (11-19°C) above air temperature. When the rain came before the pavement had a chance to heat up, runoff temperatures from the rural and urban areas differed by less than 4°F (2°C).[19] This heated stormwater generally drains into storm sewers (see Figure 5) and raises water temperatures as it is released into streams, rivers, ponds, and lakes. A study in Arlington, Virginia, recorded temperature increases in surface waters as high as 8°F (4°C) in 40 minutes after heavy summer rains.[20]

Water temperature affects all aspects of aquatic life, especially the metabolism and reproduction of many aquatic species. Rapid temperature changes in aquatic ecosystems resulting from warm stormwater runoff can be particularly stressful. Brook trout, for example, experience thermal stress and shock when the water temperature changes more than 2 to 4°F (1-2°C) in 24 hours.[21]

4. Strategies to Reduce Urban Heat Islands

Although urban climatologists have been studying urban heat islands for decades, community interest and concern regarding them has been more recent. This increased attention to heat-related environment and health issues has helped to advance the development of heat island reduction strategies, mainly trees and vegetation, green roofs, and cool roofs. Interest in cool pavements has been growing, and an emerging body of research and pilot projects are helping scientists, engineers, and practitioners to better understand the interactions between pavements and the urban climate.

This compendium *Reducing Urban Heat Islands: Compendium of Strategies* provides details about how these strategies work, their benefits and costs, factors to consider when selecting them, and additional resources for communities to further explore. It presents the multiple benefits—beyond temperature reduction—that a community can accrue from advancing heat island reduction strategies. It also gives examples of how communities have implemented these strategies through voluntary and policy efforts in the "Heat Island Reduction Activities" chapter. Communities can use this compendium as a foundation and starting point for understanding the nuts and bolts of existing urban heat island reduction strategies that communities are currently advancing.

Future policy efforts may focus on encouraging strategies to modify urban geometry and anthropogenic heat in communities to reduce urban heat islands. Research in this area is on-going, and there is a growing awareness of the importance of these factors.

5. Additional Resources

The table on the next page provides additional resources on urban heat island formation, measurement, and impacts.

Table 3: Urban Heat Island Resources

Name	Description	Web Link
General Information		
EPA's Heat Island Website	Through this website, EPA provides background information, publications, reports, access to national webcasts, a database of urban heat island activities, and links to other resources to help communities reduce urban heat islands.	<www.epa.gov/heatislands>
International Association for Urban Climate (IAUC)	This international website is the main forum in which urban climatologists communicate. Urban climate resources, including a bimonthly newsletter, and information on upcoming meetings can be found here.	<www.urban-climate.org>
Lawrence Berkeley National Laboratory (LBNL) Heat Island Group	LBNL provides background information on urban heat islands and their impacts through this website. It also presents some of the impacts heat island reduction strategies can have on temperature, energy consumption, and air quality.	<http://eetd.lbl.gov/HeatIsland>
National Center of Excellence - SMART Innovations for Urban Climate and Energy	Arizona State University's National Center of Excellence collaborates with industry and government to research and develop technologies to reduce urban heat islands, especially in desert climates. Its website provides background information on urban heat islands.	<www.asusmart.com/urbanclimate.php>
Urban Heat Islands: Hotter Cities	This article explains urban heat islands and presents solutions to mitigate them.	<www.actionbioscience.org/environment/voogt.html>
Measuring Heat Islands and Their Impacts		
National Aeronautics and Space Administration (NASA) and the U.S. Geological Survey Landsat Program	The Landsat program is a series of Earth-observing satellites used to acquire images of the Earth's land surface and surrounding coastal regions. These images provide information from which researchers can derive surface temperatures and evaluate urban heat islands.	<http://landsat.gsfc.nasa.gov/>
National Weather Service	The National Weather Service is a source for air temperature measurements, climate and weather models, and past and future climate predictions. The site also has links to excessive heat outlooks, fatality statistics, historic data on major heat waves, drought information, and advice on how to minimize the health risks of heat waves.	<www.nws.noaa.gov/>
EPA's Excessive Heat Events Guidebook	This document is designed to help community officials, emergency managers, meteorologists, and others plan for and respond to excessive heat events by highlighting best practices that have been employed to save lives during excessive heat events in different urban areas. It provides a menu of options that officials can use to respond to these events in their communities.	<www.epa.gov/hiri/about/heatguidebook.html>

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EXHIBIT 12

Green Infrastructure

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What is Green Infrastructure?

What is Green Infrastructure?

Overcoming Barriers to Green Infrastructure

Green infrastructure is a cost-effective, resilient approach to managing wet weather impacts that provides many community benefits. While single-purpose gray stormwater infrastructure—conventional piped drainage and water treatment systems—is designed to move urban stormwater away from the built environment, green infrastructure reduces and treats stormwater at its source while delivering environmental, social, and economic benefits.

Stormwater runoff is a major cause of water pollution in urban areas. When rain falls on our roofs, streets, and parking lots in cities and their suburbs, the water cannot soak into the ground as it should. Stormwater drains through gutters, storm sewers, and other engineered collection systems and is discharged into nearby water bodies. The stormwater runoff carries trash, bacteria, heavy metals, and other pollutants from the urban landscape. Higher flows resulting from heavy rains also can cause erosion and flooding in urban streams, damaging habitat, property, and infrastructure.

When rain falls in natural, undeveloped areas, the water is absorbed and filtered by soil and plants. Stormwater runoff is cleaner and less of a problem. Green infrastructure uses vegetation, soils, and other elements and practices to restore some of the natural processes required to manage water and create healthier urban environments. At the city or county scale, green infrastructure is a patchwork of natural areas that provides habitat, flood protection, cleaner air, and cleaner water. At the neighborhood or site scale, stormwater management systems that mimic nature soak up and store water.

Learn more about green infrastructure elements that can be woven into a community, from small-scale elements integrated into sites to larger scale elements spanning entire watersheds.

On this page:

- Downspout Disconnection

- Rainwater Harvesting
- Rain Gardens
- Planter Boxes
- Bioswales
- Permeable Pavements
- Green Streets and Alleys
- Green Parking
- Green Roofs
- Urban Tree Canopy
- Land Conservation

Downspout Disconnection

Water from the roof flows from this disconnected downspout into the ground through a filter of pebbles.

This simple practice reroutes rooftop drainage pipes from draining rainwater into the storm sewer to draining it into rain barrels, cisterns, or permeable areas. You can use it to store stormwater and/or allow stormwater to infiltrate into the soil. Downspout disconnection could be especially beneficial to cities with combined sewer systems.

Examples

- Los Angeles Downspout Disconnection Program EXIT
- Milwaukee Downspout Disconnection EXIT
- Portland, OR, Downspout Disconnection Program

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Rainwater Harvesting

This rainwater harvesting system is adapted to the architecture of the building and its surroundings.

Rainwater harvesting systems collect and store rainfall for later use. When designed appropriately, they slow and reduce runoff and provide a source of water. This practice could be particularly valuable in arid regions, where it could reduce demands on increasingly limited water supplies.

Examples

- Technicians for Sustainability: Water Harvesting EXIT
- New York City Rain Barrel Giveaway Program

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Rain Gardens

A rain garden can be beautiful as well as functional.

Rain gardens are versatile features that can be installed in almost any unpaved space. Also known as bioretention, or bioinfiltration, cells, they are shallow, vegetated basins that collect and absorb runoff from rooftops, sidewalks, and streets. This practice mimics natural hydrology by infiltrating, and evaporating and transpiring—or “evapotranspiring”—stormwater runoff.

Examples

- Burnsville, MN, Stormwater Retrofit Study (PDF) (18 pp, 2.7 MB, About PDF) EXIT
- 12,000 Rain Gardens in Puget Sound EXIT

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Planter Boxes

Planter boxes are an attractive tool for filtering stormwater as well as reducing the runoff that goes into a sewer system.

Planter boxes are urban rain gardens with vertical walls and either open or closed bottoms. They collect and absorb runoff from sidewalks, parking lots, and streets and are ideal for space-limited sites in dense urban areas and as a streetscaping element.

Examples

- Michigan Avenue Streetscape EXIT
- Philadelphia Water Department EXIT

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Bioswales

Bioswales are essentially rain gardens placed in long narrow spaces such as the space between the sidewalk and the curb.

Bioswales are vegetated, mulched, or xeriscaped channels that provide treatment and retention as they move stormwater from one place to another. Vegetated swales slow, infiltrate, and filter stormwater flows. As linear features, they are particularly well suited to being placed along streets and parking lots.

Examples

- Wisconsin Department of Natural Resources Technical Standard

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Permeable Pavements

Permeable pavement is a good example of a practice that catches water where it falls.

Permeable pavements infiltrate, treat, and/or store rainwater where it falls. They can be made of pervious concrete, porous asphalt, or permeable interlocking pavers. This practice could be particularly cost effective where land values are high and flooding or icing is a problem.

Examples

- Use of Pervious Concrete Eliminates over $260,000 in Construction Costs in Sultan, WA EXIT
- Designing Impervious: A Minnesota city eschews storm drains for pervious streets EXIT

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Green Streets and Alleys

Green streets combine more than one feature to capture and treat stormwater.

Green streets and alleys are created by integrating green infrastructure elements into their design to store, infiltrate, and evapotranspire stormwater. Permeable pavement, bioswales, planter boxes, and trees are among the elements that can be woven into street or alley design.

Examples

- EPA Region 3 Green Streets, Green Jobs, Green Towns (G3) Program
- Seattle Public Utilities GSI Projects
- Syracuse Green Street: Concord Place (PDF) (2 pp, 220 K, About PDF) EXIT
- Los Angeles Green Street: Elmer Ave EXIT
- The Chicago Green Alley Handbook (PDF) (24 pp, 3.7 MB, About PDF) EXIT

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Green Parking

Parking lots are a good place to install green infrastructure that can capture stormwater that would usually flow into the sewer system.

Many green infrastructure elements can be seamlessly integrated into parking lot designs. Permeable pavements can be installed in sections of a lot and rain gardens and bioswales can be included in medians and along the parking lot perimeter. Benefits include mitigating the urban heat island and a more walkable built environment.

Examples

- Ipswich River Watershed Demonstration Project in Wilmington, MA
- Toronto Design Guidelines for “Greening” Surface Parking Lots (PDF) (40 pp, 9.6 MB, About PDF) EXIT

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Green Roofs

A green roof system atop a building helps manage stormwater and reduce energy costs for cooling.

Green roofs are covered with growing media and vegetation that enable rainfall infiltration and evapotranspiration of stored water. They are particularly cost-effective in dense urban areas where land values are high and on large industrial or office buildings where stormwater management costs are likely to be high.

Examples

- King County, WA, Green Roof Case Study Report (PDF) (31 pp, 1 MB, About PDF)
- Green Roof and Wall Projects Database EXIT

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Urban Tree Canopy

City trees, or tree canopy, soak up stormwater, provide cooling shade and help to slow traffic.

Trees reduce and slow stormwater by intercepting precipitation in their leaves and branches. Many cities have set tree canopy goals to restore some of the benefits of trees that were lost when the areas were developed. Homeowners, businesses, and community groups can participate in planting and maintaining trees throughout the urban environment.

Examples

- Chicago Trees Initiative EXIT
- Philadelphia Water Department: Stormwater Tree Trench EXIT

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Land Conservation

Land conservation is another good tool for communities to use for reducing the risks of stormwater runoff and sewer overflows.

The water quality and flooding impacts of urban stormwater also can be addressed by protecting open spaces and sensitive natural areas within and adjacent to a city while providing recreational opportunities for city residents. Natural areas that should be a focus of this effort include riparian areas, wetlands, and steep hillsides.

Examples

- Green Seams: Flood Management in Milwaukee EXIT
- Alachua County, FL, Green Infrastructure Investment Program (PDF) (8 pp, 233 K, About PDF) EXIT

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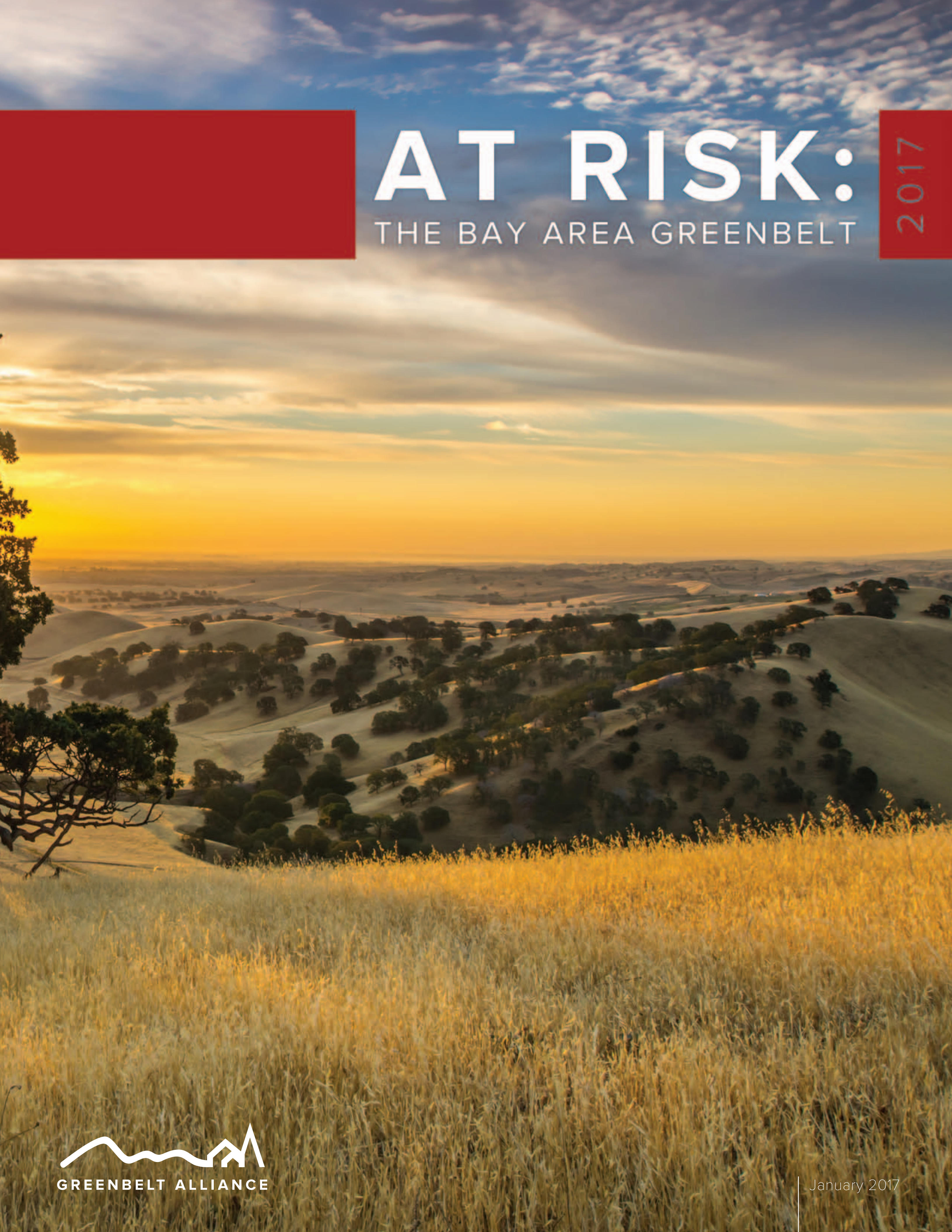

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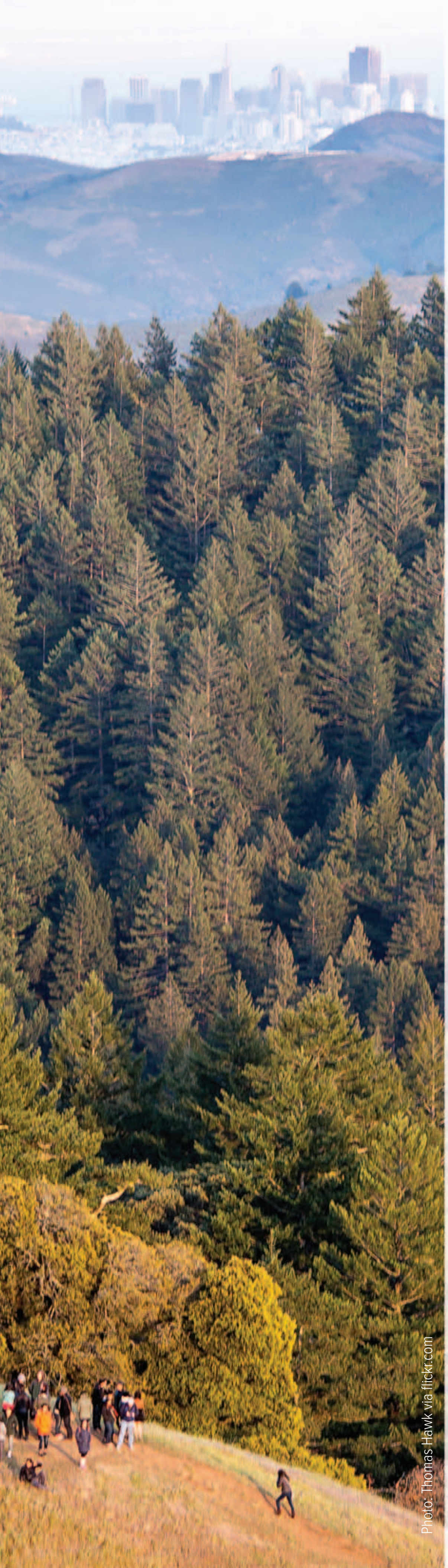


Photo: Thomas Hawk via flickr.com

COUNTY BY COUNTY RESULTS

FOREWORD

BARBARA BOXER

When I first moved from Brooklyn to the San Francisco Bay Area more than 50 years ago, I fell in love with its wonder and beauty. Anyone who has seen the majestic Bay with its wetlands and wildlife, the coastal ridge mountains hugged by fog, the towering redwoods, and historic agricultural lands knows these landscapes take your breath away. It is our responsibility to protect them for current and future generations to enjoy.

That's why one of my very first priorities as a Marin County Supervisor was to address local land-use planning, and I worked successfully to prevent West Marin from being over-developed and to protect our coast from offshore drilling. And it's why I worked for years in the House and Senate to protect more than a million acres of California land as wilderness, convert the Presidio into a national park, and expand our national monuments.

The efforts to protect these magnificent places is often driven by the people who are closest to them, and that's why the work Greenbelt Alliance has done for the past 59 years is so important. It's impossible to imagine what the Bay Area would be like without those who started this movement to save our farmland and our hills, and all the members and volunteers who continue to do their part. This report continues that legacy by taking a closer look at every threat to this region's magnificent landscapes and providing the kind of information decision-makers need to shape smart policy.

While I will not be in the Senate, I will never stop fighting for these issues, and I hope you will join me in working to protect our pristine lands for generations to come.

EXECUTIVE SUMMARY

293,100 ACRES AT RISK OF DEVELOPMENT

To appreciate the values of the San Francisco Bay Area's greenbelt, a good first stop might be a farmers market.

But that's just a taste of what the greenbelt provides.

VALUES WE DEPEND ON

In addition to spectacular scenery, the region's natural and agricultural lands provide us with benefits that are less visible: Wetlands protect us from floods and sea-level rise, watersheds provide clean drinking water, and forests store carbon to help stabilize our climate.

A LEGACY OF CONSERVATION

The Bay Area's greenbelt is no accident. Generations of Bay Area residents have worked hard to protect it. Today, of the roughly 4.4 million total acres of the region's nine counties, almost 1.2 million acres are permanently protected from development.

Bay Area communities and their leaders have also voted to restrict development on an additional 2.2 million acres of land with policies such as growth boundaries, hillside ordinances, and agricultural zoning.

THE RISK ADDS UP

But the threat persists. While the Bay Area's sizzling economy is the envy of many other parts of the country, it also brings challenges. Skyrocketing housing costs have led to development proposals on open space and farmland all over the region. There's no question that the Bay Area needs more homes we can all afford, but the evidence shows that sprawl is not the solution.

Today, across the Bay Area, 293,100 acres of natural and agricultural lands are at risk of sprawl development over the next 30 years. The most acute threat exists on 63,500 acres, which are likely to be developed in the next 10 years.

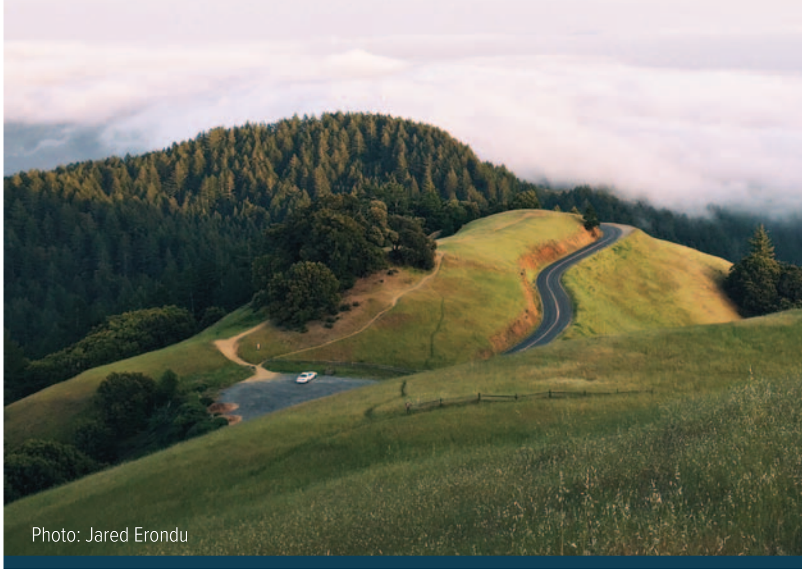


Photo: Jared Erondu

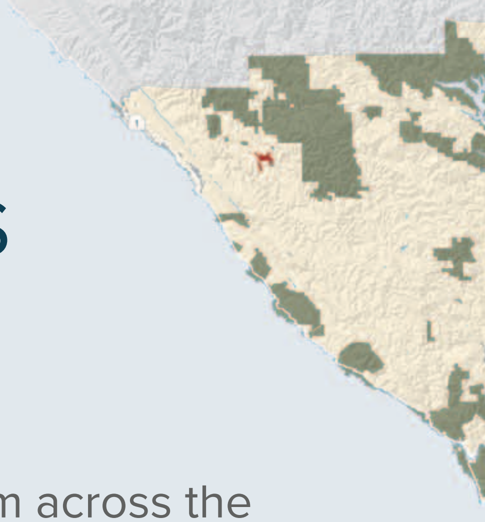
The total land at risk is about 458 square miles, nearly 10 times the size of San Francisco.

HOLDING THE LINE

Despite the increasing pressure in today's economy, there is less total land at risk today than when Greenbelt Alliance released our last *At Risk* analysis in 2012—by 29,700 acres. Some of that land has been acquired for permanent protection; some has been lost to development.

But on much of this land, the risk has dropped thanks to new policy protections. Since our last report in 2012, Bay Area land at a strong or moderate level of policy protection has increased by over 66,000 acres.

This progress is promising, but much more action is needed to protect the remaining greenbelt land at risk. Once it's lost, it's gone forever.



REGION-WIDE RESULTS

The San Francisco Bay Area attracts people from across the world, in part for its spectacular landscapes: golden hills and ridgelines, orchards and green valleys, all cradling the iconic Bay.

These lands that make up the greenbelt frame our cities, draw us out on adventures, and provide a rich abundance of fresh local food in all seasons. The benefits add up: New economic studies estimate that services provided by greenbelt lands—such as catching and filtering drinking water—are worth billions of dollars.

Despite its beauty and its value, the Bay Area's greenbelt is threatened. A comprehensive survey of city and county plans and proposals reveals that large areas of land are at risk of development.

The risks vary. In some areas, specific development proposals may already be adopted or are being considered—such as luxury housing on a Napa hilltop. Some lands may be zoned for development—for example, grazing land that is zoned for rural residential development. Other areas are designated for development in city or county plans, or are included in proposed boundary expansions, like farmland outside of Brentwood. Some lands may be vulnerable to development based on qualities of being flat, or being close to roads and to existing development. Some have a long history of development proposals that so far have failed.

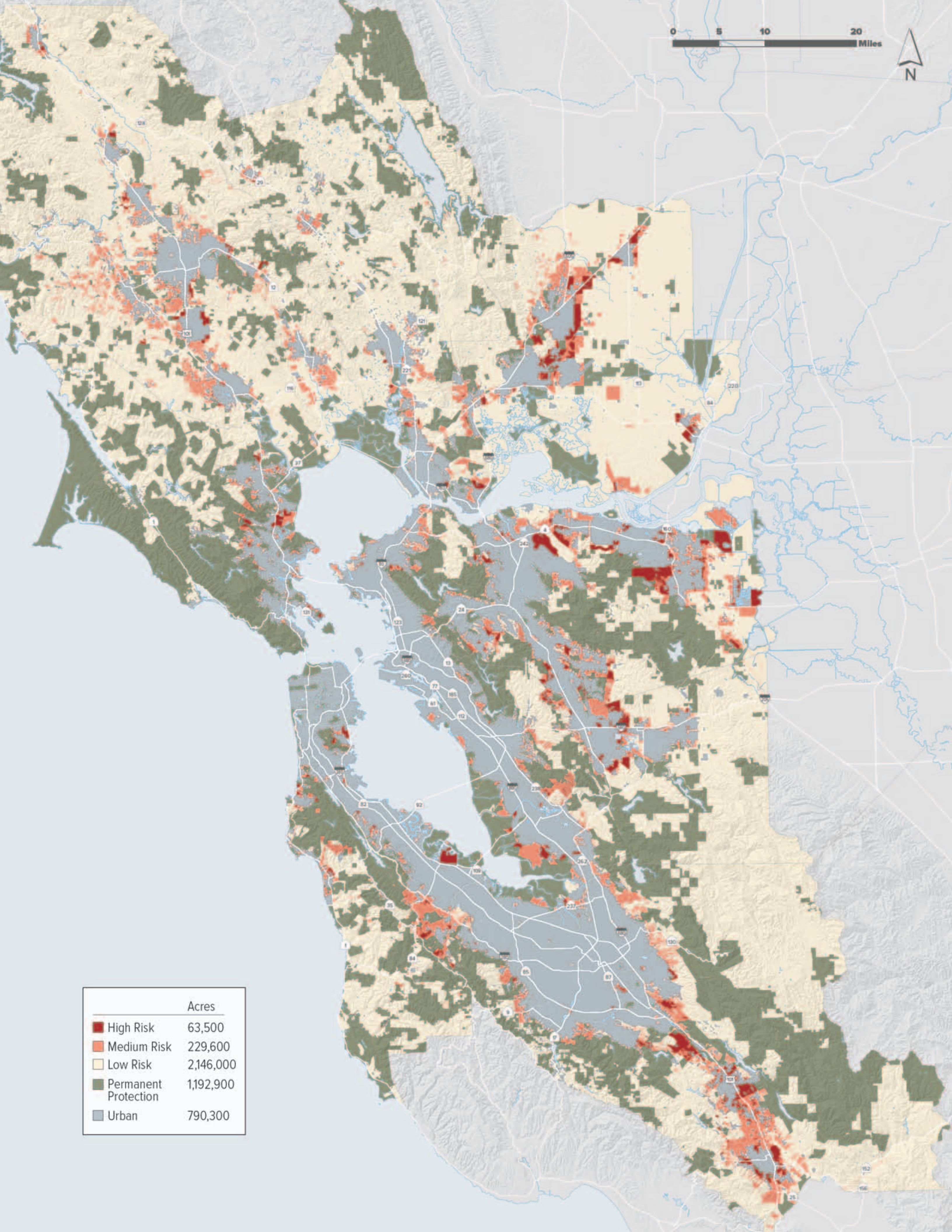
For this report, these risks are scored relative to one another—an approved project, for example, puts an area at higher risk of development than zoning or historic threats. The land's risk score is then adjusted based on whether that given area is protected by policies to prevent development.

The resulting At Risk Map brings to light—out of the depths of city and county planning documents—what the region's future could hold.

HARD NUMBERS

Today, 293,100 acres of the region's farmland and natural areas are threatened with development within the next 30 years. This is an area of 458 square miles, almost 10 times the size of San Francisco, that could be paved over in a generation.

Of that land, 63,500 acres are at high risk, meaning they face development within the next 10 years. These areas are under extreme market pressure; the bright red areas on the At Risk Map reflect dozens of proposals that threaten the Bay Area's ranchland, farms, wildlife habitat, and wetlands.


0
5
10
20
Miles
N
Acres
🟥 High Risk 63,500
🟥 Medium Risk 229,600
⬜ Low Risk 2,146,000
🟩 Permanent Protection 1,192,900
⬜ Urban 790,300

Across the eight Bay Area counties addressed in this report, Contra Costa County has the most total land at risk; about one out of every five acres of threatened land in the region is in Contra Costa. Contra Costa also has the most land at high risk, land that could be developed in the near term. The next two counties with the most land at high risk are Santa Clara and Solano counties. There, developers have put forward many proposals to build on farmland and in valleys, and cities seek to expand out into the greenbelt.

POLICIES PROTECT THE GREENBELT

Since Greenbelt Alliance's last *At Risk* report was released in 2012, the amount of total land at risk in the Bay Area—land that could be developed in the next 30 years—has dropped, from 322,800 to 293,100 acres. Some of that land has been acquired for permanent protection: Those areas have either been purchased by land trusts or park agencies, or the right to develop them has been sold as part of an agreement called a conservation easement. Other lands have been lost to development.

HOW BIG IS AN ACRE?

AN ACRE CAN BE HARD TO PICTURE. ONE ACRE IS:

- ROUGHLY 200 X 200 FEET.
- ABOUT HALF OF A SOCCER PITCH, OR MOST OF A FOOTBALL FIELD.

But much of the land no longer at risk is now protected by policies. Greenbelt Alliance's focus for over 50 years has been policy protection: working with residents to pass city and county laws—such as urban growth boundaries, hillside protections, or agricultural zoning—to encourage development in central urban areas, rather than on remote natural lands.

Greenbelt Alliance has been tracking policy protections around the region since 2012. Many different policies can preserve land and the natural values of the greenbelt. We categorize lands by their level of protection—that is, how effectively the policies on that land are likely to prevent its development. A strong level of protection comes from policies such as voter-approved growth boundaries, requiring a vote of the people to overturn. A moderate level of protection is afforded by boundaries that are not voter-approved, or other ordinances addressing hillside or riparian lands, though these ordinances must still have strong language that clearly limits development. A weak level of protection applies to land with only vaguely worded ordinances or zoning, or no protection at all. If several policies apply to a given landscape, they may add up to give that land a stronger level of protection from development.

Different approaches to land protection work in concert. For some landscapes, permanent protection is the goal, but policy protection must come first. Policies can hold the line against development, often for many years, until funds can be found to preserve lands in perpetuity. In other cases, purchasing land is not needed or not possible. Policies can protect far more acres, far more cost-effectively.

STRONGER PROTECTIONS SINCE 2012

The Bay Area has made significant strides since 2012: The total amount of land under strong- or moderate-level policy protections in the Bay Area has increased by over 66,000 acres, and now totals 2,172,900 acres. This total is almost evenly split between strong and moderate levels of protection: 1,067,000 acres enjoy strong protection and

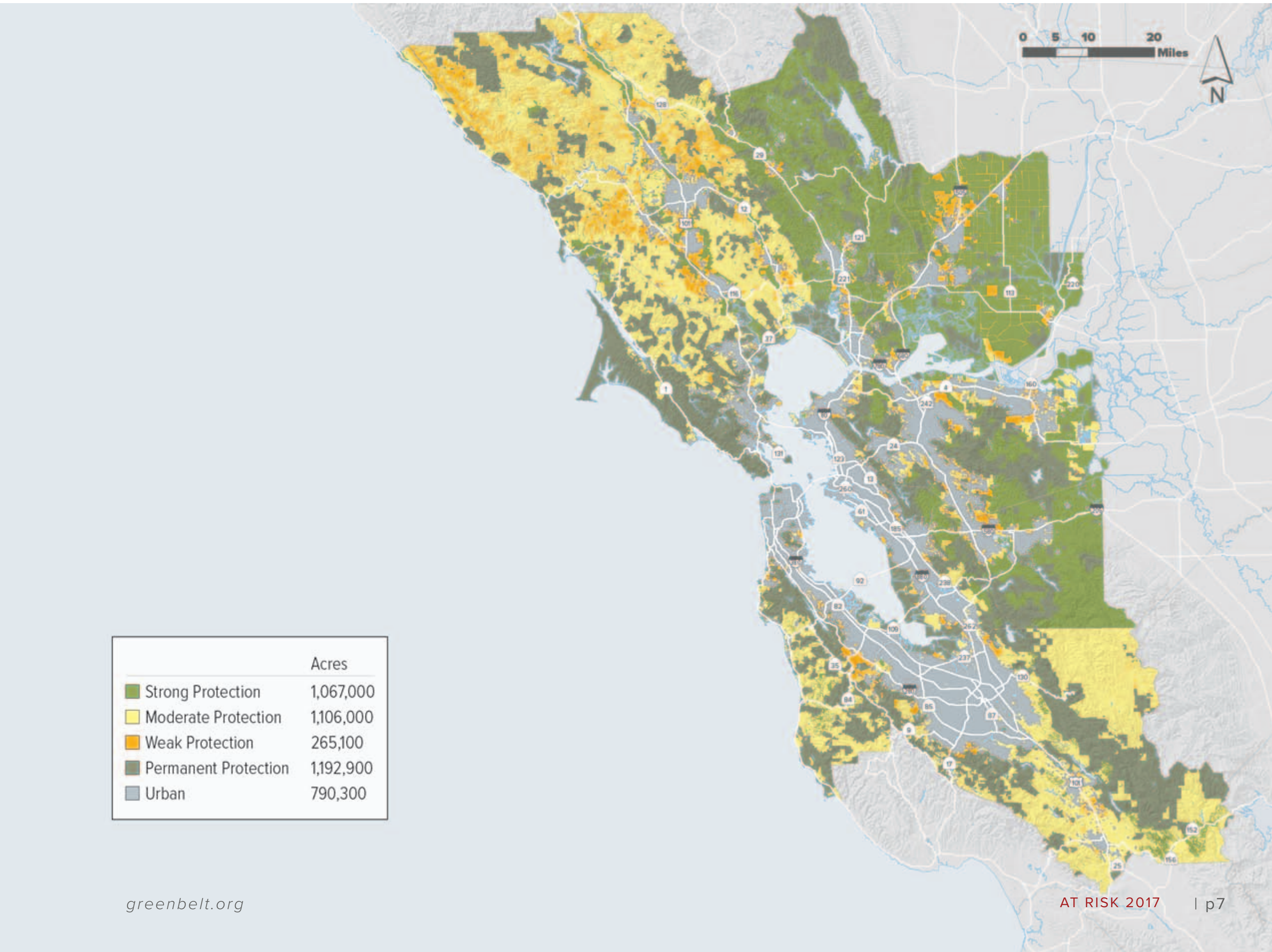
1,106,000 acres have moderate protection. In addition, 1,192,900 acres of the greenbelt are permanently protected. Just over a quarter-million acres—265,100 acres—are today left with little or no protection from sprawl development.

Several new policies stand out as examples of how the region has protected more land. Santa Clara County's 2013 Habitat Conservation Plan is helping fund conservation while deterring development on natural areas. In 2014, the East Bay city of Dublin adopted an urban limit line protecting the rolling hills of Doolan Canyon. In 2016, Gilroy adopted an urban growth boundary, protecting South Bay farmland. Also in 2016, Sonoma County designated 36,000 acres of land as new "community separators," and voters renewed protection of the entire system of community separators, now totaling over 53,000 acres of greenbelt lands between towns.

These policies are good models. Cities and counties around the region can adopt more like them to protect the lands on the Policy Protection map that are colored bright orange: the quarter-million acres of the Bay Area's greenbelt still left vulnerable.

BUT THE PRESSURE IS GROWING

Recent policy protections are especially impressive—and especially necessary—given the rebounding economy and housing market. As the nation has recovered from the recession, the housing market has surged—especially here in the Bay Area, as the booming, high-paying tech economy has attracted thousands of new workers. The rise



	Acres
🟩 Strong Protection	1,067,000
🟨 Moderate Protection	1,106,000
🟧 Weak Protection	265,100
■ Permanent Protection	1,192,900
▨ Urban	790,300

in housing prices has not only made life tougher for many Bay Area families, it has also increased incentives to build on greenbelt land around the region.

The speculative pressure is acute, with 63,500 acres of Bay Area land at high risk of development within the next 10 years. On the At Risk Map, most of this high-risk land is just outside cities. The bright red shapes include dozens of current proposals cropping up to cash in on the latest real estate boom.

The rise in housing prices has caused a crisis for Bay Area residents and workers struggling to find a place to live. The region desperately needs more homes people can afford: homes close to jobs, in existing cities and towns. Sprawling onto the greenbelt won't help. Not long ago, the crash of the housing market resulted in foreclosures that hit hardest in areas with the most sprawl. The Bay Area can avoid making that mistake again; protecting land will protect people as well.

HOW DO WE DEFINE RISK AND PROTECTION?

HIGH RISK

Greenbelt lands that are likely to be developed in the next 10 years.

MEDIUM RISK

Greenbelt lands that are likely to be developed in the next 30 years.

LOW RISK

Greenbelt lands that are not likely to be developed in the next 30 years.

STRONG PROTECTION

Greenbelt lands that are protected by one or more policy measures that prohibit most development on that land.

MODERATE PROTECTION

Greenbelt lands that are protected by one or more policy measures where development is intended to be limited but is still possible with a special permit.

WEAK PROTECTION

Greenbelt lands that do not fall under any protective policy measures or that are protected by only vaguely worded ordinances or zoning.

GLOSSARY

TYPES OF POLICY PROTECTION

The level of protection of policies below generally goes from stronger to weaker. However, any given policy may vary in its efficacy; for example, one hillside policy may forbid development and another may just limit it.

Permanent Protection

The purchase of land or development rights to permanently prevent development, as on most public lands, land trust properties, and conservation easements.

Growth Boundary

A line drawn between urban and rural lands defining where growth can and cannot occur. Depending on the details of the policy, changes to the boundary can be approved by either elected officials or voters. These include urban service areas, urban growth boundaries, urban limit lines, and city limits.

Williamson Act Properties

A contract with local governments restricting land use to agricultural or related uses. Land owners receive reduced property-tax assessments from local governments, who receive the difference in property-tax revenues from the state.

Agricultural Policies

A measure that prohibits conversion of agricultural lands to other uses or requires a buffer to maintain a distance between urban development and farmland or grazing land.

Watershed Policies

A policy that minimizes or restricts new construction on lands that drain to sources of irrigation and drinking water.

Riparian Policies

A policy that limits or forbids new construction within a certain distance of rivers and streams to avoid the adverse impacts of urban development, such as pollution runoff, erosion, and habitat degradation.

Hillside Policies

A policy that reduces or prohibits development on a city's or county's hills based on the slope or distance from a ridgeline. Intended to preserve the scenic value of an area and/or reduce the threat of landslides.

Coastal Zone Policy

Measures taken under the California Coastal Act to protect important coastal resources for public enjoyment, safeguarding natural landscapes, and reducing impact on existing urban development.

Baylands Policy

Measures taken under the Bay Plan by the San Francisco Bay Conservation and Development Commission to protect the open water, wetlands, marshes, and mudflats of the greater San Francisco Bay, and areas 100 feet inland from the high-tide line.

General Conservation Policies

A local jurisdiction's designation of land for agricultural use or wildlife habitat that still leaves the land susceptible to future development.

County Zoning for Agriculture or Open Space

Land designated by the county for farmland, grazing land, watershed lands, or natural resource management.

Habitat Conservation Policies

A plan prepared for an area under the Federal Endangered Species Act to protect endangered species' habitat while still allowing some development to occur.

Critical Habitat Policy

The designation of land, under the Federal Endangered Species Act, as essential for the conservation of a threatened or endangered species, potentially requiring special management and protection.

Flood Hazard Zone

A designation by the Federal Emergency Management Agency based on the severity or type of flooding in an area.

TYPES OF DEVELOPMENT PRESSURES

The severity of threat of the development pressure factors below generally goes from higher threat to lower threat.

Market Activity

Projects or plans proposed on or approved for a given parcel of land.

Speculative Value

Land subject to speculation based on past proposed projects and future upcoming development opportunities (such as expiring protections or urban reserves), and Regional Housing Needs Assessment housing sites.

Rural Subdivision

Plans allowing large lot properties to subdivide into smaller parcels.

County Zoning for Development

The designation by the county of land for development at varying levels of density. "Urban" density is greater than 1.5 to 2.5 acres per unit, "rural ranchette" is up to 20 acres per unit, and "rural estate" is more than 20 acres per unit.

Long-term Planning Boundaries

City boundaries that establish where urban growth will occur in the future, including Spheres of Influence and Planning Areas.

Locational Attributes

Geographical characteristics that encourage urban-scale development, including proximity to recent and existing development, major roads, or low-slope lands.

Regional Projections

Forecasts by regional and state agencies of areas for long-term growth including Plan Bay Area and California's urban growth scenario.

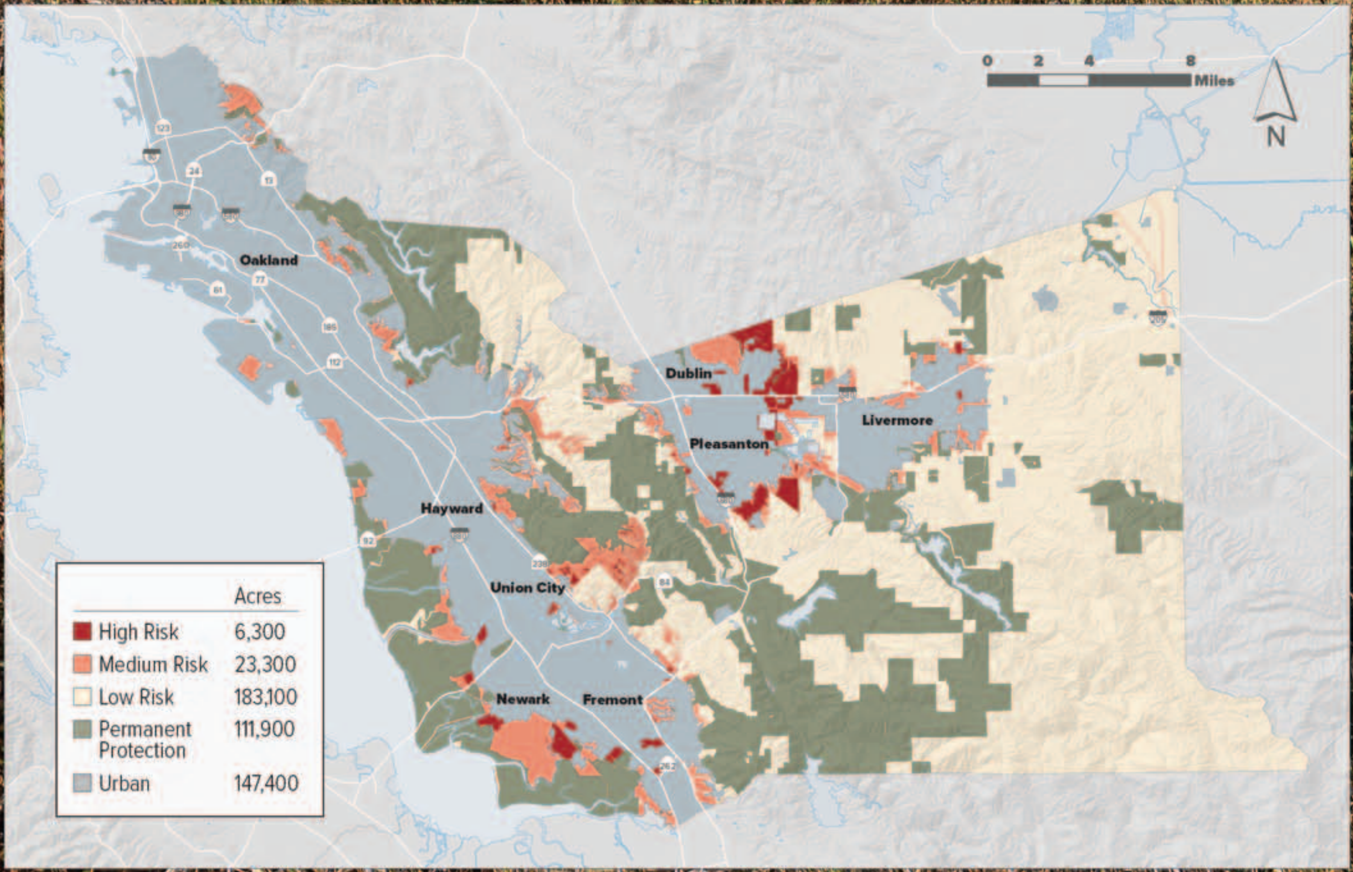
In Alameda County, 29,500 acres or 46 square miles of rangeland, farmland, and natural areas are at risk of development in the next 30 years. This total has not changed significantly since our last report in 2012, but the threat is less imminent: Today, land at high risk—facing development in the next 10 years—now totals 6,300 acres, a drop of a third since 2012.

This drop in threat came in part from Dublin's 2014 adoption of an urban limit line, a campaign in which Greenbelt Alliance played a significant role. The urban limit line halted proposals to develop Doolan Canyon, a remote and beautiful area to the city's northeast. Part of the land is now permanently protected, and the area's policy protection is strong: Changes require a vote of the people.

With the economic recovery, large areas of land to the city's north and east have become hot spots for speculative development proposals. As of August 2016, there were 7,459 housing units slated to be built as part of the city's various specific plans. These proposed projects are within the urban limit line, but several are on undeveloped land on the city's edges—which is intended to be a reserve over decades, not immediately be filled with subdivisions.

The hills southeast of Pleasanton are also being battered by development proposals. For example, in 2016 voters allowed Lund Ranch to break through the hillside protection ordinance and build roads and luxury houses up to the ridgeline.

Alameda County's countywide growth boundary, adopted in 2000 with Measure D, remains a regional model for land protection, covering nearly 90 percent of the county's grazing land. However, important watershed and habitat lands are still at risk if cities and towns don't choose to build well and use land wisely.



IN ALAMEDA COUNTY 46 SQUARE MILES ARE AT RISK

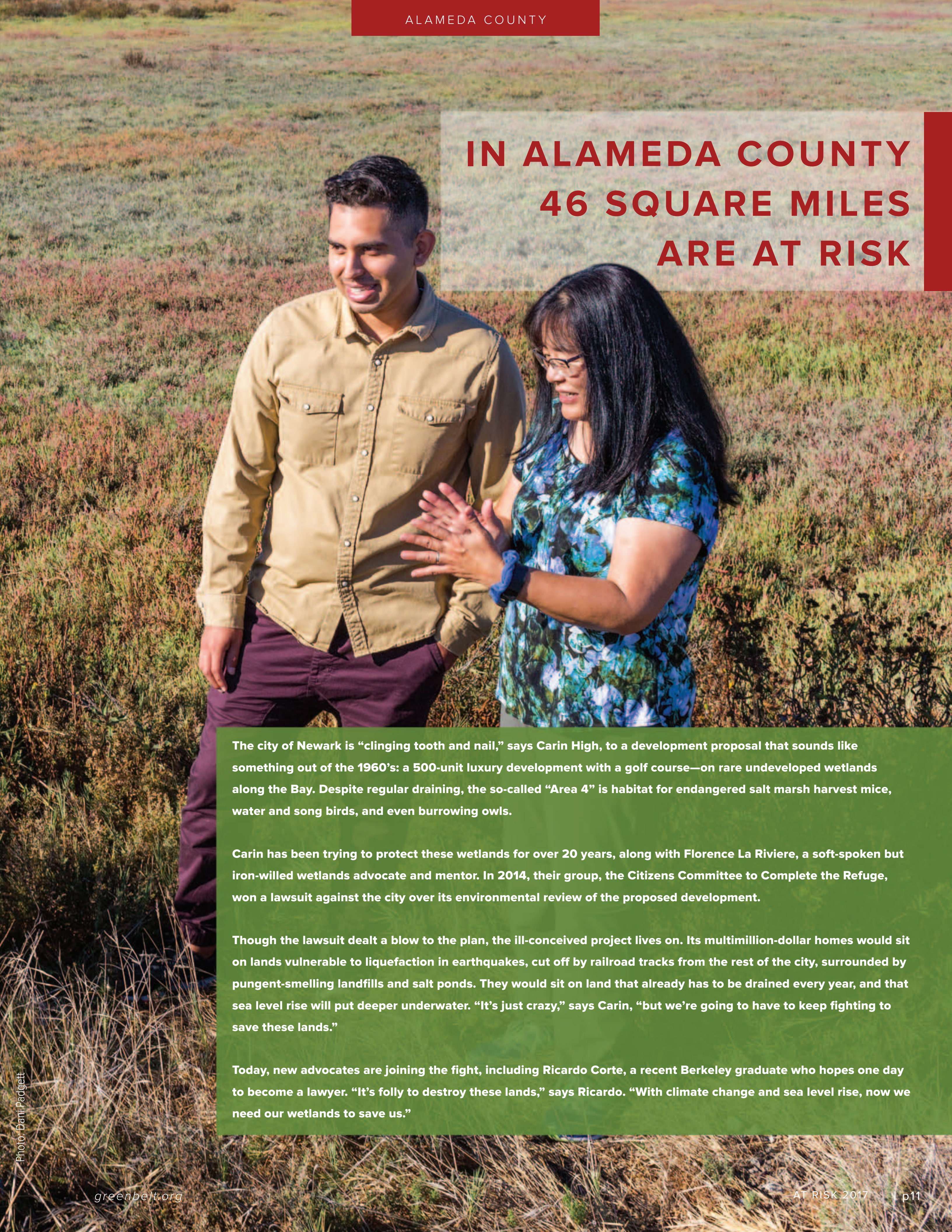


Photo: Dani Padgett

The city of Newark is "clinging tooth and nail," says Carin High, to a development proposal that sounds like something out of the 1960's: a 500-unit luxury development with a golf course—on rare undeveloped wetlands along the Bay. Despite regular draining, the so-called "Area 4" is habitat for endangered salt marsh harvest mice, water and song birds, and even burrowing owls.

Carin has been trying to protect these wetlands for over 20 years, along with Florence La Riviere, a soft-spoken but iron-willed wetlands advocate and mentor. In 2014, their group, the Citizens Committee to Complete the Refuge, won a lawsuit against the city over its environmental review of the proposed development.

Though the lawsuit dealt a blow to the plan, the ill-conceived project lives on. Its multimillion-dollar homes would sit on lands vulnerable to liquefaction in earthquakes, cut off by railroad tracks from the rest of the city, surrounded by pungent-smelling landfills and salt ponds. They would sit on land that already has to be drained every year, and that sea level rise will put deeper underwater. "It's just crazy," says Carin, "but we're going to have to keep fighting to save these lands."

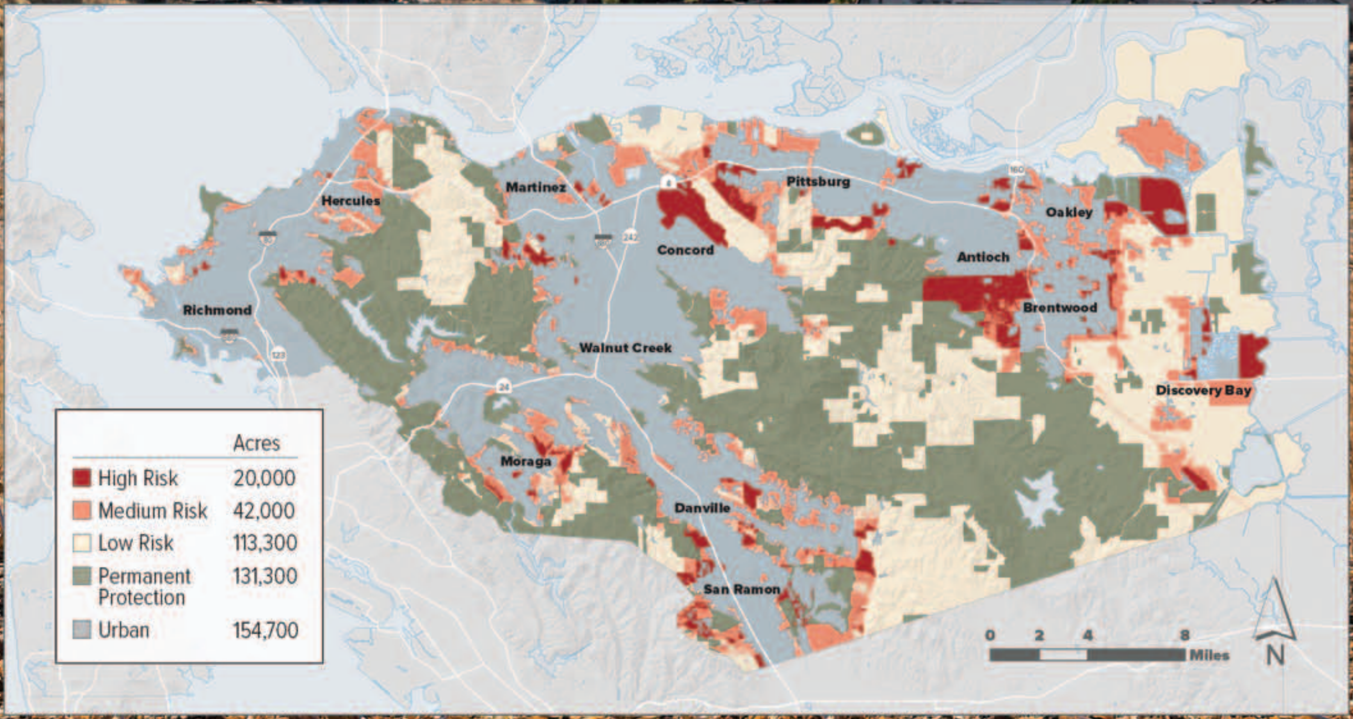
Today, new advocates are joining the fight, including Ricardo Corte, a recent Berkeley graduate who hopes one day to become a lawyer. "It's folly to destroy these lands," says Ricardo. "With climate change and sea level rise, now we need our wetlands to save us."

CONTRA COSTA COUNTY HAS 20,000 ACRES AT HIGH RISK: THE MOST IN THE BAY AREA

Out of all Bay Area counties, Contra Costa County has the most land at risk, with 62,000 total acres at risk, including the most land at high risk: 20,000 acres. That means that in just the next 10 years, development the size of Concord, the county's largest city, could pave over the county's golden hills, farmland, and habitat for wildlife. Since 2012, the county's amount of land at risk has increased by almost a third.

The overheated housing market has again driven up pressure to build anywhere and everywhere.

Despite opportunities to build more central, walkable communities, Pittsburg, Antioch, Oakley, and Brentwood all continue to sprawl outward. Pittsburg and Antioch both passed developer-backed growth boundaries in 2005 that allow building on hillsides, ranches, and critical habitat. Antioch is considering several projects to its south, including 1,667 housing units on 550 acres of grasslands. Brentwood is rapidly consuming



farms and ranches in every direction. Despite two successive "no" votes from local residents, Brentwood is still seeking to annex a large area southwest of the city.

In a longer-term risk that is a kind of "death by a thousand cuts," Contra Costa County's urban limit line is vulnerable to expansions of less than 30 acres next to the line. Developers are already using this vulnerability to propose carving up Tassajara Valley. While these 30-acre expansions might seem small, the land affected totals 9,300 acres. Over time, these expansions could unravel the limit line around the county and threaten the local farm economy.

Threats have grown since our last report in 2012, but Greenbelt Alliance and partners have also won major conservation victories. The long western face of the ridgeline between Concord and Pittsburg should soon be permanently protected as part of the Concord Naval Weapons Station reuse plan. If this goes through, it will be transformed into the new Concord Hills Regional Park.

The county's Habitat Conservation Plan, in effect since 2008, helped make it possible to purchase thousands of acres of important lands. Today, however, Contra Costa County still has 41 percent of the Bay Area's at-risk Critical Habitat lands. The future of many of the region's remaining burrowing owls, kit foxes, and other rare species depends on the county's growth decisions.

"Every Saturday morning I'd be at Willy's Bagels—that's how it all started. We made flyers. We walked neighborhoods. Spoke at City Council meetings. We did everything we possibly could." In 2010, local mom Kathy Griffin helped turn the tide on sprawl in Brentwood—one of the fastest-growing cities in California.

She'd had some practice: In 2005 and 2006, Kathy fought for voter approval of a tight urban limit line, halting the city's relentless sprawl. Then, in 2010, developers tried to break through the boundary to allow enormous expansion on the city's western edge. Kathy and her cadre of concerned Brentwoodians sprang into action. Developers spent $300,000 trying to pass their measure, but to no avail: Kathy's small group convinced voters to hold the line.

Now, Brentwood is again trying to burst through the limits its voters have set. Though the city's leaders have expressed concern about the city's imbalanced growth—all housing, few jobs—they are planning more low-density residential development outside the urban limit line. More than 2,000 acres of rich agricultural land and valleys are at risk.

These plans, says Kathy, are "still terrible, bad ideas. Where is the promised economic and job-sustaining growth we need—inside our city boundaries?"

"For the time being, we've won the common-sense battle. But it's always a fight." Kathy laughs. "I'll retire next year. I'll have a lot of time on my hands." She's ready.

Photo: Dani Padgett

Marin County has long been a national model of land conservation with 58 percent of the county's natural and agricultural lands permanently protected—more than any other Bay Area county. The county also has less land at risk of development than most other counties—11,600 total acres. Of that, 2,400 acres are at high risk, where development is likely in the next 10 years.

The largest area at risk of development is the Silveira-St.Vincent's property, where a boys' school sits next to ranchland on a rolling grassy expanse of 1,200 acres along San Pablo Bay. For decades, this has been a contested landscape. The land separates Novato and San Rafael, and Marin's Countywide Plan allows for 221 homes on the site. While earlier proposals planned to cluster homes and prioritize open space, new discussions include spreading homes out over the site, consuming more natural lands. Though Marin very much needs affordable homes, they would be more appropriate in already-developed areas where residents can be close to services, schools, and jobs.

Marin County's greatest environmental challenge is building homes for workers who cannot afford to live there. The lack of affordable homes close to jobs puts sprawl pressure on outlying areas, and as of 2014, 68,000 people or 62 percent of the workforce, drove in every day.[1] These long car commutes

"It gives me great joy to see families walking here. It's so easy to get here by ferry. The vista draws people, and once they get here, they're out in real nature." Jerry Riessen looks out at the vista stretching from Mount Tamalpais to the Golden Gate Bridge, and beyond the San Francisco skyline. The views from Tiburon's hilltops are spectacular, and thanks to Jerry and the Tiburon Open Space Committee, they're free to visit and enjoy. The group spent years organizing the public purchase of two of three pieces of hilltop land—and now they hope to preserve the last.

On the 110 acres of remaining unprotected land along the ridge, irises flutter between outcroppings of serpentine rock. A rare population of threatened Marin dwarf flax opens delicate white flowers. The proposed Easton Point development by the Martha Company would put 43 large houses on this fragile hillside, much of which is prone to mudslides, and crown it all with a massive water tank.

Jerry has been watching legal battles over this land for 40 years. Today, his group sees a chance to preserve this last key piece in a system of lands stretching from Angel Island across to the historic coast and up to these ridgelines, and someday to join these lands to the Golden Gate National Recreation Area. Their goals are laid out at tiburonopenspace.org.

create more than 284,000 tons of carbon dioxide pollution per year.[2] More affordable homes are needed close to jobs and transportation, such as Golden Gate Transit and the new SMART train.

Since the last *At Risk* report in 2012, Marin increased its protected land and, thanks in large part to the Marin Agricultural Land Trust, 47 percent of the county's farmland is now safeguarded. The leadership Marin County has shown in protecting land is needed now to help its communities grow in a way that is truly sustainable.

MARIN COUNTY, A LEADER IN CONSERVATION, STILL HAS OVER 10,000 ACRES AT RISK

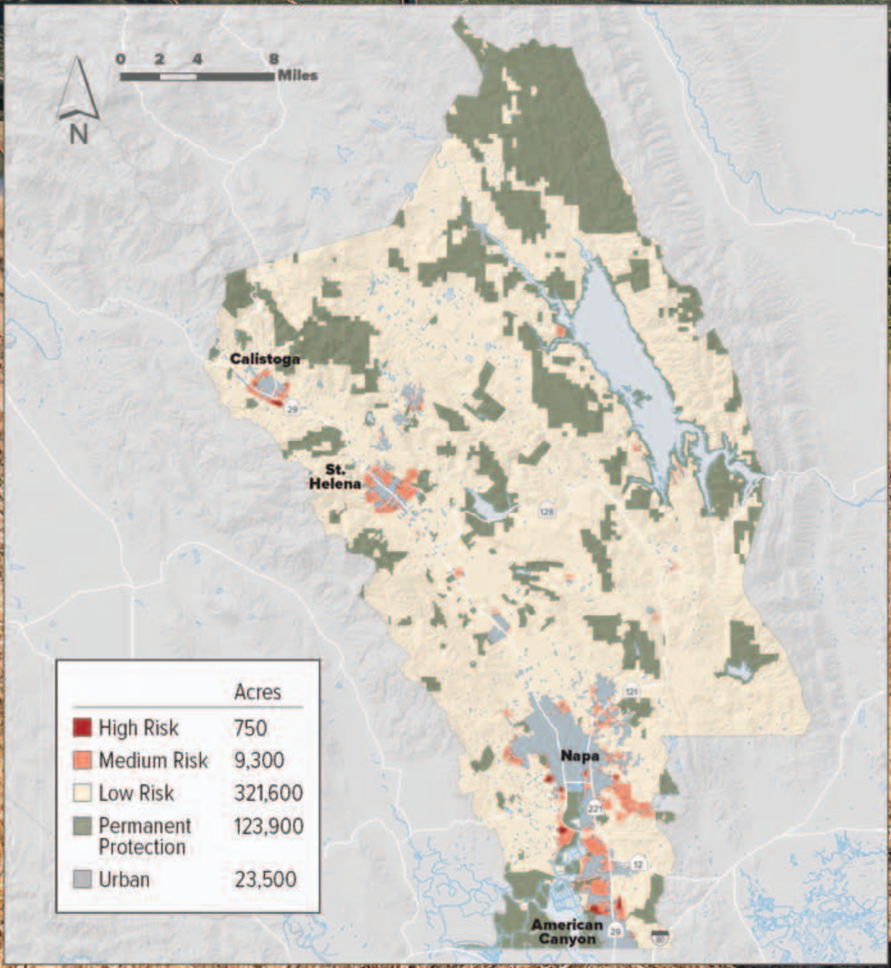
	Acres
🟥 High Risk	2,400
🟧 Medium Risk	9,200
☐ Low Risk	87,600
🟩 Permanent Protection	191,300
▨ Urban	42,300

Photo: Nels Andarek

Napa County has led the region on protecting agricultural land, especially for its famous grapes; however, the success of the wine industry itself may now be putting land at risk. Today, 10,100 acres of land in Napa County are at risk of development, with only 750 at high risk. Napa County has the region's least at-risk land, in part because it requires a two-thirds popular vote to take land out of agricultural use. But since 2012, the county's total land at risk has increased by 55 percent.

In recent years, one longstanding threat in particular has grown acute: the construction of large-scale event centers and resorts on farmland, especially vineyards. The agricultural connection may allow these to sidestep the review required for large-scale development—even as they pave land with new buildings and roads, and put new demands on scarce groundwater. The county is debating the issue with no resolution in sight.

Napa County's fastest-growing city, American Canyon, has a very loosely drawn urban growth boundary, encouraging development outward rather than containing it. A giant "new town center" called Watson Ranch proposes 1,250 housing units, a luxury hotel, a school, and commercial development, paving over farmland north of the city.[3, 4]



The county's most alarming threat is to a park south of the city of Napa, where land now considered permanently protected could be sold for development. Skyline Wilderness Park's 850 acres of land is leased to the county by the state, and the state has resisted selling the land to the county. In fact, the state has attempted to remove the land's designation as a park, to allow its sale at a higher price for development—possibly even for gravel mining.[5, 6] The precedent this would set is deeply disturbing.

In Napa, both land and water can be protected together. A full 90 percent of Napa's land at risk is in groundwater basins, vital for collecting the rainwater that fills underground aquifers.

90% OF NAPA COUNTY'S AT RISK LAND IS IN GROUNDWATER BASINS

Photo: Dani Padgett

"I felt like the Lone Ranger out there. We were the ones keeping the city from coming over the hill." Jo Ann Truchard and her family have been growing wine grapes for 40 years, in a long love affair with Napa, and with farming. For almost as long, they've been leading the fight against development on the hill, just north of their vineyard, that separates the city of Napa from the surrounding countryside.

Neighbors have joined Jo Ann and her family against the latest threat. The developers of the "Napa Oaks II" project—which would cut down 570 oak trees—seek to change the zoning to allow 53 homes on the hillside. The current "resource area" zoning is supposed to protect the land's views, natural springs, and wildlife, and also protect people: The 6.1 earthquake that shook Napa in 2014 ran along a fault just below the hill, making it a dangerous place to build.

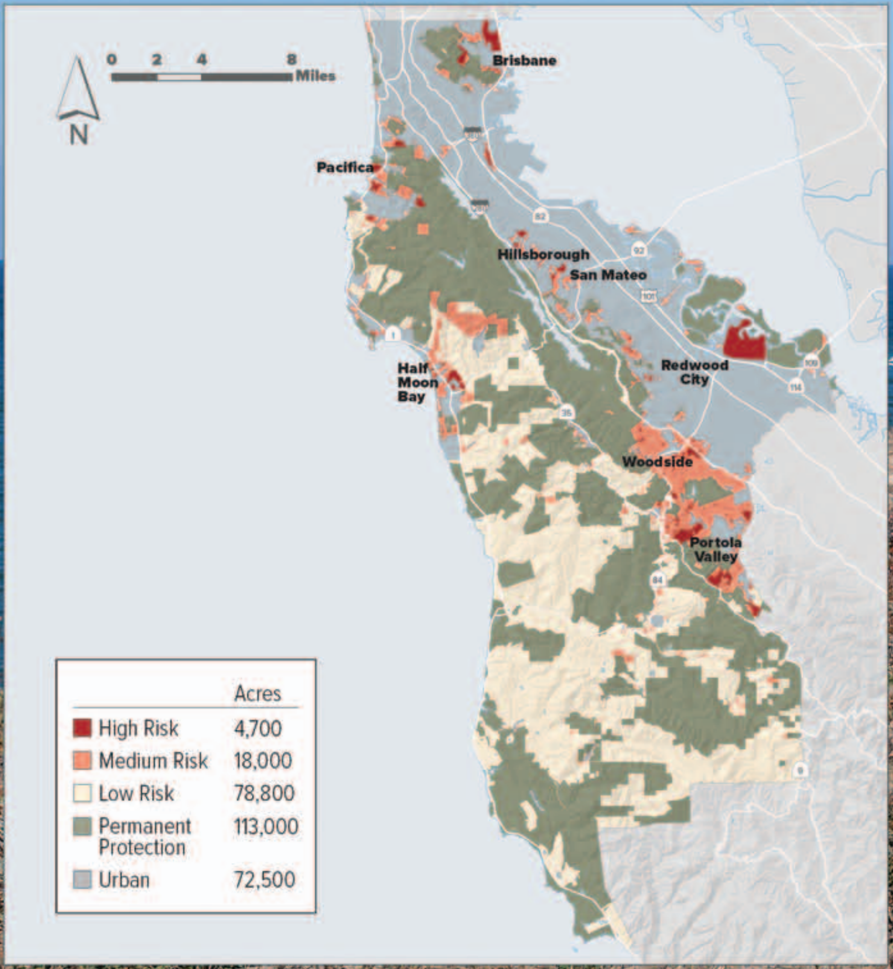
"You need to be vigilant about your community," says Jo Ann's daughter-in-law Suzanne Truchard, who has also joined the fight. A land use attorney, Suzanne scrutinized all the proposal documents. "What was really disconcerting was their tone," she says, "Like it's all a done deal."

But it's not, thanks to the Truchards and their neighbors. As one neighbor said, "They're speculators. They want to cash in. They made a bet—and they're going to lose."

SAN MATEO COUNTY'S LAND AT RISK HAS INCREASED BY ALMOST A THIRD SINCE 2012

San Mateo County is the smallest county in the Bay Area. Despite its small size, the county has a considerable amount of land at risk: 22,700 acres total, about 8 percent of its land area. Of this, 4,700 acres are at high risk, likely to be developed within the next 10 years. Since our last report, the county's amount of land at risk has increased by almost a third.

Some of the most important land at risk in San Mateo County is farmland along the county's western coast. Half Moon Bay, the county's largest coastal city, is updating its Local Coastal Program; this plan is required by the state to guide development and protect unique coastal resources. But the city's draft plan would significantly weaken protections for sensitive habitat, agricultural lands, and scenic landscapes.



Further inland, many hillside lands are newly at risk because the county has planned for housing in remote areas on the eastern slope of the Santa Cruz Mountains. These areas are often steep and forested, with little infrastructure, and largely inappropriate for development. Many do not believe the county intends to develop in these areas—but this calls into question whether the county has done its required housing planning in good faith. Either way, these plans raise serious concerns.

On the Bay, northeast of Redwood City, a major waterfront development is being considered for 1,500 acres of salt ponds owned by Cargill. With up to 12,000 homes, this would be the largest Bay development in 50 years.[7] In 2003, 16,500 acres of these salt ponds were sold for wetland restoration. The fate of the rest remains an open question.

Despite these threats, an impressive amount of San Mateo County's land has been protected, almost 40 percent of its farms, ranches, and natural areas.

The county's forests store carbon, keeping tons of greenhouse gases out of the atmosphere. Development would destroy these benefits, and though San Mateo is the region's smallest county, it has the second most above-ground stored carbon at risk: 257,700 metric tons. Protecting land in San Mateo County can benefit the climate—and everyone who depends on it.

Photo: Dani Padgett

"I've been a surfer since I was a little kid," says Edmundo Larenas. "Surfers are always looking for public access; but for many of us, environmental protection comes first." As the chair of the local chapter of the Surfrider Foundation as well as a biochemist, Edmundo is a strong advocate for clean water. But clean water and the undeveloped land it depends on—San Mateo County's whole scenic coast—are threatened by a new plan in Half Moon Bay.

"Cities always want to do more development, and the city of Half Moon Bay has a long history of doing crazy stuff." The city's decisions can affect the county's entire coastline—especially now that the city is updating its Local Coastal Program, a state-required plan to guide coastal development. The new draft of the plan would dramatically weaken wildlife and farming protections.

"We're not anti-development, we just want it in the right places," says Edmundo. But this plan would allow long slices of suburban development to cut through green cropland, from the shoreline to the hills. Coastal wetlands could also be at risk.

The wild beauty of San Mateo County's coast, says Edmundo, "is not an accident. People purposely defended it from development over the years." Unfortunately, the defense cannot rest.

Santa Clara County, the Bay Area's second-largest county, was once famous for fruit orchards; today, over half of its last remaining farmland is at risk. The county has a total of 54,100 acres of land at risk of development, with 13,000 acres of land at high risk. However, its land at risk has dropped since 2012, thanks in part a sweeping Habitat Conservation Plan.

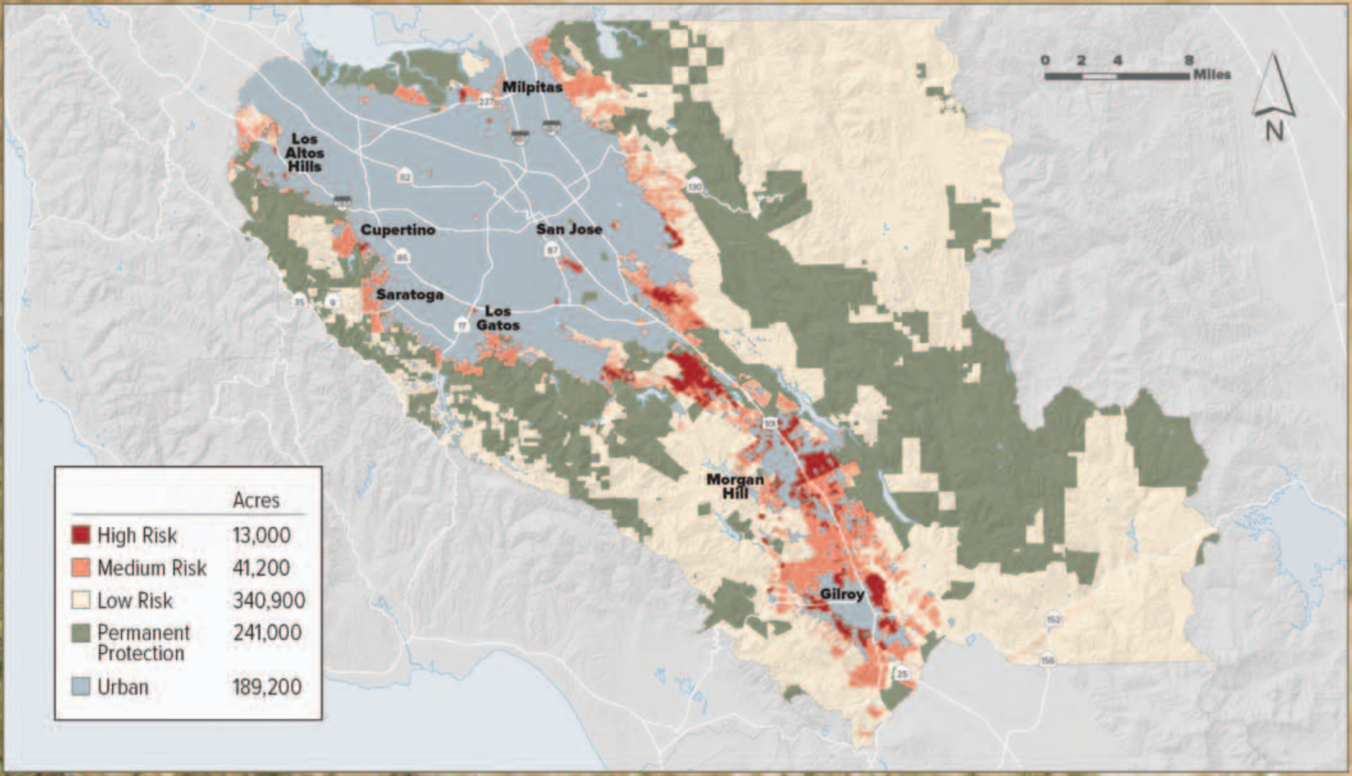
South of San Jose, about half of the 7,000-acre Coyote Valley is at risk of development. The land in the valley's north is rare and valuable for its agriculture, wildlife corridors, groundwater recharge, and recreation—but this land is at high risk. San Jose has zoned northern Coyote Valley for industrial development, and it faces multiple proposals, including a 517,000-square-foot warehouse distribution center for e-commerce deliveries—a growing development threat throughout the state.

At the southern tip of the county, farmland around Gilroy is being pelted with development threats. A reprieve came when voters passed an urban growth boundary in November 2016, protecting over 2,000 acres east of the city. But multiple proposals still threaten agricultural land to the city's east, and if a remote site is chosen for the new high-speed rail station, that could spur sprawl. To the city's north, over 700 acres of farmland were at risk until 2016, when the Local Agency Formation Commission, or LAFCo, actually sued the city, bringing the plan to a halt—at least for now.

For years, Morgan Hill has sought to develop the last farmland between it and San Martin, a 1,300-acre region called the "Southeast Quadrant." The city proposed to annex and develop more than half of the valley's farmland; but in 2016 the county's LAFCo refused the annexation. An attempt by San Martin met a similar fate. The county is lucky to have a vigilant LAFCo agency.

Since our 2012 report, Santa Clara County achieved a major conservation milestone by adopting a 50-year Habitat Conservation Plan championed by Greenbelt Alliance. This plan levies a fee on development to mitigate impacts on wildlife and natural resources. With higher fees on key habitat lands, the plan also discourages development of the most important natural areas.

Farmland in Santa Clara County desperately needs conservation. With an astounding 56 percent of the county's farmland at risk of development, this fertile and irreplaceable resource is very close to being lost forever.



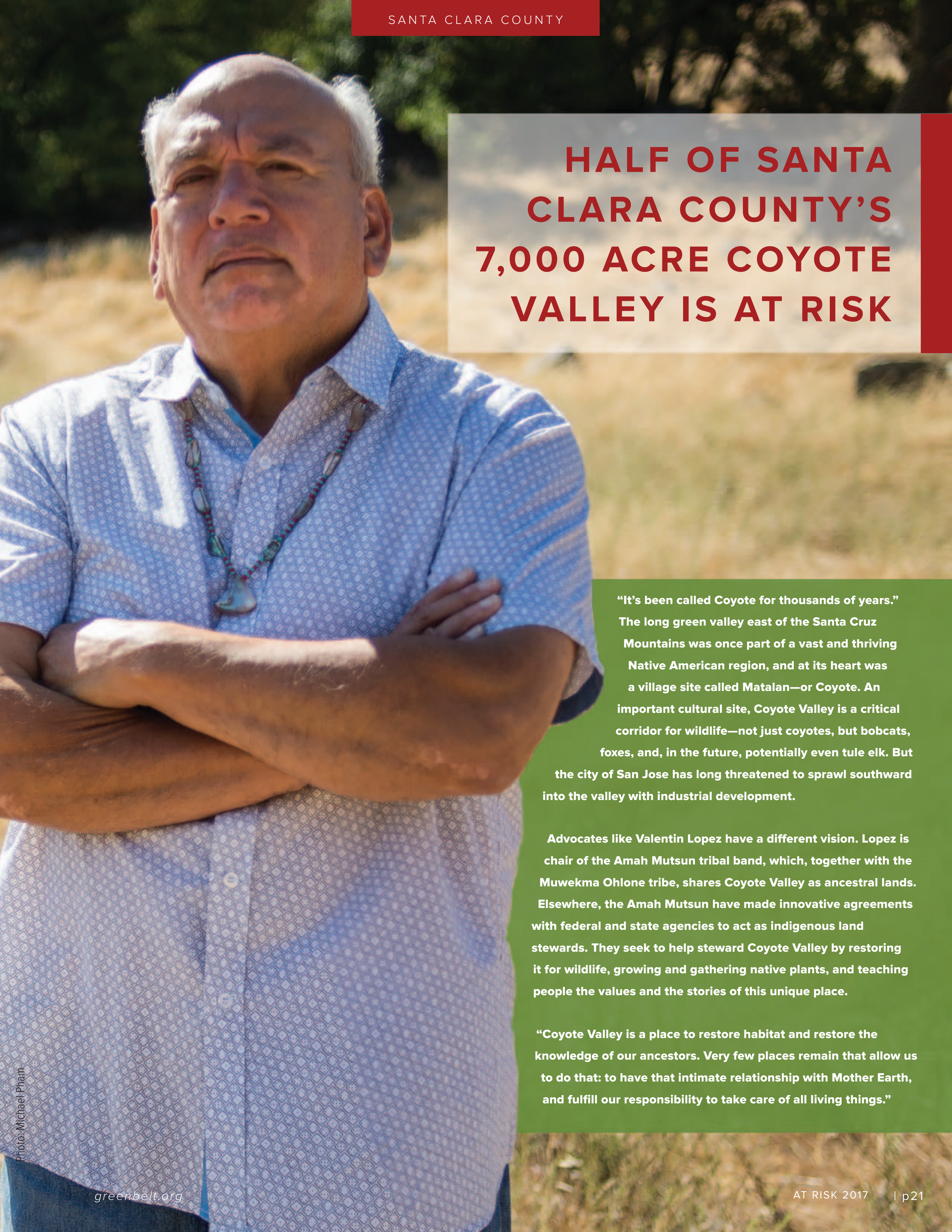


Photo: Michael Pham

HALF OF SANTA CLARA COUNTY'S 7,000 ACRE COYOTE VALLEY IS AT RISK

"It's been called Coyote for thousands of years." The long green valley east of the Santa Cruz Mountains was once part of a vast and thriving Native American region, and at its heart was a village site called Matalan—or Coyote. An important cultural site, Coyote Valley is a critical corridor for wildlife—not just coyotes, but bobcats, foxes, and, in the future, potentially even tule elk. But the city of San Jose has long threatened to sprawl southward into the valley with industrial development.

Advocates like Valentin Lopez have a different vision. Lopez is chair of the Amah Mutsun tribal band, which, together with the Muwekma Ohlone tribe, shares Coyote Valley as ancestral lands. Elsewhere, the Amah Mutsun have made innovative agreements with federal and state agencies to act as indigenous land stewards. They seek to help steward Coyote Valley by restoring it for wildlife, growing and gathering native plants, and teaching people the values and the stories of this unique place.

"Coyote Valley is a place to restore habitat and restore the knowledge of our ancestors. Very few places remain that allow us to do that: to have that intimate relationship with Mother Earth, and fulfill our responsibility to take care of all living things."

NEARLY 10% OF SOLANO COUNTY'S LAND IS AT RISK

The valleys and oak-dotted hillsides of Solano County have long been threatened by growth sprawling out from I-80. Today, feverish speculation has turned up the heat. A total of 44,600 acres of Solano's land is at risk of development over the next 30 years, and in just the next 10 years, 12,300 acres could be developed. The amount of land at risk has increased by almost half since 2012. Now, nearly one out of ten acres of the county's land is at risk. Only Contra Costa County has a higher percentage of all land at risk.

Vacaville is a hotspot, surrounded by farmland and ranchlands at high risk from an onslaught of new development proposals. Despite central areas available for development, the city is planning to develop out on rural land to its south and east. Large areas of land to the city's northeast and southeast are

"When people come visit, they always say, 'It's so quiet here!'" says Esther Pryor, owner of four goats, nine cats, and a small bike shop on Suisun Valley Road.

Here at the gateway to the fertile Suisun Valley, the quiet is made possible in part by Esther and her neighbor Carol Herzig's efforts to keep this place rural. On a small plot of land below Rockville Hills Regional Park, horses and cattle graze, and Swainson's hawks catch prey in golden grass. But the "Woodcreek 66" developer is trying to change the area's zoning to allow 66 homes, and the City of Fairfield is supporting the proposal, hoping to annex the land.

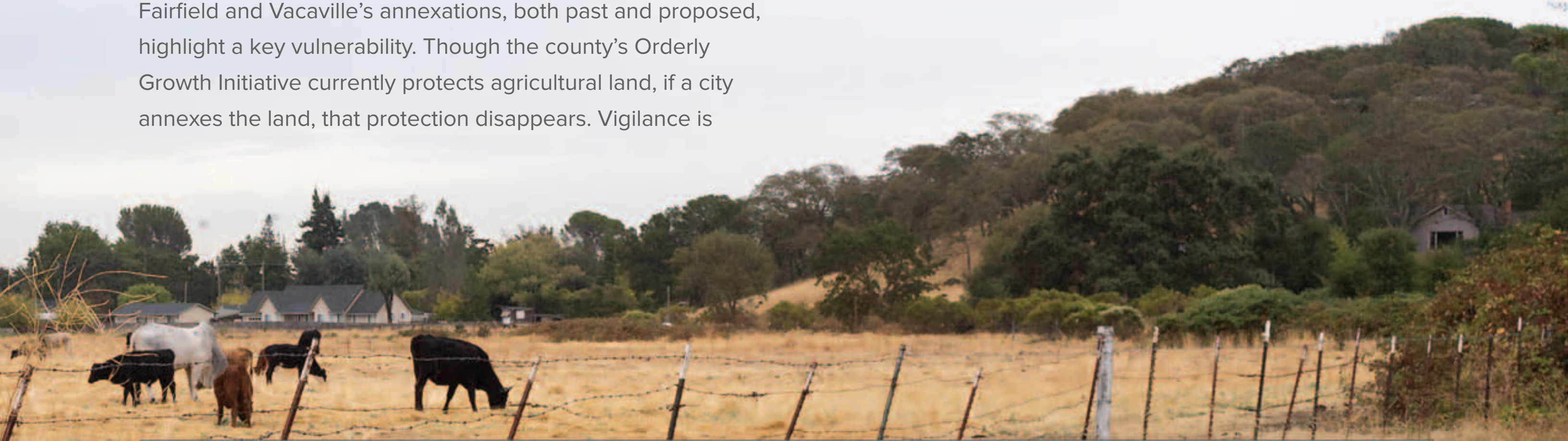
Esther's group and others are suing—not for the first time—to stop this. It's a dangerous precedent, a direct attack on the county's voter-approved Orderly Growth Initiative. "These developers are trying to wrangle water and sewer into land outside the city, so the city can swallow us up," says Esther. If allowed, this would pave the way for a much larger proposal for 400 homes in nearby Green Valley, and Fairfield's continued sprawl out into rural land.

at risk as well. The county has proposed to meet its regional housing requirements with development scattered across grazing land. Though some say this is unlikely, the county has mapped projected development here, so either the county's housing plans are not in good faith or this land is at risk—both alternatives raise concerns.

Fairfield, like Vacaville, is threatening to annex rural areas in Suisun Valley and Green Valley. Fairfield is also building a new train station on its northeastern edge, likely to induce development on surrounding open space and farmland.

Fairfield and Vacaville's annexations, both past and proposed, highlight a key vulnerability. Though the county's Orderly Growth Initiative currently protects agricultural land, if a city annexes the land, that protection disappears. Vigilance is needed on the part of residents and elected leaders, as well as Solano's Local Area Formation Commission, which is responsible for arbitrating boundaries and stopping sprawl.

Solano County is home to more wetlands and vernal pools than any other Bay Area county. In a conservation victory, after decades of debate, in 2014 federal agencies signed a plan to protect almost half of the 116,000-acre Suisun Marsh. But Solano is still the only county in the Bay Area without a public open space district, and has the least permanently protected land. With 27 percent of all the region's at-risk wetlands, Solano County must act to protect a rare resource.



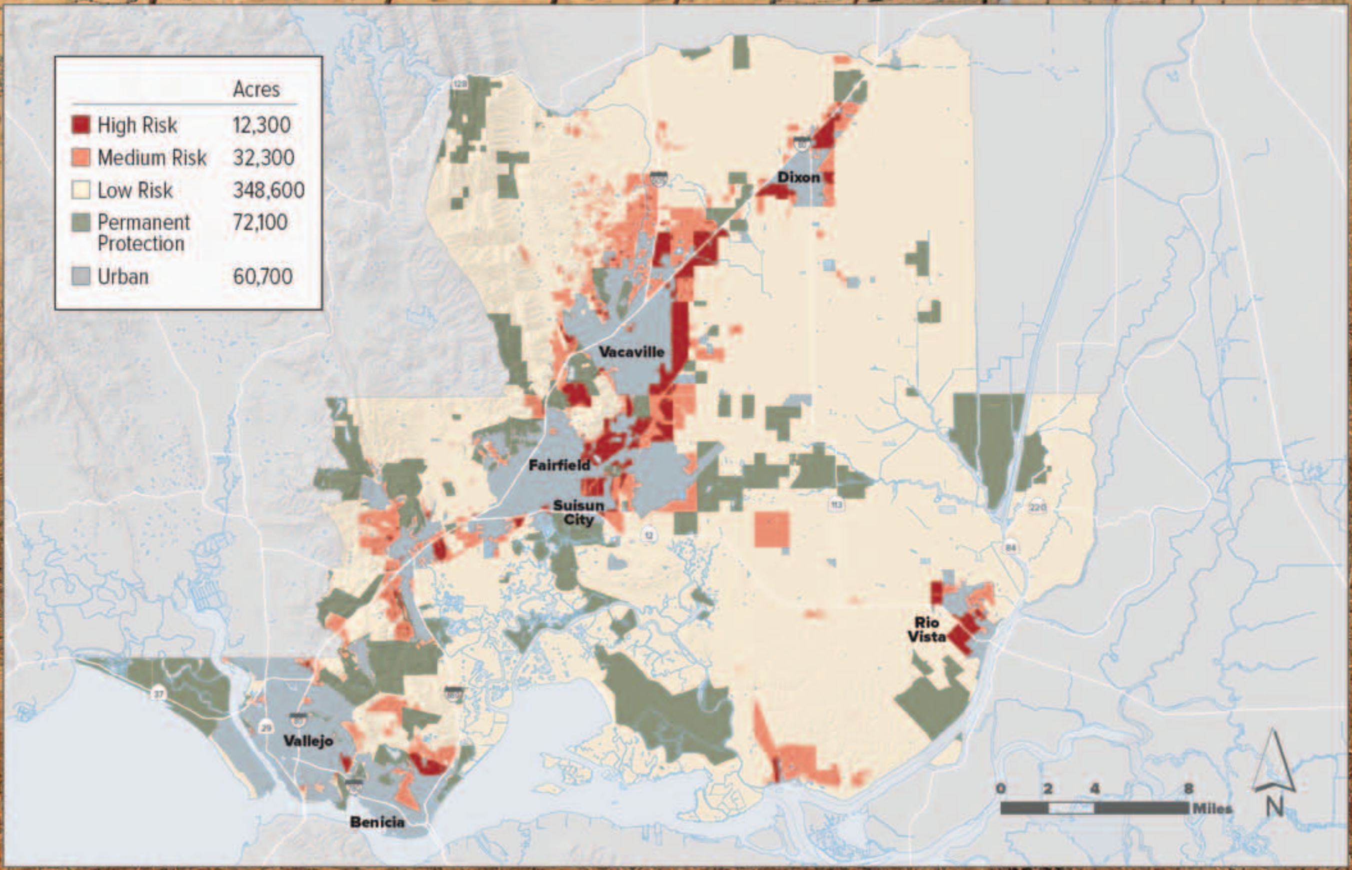


Photo: Dan Padgett

Sonoma County, the Bay Area's largest county, has made the region's largest recent strides in land protection. Today, the county has 58,400 acres of total land at risk of development over the next 30 years—more than any county but Contra Costa—but this number has been cut in half in just five years, thanks to new greenbelt protections. Land at high risk—threatened in the next 10 years—has dropped by 70 percent since 2012 to 4,100 acres.

Several areas remaining at high risk are around Rohnert Park; the city has adopted multiple plans for greenfield lands, building out toward its growth boundary. Rohnert Park would be better served by focusing new development in downtown and near the train station, rather than quickly using up its remaining open lands.

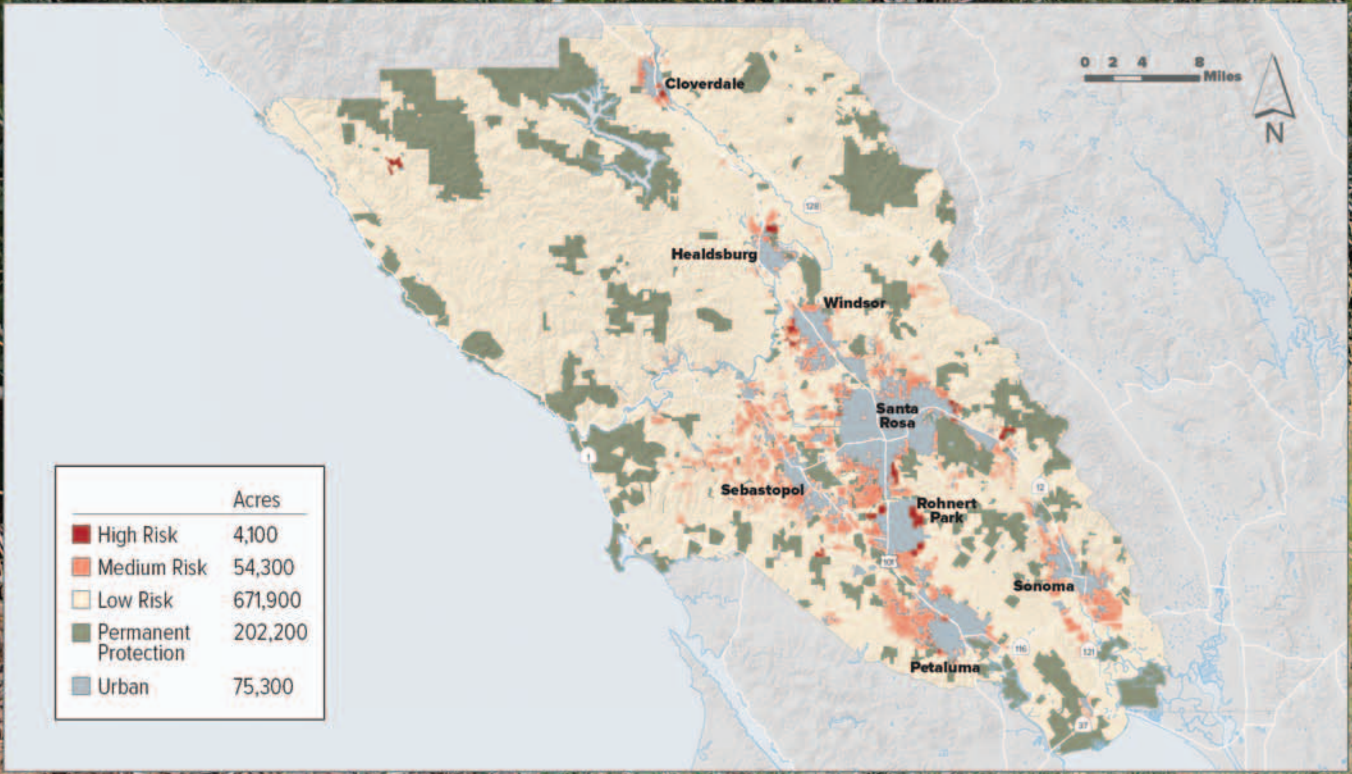
Like its neighbor Napa, Sonoma County is also grappling with large event centers on rural lands, putting additional pressure on land and groundwater. These projects remain controversial and continue to be negotiated.

Another insidious threat to Sonoma's greenbelt is parcelization, or the division of undeveloped land into small lots. This division is largely invisible until development occurs, fragmenting landscapes. Parcelization can occur far from cities and towns, slicing up valuable habitat or farmland and rendering it vulnerable to development.

Though threats persist, Sonoma has made impressive strides on conservation. The historic 2013 purchase of the 20,000-acre redwood forests of Preservation Ranch will preserve wildlife habitat and store carbon for climate protection.

And, in 2016, Sonoma County voters dramatically expanded protections for rural lands between cities and towns. Greenbelt Alliance led the effort to more than triple the area of open space and farmland designated as community separators to 53,600 acres. Voters then renewed these protections for another 20 years, blocking any housing tracts, shopping malls, or resort hotels without a vote of the people.

A growing challenge for Sonoma County is that more than half of its water—both for drinking and irrigation—comes from groundwater.[8] The lands that collect this water are at risk—in fact, 28 percent of all the region's at-risk groundwater basins are in Sonoma County. Protecting this land is essential, for water and for the people who depend on it.



	Acres
🟥 High Risk	4,100
🟧 Medium Risk	54,300
☐ Low Risk	671,900
🟩 Permanent Protection	202,200
▨ Urban	75,300

58,400 ACRES OF SONOMA COUNTY'S LAND IS AT RISK

Photo: Dani Padgett

"It's a resource for wildlife, and for people who really need it. Developing the land will destroy a resource that can't be replaced." Studies show that being in nature is good for our mental health; for Kathleen Miller, it has been a lifesaver. Kathleen's son Danny (pictured left) has lived for many years at the Sonoma Developmental Center, which cares for people with developmental disabilities and mental illness. The center sits amid an idyllic 900-acre expanse of redwood forests, grasslands, and oak woodlands along Sonoma Creek. Most of this land is left alone, which has allowed wildlife—from bobcats to threatened steelhead trout—to thrive. But the state is planning to close the 120-year-old facility, and the land is at risk.

To preserve this rare resource, the families of patients have joined with the Sonoma Land Trust, the Sonoma Ecology Center and the community of Sonoma Valley in a coalition called Transform SDC. Together, they're seeking to keep safety-net services for the most disabled, while protecting the land for wildlife habitat and recreation. It's an unusual alliance to save a unique place.

"Nothing like this place could be created now," says Kathleen. "All we can do is save it."

THE VALUES OF NATURAL LANDS


Photo: Don DeBold via Flickr.com

The Bay Area's economy, and its prosperity, could not exist without its natural landscapes. Some of the benefits these lands provide are obvious, like the scenic views and outdoor opportunities that draw people here from across the world to visit, work, and live. But nature does far more for us than we often acknowledge: It provides clean air, clean reliable water, safety from storms and floods, healthy food, and more.

ECONOMIC VALUES

Though most people would probably say they value nature, as a society we have often failed to assign it any economic value. When we make important decisions, the services and benefits our landscapes provide are often left out of the equation. As we confront global climate change, drought, and more, we are learning that this has been a costly omission.

New studies are changing this, assessing and assigning economic value to these natural goods and services.

In Santa Clara County, a recent comprehensive study added up the economic value provided by the county's natural landscapes.[9] It found that the benefits people obtain from ecosystems—filtering water, growing food, providing recreation opportunities, and more—are worth up to $3.9 billion per year. The county's natural capital—the infrastructure that provides these benefits—is worth up to $386 billion.

An example from New York shows how this information can be used: New York City's water utility began investing millions of dollars in conservation after seeing that the Catskill/Delaware River watershed filters water naturally for a far lower cost than a new water treatment facility, which would cost $6-10 billion to build and $300 million per year to maintain.

Another study found that just the benefit provided by rangeland for pollinators—habitat for wild bees—is likely to be worth $2.4 billion statewide.[10] Almost all crops other than grains rely on pollinators, and most now depend on just one species of bee. Honeybee populations have been declining steeply, driving up prices and uncertainty for farmers who must rent them. Farmers who have access to wild bees benefit from a source of pollinators that is less costly and more resilient.

These estimates are conservative. As the Santa Clara report points out, though it is based on many studies, more are needed; for example, no peer-reviewed estimate was available for lands that recharge groundwater—obviously a critical service in drought-stricken California. The true value of these lands is likely to be higher than these initial studies report.

Protecting natural and working lands is one of the smartest investments we can make. The Santa Clara study found that the return on investment (ROI) of the 352-acre Coyote Valley Open Space Preserve, based on its costs and the ecosystem benefits it provides, was $3 for every $1 invested. These come from grazing leases, recreation value, and the services provided by the various types of ecosystems there.

NATURAL VALUES

Greenbelt Alliance gathered data on the natural values of all Bay Area lands, including those that are protected and those still at risk.

The Bay Area has a total of 2.3 million acres of agricultural land, 1.8 million acres of lands that provide water resources—watersheds and wetlands—and 2.5 million acres of lands that are important for wildlife—habitat, corridors, and areas rich in biodiversity. Planned trails around the region total an impressive 1,600 miles, including those that will someday connect all 9 counties, such as the Bay Trail and the Ridge Trail. And together, the region's lands store an enormous 111 million tons of carbon, helping to regulate and protect our climate. These values often overlap, as one landscape provides many benefits. For example, a forested watershed helps provide clean water, wildlife habitat, and carbon storage, and if it is open to the public, it provides recreation as well, with trails and scenic views.

NATURAL BENEFITS ADD UP

Our local and regional economies and the health of our communities rely on the benefits natural landscapes provide:

- Clean, plentiful drinking water
- Protection from floods and storms
- Food production and food security
- Basic materials for building and for medicine
- Carbon storage for climate regulation and resiliency
- Recreation and tourism opportunities
- Health benefits from clean air and recreational opportunities

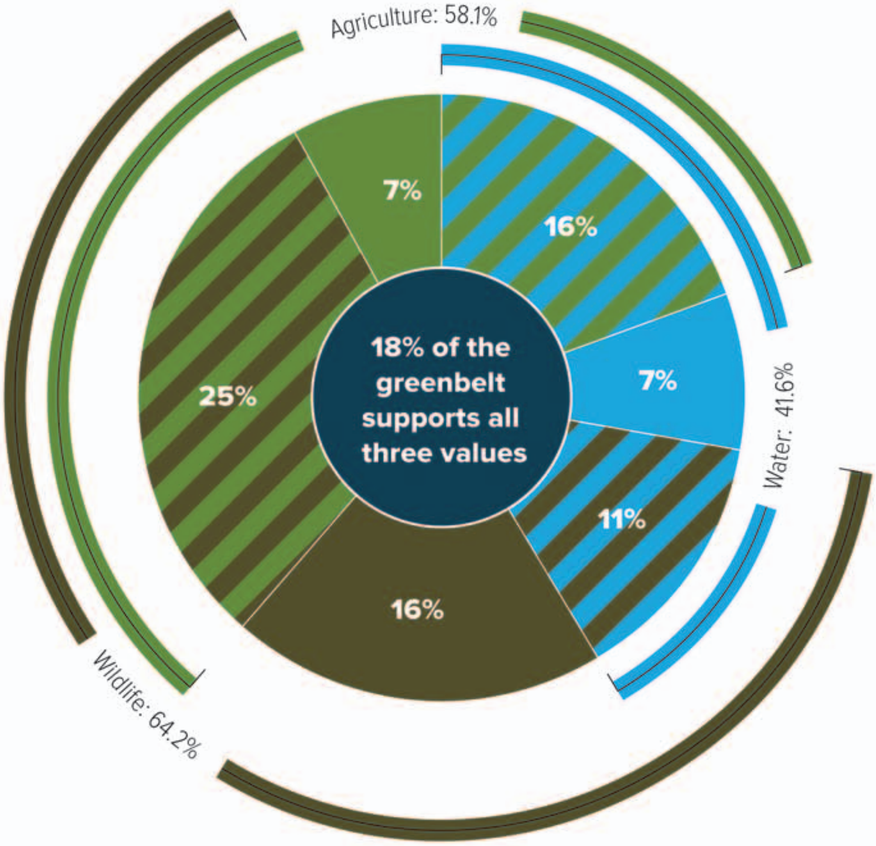
These values help show what is at risk from development. For example:

- **Clean drinking water is at risk:**
  Undeveloped Bay Area lands catch and filter rain, replenishing groundwater supplies. But this service is threatened by development; if lands are paved over, they cannot collect water. This is a critical issue in California's long drought, especially in counties like Sonoma, where groundwater is what people drink. **If the region's at-risk landscapes are lost to sprawl development, 46 billion gallons of water—a year's worth of water for 677,000 households—is at stake.**[11]

- **The climate is at risk:**
  Bay Area ecosystems, especially forests and wetlands, are very efficient at storing carbon, whose release is a primary driver of climate change. Together, the region's at-risk landscapes store more than 6 million metric tons of carbon. **If these lands are developed, the carbon that would be released is equivalent to putting 1.3 million cars on the road every year.**[12]

As we begin to understand the benefits of our natural areas and working lands to our economy, our health, and our communities, we better grasp how their loss would affect us. We start to see we cannot afford to lose them, and when they are at risk, so are we.

This graphic represents the 3.6 million acres of the Bay Area's greenbelt. The sections represent wildlife, watershed, and agricultural lands, and where they overlap.



■ Wildlife, Water, & Agriculture

■ Wildlife

■ Water

■ Agriculture

▨ Striped segments show percentages where two values, indicated by color, overlap.

THE HOUSING CRISIS

SPRAWL DEVELOPMENT VS. REAL SOLUTIONS

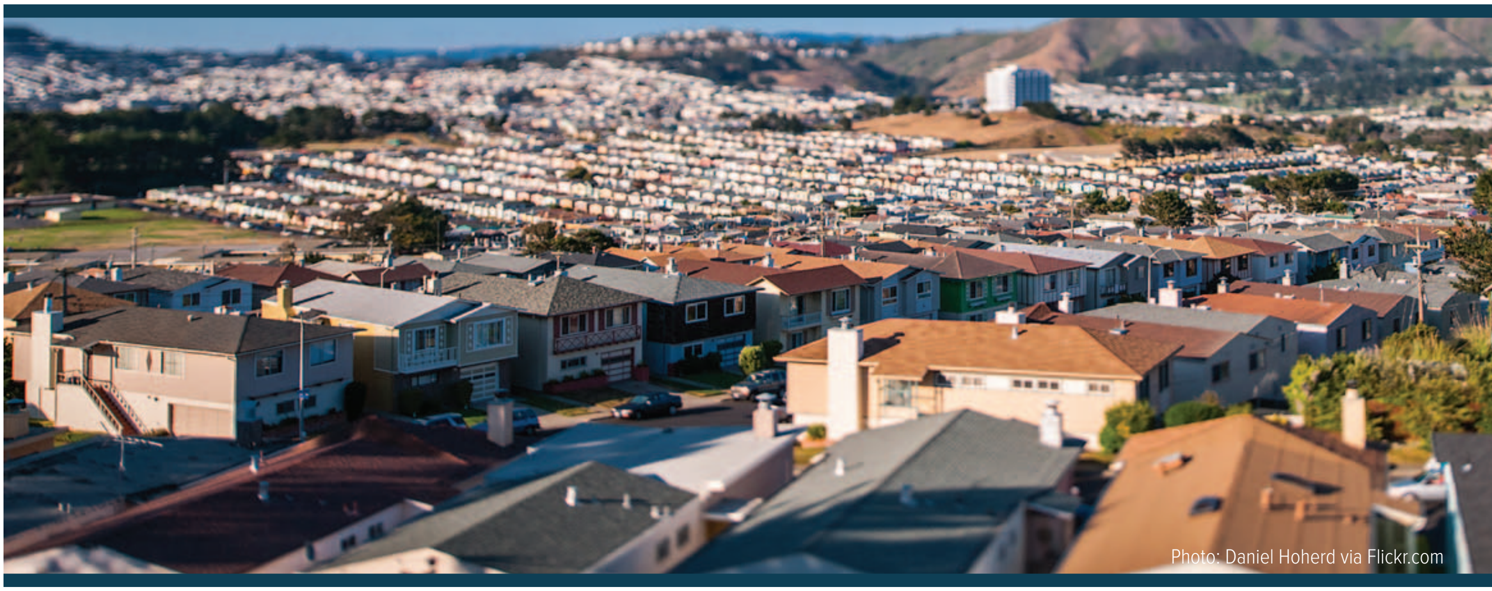


Photo: Daniel Hoherd via Flickr.com

The Bay Area is in an affordable housing crisis. More and more people are burdened by housing costs that are more than 30 percent—the national standard—or even half of their income. Home prices in some parts of the region have doubled since 2004—the national average increase is 13 percent—and some have even doubled since 2010.[13, 14] While this might allow some people to “cash out”—though they must leave the Bay Area to do it—it is hard on everyone else, especially those with low incomes.

The impacts also go beyond those directly affected.

If affordable homes are not available close to jobs, people “drive ‘til they qualify” to find a less expensive home farther away, and commute long distances—mostly in cars. The resulting costs affect all the region’s residents: worse traffic, polluted air, more carbon changing our climate, and a lower quality of life.

SPRAWL IS NOT THE ANSWER

Some people suggest that the solution to the housing crisis is to build more homes on farmland and natural areas. But sprawl won’t actually help reduce household costs.

Most of the region’s farmlands and natural areas that are threatened by sprawl are in communities at the edges of the region, such as southern Santa Clara County, eastern Contra Costa County, and Solano County. Sprawling developments are car-dependent; their residents must not only make long commutes to work, but drive more to meet every need in daily life.[15]

So while housing prices may be lower in sprawl developments in outlying areas, other expenses go up, especially for transportation.[16] These costs are often hidden and include not just the price of gas, but the purchase of a second car and the insurance and maintenance it requires, and the cost of additional child care to cover the extra hours spent commuting. The costs are not all financial: More time spent in traffic takes away opportunities to be with family and friends. Ultimately, living in sprawling development is rarely cheaper; the costs simply hit in different ways.

In addition, greenfield development—building on farmland and natural areas—is expensive for taxpayers, who foot the bill for providing services to far-flung neighborhoods. These communities pay more for infrastructure and services including water, roads, sewers, libraries, parks and recreation, governance, and more. Annual per-household costs for roads can cost 4,000 percent more in sprawling areas than in dense communities.[17] Services cost more and serve fewer, too: A fire station in a low-density neighborhood serves just one-quarter of households at four times the cost of one in a more compact neighborhood.[18]

REAL SOLUTIONS: THE RIGHT DEVELOPMENT IN THE RIGHT PLACES

Increasing the region's housing supply is one key tool to reduce home prices, but supply is not just about land. Zoning for large lots or only single-family homes has reduced the housing supply for many years. Communities can use land more efficiently and rebuild on existing urbanized land, such as aging strip malls and unused parking lots. They can also encourage the creation of a variety of types of homes: townhomes, apartments, and in-law units, as well as single-family homes. People need more options. Demand is high and growing among single people—now more than half the nation's population and more than a quarter of households—as well as couples without children, empty nesters, and families seeking smaller, more affordable homes.[19]

The solution to the housing crisis is not to build on farmland and natural areas around the edges of the region. A better choice is to add new homes as "infill" in existing cities and towns. Plan Bay Area, the region's shared blueprint for land use and transportation through 2040, shows that the Bay Area can accommodate all its projected growth within existing urban growth boundaries.[20]

But doing so will not be easy. Infill development faces many challenges. To truly address the housing crisis, every community must do its part:

- **Pass policies that make it easier to build more homes in existing cities and towns.**
  Greenbelt Alliance's *Fixing the Foundation* report outlines local policy solutions to promote infill housing.[21] For example, reducing parking requirements can make building infill more cost-effective. Allowing more height and more homes in a given building, in exchange for community benefits, can create more new homes while also bringing amenities for existing residents. And encouraging, rather than prohibiting, the creation and rental of in-law apartments can provide more homes and also benefit the local homeowners who create them.
- **Ensure that new homes are affordable to households at all income levels, and fund the creation of affordable homes.**
  Inclusionary housing policies can help, by requiring every new development to include a certain percentage of affordable homes. Impact fees, too, can ensure that new commercial or residential development contributes to providing affordable homes. These fees recognize that the lower-income workers who will be needed to support that development (for example, the gardeners needed to maintain the grounds of a new office building) will need an affordable place to live. Greenbelt Alliance has helped win inclusionary housing and impact fee policies in cities across the region.
- **Say "Yes" to good development in the right places.**
  Plans, policies, and funding streams are a good start. But at the end of the day, new homes only get built when communities approve specific, individual development projects. Endorsement programs run by Greenbelt Alliance and others speak up for good projects.

A CALL TO ACTION

Photo: Carol Dula

The Bay Area is a leader in protecting its iconic landscapes: rolling hills, fields and forests, and windswept coastlines. But too much land—almost 300,000 acres—is still at risk, and the stakes are high.

The fate of the greenbelt depends on decisions that are being made every day in cities and counties around the region. A vote in Sonoma County could decide the future of groundwater supplies for thousands of people. Decisions in Solano or Alameda County to build on wetlands could release tons of carbon to change our climate. Votes in Contra Costa and Santa Clara County could impact the availability of fresh, local food.

THESE DECISIONS MATTER.

Bay Area communities can act now to:

- Adopt policies—like Sonoma's community separators, Santa Clara's Habitat Conservation Plan, and Dublin's urban limit line—that protect the most valuable natural and agricultural lands.
- Take the natural values of land into account when making development decisions. The data from this report is available on Greenbelt Alliance's website at greenbelt.org/at-risk-2017.
- Support the right development in the right places. Creating more new homes within our existing cities and towns relieves pressure to sprawl onto natural areas, farms, and grazing land.

We are lucky to have the greenbelt and all the bounty it provides, from clean drinking water, to spectacular scenery, to juicy peaches. We are lucky to have the power to preserve it—because when we consider the greenbelt's future, we decide our own.

METHODOLOGY

To create this report, Greenbelt Alliance does a detailed mapping analysis using Geographic Information Systems (GIS) software. The report covers eight Bay Area counties (San Francisco is not included, as all its land is generally either developed or permanently protected). This analysis addresses three topics: development pressure, policy protection, and natural values.

DEVELOPMENT PRESSURE AND POLICY PROTECTION: HOW WE FIND WHAT'S AT RISK

To assess development pressure and policy protection, we review all city and county general plans and zoning, as well as other local ordinances. We also review city and county websites and local news for development proposals, talk with local advocates, and use our staff's local knowledge to get as comprehensive a picture as possible of all proposals and plans, both past and present. (Multiple past proposals for an area can be an indication of future risk.)

Growth projections from the state and the region's Plan Bay Area also feed into our analysis. And this year, for the first time, new maps became available showing where each city and county is planning to accommodate needed new homes through 2022.

We gather information on boundaries—city limits, growth boundaries, service areas, spheres of influence, and longer-term planning areas—largely from city and county general plans and from Local Area Formation Commission (LAFCo) agencies, which oversee these boundaries. We also factor in natural boundaries and the geography of the landscape, such as proximity to roads or existing development, as well as slope—flat land is generally at greater risk.

For policy protections, we look at city and county plans to find hillside, riparian, and agricultural policies, as well as habitat conservation plans and more. We use a statewide protected lands database from GreenInfo Network, and include coastal and bayland data from regional and state agencies to map shoreline protections.

Finally, we assign scores to both development pressures and policy protections. These scores are relative. For example, land with an actual project being considered for approval would get a high development-pressure score, whereas farmland zoned "rural residential," where nothing is yet proposed, would get a lower development-pressure score. Similarly, agricultural land under voter protections would get a greater protection score than land subject to a city council-adopted hillside ordinance, since voter-adopted protections are harder to change. We combine the development pressure and policy protection scores to determine the overall likelihood that the land will be developed.

The timing then establishes whether land is at high or medium risk, with development likely within 10 years, or 30 years respectively. For example, if a site has a current development proposal, that land would be at high risk. If land is at risk of development for more general reasons, such as being within a growth boundary and near roads, it is at medium risk.

NATURAL VALUES: HOW WE FIND WHAT'S AT STAKE

To assess the natural values of the land, both for agriculture and for ecosystems, we gather many types of information, largely from public agencies. We compile farm and rangeland maps, as well as data on watersheds, groundwater basins, and wetlands, from state agencies. We include maps of critical habitat and flood zones from federal agencies. The Bay Area Open Space Council provides maps of biodiversity conservation lands, and we compile trails data from several sources.

A fascinating new addition to this year's report is the natural value of carbon storage for protection from climate change. Biomass and carbon data come from recent research by federal agencies and universities. A more detailed methodology can be found at greenbelt.org/at-risk-2017.

ENDNOTES

1 Longitudinal Employer-Household Dynamics Program, Center for Economic Studies, U.S. Census Bureau, 2014, cited in Marin Environmental Housing Collaborative 2016 platform, http://www.marinmehc.org/images/pdfs/mehc-2016-platform.pdf

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Based on report’s calculation using the US EPA’s Greenhouse Gas Equivalencies Calculator, 2.6 million vehicle miles x 0.916 lbs/passenger mile x 5 workdays per week, 48 workweeks per year.

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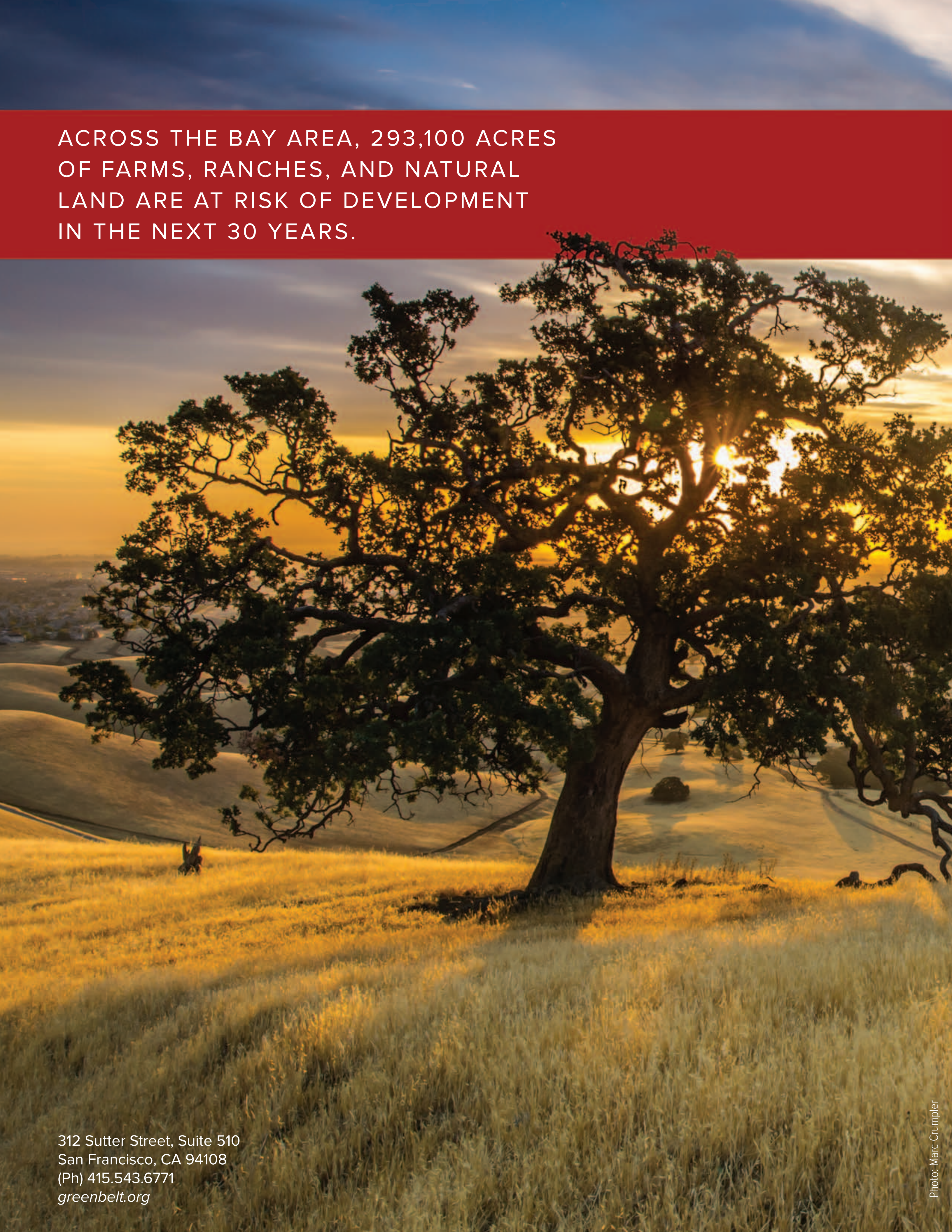

ACROSS THE BAY AREA, 293,100 ACRES OF FARMS, RANCHES, AND NATURAL LAND ARE AT RISK OF DEVELOPMENT IN THE NEXT 30 YEARS.

312 Sutter Street, Suite 510
San Francisco, CA 94108
(Ph) 415.543.6771
greenbelt.org

Photo: Marc Crumpler

EXHIBIT 14

Daily Democrat (http://www.dailydemocrat.com)

State Water Board Issues Moratorium on New Water Connections

By

By Adrian Baumann

abaumann@willitsnews.com">abaumann@willitsnews.com

Wednesday, November 5, 2014

The State Water Resources Control Board Division of Drinking Water has placed a moratorium on all new water connections and upgrades for both the Willits, Brooktrails and Pine Mountain water systems.

The order was received October 17, and both governments have been working to have the building ban modified or at least partially rescinded, but it is now clear that there will be at least some temporary impacts.

Willits, for its part, was given 30 days and will know by November 17 if they have succeeded in getting a variance by meeting the requirements of the water board. At least three homes under construction in the Willits Haehl Creek Subdivision will be affected by the moratorium, and it is possible that some of the campus buildings at the new hospital will also be affected.

Willits, Brooktrails and Pine Mountain were the only Mendocino County water agencies among the 22 districts state wide slapped with a moratorium. According to the Division of Drinking Water these "community public water systems (were ordered) to find a reliable, alternative source of water to replace that curtailed earlier this summer due to the drought. Within the affected water systems, the orders prohibit new water service connections to residences and businesses in the service area, require metering for all customers, and establish a schedule to develop a reliable alternate source of supply. This prohibition is in effect until a new source of water is identified and established for regular water service to existing customers."

As Willits City Manager Adrienne Moore explained at the last Willits City Council meeting, "There are a lot of implications for this order, what it's seeming to state is that we have an immediate moratorium on new connections, upgrades, expansions, and will-serves, which are connections that there's been a deposit or payment for, and a promise to put those in, but the building permit has not been issued yet."

The Willits legal counsel, Jim Lance, continues to look into exactly what restrictions will end up applying. Lance in turn has been in contact with the city's water attorney in Sacramento, Alan Lilly, who is working with the city to press the state water board for clarifications and exemptions if possible.

Moore elaborated at the council meeting the city was essentially trying to get the order revoked, adding, "I would imagine every recipient of that order is trying to find a way to at least get it modified if not revoked, because it has widespread ramifications. Certainly in the city of Willits there are number projects underway it impacts." The Mendo Mill expansion will not be affected, as their water connection will not change, but other building plans which require new or upgraded water connections will be impacted.

Since, at this point, it appears that the order will not be revoked, instead the city is seeking a modification, which might include partially lifting some of the restrictions, but how everything shakes out remains to be seen. The process of making a decision on the moratorium is an internal review process within the water board.

This process is similar to what Brooktrails went through following the 2003 building moratorium imposed by the state due to the lack of a sufficient water supply.

Willits has known following its 2006 water study that it did not have enough water storage to supply current customers during a multi-year drought. The city held many meetings, some quite emotionally charged, but the council has not been able to reach a consensus on moving forward with developing either new water sources or a conservation strategy since 2007.

Only empty reservoirs and no rain through January 2014 helped the city move forward on an emergency water supply in the teeth of a major drought. When citizens cut water use, let landscaping die and the reservoirs drained more slowly than normal, the priority to complete the emergency water supply project slipped. It remains incomplete nearly a year after it began. This is, in part because, the city failed to garner significant funding for the project through grants from state and federal agencies.

But as Willits Building Official John Sherman explained in an interview, "We're basically hoping that we've got some significant rain on the way and if we fill up our reservoir I don't see how they wouldn't change their position."

As of Monday, Moore said of the city's efforts to modify the moratorium, "We're working on it, but there's nothing new to report."

If the moratorium does continue without exemptions it could effectively mean no new construction in the Willits area until the drought ends, or longer.

Alternatively it might mean that any new construction project would require an exemption of some sort, meaning that local construction decisions would have to be decided at the state level.

The moratorium is the next step in the curtailment orders that were issued to several Northern California municipalities in June. In California any water rights established after 1914 are referred to as "junior rights." "Senior right" holders, those property owners or entities that claimed their water before 1914, are entitled to their full share of water before any can go to junior rights holders, though there are exemptions for public safety.

Even though Willits does not pull any water directly from the Eel River, the two reservoirs, Morris and Centennial, collect water from sections of the watershed that would otherwise run into the Eel River, meaning less water gets into the Eel River as a result. Most of the time this is not a problem, but with the severe drought it has become an issue. Councilman Bruce Burton said at the meeting he thought that the amount of water that Willits collects that would otherwise wind up in the Eel is actually miniscule, calling it, "One tenth, of one fifth, of one quarter, of one percent of the watershed."

Though the authority behind the moratorium stems from the Water Resources Control Board in Sacramento, the order has actually been sent to Willits and Brooktrails from the division of drinking water, within the water board. Confusingly, the Drinking Water Program was until recently part of the California Department of Public Health, and has been subsequently reorganized into the water board system.

The moratorium could also potentially impact both the proposed inter-tie between Willits and Brooktrails, and as a result Willits has tabled a decision on this issue until further clarification arrives from the state. The inter-tie, a connection that would allow Brooktrails to pump water up from the Willits system, was requested by the District at the behest of the state water board. The proposed inter-tie would be about 10,000 ft. of eight inch line, running parallel to the sewage line that currently goes down the fire trail, on its way to the Brooktrails treatment plant.

As for the upgraded water connection to the REACH site at the Willits Airport, Brooktrails says that is has found an effective work around and that they will be able to provide the upgrade.

URL: http://www.dailydemocrat.com/general-news/20141105/state-water-board-issues-moratorium-on-new-water-connections

EXHIBIT 15

CITY OF EAST PALO ALTO
OFFICE OF THE CITY MANAGER
2415 UNIVERSITY AVENUE
EAST PALO ALTO, CA 94303

P&A
Item: #10D

City Council Agenda Report

Date: July 19, 2016

To: Honorable Mayor and Members of the City Council

Via: Carlos Martínez, City Manager

From: Sean Charpentier, Assistant City Manager

Subject: Approving an Ordinance Prohibiting New or Expanded Water Connections to the City of East Palo Alto Water System

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Recommendation

Adopt an Uncodified Ordinance temporarily prohibiting new or expanded water service connection within the Service Territory of the City of East Palo Alto's Water System.

Alignment with City Council Strategic Plan

This recommendation is primarily aligned with:

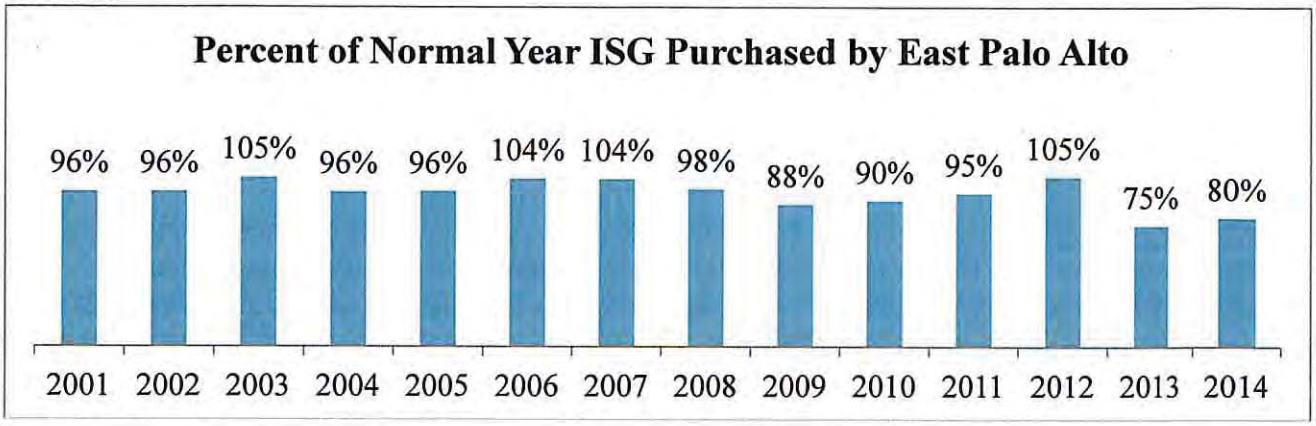
- Priority #1: Enhance Public Safety and Emergency Preparedness
- Priority #2: Enhance Economic Vitality
- Priority #4: Improve Public Facilities and Infrastructure
- Priority #6: Create a Healthy and Safe Community

Background

All the water in the City of East Palo Alto's water system is supplied by the San Francisco Public Utilities Commission (SFPUC) water system. The City has an Interim Supply Guarantee (ISG) of 1.963 million gallons a day (mgd) or approximately 2,199 acre feet a year (AFY.) There are two small water mutual companies that provide water for about 1,000 residential connections in East Palo Alto.

The City has been using in average approximately 95%, or practically all of its ISG for the last 14 years, and in some years (2006, 2007, 2012) exceeded its ISG. Table 1 below displays the percentage of the Normal Year ISG that has been purchased by East Palo Alto between 2001 and 2015.

Table 1.



The City's Urban Water Management Plans (UWMP) of 2005, 2010, the updated 2013 UWMP; the 2012 Water Supply Assessment for the Ravenswood Specific Plan; and the 2016 Water Supply Assessment for the General Plan Update have documented the need for additional water supply to meet the City's current and future needs.

East Palo Alto Water Allocation and Usage

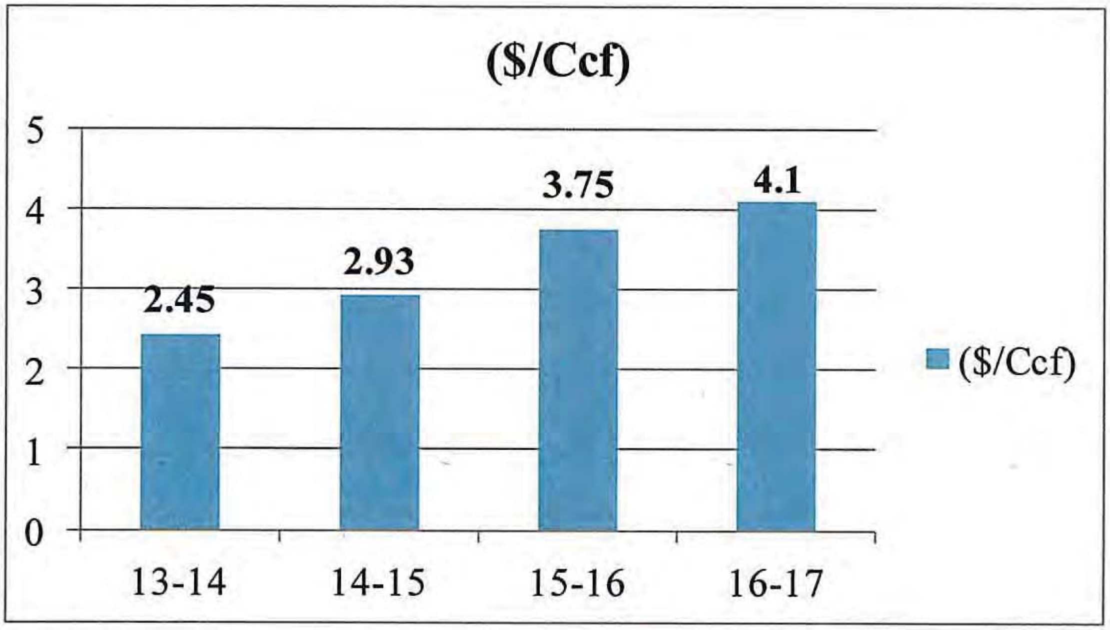
Water planning looks at normal year water supply conditions and dry year (or drought conditions). The City of East Palo Alto has an Individual Water Supply Guarantee of 2,199 acre feet per year (AFY) from the SFPUC under normal year conditions. This amount is equivalent to 1.96 million gallons per day. During dry years, as determined by the SFPUC, the City's guarantee will decrease in accordance with adopted plans and the specific hydrologic conditions. The SFPUC has not instituted dry year reductions nor declared a drought. However, the State of California has imposed drought reductions on all water users in California. All BAWSCA members have been meeting their state mandated drought reductions. In June 2015, the State imposed mandatory drought water restrictions on all water suppliers. East Palo Alto's target was to achieve an 8% reduction between June 2015 and February 2016. East Palo Alto achieved a 19% water reduction during that period. See: http://projects.scpr.org/applications/monthly-water-use/city-of-east-palo-alto/

The last three years have experienced significant volatility in water usage that staff attribute to drought reductions and SFPUC water price increases. In addition, these numbers do not include the water usage for the four major entitled, but not constructed, projects with 166 new residential units and 265,000 square feet of commercial development (Edenbridge Homes, Sobrato Office project, DKB Industrial project, and 4 Corners mixed-use project). There is a fifth entitled project, the MidPen/EPACando senior affordable housing project. However, it utilized a water demand offset for its water supply and accordingly is not anticipated to result in a net increase in water usage. As a result, the City's updated Urban Water Management Plan shows that the City used in 2015; 1,574,600 mgd, or 80.22% of its water allocation. See Table 2 below.

Table 2.

	MGD	% of ISG	Available
ISG from SFPUC	1,963,000		
ISG Actual Use (2015 UWMP)	1,574,680	80.22%	19.78%

The reduction in water use is mainly driven by a couple of factors, mandatory drought reductions and SFPUC water commodity price increases, that have gone up from 2.45 Centum (100 hundred) cubic feet (Ccf,) to 4.1 Ccf from 2013 to 2016, a 40% increase. Thus, the approximately 80% actual water use reflected in the City's 2015 Urban Water Management Plan, which suggests that the City is not using about 20% of its ISG, practically mirrors the 19% water reduction achieved due to both SFPUC water price increases and mandatory drought reduction measures.



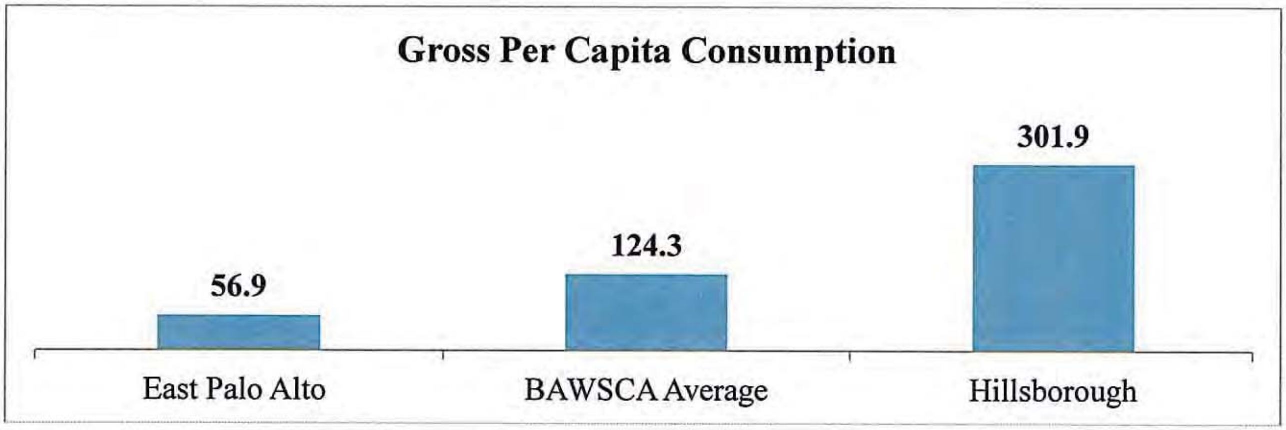
Source: SFPUC

Another complicating factor is that Equity Residential, the former owner of 1,800 rent stabilized units, created a 36% vacancy rate between 2012 and 2015 that reduced demand for city water.

However, for long range water planning purposes, the City needs to take into account the demand of entitled projects that are under construction, or not yet built, and for potential SFPUC dry year mandatory cutbacks. Taking into account the entitled projects in Table 3 below, the available water is approximately 13%. In case that the SFPUC does declare Mandatory dry year water reductions, the SFPUC can reduce the City's water supply by 6% (2015 UWMP Table 6-1), leaving only 7%, or 0.12 mgd available in the Water system.

Entitled Projects Estimated Demand					
Projects	gpcd/unit	sq.ft./People	Demand		
Sobrato	0.16	200,000	32,000		
Edenbridge	120	220	26,400		
Four Corners	75	460	34,500		
DKB Industrial	235	160	37,600		
Unaccounted Demand			130,500	6.65%	
Net use with Entitled Projects			1,705,180	86.87%	13.13%

This very small amount leaves no room for error, especially given the fact that the City of East Palo Alto uses the least amount of water among the BAWSCA members on a per capita basis. The BAWSCA members' average gross per capita per day usage is 124.3 gallons.



Source: BAWSCA Annual Report, Table 7B.

At 56.9 gallons (FY 2013-14) per day per capita, East Palo Alto has the lowest daily per capita usage. Hillsborough has one of the highest uses at 301.9 gallons per capita per day. See Attachment 2, Figure 7b for more detailed information. At such a low per capita consumption level, there is practically no room for residents of East Palo Alto to increase the aggregate water supply available with additional conservation measures. For many municipalities, another alternative to expanding supply is increasing the use of recycled water. This would have very limited use to East Palo Alto because the City doesn't have large parks, industrial users, or a golf course where recycled water could make a difference.

As a result, the City Council has directed staff to pursue a couple of strategies that would increase our existing water supply: 1) initiating the design and environmental work to develop a new groundwater well (Pad D), and a water treatment system for an existing well (Gloria Way Well); and, 2) exploring potential water allocation transfers from other municipal entities such as the SFPUC or other BAWSCA agencies that may be interested in transferring their excess water supply to meet future water demands.

East Palo Alto Existing and Future Water Demand

The City of East Palo Alto adopted and certified its Ravenswood 4 Corners Transit Oriented Development Specific Plan and Program EIR in September 2012. The EIR Mitigation for the lack of water supply included the following Specific Plan Policy.

Policy UTIL-2.2: Before individual development projects are approved in the Plan Area, require the developer to demonstrate verifiable, enforceable proof that either they have secured new water supplies to serve the new development or that the proposed development will create no net increase in total water demand in East Palo Alto. Ensure that environmental review is carried out for augmentations to the supply from additional groundwater pumping in the Specific Plan area and within a quarter mile radius.

The City is updating its General Plan, which includes the Ravenswood Specific Plan.

Table 2: General Plan Growth Projections

	Net New Units	Net Retail Sq. Ft.	Net Office Sq. Ft	Net Industrial Sq. Ft.
Ravenswood/4 Corners Area	835	112,400	1,235,853	267,987
Westside	900	45,000		
2nd Units on single-family parcels	119			
All other Areas Citywide	665	176,006	704,000	
Total	**2,519**	**333,406**	**1,939,853**	**267,987**

The City conducted a Water Supply Assessment for the General Plan Update. The Water Supply Assessment indicated a need, during a Normal Water Year, for approximately 1,662 additional AFY, or approximately up to 1.5 mgd by 2040. The 2015 UWMP identifies a projected total demand of 3,417 Acre Feet a Year (AFY), or 3.05 mgd by the year 2040. This is 1,218 AFY, or 1.08 mgd over our 2,199 AFY, or 1.963 mgd allocation from the SFPUC.

The General Plan Draft EIR includes Mitigation Measure UTIL-1.

Mitigation Measure UTL-1: The General Plan Update shall be amended to include the following policy under Infrastructure, Services, and Facilities Goal ISF-2:Require new or intensified development to demonstrate that adequate water is available before project approval. Before new or intensified development projects are approved, the development proponent must provide the City with enforceable, verifiable proof that adequate water supply exists to supply the new or intensified development. The enforceable proof can take three forms:1) Depending on the location of the development, a will-serve letter, or similar instrument from the City of East Palo Alto, the Palo Alto Park Mutual Water Company, or the O'Connor Tract Co-Operative Water Company.2) A verifiable recordable water demand offset project or program that ensures that there is no net increase in new water demand.3)

Verifiable and enforceable proof that the developer has secured new water supplies necessary to serve the project.

The City is pursuing groundwater supplies and anticipates that between 700 and 1,200 AFY of groundwater will be available by 2020. The UWMP conservatively assumed that an additional 700 AFY, or a total of 2,899 AFY will be available over the forecast (2040) timeframe.

Analysis

Under these conditions, the City cannot entitle additional projects, and there is a de facto moratorium in place for any new construction in the City that creates a demand for additional water supply. The City currently requires all applicants to sign a disclosure form that indicates that there is insufficient water supply. See Attachment 4.

Staff believe that there is sufficient supply, given current use patterns, to meet the needs of the exempt projects, including vested projects that are anticipated to be build during the moratorium period.

PROPOSED WATER MORATORIUM

Therefore, staff is recommending that the City clearly articulates the implicit Water Moratorium conditions that are in place by officially adopting an Ordinance to temporarily prohibit new or expanded water service connections within the service territory of the City of East Palo Alto's water system.

The Water Moratorium period would allow staff sufficient time to study the water shortage issue, to develop new water supply and water demand offset policies for the City Council to consider for adoption.

A water demand offset policy defines how the City will treat projects that reduce water use elsewhere. The Mid Peninsula/EPACando Affordable Senior Housing project used a water demand offset. Key policy questions include the ratio of offset, how to calculate existing water use, and exemptions. Upon adoption of a Water Demand Offset Policy, staff will request that the City Council update the exemptions in the Moratorium ordinance to include projects that use the adopted water demand offset policy.

Staff will also prepare a water allocation strategy which will identify key priorities for water allocation. It is important that if there is limited water supply available, it is allocated based on the priorities of the community and City Council rather than which project applied first. Depending on the City's ability to secure new water supply, the Water Allocation strategy might have a triggering threshold.

This is critical if there is limited water, however, if the future new water supply equals 1mgd or more, there might be sufficient water supply so that a water allocation strategy would not be necessary.

These policies, once adopted, will provide clear guidance regarding how land use applications for existing buildings or new uses in existing buildings will be treated, will define the specifics of a water offset policy, will clarify the conditions necessary to lift the Moratorium, will define how to treat the limited capacity that exist in the water system, and how to use and allocate the additional amount of water secured by the City when the wells are in production in a post Moratorium environment.

PROPOSED ORDINANCE

This ordinance is necessary for the immediate preservation of the public peace, health or safety, for the reasons stated in this section and based on the facts stated in Resolution No. 4723, the City Manager's report to the City Council dated April 19, 2016 in support of Resolution No. 4723, the City Manager's report to the City Council dated July 19, 2016 in support of this ordinance, the City Manager's report to the City Council dated June 21, 2016 relating to the City's Urban Water Management Plan update, the documents referenced those reports, and further, on the testimony of the meeting at which Resolution No.4723 and the public hearings at the meeting at which this ordinance and the Urban Water Management Plan were considered.

The proposed ordinance only affects new or expanded meters. If a rehabilitation project does not require a new or expanded meter, it should not be impacted. There are multiple exemptions, including projects with vested rights, meters required for fire safety systems, temporary closures, and others. This proposed action applies only to the area within the City water service area and does not apply to areas served by the two water mutual companies.

If this Ordinance is adopted by the City Council it will go into effect immediately and will last for two years.

During that time, staff will not process new development applications that do not fall into the exemptions unless prior to the expiration of the Ordinance in two years, the City Council determines that the City has obtained sufficient water supplies either through the activation of new groundwater wells or by securing a water transfer, meeting the intent of Resolution 4723, here included as Attachment 3. The City Council may extend the term of this ordinance for additional two year periods upon adoption of a resolution finding that water supply shortage conditions continue to exist.

Existing major entitled projects

There are 5 major entitled projects with a vested right to development including approximately 207 new residential units, and 265,000 square feet of commercial development.

1. Senior Housing: EPACando and Mid Peninsula Housing Development, 41 affordable senior units along University Avenue. This project is under construction. It utilized a water demand offset program for its water supply.
2. DKB/Edenbridge Montage Homes: 51 townhomes at Bay Rd and Pulgas. Almost completely constructed and occupied.
3. Sobrato Office Project, corner of University Ave. and Donohoe: 200,000 sqft of office development, under construction.
4. Pulgas Industrial Condos, Bay Rd. and Pulgas: Approximately 50,000 sqft of industrial/flex space. New owner Mural Arts has submitted an application for an arts community center.
5. 4 Corners: 115 Condos over 15,000 square feet of retail at intersection of University Ave. and Bay Road. Developer seeking investors.

There are approximately 11 projects in the pipeline. All have been impacted by the water shortage.

#	SITE ADDRESS	Project Type	Units/Sqft	Application Type (1)
1	809 Donohoe Street	Residential	4 lot subdivision	Application
2	717 Donohoe Street	Residential	6 lot subdivision	Application
3	961 Beech Street	Residential	4 lot subdivision	Application
4	2123 Clarke Avenue	Residential	Lot Split	Application
5	800 Weeks Street	Residential	3 lot subdivision	Application
6	2331 University Avenue	Residential	16 townhomes	Application
7	1255 Weeks	Industrial/Flex	120,000	Administrative Use Permit for interim use
8	1950 Bay Road	Art Center	25,000 sq.ft. building	Application
9	1200 Weeks Street	School	500 Students	Application
10	2020 Bay Road	Office	1,400,000	Pre Application
11	2115 University	Office	200,000	Reimbursement Agreement

(1) Application does not mean that the application is complete.

Projects #1-#6 are generally smaller residential projects that could proceed to the Planning Commission quickly if there were water supply. Staff are recommending that no further processing of these applications shall occur until there is additional water supply. Upon securing additional water supply, staff will continue processing these applications.

Project #7 is an application for an interim use of outdoor storage for an existing former agricultural/greenhouse building and paved area at 2555 Pulgas. The application was recently submitted, and the applicant also indicated in the application that they would want to submit an application for a 120,000 sqft industrial/flex building in the future. To continue with the interim application, the applicant would have to provide verification of meeting one of the exceptions in the ordinance. Continuing to process the application means that the applicant will have to meet all planning, building, and Fire Department requirements for the proposed interim use.

Project #8 is a new application for a site that has entitlements for approximately 50,000 sqft of industrial/flex space. The application is for an arts/performing center. Staff will return to the City Council with a determination of whether the use is sufficiently consistent with the original entitlements and should be a vested right.

Projects #9, #10, and #11 included in the reimbursement agreement for funding a groundwater engineer and other services associated with securing new water supplies. If the Water Reimbursement is adopted, staff will continue processing these applications. If the Water Reimbursement is not adopted, staff will not continue processing these applications.

The goal of the reimbursement agreement is to accelerate a solution for the City's water shortfall by leveraging contributions from developers.

These three projects covered by the reimbursement agreement will not be approved until there is water either from the completion of the groundwater wells or from a water transfer. Participating with the Reimbursement does not constitute a project approval.

Notification

The public was provided notice of this agenda item by posting the City Council agenda on the City's official bulletin board outside City Hall and making the agenda and report available at the City's website and at the San Mateo County Library located at 2415 University Avenue. Letters were mailed and emailed to all applications noticed on July 13, 2016. A notice was published on Friday, July 8, 2016, in the San Mateo Times. See attachment 5 for a copy of the notice.

Environmental

Approval of this Resolution and Ordinance is exempt from the requirements of the California Environmental Quality Act ("CEQA") because: it is not a project as it has no potential to result in direct or reasonably foreseeable indirect physical change to the environment (14 Cal. Code Regs. §15378(a); there is no possibility that the ordinance or its implementation would have a significant effect on the environment (14 Cal. Code Regs. §15061(b)(3); or because it is an action taken by a regulatory agency for the maintenance or protection of the environment (14 Cal. Code Regs. §15308).

Attachments

1. Uncodified Ordinance
2. East Palo Alto Gross Per Capita Water Consumption
3. Resolution 4723
4. East Palo Alto Water Disclosure
5. Published Notice

ATTACHMENT 1

ORDINANCE NO. _____

AN UNCODIFIED ORDINANCE OF THE CITY OF EAST PALO ALTO TEMPORARILY PROHIBITING NEW OR EXPANDED WATER SERVICE CONNECTIONS WITHIN THE SERVICE TERRITORY OF THE CITY'S WATER SYSTEM

The City Council of the City of East Palo Alto does ordain as follows:

Section 1. Purpose

(a) The City Council has determined the current ordinary demands and requirements of water consumers within the service territory of the City's Water System meet or exceed the amount of the water supply available to the City. Demands created by new, additional, or expanded water service connections cannot be satisfied without adversely affecting the health, safety, and welfare of current water uses. Therefore, it is necessary to set aside and allocate all of the City's currently available water supply to meet the demands of current water users and to establish a temporary prohibition of new or expanded water service connections within the Service Area of the City's Water System.

(b) The City is experiencing a City-wide water supply shortage and has been working diligently to implement identified solutions, including the design and installation of new wells and water treatment systems, often referred to as the Gloria Way Well and the Pad D Well, to take advantage of potential groundwater resources. However, the completion date and water supply yield of these projects are currently uncertain.

(c) On April 19, 2016, the City Council adopted Resolution No.4723 titled, *A Resolution of the City Council of the City of East Palo Alto advocating for an additional water supply of up to 1.5mgd and authorizing the city manager to work with the City's partners at the BAWSCA and the SFPUC to secure up to an additional 1.5mgd in water supply*. Resolution No. 4723 is intended to assure sufficient water to implement the City's General Plan, Urban Water Management Plan, and other official plans and policies of the City through a program to obtain additional water supplies. Likewise, this ordinance is intended to implement these same policies by assuring precluding new demands on the City's Water System until additional water supplies are obtained.

(d) This ordinance is necessary for the immediate preservation of the public peace, health or safety, for the reasons stated in this section and based on the facts stated in Resolution No. 4723, the City Manager's report to the City Council dated April 19, 2016 in support of Resolution No. 4723, the City Manager's report to the City Council dated July 19, 2016 in support of this ordinance, the City Manager's report to the City Council dated June 21, 2016 relating to the City's Urban Water Management Plan update, the documents referenced those reports, and further, on the testimony of the meeting at which Resolution

No.4723 and the public hearings at the meeting at which this ordinance and the Urban Water Management Plan were considered.

Section 2. Prohibition of new, additional, or expanded water service connections

(a) It is unlawful to install or make, or cause to be installed or made a new or expanded water service connection to the City's Water System, except as provided in subdivision (b).

(b) The following connections are exempt from the prohibition established by subdivision (a):

1. Sub-meters receiving water through an existing connection provided there is no increase in the size of the existing connection;
2. New connections through a water meter used to measure water provided solely to a fire suppression system and equipment approved by the Fire Marshal;
3. Expansion of an existing connection when the expansion is required by the Fire Marshal in order to provide additional capacity expressly for the purpose of supplying water for a fire suppression system and equipment.;
4. Reinstallation or unlocking of a water meter for parcel connected to the Water System before the effective date of this ordinance where the reinstallation or unlocking is required to restore service following a temporary disconnection or disruption of service;
5. Installation of a meter on an existing unmetered connection or the replacement of existing meter provided there is no increase in the capacity of the connection;
6. A connection for a development project for which a vested right to build existed on the effective date of this ordinance and all land use and building permits are valid as of the date of connection;
7. A connection for a development project for which the applicant has obtained and dedicated to the City a new long-term water supply that the City Council has determined is in an amount and duration sufficient to meet the needs of the development project.
8. Installation of a new or increase in size of an existing meter to provide service to an previously unpermitted secondary residential unit on property zoned for single-family residential use provided that the unit is brought into compliance with all applicable Planning and Building regulations.

(c) "Water System" and "Service Area" have the same meanings as in the *Agreement for Lease of Real Property (Water System)* entered into as of May 22, 2001 between the City of East Palo Alto and American Water Services, Inc., as amended or extended (the "Water System Lease"). "Expanded" or "expansion" means an increase in the size or water supplying capacity of a water service connection existing on the date of this ordinance.

(d) No application for approval of a development project or a permit to build that is submitted after July 1, 2016, or has not been deemed complete or otherwise authorized for processing before July 1, 2016, will be deemed complete unless at the time of the application there is substantial evidence that water service is authorized in compliance with Section 2 of this ordinance. The applicant shall provide the evidence in a form acceptable to the City Manager at the time of submission of the application. Any application that is submitted without acceptable evidence of compliance is incomplete and may be returned without further processing. This section does not apply to a development project for which the city council has approved and the city has executed an agreement for reimbursement of water supply development costs with the project applicant or applicants.

Section 3. Enforcement

Violations of this ordinance are punishable pursuant to the provisions of Chapters 1.12 and 1.14 of the East Palo Alto Municipal Code. In addition, this ordinance constitutes a Legal Requirement as defined in the Water System Lease. As an additional, cumulative, and non-exclusive remedy, the City Manager is authorized to disconnect or cause to be disconnected any connection made or maintained in violation of this ordinance.

Section 4. Administration

The City Manager is authorized to administer and enforce this ordinance and may adopt and enforce supplemental administrative policies and procedures consistent with the restrictions imposed by this ordinance.

Section 5. Effective Date

(a) This ordinance is adopted as an urgency measure and is effective immediately upon adoption.

(b) This ordinance will remain in effect for a period of two years from the effective date unless prior to the expiration of two years the City Council determines that the City has obtained water supplies sufficient to meet the intent of Resolution No. 4723. The City Council may extend the term of this ordinance for additional two year periods upon adoption of a resolution finding that water supply shortage conditions continue to exist.

Section 6. California Environmental Quality Act Exemption

The adoption of this ordinance is exempt from the requirements of the California Environmental Quality Act ("CEQA") because: it is not a project as it has no potential to result in direct or reasonably foreseeable indirect physical change to the environment (14 Cal. Code Regs. §15378(a); there is no possibility that the ordinance or its implementation would have a significant effect on the environment (14 Cal. Code Regs. §15061(b)(3); or because it is an action taken by a regulatory agency for the maintenance or protection of the environment (14 Cal. Code Regs. §15308). The Director of Community Development is directed to cause a notice of exemption to be filed as authorize by CEQA and the CEQA Guidelines.

Section 7. Publication

The City Clerk is directed to cause publication of this ordinance as required by law.

INTRODUCED and **ADOPTED** at a regular City Council meeting held on July 19, 2016, by the following four-fifths vote:

AYES:
NOES:
ABSENT:
ABSTAIN:

SIGNED:

Donna Rutherford, Mayor

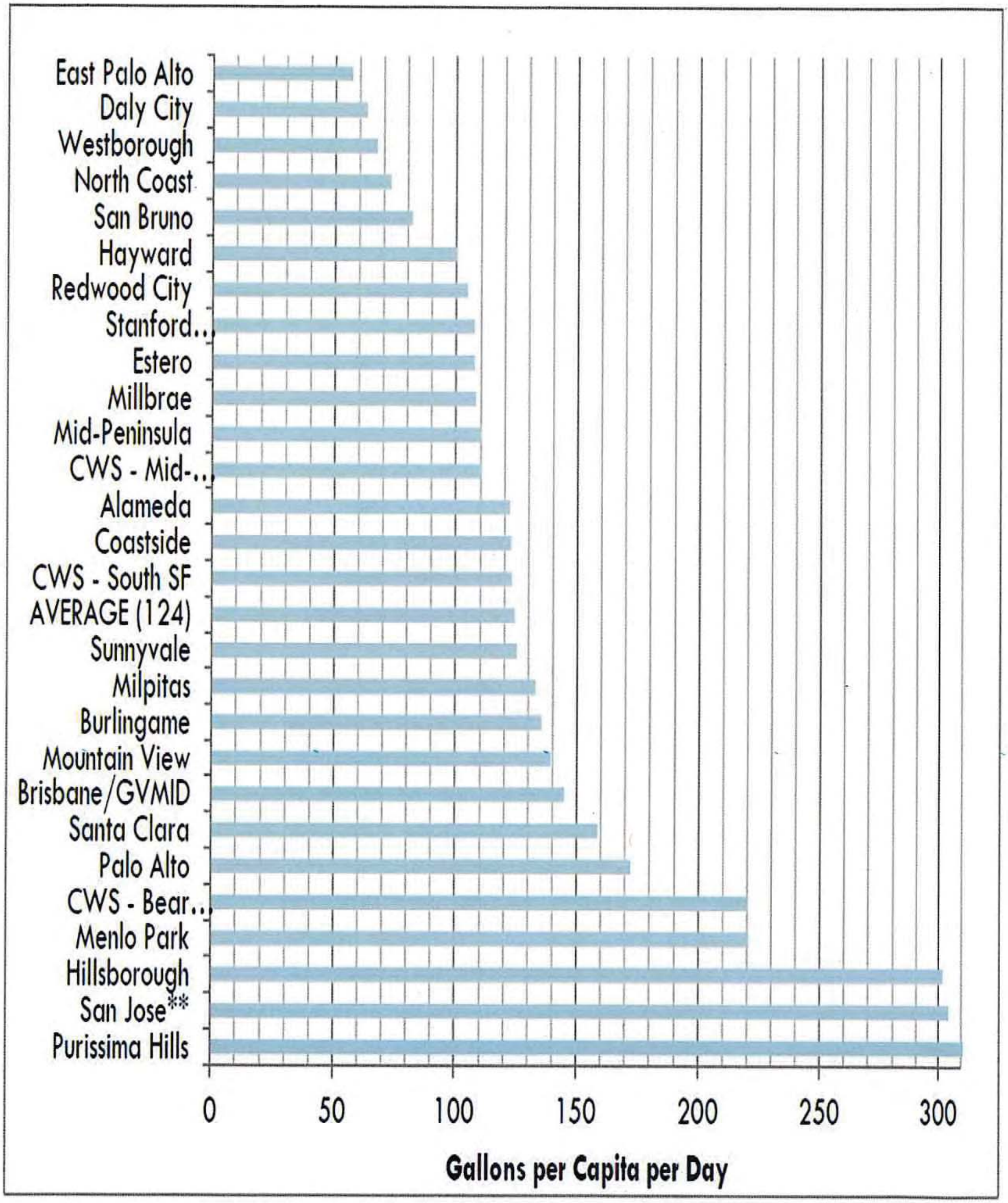
ATTEST:

Terrie Gillen, Deputy City Clerk

APPROVED AS TO FORM:

Marc G. Hynes, Interim City Attorney

Figure 7B: Gross Per Capita Consumption(in gpcd) – FY 2013-14



Source: BAWSCA Annual Survey, Figure 7b

ATTACHMENT 3

RESOLUTION NO. 4723

A RESOLUTION OF THE CITY COUNCIL OF THE CITY OF EAST PALO ALTO ADVOCATING FOR AN ADDITIONAL WATER SUPPLY OF UP TO 1.5MGD AND AUTHORIZING THE CITY MANAGER TO WORK WITH THE CITY'S PARTNERS AT THE BAWSCA AND THE SFPUC TO SECURE UP TO AN ADDITIONAL 1.5MGD IN WATER SUPPLY.

WHEREAS, the City of East Palo Alto is the youngest, smallest, most densely populated City in San Mateo County; and

WHEREAS, the City of East Palo Alto, when controlled for size, provides more affordable housing than any city in Silicon Valley; and

WHEREAS, approximately 40% of the total housing stock in the City of East Palo Alto is affordable housing (income restricted rental, rent stabilization units, or below market rate ownership units); and

WHEREAS, 6.2% of East Palo Alto's housing is income restricted affordable developed with Low Income Housing Tax Credits, compared to 1.1% for San Mateo County as a whole; and

WHEREAS, with 0.2 jobs per employed resident, the City of East Palo Alto has one of the lowest jobs per employed resident ratio in Silicon Valley; and

WHEREAS, the amount of housing and the affordability of housing in the City of East Palo Alto support commercial land uses that generate jobs and revenue in other Cities throughout Silicon Valley; and

WHEREAS, the per capita property tax, sales tax, and transient occupancy tax in the City of East Palo Alto is approximately 50% to 60% that of other Cities in Silicon Valley; and

WHEREAS, the City of East Palo Alto relies solely on the San Francisco Public Utilities Commission, (SFPUC) for water supply and does not have access to other major sources of water supplies or water suppliers; and

WHEREAS, the adopted Ravenswood Business District Specific Plan and the draft General Plan update represent a vision of a more balanced land use pattern with an improved jobs per employed resident ratio and improved financial stability; and

WHEREAS, the City of East Palo Alto is a permanent member of the Bay Area Water Supply and Conservation Agency (BAWSCA) and has signed the 2009 Water Supply Agreement between the SFPUC and its wholesale customers (the BAWSCA members); and

WHEREAS, the City of East Palo Alto has a normal year Individual Supply guarantee of 1.963 mgd; and

WHEREAS, the City of East Palo Alto has one of the lowest gross per capita usage in BAWSCA and one of the lowest in the State of California; and

WHEREAS, the SFPUC Wholesale Customers used approximately 80% of their collective Individual Supply Guarantee of 184 mgd of water supply permanently allocated to them in 2014; and

WHEREAS, the 2009 Water Supply Agreement contains provisions for the transfer of Individual Water Supply Guarantees among SFPUC wholesale customers, however it has not been utilized to date; and

WHEREAS, the City of East Palo Alto has exceeded its normal year Individual Supply Guarantee four (4) years between 2001 and 2014 and on average used 95% of the normal year Individual Supply Guarantee; and

WHEREAS, a water shortfall has been identified in the 2005, 2010, and the updated 2013 Urban Water Management Plans; the Water Supply Assessment for the Ravenswood Business District 4 Corners Transit Oriented Development Specific Plan; and the General Plan Update Water Supply Assessment; and

WHEREAS, the certified EIR for the RBD 4 Corners Transit Oriented Development Specific Plan included the mitigating Specific Plan policy UTIL-2.2, which specified that prior to project approval, there must be proof of sufficient water supply or no net increase in water demand; and

WHEREAS, the Water Supply Assessment for the General Plan Update identified the need for up to an additional 1,666 AFY or 1.5 mgd to support the balanced growth envisioned in the adopted Ravenswood/4 Corners Specific Plan and Draft General Plan update; and

WHEREAS, the lack of water supply has immediate negative impacts on the City's ability to develop affordable housing and achieve its economic development goals; and

WHEREAS, the lack of water supply has required the city to delay an affordable housing project with up to 120 units on the City owned land at 965 Weeks Street; and

WHEREAS, developers have started the pre application process for a private school that could provide up to 500 students with comprehensive wrap around social and health services; a 200,000 square foot office project; and 1.4 million square feet of office development that would remediate one of the most contaminated parcels in the City; and

WHEREAS, the lack of water means that these projects cannot be brought to the Planning Commission or City Council for a vote until a source of water has been identified; and

WHEREAS, City of East Palo Alto has invested significant resources in diversifying its supply, including the Gloria Way Feasibility Study; designing, entitling, and securing State approval for the rehabilitation of Gloria Way Well; drilling a test well at Pad D and initiating the design and environmental review; adopting a Groundwater Management Plan in 2015; adopting a $6.75 water capital surcharge for water supply and emergency storage investments and a $6.24 rate charge for replacing inefficient meters; securing and allocating to groundwater well projects more than $3 million in outside funding, including State and Tribal Assistance Grant, Community Development Block Grant, and Integrated Resources Water Management Plan funds; and

WHEREAS, the City of East Palo Alto would seek to add up to 1.5 mgd to its Individual Supply Guarantee; and

NOW, THEREFORE, BE IT RESOLVED BY THE CITY COUNCIL OF THE CITY OF EAST PALO ALTO THAT the City Council advocates for an increased water allocation of up to 1.5 mgd from the SFPUC and authorizes the City Manager to work with the City's partners at BAWSCA and the SFPUC to secure up to an additional 1.5 mgd.

BE IT FURTHER RESOLVED that the City Council requests that the SFPUC include "How will the SFPUC ensure that East Palo Alto has an additional 1.5mgd of water supply for future growth?" as a fourth question in the SFPUC's 2035 Water Management Action Plan.

BE IT FURTHER RESOLVED that the City Council requests that the SFPUC and BAWSCA create mechanisms that would empower and incentivize the BAWSCA members that are not using their full water supply allocation to transfer a portion to other City's like East Palo Alto that have significant demand for new water supply.

[SIGNATURES ON FOLLOWING PAGE]

PASSED AND ADOPTED this 19th day of April 2016, by the following vote:

AYES:
NAES:
ABSENT:
ABSTAIN:

SIGNED:

Donna Rutherford

Donna Rutherford, Mayor

ATTEST:

Terrie Gillen

Terrie Gillen, Deputy City Clerk

APPROVED AS TO FORM:

Marc G. Hynes, Interim City Attorney

ATTACHMENT 4

CITY OF EAST PALO ALTO
OFFICE OF THE CITY MANAGER
2415 UNIVERSITY AVENUE
EAST PALO ALTO, CA 94303

WATER SUPPLY DISCLOSURE AND ACKNOWLEDGEMENT

Dear Applicant:

The City of East Palo Alto has insufficient water resources to supply new or intensified development. The City meets or exceeds its annual water allocation from the San Francisco Public Utilities Commission (SFPUC). The City is working on increasing its water supply through groundwater resources and a water transfer from other recipients of SFPUC water supply; however, currently, the City does not have water to supply new or intensified development.

Accordingly, new or intensified development projects cannot be approved without the following:

1. Applicant provides proof of location within the boundaries of the Palo Alto Park Mutual Water Company or the O'Connor Tract Water Mutual Company and proof of water supply.
2. Applicant secures verifiable water supply from another source, in a form and manner approved by the City and other applicable agencies.
3. The project leads to no net increase in water usage as determined by a City approved Water Demand Offset project. Such a project may include existing continuous water use on site and/or water savings generated by the installation of water saving devices elsewhere in the City.

By signature and date below, Applicant acknowledges that the City has informed Applicant the City does not have sufficient water supply for new or intensified development. Applicant further acknowledges no applications shall be processed by City without a signed Water Supply Disclosure and Acknowledgement.

Print Name

Signature and Date

Phone: (650)853-3118 • Fax: (650)853-3136 • www.cityofepa.org

ATTACHMENT 5

Redwood City Daily News
255 Constitution Drive
Menlo Park, CA 94025

3730465

CITY OF EAST PALO ALTO/CITY CLERK
2415 UNIVERSITY AVE
PALO ALTO, CA 94303

PROOF OF PUBLICATION
IN THE STATE OF CALIFORNIA
COUNTY OF SAN MATEO

In the matter of

Redwood City Daily News

The undersigned, being first duly sworn, deposes and says: That at all times hereinafter mentioned affiant was and still is a citizen of the United States, over the age of eighteen years, and not a party to or interested in the above entitled proceedings; and was at and during all said times and still is the principal clerk of the printer and publisher of the Redwood City Daily News, a newspaper of general circulation printed and published daily in the County of San Mateo, State of California as determined by the court's decree dated December 26, 2001, Case Number CIV4199153, and that said Redwood City Daily News is and was at all times herein mentioned a newspaper of general circulation as that term is defined by Sections 6000; that at all times said newspaper has been established, printed and published in the said County and State at regular intervals for more than one year preceding the first publication of the notice herein mentioned. Said decree has not been revoked, vacated or set aside.

I declare that the notice, of which the annexed is a true printed copy, has been published in each regular or entire issue of said newspaper and not in any supplement thereof on the following dates, to wit:

07/08/2016

Dated at San Mateo County, California
July 8, 2016

I declare under penalty of perjury that the foregoing is true and correct.

Principal clerk of the printer and publisher of the Daily News

Legal No. **0005769983**

NOTICE OF PUBLIC HEARING -TEMPORARY MORATORIUM ON WATER SRVICE CONNECTIONS

At a Special meeting of the City Council of the City of East Palo Alto commencing at 7:30PM on July 19, 2016 at the City Council Chambers 2415 University Avenue, East Palo Alto, CA 94303, the City Council will conduct a Public Hearing to consider the adoption of an Ordinance temporarily prohibiting new or expanded water service connections within the service territory of the City's water system owing to a water shortage in the City requiring that measures be taken to provide for sufficient water for human consumption, sanitation and fire protection.

All persons attending the special meeting shall have an opportunity to be heard to protest against this action and to present their respective needs to the City Council. The agenda for the meeting can be found at: http://www.cityofepa.org/AgendaCenter

The Americans with Disabilities Act (ADA) requires reasonable accommodation and access for the physically challenged. Those requesting such accommodation should contact the Office of the City Clerk at (650) 853-3127 four days before the hearing date.

Legal No. **0005769983**

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The Americans with Disabilities Act (ADA) requires reasonable accommodation and access for the physically challenged. Those requesting such accommodation should contact the Office of the City Clerk at (650) 853-3127 four days before the hearing date.

EXHIBIT 16

Business

East Palo Alto imposes development moratorium due to lack of water

A man walks by University Circle, which houses Four Seasons Hotel, international law firms and other offices in East Palo Alto, on Feb. 23, 2011. The city's redevelopment agency has completed two projects off University Avenue. On the east side of Highway 101, the massive blue IKEA furniture store abuts a big-box retail center and neat rows of 219 single-family homes. On the west side, the sleek University Circle office complex. (Dai Sugano/Mercury News)

By **MERCURY NEWS** | themerc@bayareanewsgroup.com |
PUBLISHED: July 20, 2016 at 7:04 am | **UPDATED:** August 11, 2016 at 11:06 pm

klandgraf@bayareanewsgroup.com

EAST PALO ALTO — A water crisis three decades in the making came to a head this week when East Palo Alto's City Council imposed a moratorium on development until the city can increase its historically meager water supply.

For the past 14 years, the city has used nearly all of its annual water allotment, making it increasingly difficult for East Palo Alto to approve new developments, unless they can essentially provide their own water. With no easy or affordable solution in sight, developers are caught in limbo as they wait for the city to obtain additional water resources — a process that could take years.

Three well-heeled developments managed to dodge the moratorium at Tuesday night's meeting if they pay a price. Office developments funded by the Sobrato Organization and a private equity firm, and the Primary School, founded by Mark Zuckerberg's wife Priscilla Chan, will be allowed to move forward with the projects if they agree to reimburse the city for the engineering and legal costs incurred by the city's quest to increase its water allocation.

So far, the water shortage has not delayed the Primary School's opening since it plans to start classes this fall in a temporary site, according to the school's spokesman Nathan James.

Other proposed developments are out of luck. An affordable housing project owned by the city did not make the cut, nor did 11 other developments that had recently submitted applications to build in East Palo Alto. Many of those developers showed up at Tuesday's meeting to voice their displeasure.

"We only found out about this last Thursday," said Jeff Major, a vice president and investment officer with Prologis, a real estate company that last month submitted a development proposal for an industrial building in the Ravenswood district of East Palo Alto.

Major requested that the council oppose the moratorium in favor of working with developers to obtain the water. "We'd like to help out in any way we can," he said.

The council was unswayed, however. By a 4 to 1 vote, it chose to implement the moratorium, which will last for two years or until the city manages to obtain more water. That won't be easy. The city is pumping more of its own groundwater, but those supplies are limited. It's also trying to buy water from other Bay Area cities and ask the city's main supplier, the San Francisco Public Utilities Commission, to increase its annual water allocation.

But it's unclear how long it would take to buy water from other cities or increase East Palo Alto's water allocation from the SFPUC, according to Sean Charpentier, East Palo Alto's assistant city manager. That's because neither solution has been attempted before. "This is unprecedented," Charpentier said.

East Palo Alto's current water woes began in 1984 when the SFPUC entered into a contract to sell Hetch Hetchy reservoir water to cities and water agencies on the Peninsula. East Palo Alto, which historically has been low-income, had only just been incorporated the year before, and its water needs were managed by a county agency that later dissolved.

"Like many communities of color, they're the last to know when the goodies are being handed out," said Gary Kremen, a Silicon Valley entrepreneur and member of the Santa Clara Valley Water Board District's board of directors. "East Palo Alto got a super raw deal here."

When the SFPUC water was divvied up among Bay Area cities, East Palo Alto was allocated the smallest slice of the water pie — an inequity that persists to today.

With a high share of small lots and multiple-family housing, East Palo Alto consumes less than 57 gallons per person a day, while the tony community of Hillsborough with its luxurious gardens uses more than 301 gallons per person each day.

In June, East Palo Alto petitioned the SFPUC to increase its allotment by 1.5 million gallons a day, up from the 1.96 million gallons it currently receives. But an answer isn't likely to come anytime soon: The SFPUC isn't scheduled to vote on the question until December 2018.

And East Palo Alto faces steep hurdles in obtaining water from the utility commission. In 2008 the SFPUC agreed that it would cap the water it uses from the Tuolumne River until 2018, due to environmental pressures from the Tuolumne River Trust, a conservation group.

Kremen says such conservation efforts can complicate the efforts of cities such as East Palo Alto to meet their water needs. "It's that environmental elitism over the need of people of color," said Kremen. "I'm a conservationist but a lot of things they do that increase the price of water directly affect low-income people, people on fixed incomes and people of color, specifically."

That's not the way Peter Drekmeier sees it.

"It's not the cap so much as the way the water is divided up," said Drekmeier, policy director for the Tuolumne River Trust and former mayor of Palo Alto. "You're absolutely right that East Palo Alto got the short end of the stick, but we're working with them to come up with a solution."

East Palo Alto could also try to buy water from other cities that don't use their full allotment — an uncertain proposal since no one has done it before, said Steven Ritchie, Assistant General Manager of the Water Enterprise at SFPUC.

"It's not going to be easy to do, but on the other hand it's easier than providing the additional supply," said Ritchie.

Until it finds a water solution, East Palo Alto is halting development, despite builders' objections. Because of the lack of water, "in effect, we've had a de facto moratorium," said Charpentier. "Processing (development) agreements without proof of water feels like driving toward a cliff."

With this solution, he said, "it feels like we're building a bridge."

Tags: California Drought, California Governor, Commercial Real Estate

Mercury News

EXHIBIT 17

BayArea Plan

Strategy for A Sustainable Region

Adopted July 18, 2013

Association
of Bay Area
Governments

METROPOLITAN
TRANSPORTATION
COMMISSION

Metropolitan Transportation Commission

Amy Rein Worth, Chair
Cities of Contra Costa County

Dave Cortese, Vice Chair
Santa Clara County

Alicia C. Aguirre
Cities of San Mateo County

Tom Azumbrado
U.S. Department of Housing
and Urban Development

Tom Bates
Cities of Alameda County

David Campos
City and County of San Francisco

Bill Dodd
Napa County and Cities

Dorene M. Giacopini
U.S. Department of Transportation

Federal D. Glover
Contra Costa County

Scott Haggerty
Alameda County

Anne W. Halsted
San Francisco Bay Conservation
and Development Commission

Steve Kinsey
Marin County and Cities

Sam Liccardo
San Jose Mayor's Appointee

Mark Luce
Association of Bay
Area Governments

Jake Mackenzie
Sonoma County and Cities

Joe Pirzynski
Cities of Santa Clara County

Jean Quan
Oakland Mayor's Appointee

Bijan Sartipi
State Business, Transportation
and Housing Agency

James P. Spering
Solano County and Cities

Adrienne J. Tissier
San Mateo County

Scott Wiener
San Francisco Mayor's
Appointee

Association of Bay Area Governments

Supervisor Mark Luce
ABAG President
County of Napa

Mayor Julie Pierce
ABAG Vice President
City of Clayton

Representatives From Each County

Supervisor Richard Valle
Alameda

Supervisor Scott Haggerty
Alameda

Supervisor Karen Mitchoff
Contra Costa

Supervisor John Gioia
Contra Costa

Supervisor Katie Rice
Marin

Supervisor Mark Luce
Napa

Supervisor Eric Mar
San Francisco

Supervisor Jane Kim
San Francisco

Supervisor Warren Slocum
San Mateo

Supervisor Dave Pine
San Mateo

Supervisor Mike Wasserman
Santa Clara

Supervisor Dave Cortese
Santa Clara

Supervisor Linda Seifert
Solano

Supervisor David Rabbitt
Sonoma

Representatives From Cities in Each County

Mayor Bill Harrison
City of Fremont / Alameda

Mayor Jerry Thorne
City of Pleasanton / Alameda

Mayor Julie Pierce
City of Clayton / Contra Costa

Vice Mayor Dave Hudson
City of San Ramon / Contra Costa

Mayor Pat Eklund
City of Novato / Marin

Mayor Leon Garcia
City of American Canyon / Napa

Mayor Edwin Lee
City and County of San Francisco

Jason Elliott, Director,
Legislative/Government Affairs,
Office of the Mayor
City and County of San Francisco

Joaquin Torres, Deputy Director,
Economic and Workforce
Development, Office of the Mayor
City and County of San Francisco

Mayor Pedro Gonzalez
City of South San Francisco /
San Mateo

Mayor *Pro Tem* Mary Ann Nihart
City of Pacifica / San Mateo

Councilmember Joe Pirzynski
City of Los Gatos / Santa Clara

Councilmember Ronit Bryant
City of Mountain View / Santa Clara

Mayor Harry Price
City of Fairfield / Solano

Councilmember Jake Mackenzie
City of Rohnert Park / Sonoma

Mayor Jean Quan
City of Oakland

Councilmember Libby Schaaf
City of Oakland

Councilmember Desley Brooks
City of Oakland

Councilmember Sam Liccardo
City of San Jose

Councilmember Kansen Chu
City of San Jose

Councilmember Ash Kalra
City of San Jose

Advisory Members

William Kissinger
Regional Water Quality
Control Board

COVER IMAGE: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS user community

Plan Bay Area

Regional Transportation Plan and
Sustainable Communities Strategy
for the San Francisco Bay Area
2013–2040

Adopted July 18, 2013

Association
of Bay Area
Governments

METROPOLITAN
TRANSPORTATION
COMMISSION

Welcome to Plan Bay Area

BayArea
Plan

Table of Contents

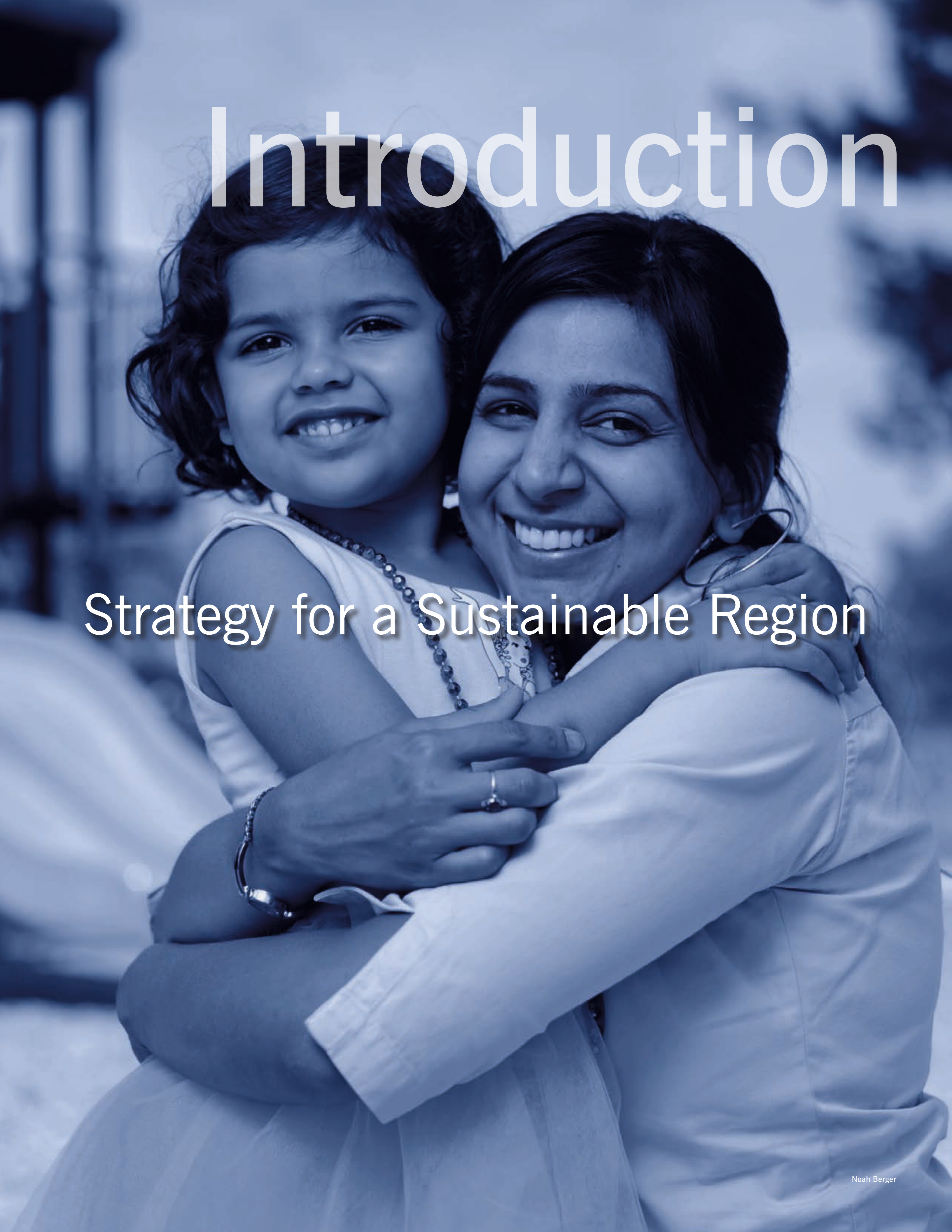
MAP 1

San Francisco Bay Area: Transportation and Land Uses

Map is for general information. For more information on local zoning or designations for a particular site or parcel, please contact your city or county.

Introduction

Strategy for a Sustainable Region



Noah Berger

Simon Marcus, Corbis Images

Introducing Plan Bay Area

Strategy for a Sustainable Region

Most of us living in the nine counties that touch San Francisco Bay are accustomed to saying we live in “the Bay Area.”

This simple phrase speaks volumes — and underscores a shared regional identity. The 7 million of us who call the nine-county San Francisco Bay Area home have a strong interest in protecting the wealth of features that make our region a magnet for people and businesses from around the globe.

The Bay Area is, after all, the world’s 21st-largest economy. The natural beauty of San Francisco Bay and the communities surrounding it, our Mediterranean climate, extensive system of interconnected parks and open space, advanced mass transit system, top-notch educational institutions and rich cultural heritage continue to draw people who seek better opportunities. Yet we cannot take for granted that we will be able to sustain and improve our quality of life for current and future generations.

With our region’s population projected to swell to some 9 million people by 2040, Plan Bay Area charts a course for accommodating this growth while fostering an innovative, prosperous and competitive economy; preserving a healthy and safe environment; and allowing all Bay Area residents to share the benefits of vibrant, sustainable communities connected by an efficient and well-maintained transportation network.

A Legacy of Leadership

Plan Bay Area, while comprehensive and forward-reaching, is an evolutionary document. The Bay Area has made farsighted regional planning a top priority for decades. Previous generations recognized the need for a mass transit system, including regional systems such as BART and Caltrain that have helped make our region the envy of other metropolitan areas. Our transbay bridges add cohesion to the regional transportation system by connecting communities across the bay. Likewise, we owe our system of parks and open space to past generations of leaders who realized that a balance between urbanized areas and open space was essential to a healthy environment and vibrant communities.

Plan Bay Area extends this legacy of leadership, doing more of what we've done well while also mapping new strategies to face new challenges. Among the new challenges are the requirements of California's landmark 2008 climate law (SB 375, Steinberg): to decrease greenhouse gas emissions from cars and light trucks, and to accommodate all needed housing growth within our nine counties. By coordinating future land uses with our long-term transportation investments, Plan Bay Area meets these challenges head on — without compromising local control of land use decisions. Each of the Bay Area's nine counties and 101 cities must decide what is best for their citizens and their communities.


San Francisco-Oakland Bay Bridge

Caltrans

Building Upon Local Plans and Strategies

For over a decade, local governments and regional agencies have been working together to encourage the growth of jobs and production of housing in areas supported by amenities and infrastructure. In 2008, the Association of Bay Area Governments (ABAG) and the Metropolitan Transportation Commission (MTC) created a regional initiative to support these local efforts called FOCUS. In recent years, this initiative has helped to link local community development aspirations with regional land use and transportation planning objectives. Local governments have identified Priority Development Areas (PDAs) and Priority Conservation Areas (PCAs), and these form the implementing framework for Plan Bay Area.

PDAs are areas where new development will support the day-to-day needs of residents and workers in a pedestrian-friendly environment served by transit. While PDAs were originally established to address housing needs in infill communities, they have been broadened to advance focused employment growth. Local jurisdictions have defined the character of their PDAs according to existing conditions and future expectations as regional centers, city centers, suburban centers or transit town centers, among other place types. PCAs are regionally significant open spaces for which there exists broad consensus for long-term protection but nearer-term development pressure. PDAs and PCAs complement one another because promoting development within PDAs takes development pressure off the region's open space and agricultural lands.

Building upon the collaborative approach established through FOCUS, local input has driven the set of alternative scenarios that preceded and informed the development of Plan Bay Area. The non-profit and business communities also played a key role in shaping the plan. Business groups highlighted the need for more affordable workforce housing, removing regulatory barriers to infill development, and addressing infrastructure needs at rapidly growing employment centers. Environmental organizations emphasized the need to improve transit access, retain open space, provide an adequate supply of housing to limit the number of people commuting into the region from nearby counties, and direct discretionary transportation funding to communities building housing in PDAs. Equity organizations focused on increasing access to housing and employment for residents of all income categories throughout the region, and establishing policies to limit the displacement of existing residents as PDAs grow and evolve. All of these diverse voices strengthened this plan.

Preserving Local Land Use Control

Adoption of Plan Bay Area does not mandate any changes to local zoning, general plans or project review. The region's cities, towns and counties maintain control of all decisions to adopt plans and permit or deny development projects. Similarly, Plan Bay Area's forecasted job and housing numbers do not act as a direct or indirect cap on development locations in the region. The forecasts are required by SB 375 and reflect the intent of regional and local collaboration that is the foundation of Plan Bay Area.

The plan assists jurisdictions seeking to implement the plan at the local level by providing funding for PDA planning and transportation projects. Plan Bay Area also provides jurisdictions with the option of increasing the efficiency of the development process for projects consistent with the plan and other criteria included in SB 375.

Sergio Ruiz

California Senate Bill 375: Linking Regional Plans to State Greenhouse Gas Reduction Goals

Plan Bay Area grew out of "The California Sustainable Communities and Climate Protection Act of 2008" (California Senate Bill 375, Steinberg), which requires each of the state's 18 metropolitan areas — including the Bay Area — to reduce greenhouse gas emissions from cars and light trucks. Signed by former Gov. Arnold Schwarzenegger, the law requires that the Sustainable Communities Strategy (SCS) promote compact, mixed-use commercial and residential development. To meet the goals of SB 375, Plan Bay Area directs more future development in areas that are or will be walkable and bikable and close to public transit, jobs, schools, shopping, parks, recreation and other amenities. Key elements of SB 375 include the following.

- The law requires that the Bay Area and other California regions develop a Sustainable Communities Strategy (SCS) — a new element of the regional transportation plan (RTP) — to strive to reach the greenhouse gas (GHG) reduction target established for each region by the California Air Resources Board. The Bay Area's target is a 7 percent per capita reduction by 2020 and a 15 percent per capita reduction by 2035. Plan Bay Area is the region's first RTP subject to SB 375.
- In the Bay Area, the Association of Bay Area Governments (ABAG) is responsible for the land use and housing assumptions for the SCS, which adds three new elements to the RTP: (1) a land use component that identifies how the region could house the region's entire population over the next 25 years; (2) a discussion of resource and farmland areas; and (3) a demonstration of how the development pattern and the transportation network can work together to reduce GHG emissions.
- Extensive outreach with local government officials is required, as well as a public participation plan that includes a minimum number of workshops in each county as well as three public hearings on the draft SCS prior to adoption of a final plan.
- The law synchronizes the regional housing need allocation (RHNA) process — adopted in the 1980s — with the regional transportation planning process.
- Finally, SB 375 streamlines the California Environmental Quality Act (CEQA) for housing and mixed-use projects that are consistent with the SCS and meet specified criteria, such as proximity to public transportation.

Plan Bay Area is one element of a broader California effort to reduce greenhouse gas emissions. While Plan Bay Area focuses on where the region is expected to grow and what transportation investments will support that growth, Assembly Bill 32 (2006) creates a comprehensive framework to cut greenhouse gases with new, cleaner fuels, more efficient cars and trucks, lower carbon building codes, cleaner power generation, as well as coordinated regional planning. In addition, Caltrans will lead efforts consistent with Senate Bill 391 (2009) to reduce greenhouse gases statewide from the transportation sector, including freight. These strategies are outlined in the California Air Resources Board's (CARB) 2008 Scoping Plan, which demonstrates there is no single way to reduce greenhouse gases. Every sector must contribute if the state is to achieve its goals today and for tomorrow's generations.

Noah Berger

Setting Our Sights

Developing a long-range land use and transportation plan for California's second-largest metropolitan region, covering about 7,000 square miles across nine Bay Area counties, is no simple task. We set our sights on this challenge by emphasizing an open, inclusive public outreach process and adopting objective performance standards based on federal and state requirements to measure our progress during the planning process.

Reaching Out

We reached out to the people who matter most — the 7 million people who live in the region. Thousands of people participated in stakeholder sessions, public workshops, telephone and internet surveys, and more. Befitting the Bay Area, the public outreach process was boisterous and contentious. Key stakeholders also included the region's 101 cities and nine counties; our fellow regional agencies, the Bay Conservation and Development Commission and the Bay Area Air Quality Management District; community-based organizations and advocacy groups, and some three dozen regional transportation partners. In addition, there were multiple rounds of engagement with the Bay Area's Native American tribes, as detailed in the tribal consultation report. (See "Plan Bay Area Prompts Robust Dialogue on Transportation and Housing," in Chapter 1.)

Establishing Performance Targets

Before proposing a land use distribution approach or recommending a transportation investment strategy, planners must formulate in concrete terms the hoped-for outcomes. For Plan Bay Area, performance targets are an essential means of informing and allowing for a discussion of quantitative metrics. After months of discussion and debate, ABAG and MTC adopted 10 targets in January 2011, reflecting input from the broad range of stakeholders engaged in the process.

Two of the targets are not only ambitious — they also are mandated by state law. The first mandatory target addresses climate protection by requiring the Bay Area to reduce its per-capita CO_2 emissions from cars and light-duty trucks by 15 percent by 2040. The second mandatory target addresses adequate housing by requiring the region to house 100 percent of its projected population growth by income level. Plan Bay Area achieves both these major milestones.

Taking Equity Into Account

About one-fifth of the Bay Area's total population lives in areas with large numbers of low-income and minority populations. Promoting these people's access to housing, jobs and transportation not only advances Plan Bay Area's objective to advance equity in the region; it also increases our chances of meeting the other performance targets. MTC and ABAG adopted five Equity Analysis measures to evaluate equity concerns: housing and transportation affordability, potential for displacement, healthy communities, access to jobs, and equitable mobility. (See Chapter 1, Table 5: "Plan Bay Area Equity Performance Measures.")

Noah Berger

The eight voluntary targets seek to promote healthy and safe communities by reducing premature deaths from air pollution, reducing injuries and fatalities from collisions, increasing the amount of time people walk or cycle for transportation, and protecting open space and agricultural lands. Other targets address equity concerns, economic vitality and transportation system effectiveness. Plan Bay Area meets some, but not all, of the voluntary targets. (See Chapter 1, Table 4 for a summary of all the Plan Bay Area performance targets.)

Planning Scenarios Take Aim at Performance Targets

Taken together, the Plan Bay Area performance targets outline a framework that allows us to better understand how different projects and policies might affect the region's future. With the targets clearly identified, MTC and ABAG formulated possible scenarios — combinations of land use patterns and transportation investments — that could be evaluated together to see if (and by how much) they achieved (or fell short of) the performance targets. An iterative process of scenario-testing begun in 2010 yielded preferred alternatives, both for transportation investments and a land use strategy. Adopted by the boards of MTC and ABAG in May 2012, they form this Plan Bay Area.

Looking Toward the Future

ABAG and MTC track and forecast the region's demographics and economic trends to inform and guide Plan Bay Area investments and policy decisions. The forecasts reflect the best picture we have of what the Bay Area may look like in 2040, so that today's decisions may align with tomorrow's expected transportation and housing needs. These forecasts form the basis for developing the regional land use plan for Plan Bay Area's Sustainable Communities Strategy (SCS) and, in turn, the region's transportation investment strategy.

Joyce Benna

Projections in three main areas informed development of the plan: population, employment and housing. Here are some highlights of each.

- **Population:** By 2040 the San Francisco Bay Area is projected to add 2.1 million people, increasing total regional population from 7.2 million to 9.3 million, an increase of 30 percent or roughly 1 percent per year. This growth means the Bay Area will continue to be California's second-largest population and economic center.
- **Employment:** The number of jobs is expected to grow by 1.1 million between 2010 and 2040, an increase of 33 percent. This is a slower rate of job growth than previous forecasts.
- **Housing:** During this same time period the number of households is expected to increase by 27 percent to 700,000, and the number of housing units is expected to increase by 24 percent to 660,000.

The demographic implications of these topline numbers are far-reaching, and some trends in particular weighed heavily in the development of Plan Bay Area. These are touched on below and examined in greater detail in Chapter 2.

Aging Baby Boomers Expected to Change Travel and Development Patterns

The U.S. Census Bureau defines baby boomers as people who were born between 1946 and 1964 during the post-World War II baby boom. By 2040 the oldest baby boomers will be in their 90s and the youngest will be in their 70s. Today, people who are 65 and over represent 12 percent of the Bay Area's total population, but by 2040 the number of seniors will increase to 22 percent. That's more than 1 in 5 people in our region. It is expected that many of these seniors will relocate to smaller homes in more urban locations to have easier access to essential services and amenities and the Bay Area's extensive transit system.

Mobility will be a special challenge for seniors who lose their ability to drive. MTC's Lifeline Transportation Program supports projects that address mobility and accessibility needs of low-income and disabled people throughout the region. Between 2006 and 2012, roughly $172 million was invested to support about 220 projects. Closely related are MTC programs that provide funding to sustain and improve mobility for elderly and disabled persons in accordance with and even beyond the requirements

By 2040 the San Francisco Bay Area is projected to add 2.1 million people.

of the Americans with Disabilities Act (ADA). These types of projects have included travel training, sidewalk and bus stop improvements, supportive ride programs and other community initiatives. Plan Bay Area reaffirms the importance of Lifeline and Elderly & Disabled programs by adding over $800 million in discretionary funding for the Lifeline program, and almost $240 million for the Elderly & Disabled programs over the 28-year period of the plan.

Racial and Ethnic Diversity Expected to Increase

The Bay Area and California are at the forefront of one of the greatest demographic changes in our nation's history: growth in the Latino population. In January 2013 the California Department of Finance projected that the state's Hispanic population will equal the non-Hispanic white population by mid-2013. By early 2014 it expects that California's Hispanic population will have become a plurality for the first time in state history.

This state forecast aligns with Plan Bay Area's projection that by 2040 the Bay Area population will become substantially more racially and ethnically diverse. Latinos will emerge as the largest ethnic group, increasing from 23 percent to 35 percent of the total population. The number of Asians also will increase, growing from 21 percent to about 24 percent of the population.

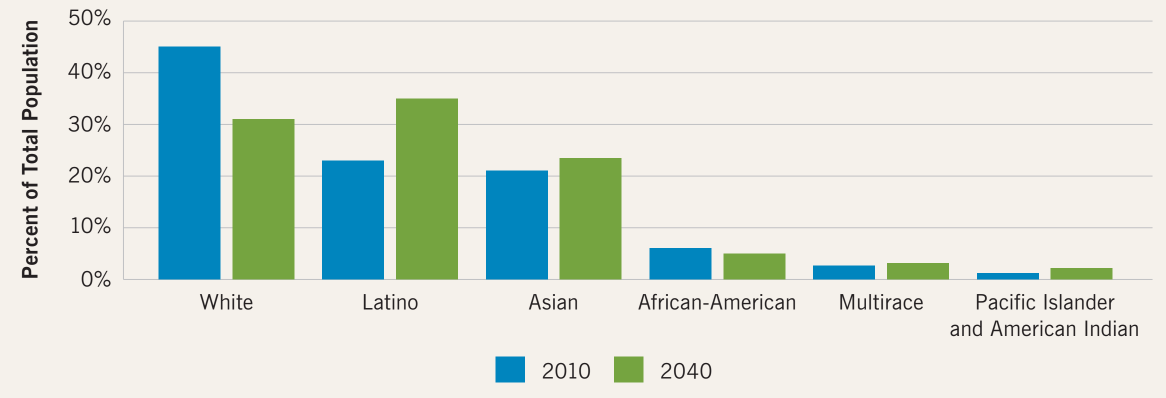

Noah Berger

Demand for Multi-Unit Housing in Urban Areas Close to Transit Expected to Increase

Single-family homes represent the majority of housing production in recent decades, but recent trends suggest that cities once again are becoming centers of population growth. Construction of multifamily housing in urban locations in the Bay Area increased from an average of 35 percent of total housing construction in the 1990s to nearly 50 percent in the 2000s. In 2010 it represented 65 percent of all housing construction.

As discussed above, demand for multifamily housing is projected to increase as seniors downsize and seek homes in more urban locations. Population growth of those aged 34 and younger is expected to have a similar effect, as this demographic group also demonstrates a greater preference for multifamily housing. All told, the number of people per Bay Area household is expected to increase from 2.69 in 2010 to 2.75 in 2040. Market demand for new homes will tilt toward townhomes, condominiums and apartments in developed areas near transit, shops and services.

FIGURE 1: Share of Population by Race and Ethnicity, 2010 and 2040



Sources: 2010 Census, California Department of Finance, ABAG

Project-Level Performance Assessment of Transportation Projects

By developing the preferred land use and transportation investment strategies, ABAG and MTC were able to answer many big-picture questions about the Bay Area's future. For example, should the region focus on expanding the transportation system or on maintaining what we have already built? And should the Bay Area invest more in transit for future generations or emphasize highway projects to improve the commutes of today's drivers? And how should our transportation investments support future growth in employment and housing?

Plan Bay Area also is based on a commitment to evaluate individual transportation projects to make sure dollars are being allocated to the most cost-effective projects. In order to take a closer look at major transportation projects, MTC performed a project performance assessment, examining billions of dollars of potential transportation projects to identify the highest-performing investments across the region. This enabled funding prioritization for the highest-performing projects. Most of them focused on leveraging existing assets and improving their efficiency, while supporting future development. Notable projects include BART Metro, which will increase service frequencies on the highest-demand segment of the BART system, and San Francisco's congestion pricing initiatives. (See Chapter 5 for a list of high-performing projects.)

Ron Finger

Building a Development Pattern That Aligns With Where We Live and Work

Plan Bay Area provides a vision for how to retain and enhance the qualities that make the Bay Area a great place to live, work and play. It builds on the legacy of leadership left to us by previous generations. In fact, many of the attributes that make the Bay Area special — a strong economy, protected natural resources, a network of diverse neighborhoods — would not have been possible without our predecessors' forward-thinking actions.

Looking ahead to the growth expected in the Bay Area over the next several decades, we face many similar problems as past generations, while also confronting new challenges that threaten the region's economic vitality and quality of life. Our economy is still recovering from the Great Recession of 2007–2009, which has resulted in uneven job growth throughout the region, increased income disparity, and high foreclosure rates. At the same time, housing costs have risen for renters and, to a lesser degree, for home buyers close to the region's job centers. Finally, Bay Area communities face these challenges at a time when there are fewer public resources available than in past decades for investments in infrastructure, public transit, affordable housing, schools and parks.

A More Focused Future

The planning scenarios and the land use and transportation investment strategies developed during the Plan Bay Area process seek to address the needs and aspirations of each Bay Area jurisdiction, as identified in locally adopted general plans and zoning ordinances. They also aim to meet the Plan Bay Area performance targets and equity performance standards. The framework for developing these scenarios consisted largely of the Priority Development Areas (PDAs) and Priority Conservation Areas (PCAs) recommended by local governments. The preferred land use scenario identified in Chapter 3 is a flexible blueprint for accommodating growth over the long term. Pairing this development pattern with the transportation investments described in Chapter 4 is what makes Plan Bay Area the first truly integrated land use/transportation plan for the region's anticipated growth.

Peter Beeler

TABLE 1: Bay Area Job Growth 2010–2040, Top 15 Cities

Rank	Jurisdiction	Jobs		2010–2040 Job Growth	
		2010	2040	Growth	Percentage Growth
1	San Francisco	568,720	759,500	190,780	34%
2	San Jose	377,140	524,510	147,380	39%
3	Oakland	190,490	275,760	85,260	45%
4	Santa Clara	112,890	146,180	33,290	29%
5	Fremont	90,010	120,000	29,990	33%
6	Palo Alto	89,690	119,470	29,780	33%
7	Santa Rosa	75,460	103,940	28,470	38%
8	Berkeley	77,110	99,330	22,220	29%
9	Concord	47,640	69,450	21,810	46%
10	Sunnyvale	74,810	95,600	20,790	28%
11	San Mateo	52,540	72,950	20,410	39%
12	Hayward	68,140	87,820	19,680	29%
13	Redwood City	58,080	77,480	19,400	33%
14	Walnut Creek	41,720	57,380	15,660	38%
15	Mountain View	47,950	63,590	15,640	33%

Source: ABAG, 2013

2040 Employment Distribution Highlights

Plan Bay Area's distribution of jobs throughout the region is informed by changing trends in the locational preferences of the wide range of industry sectors and business place types in the Bay Area. These trends capture ongoing geographic changes, as well as changes in the labor force composition and workers' preferences. The employment distribution directs job growth toward the region's larger cities and Priority Development Areas with a strong existing employment base and communities with stronger opportunities for knowledge-sector jobs.

Almost 40 percent of the jobs added from 2010 to 2040 will be in the region's three largest cities — San Jose, San Francisco and Oakland — which accounted for about one-third of the region's jobs in 2010. Two-thirds of the overall job growth is anticipated to be in PDAs throughout the region. Due to the strength of the knowledge sector, nine of the 15 cities expected to experience the greatest job growth are in the western and southern part of the region surrounding Silicon Valley. The remaining communities expecting high levels of job growth are in the East Bay and North Bay, owing to their strong roles in the current economy, diverse employment base, and their proximity to a large base of workers. The 15 cities expected to experience the most job growth will account for roughly 700,000 jobs, or just over 60 percent of the new jobs added in the region by 2040. (See Table 1 above.)

2040 Housing Distribution Highlights

The Plan Bay Area housing distribution is guided by the policy direction of the ABAG Executive Board, which voted in July 2011 to support equitable and sustainable development by “maximizing the regional transit network and reducing GHG emissions by providing convenient access to employment for people of all incomes.” This was accomplished by distributing total housing growth numbers to: 1) job-rich cities that have PDAs or additional areas that are PDA-like; 2) areas connected to the existing transit infrastructure; and 3) areas that lack sufficient affordable housing to accommodate low-income commuters. The housing distribution directs growth to locations where the transit system can be utilized more efficiently, where workers can be better connected to jobs, and where residents can access high-quality services.

Substantial housing production is expected on the Peninsula and in the South Bay, where eight of the top 15 cities expected to experience the most housing growth are located. Two-thirds of the region’s overall housing production is directed to these 15 cities, leaving the more than 90 remaining jurisdictions in the region to absorb only limited growth. This development pattern preserves the character of more than 95 percent of the region by focusing growth on less than 5 percent of the land. (See Table 2 below.)

Transportation Investments

Plan Bay Area structures an infrastructure investment plan in a systematic way to support the region’s long-term land use strategy, relying on a performance assessment of scenarios and individual projects. The plan makes investments in the region’s transportation network that support job growth and new homes in existing communities by focusing the lion’s share of investment on maintaining and boosting the efficiency of the existing transit and road system. Plan Bay Area also takes a bold step with strategic investments that provide support for focused growth in Priority Development Areas, including the new OneBayArea Grant program.

TABLE 2: Bay Area Housing Unit Growth 2010–2040, Top 15 Cities

		Housing Units		2010–2040 Housing Unit Growth	
Rank	Jurisdiction	2010	2040	Growth	Percentage Growth
1	San Jose	314,040	443,320	129,280	41%
2	San Francisco	376,940	469,430	92,480	25%
3	Oakland	169,710	221,160	51,450	30%
4	Sunnyvale	55,790	74,820	19,030	34%
5	Concord	47,130	65,200	18,070	38%
6	Fremont	73,990	91,620	17,630	24%
7	Santa Rosa	67,400	83,430	16,030	24%
8	Santa Clara	45,150	58,930	13,780	31%
9	Milpitas	19,810	32,430	12,620	64%
10	Hayward	48,300	60,610	12,320	26%
11	Fairfield	37,180	48,300	11,120	30%
12	San Mateo	40,010	50,200	10,180	25%
13	Livermore	30,340	40,040	9,700	32%
14	Richmond	39,330	49,020	9,690	25%
15	Mountain View	33,880	43,280	9,400	28%

Source: ABAG, 2013

Tom Tracy

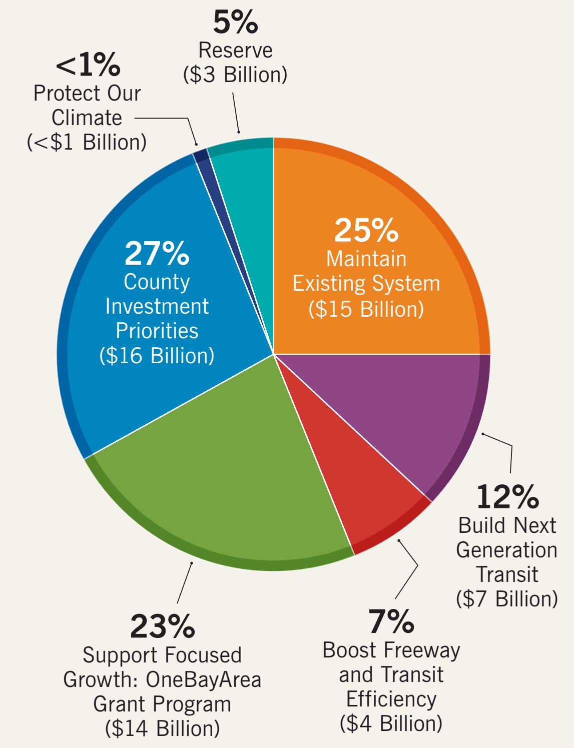
Plan Bay Area transportation revenue forecasts total $292 billion over the 28-year period. Over two-thirds (68 percent) of these funds are from regional and local sources, primarily dedicated sales tax programs and bridge tolls. Making up the remainder of the pie are state and federal revenues (mainly derived from fuel taxes). Of the total revenues, $60 billion are “discretionary,” or available for assignment to projects and programs through Plan Bay Area.

The plan invests those discretionary funds via six key investment strategies, as shown in Figure 2 and presented in greater detail in Chapter 4. (See Table 3 for a look at the “big-ticket” plan investments, overall.) The first two discretionary strategies merit special mention.

Maintain Our Existing System

Though its fund sources are many and varied, Plan Bay Area’s overriding priority in investing those funds can be stated quite simply: “Fix It First.” First and foremost, this plan should help to maintain the Bay Area’s transportation system in a state of good repair. Plan Bay Area’s focus on “fix it first” ensures

FIGURE 2: Plan Bay Area — Discretionary Investment Summary
($60 billion in year of expenditure $)



"Top 10" Plan Bay Area Investments, by Project

(includes Committed and Discretionary funds)

TABLE 3: 10 Largest Plan Bay Area Investments

Rank	Project	Investment (YOE* Millions $)
1	BART to Warm Springs, San Jose and Santa Clara	$8,341
2	MTC Regional Express Lane Network	$6,057
3	Transbay Transit Center/Caltrain Downtown Extension (Phases 1 and 2)	$4,185
4	Integrated Freeway Performance Initiative (FPI)	$2,729
5	Presidio Parkway/Doyle Drive US 101 seismic replacement	$2,053
6	Caltrain Electrification and Operational/Service Frequency Improvements	$1,843
7	SF MUNI Central Subway: King Street to Chinatown	$1,578
8	Valley Transportation Authority (VTA) Express Lane Network	$1,458
9	San Jose International Airport Connector	$753
10	Hunters Point and Candlestick Point: New Local Roads	$722

*YOE = Year of Expenditure

that we maintain existing transportation assets, primarily concentrated in the region's core, which reinforces the plan's focused growth strategy.

In total, Plan Bay Area dedicates 87 percent of all available funding (committed and discretionary) to sustaining the existing transportation network. Given the age of many major assets — BART turned 40 last year and San Francisco Muni turned 100 — this should come as no surprise.

Support Focused Growth — OneBayArea Grant Program

The OneBayArea Grant (OBAG) program is a new funding approach that better integrates the region's transportation funding program with SB 375 and the land use pattern outlined in Chapter 3. The OBAG program rewards jurisdictions that focus housing growth in Priority Development Areas (PDAs) through their planning and zoning policies, and actual production of housing units. The OBAG program allows flexibility to invest in a community's transportation infrastructure by providing funding for Transportation for Livable Communities, bicycle and pedestrian improvements, local streets and roads preservation, and planning activities, while also providing specific funding opportunities for Safe Routes to Schools projects and Priority Conservation Areas.

Plan Bay Area Achieves Key Performance Targets

As described earlier, Plan Bay Area was developed within a framework of objective performance standards, both mandatory and voluntary or aspirational. As has been the case in past long-term transportation plans, no single strategy is able to achieve all the plan's performance targets. An analysis of the 10 main targets and five sub-targets (for a total of 15 performance measures) clearly bears this out. Specifically, the plan meets or exceeds six targets, including the statutory greenhouse gas emissions and housing targets, narrowly misses three targets, falls well short of two targets and unfortunately moves in the wrong direction on four of the targets. In other words, the draft plan makes great progress on nine of 15 performance measures, which represents a solid first effort. The region will need to focus future attention on conceptualizing breakthrough strategies to achieve the four targets where we are falling behind.

For a more detailed discussion of the plan's performance as measured against each individual target, please see Chapter 5.

A Plan To Build On

Plan Bay Area is a work in progress that will be updated every four years to reflect new initiatives and priorities. It builds upon the work of previous initiatives, complements ongoing work and lays the groundwork for closer examination of certain critical issues that can further prepare the region to meet the future head-on. The plan highlights the relationship between transportation investments and land use planning, and represents the region's newest effort to position itself to make the most of what the future will bring.

No single level of government can be expected to address all the critical components needed to create a stronger and more resilient Bay Area. It will take a coordinated effort among diverse partners to promote regional economic development, adapt to climate change, prepare for natural disasters, get creative about how to provide affordable housing for all Bay Area residents, ensure clean and healthy air for our communities, and prepare for emerging technologies that will change the way people work and get around. Further steps will be needed to fully realize the Plan Bay Area vision and implement some of its forward-looking plans and policies. (See Chapter 6 for a discussion of some needed "next steps.")

But we have made a strong start. Look closely at Plan Bay Area, and you will see a plan that takes great strides toward:

Tackling Problems That Cross Boundaries and Require Regional Solutions

Housing, air quality, traffic, jobs, economic development, open space preservation — the list is a long one.

Embodying Local Visions

Priority Development Areas were recommended by local governments, and land use and transportation strategies are linked to local input and priorities; different kinds of investments and development are envisioned for different parts of the region.

Arlene Finger

Helping To Ensure a Vibrant and Healthy Region for Our Children and Grandchildren

Cleaner air, fewer greenhouse gas emissions, more housing options, improved infrastructure, better access to jobs, and access to open space and recreation — these are the building blocks of a better future.

Making Bay Area Businesses More Competitive

A well-constructed, sustainable regional plan can help us attract private sector investment and compete for federal and state funding.

Providing a Range of Housing and Transportation Choices

A greater variety of multifamily and single-family housing will be available in places with better transit access, and improved walking conditions and local services.

Stretching Tax Revenues Through Smart Investments

By making the most of existing infrastructure, using a performance-based approach to transportation investments and coordinating the location of future housing and jobs with major transportation investments, we can get more bang for our buck in public expenditures.

Preserving Open Spaces, Natural Resources, Agriculture and Farmland

By developing in existing downtowns, main streets and neighborhoods, we don't need to develop on open spaces or in places that over-utilize our water supply, energy resources and road capacity.


Jay Jones

Helping To Create Healthy Communities

More people will be able to live in neighborhoods where they can walk to shops, transit and local parks because of the groundwork laid in this plan.

Plan Bay Area cannot guarantee these outcomes, of course, but we believe it can greatly boost the region's odds of achieving them. For surely we must work together as a region to promote sustainability, and to leave a better Bay Area for our children and grandchildren. By helping to harmonize local decision-making and regional goals, by better integrating transportation investment and land use planning, by more closely aligning our policies with our vision — in short, by creating a strategy for a sustainable region — Plan Bay Area gives us a chance to do that.

1

Setting Our Sights

Noah Berger

Caldecott Tunnel

Karl Nielsen

Chapter 1

Setting Our Sights

Crafting a plan to meet the challenges and opportunities of the coming quarter-century is a big job. MTC and ABAG tackled this assignment with enthusiasm, emphasizing both an open, inclusive attitude and a commitment to analytical rigor.

We reached out to thousands of people from around the region, through stakeholder sessions, public workshops, telephone and internet surveys, and countless other means to involve a wide swath of the public in the development of the plan. The region's 101 cities and nine counties also participated in the development of the plan, as did our fellow regional agencies, the Bay Conservation and Development Commission and the Bay Area Air Quality Management District. Community-based organizations and advocacy groups representing the diverse interests of the Bay Area played their part, as did some three dozen regional transportation partners. The plan's outreach effort was both broad-based and deep.

At the same time, wanting to hew to strict objective standards of progress, MTC and ABAG adopted 10 specific targets against which to measure the success of the plan in achieving genuine regional benefits and required statutory goals. This chapter traces the overall development of Plan Bay Area, with special attention to the public process followed, and to the setting, adjusting and assessment of key performance objectives.

Establishing a Performance Framework

What are we aiming for in Plan Bay Area, and how can we measure our success in achieving it? New mandates answer those questions to some degree. California Senate Bill 375, enacted in 2008, requires that we plan for future housing needs and complementary land uses, which in turn must be supported by a transportation investment strategy. And we must do this in a way that reduces emissions of greenhouse gases from cars and light-duty trucks. A fully integrated land use and transportation planning approach is needed to meet these requirements, and Plan Bay Area embraces and embodies such an approach.

Combining these mandated objectives with a careful assessment of the long-range needs of the Bay Area and an understanding of the desires and aspirations of its residents — communicated loudly and diversely through the many avenues provided for public participation (see sidebar on page 28) — we can begin to structure a serious plan for the region. But before proposing a land use distribution approach or recommending a transportation investment strategy, planners must formulate in concrete terms the hoped-for outcomes we seek. For Plan Bay Area, performance targets are an essential element of this regional planning process, allowing for rational discussion of quantitative metrics. Establishing targets allows for various alternative strategies to be assessed and compared using a consistent set of metrics.

Collaborative Process

MTC and ABAG engaged a broad spectrum of regional stakeholders in order to make the targets as meaningful as possible in measuring the plan's success. This collaborative process in the latter half of 2010 involved reviewing nearly 100 possible performance targets, which were critically examined using a set of evaluation criteria. These criteria emphasized targets that could be forecasted by modeling tools and potentially influenced by policies and investments in the future plan. After six months of discussion and debate reflecting input from local stakeholders, equity, environment and business advocates, and concerned members of the public, a list of the preferred targets took shape. These targets went beyond traditional transportation concerns, such as metrics for regional mobility, and instead embraced broader regional concerns, including land use, environmental quality and economic vitality.

Noah Berger

The Plan Bay Area targets, adopted in January 2011, reflect this plan's emphasis on sustainability. Sustainability encapsulates a broad spectrum of concerns, including environmental impacts from greenfield development and vehicle emissions, equity impacts from displacement and low-income household affordability, and economic impacts from regional competitiveness. By integrating these three E's — environment, equity and economy — throughout the targets, Plan Bay Area truly aims to measure the success of creating sustainable communities. We paid special attention to the equity component of the three E's triad, as detailed later in this chapter.

Of course, adopting these voluntary targets is not the same as achieving them. Many are extremely ambitious. But two of the targets are not only ambitious, but also mandatory and vitally important. Plan Bay Area must reduce greenhouse gas emissions by specified amounts, and it must plan for housing in a quantity sufficient for the region's population. These targets are critical to achieving state and regional goals in combating climate change — and the plan meets those major milestones.

The Plan Bay Area targets adopted by MTC and ABAG are displayed in Table 4; information on how the plan performs against the targets can be found in Chapter 5, "Performance."

TABLE 4: Adopted Plan Bay Area Performance Targets*

Goal/Outcome		Performance Target
Required		
Climate Protection	1	Reduce per-capita CO$_2$ emissions from cars and light-duty trucks by 15 percent (Statutory requirement is for year 2035, per SB 375)
Adequate Housing	2	House 100 percent of the region's projected growth (from a 2010 baseline year) by income level (very-low, low, moderate, above-moderate) without displacing current low-income residents (Statutory requirement, per SB 375)
Voluntary		
Healthy and Safe Communities	3	Reduce premature deaths from exposure to particulate emissions: • Reduce premature deaths from exposure to fine particulates (PM$_{2.5}$) by 10 percent • Reduce coarse particulate emissions (PM$_{10}$) by 30 percent • Achieve greater reductions in highly impacted areas
	4	Reduce by 50 percent the number of injuries and fatalities from all collisions (including bike and pedestrian)
	5	Increase the average daily time walking or biking per person for transportation by 70 percent (for an average of 15 minutes per person per day)
Open Space and Agricultural Preservation	6	Direct all non-agricultural development within the urban footprint (existing urban development and urban growth boundaries) (Note: Baseline year is 2010.)
Equitable Access	7	Decrease by 10 percentage points (to 56 percent, from 66 percent) the share of low-income and lower-middle income residents' household income consumed by transportation and housing
Economic Vitality	8	Increase gross regional product (GRP) by 110 percent — an average annual growth rate of approximately 2 percent (in current dollars)
Transportation System Effectiveness	9	• Increase non-auto mode share by 10 percentage points (to 26 percent of trips) • Decrease automobile vehicle miles traveled per capita by 10 percent
	10	Maintain the transportation system in a state of good repair: • Increase local road pavement condition index (PCI) to 75 or better • Decrease distressed lane-miles of state highways to less than 10 percent of total lane-miles • Reduce share of transit assets past their useful life to 0 percent (Note: Baseline year is 2012.)

*Unless noted, the Performance Target increases or reductions are for 2040 compared to a year 2005 baseline.

Taking Equity Into Account

In addition to assessing Plan Bay Area's impact on the 10 adopted targets, which collectively cover a wide range of issues and policies, MTC and ABAG also made a special effort to gauge the effects of Plan Bay Area on the region's low-income and minority populations. Indeed, a commitment to achieving equity in the long-range planning process is a key element of Plan Bay Area's performance-based approach. MTC and ABAG staff prepared an Equity Analysis to evaluate quantitative measures of equity concerns. Aspects of this analysis serve both to satisfy MTC's federal requirements with respect to the metropolitan planning process, as well as Plan Bay Area's objective to advance equity in the region.

The Equity Analysis identifies "communities of concern" in the region with concentrations of socioeconomically disadvantaged or vulnerable populations. MTC developed the definition of communities of concern in concert with key regional equity stakeholders, public agency staff, and community representatives, who also prioritized the equity measures based on what stakeholders believed were the region's most significant equity-related issues today and in the context of future growth: affordability, equitable growth, healthy communities, access to jobs, and equitable mobility for all system users. Guided by these priorities, MTC staff developed the set of five equity performance measures displayed in Table 5.

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TABLE 5: Plan Bay Area Equity Performance Measures

	Equity Issue	Performance Measure
1	**Housing and Transportation Affordability**	% of income spent on housing and transportation by low-income households
2	**Potential for Displacement**	% of rent-burdened households in high-growth areas
3	**Healthy Communities**	Average daily vehicle miles traveled per populated square mile within 1,000 feet of heavily used roadways
4	**Access to Jobs**	Average travel time in minutes for commute trips
5	**Equitable Mobility**	Average travel time in minutes for non-work-based trips

Scenarios Take Aim at Targets

Plan Bay Area performance targets outline a framework that allows us to better understand how different projects and policies might affect the region's future.

Taken together, the Plan Bay Area performance targets outline a framework that allows us to better understand how different projects and policies might affect the region's future. We can compare conditions over the lifespan of the plan by measuring changes in the performance target metrics between 2005 and 2040. Because many of the targets are aspirational in nature, ABAG and MTC understood and made clear through the scenario-development process (described below) that some targets might not be achievable through Plan Bay Area. Also, and importantly, the targets were crafted to focus on desirable regional outcomes that did not preordain a specific land use pattern, transportation mode or investment strategy to reach that goal.

With the targets clearly identified, MTC and ABAG formulated possible "visioning" scenarios — combinations of land use patterns and transportation investments — that could be evaluated together to see if (and by how much) they achieved (or fell short of) the performance targets. In simplified terms, if the targets delineate the plan's aspirations, the scenarios represent possible ways to realize them. Obviously, the goal is to identify the most promising scenario, especially with respect to the attainment of the statutory requirements for greenhouse gas emission reductions and for the provision of an adequate amount of housing.

See the full Performance Assessment Report *(listed in Appendix 1) for detailed information on the scenario evaluation process.*


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> MTC and ABAG staff developed a second set of scenarios, relying on input from the public, cities and counties, and transportation agencies.

Visioning Scenarios

The transportation and land use alternative included in this Plan Bay Area resulted from three rounds of scenario analyses. (For a helpful flow-chart graphic of this process, see pages 24–25.) In early 2011, two potential land use patterns were developed by ABAG staff: “Current Regional Plans,” which reflected cities’ current general plans and visions for growth; and an “Initial Vision Scenario,” a hypothetical growth pattern put forward by ABAG staff with input from local governments and county congestion management agencies. As depicted in Table 6, each land use pattern was paired with the transportation network contained in the Transportation 2035 Plan (adopted in 2009) and tested to yield a set of both target and equity performance results. These scenario results provided a starting point for a first round of visioning conversations with local governments and Bay Area residents about where new development should occur, and how new long-term transportation investments might serve this new growth.

Alternatives to the Visioning Scenarios

Over the winter of 2011–12, MTC and ABAG staff developed a second set of scenarios, relying on input from the public, cities and counties, and transportation agencies. These scenarios included a wider range of alternative land use patterns as the basis for expanding the regional dialogue on the type of development, planning strategies and investments that would be best for Plan Bay Area. Five land use patterns were identified, and each was matched with one of two proposed transportation networks — the Transportation 2035 Network (i.e., the 2009 long-range plan) or a Core Capacity Transit Network — based on which best supported the pattern of development. These combinations were then separately evaluated against the performance targets, and against the five social equity measures discussed elsewhere in this chapter. See Table 7 for the specific scenario pairings.

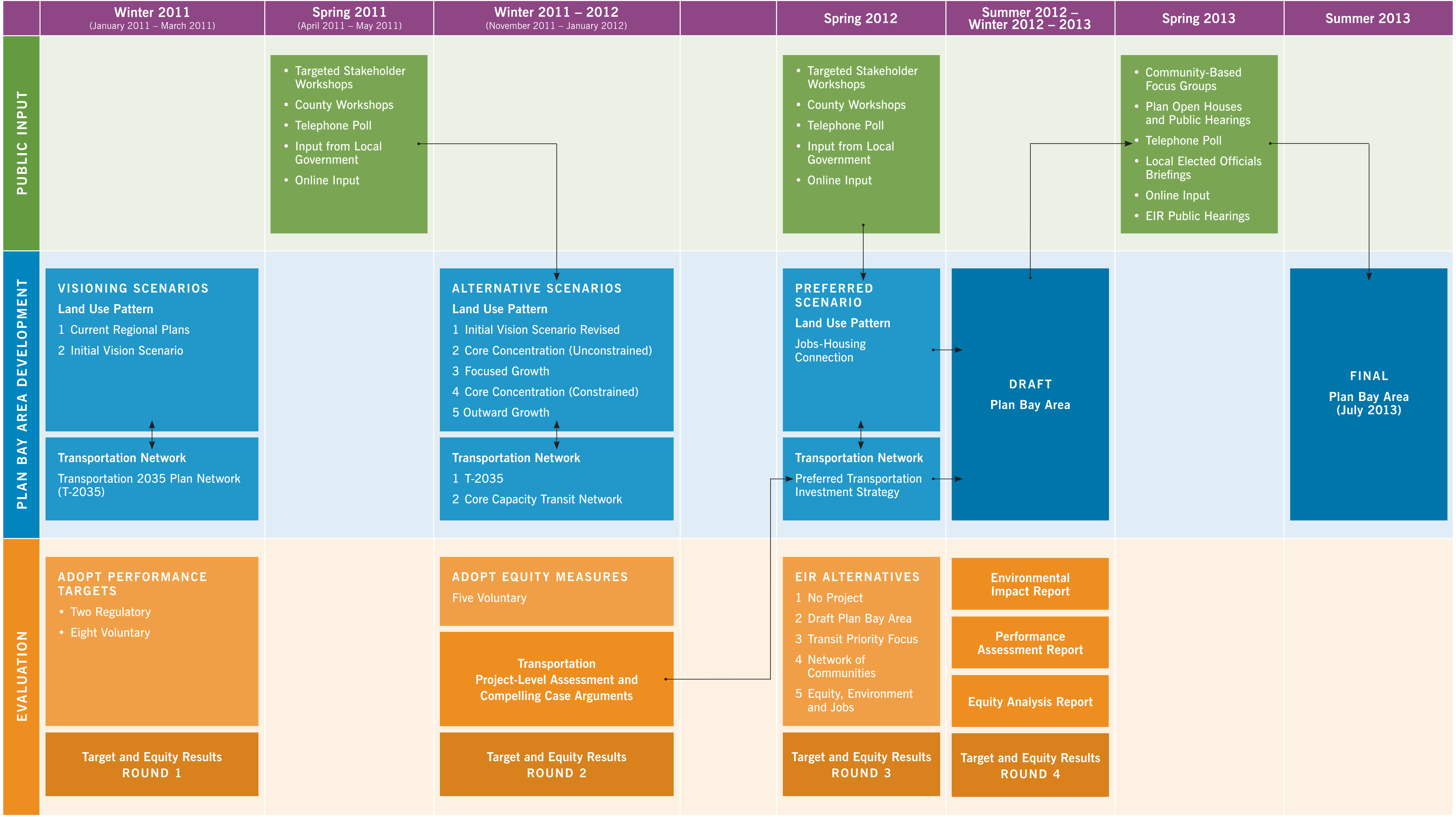
TABLE 6: Visioning Scenarios

Land Use Patterns	Transportation Network
Current Regional Plans • Generally reflects cities’ current general plans for lower amounts of growth. • Growth includes 634,000 new housing units and 1.1 million new jobs.	**Transportation 2035 Plan Network (T-2035)** • Network is the multimodal investment strategy in the Transportation 2035 Plan. • Contains significant funding for operations and maintenance of the existing system; limited expansions of highway and transit networks.
Initial Vision Scenario • Growth pattern developed with input from local governments and county congestion management agencies. • Land uses based on Priority Development Areas and Growth Opportunity Areas. • Growth includes 902,000 new housing units and 1.2 million new jobs.	

TABLE 7: Alternatives to the Visioning Scenarios

Land Use Patterns	Transportation Networks
Initial Vision Scenario Revised • Concentrates housing and job growth in Priority Development Areas (PDAs).	**Transportation 2035 (T-2035) Plan Network** • Network is the multimodal investment strategy in the Transportation 2035 Plan. • Contains significant funding for operations and maintenance of existing system; limited expansions of highway and transit networks.
Core Concentration (Unconstrained) • Concentrates housing and job growth in locations served by frequent transit service, and/or in core Bay Area locations within a 45-minute transit commute area of downtown San Francisco, downtown Oakland or downtown San Jose. • Scenario is “unconstrained” due to the high levels of population and job growth that were assumed.	**Core Capacity Transit Network** • Significantly increases transit service frequencies along core transit network. • Keeps T-2035 investment levels for maintenance and bike/pedestrian projects; reduces T-2035 roadway expansion investments. • Requires additional capital and operating funds to pay for major expansion of transit services.
Core Concentration (Constrained) • Similar to unconstrained version above; housing and job growth is distributed to selected PDAs in the inner Bay Area, focusing on major downtowns and areas along the region’s core transit network. • Scenario is “constrained” with lower levels of population and job growth relative to Initial Vision Scenario (Revised) and Core Concentration (Unconstrained).	
Focused Growth • Growth is distributed more evenly along transit corridors and job centers, with emphasis on development in PDAs and Growth Opportunity Areas (potential locations for focused growth outside already established PDAs).	
Outward Growth • Distributes greater amounts of growth to the inland Bay Area, with some emphasis on focused growth near suburban transit hubs. Scenario is closer to historical trends than the other land use options considered.	**T-2035 Network** See description above.

FIGURE 3: Plan Bay Area Development Process



	Winter 2011 (January 2011 – March 2011)	Spring 2011 (April 2011 – May 2011)	Winter 2011 – 2012 (November 2011 – January 2012)		Spring 2012	Summer 2012 – Winter 2012 – 2013	Spring 2013	Summer 2013
PUBLIC INPUT		• Targeted Stakeholder Workshops • County Workshops • Telephone Poll • Input from Local Government • Online Input			• Targeted Stakeholder Workshops • County Workshops • Telephone Poll • Input from Local Government • Online Input		• Community-Based Focus Groups • Plan Open Houses and Public Hearings • Telephone Poll • Local Elected Officials Briefings • Online Input • EIR Public Hearings	
PLAN BAY AREA DEVELOPMENT	**VISIONING SCENARIOS** **Land Use Pattern** 1 Current Regional Plans 2 Initial Vision Scenario **Transportation Network** Transportation 2035 Plan Network (T-2035)		**ALTERNATIVE SCENARIOS** **Land Use Pattern** 1 Initial Vision Scenario Revised 2 Core Concentration (Unconstrained) 3 Focused Growth 4 Core Concentration (Constrained) 5 Outward Growth **Transportation Network** 1 T-2035 2 Core Capacity Transit Network		**PREFERRED SCENARIO** **Land Use Pattern** Jobs-Housing Connection **Transportation Network** Preferred Transportation Investment Strategy	**DRAFT** **Plan Bay Area**		**FINAL** **Plan Bay Area (July 2013)**
EVALUATION	**ADOPT PERFORMANCE TARGETS** • Two Regulatory • Eight Voluntary **Target and Equity Results ROUND 1**		**ADOPT EQUITY MEASURES** Five Voluntary **Transportation Project-Level Assessment and Compelling Case Arguments** **Target and Equity Results ROUND 2**		**EIR ALTERNATIVES** 1 No Project 2 Draft Plan Bay Area 3 Transit Priority Focus 4 Network of Communities 5 Equity, Environment and Jobs **Target and Equity Results ROUND 3**	**Environmental Impact Report** **Performance Assessment Report** **Equity Analysis Report** **Target and Equity Results ROUND 4**		

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Preferred Scenario

In the spring of 2012, after conducting a second round of outreach to the public, local transportation agencies, cities and counties, and other stakeholders, ABAG and MTC developed the Jobs-Housing Connection Strategy. This land use scenario placed 78 percent of residential growth and 62 percent of job growth in Priority Development Areas throughout the region.

Drawing on the same outreach process and the results of a project-level transportation performance assessment (see Chapter 5), the two agencies also developed the Preferred Transportation Investment Strategy. The Jobs-Housing Connection Strategy and the Preferred Transportation Investment Strategy (displayed in Table 8) combined to form the draft Plan Bay Area, which was released in March 2013. The final Plan Bay Area was adopted by MTC and ABAG in July 2013. The main components of the plan are described in detail in chapters 3 and 4. The Plan Bay Area performance results are presented in Chapter 5.

TABLE 8: Preferred Scenario (Plan Bay Area)

Land Use Pattern	Transportation Network
Jobs-Housing Connection Strategy • Focuses 78 percent of new housing and 62 percent of new jobs in Priority Development Areas. • Reduces greenhouse gas emissions, limits growth outside of the region's core, and preserves natural resources and open space.	**Preferred Transportation Investment Strategy** • Devotes 87 percent of funding to operate and maintain existing transportation network. • Directs remaining funding to next-generation transit projects and other high-performing projects; to programs aimed at supporting focused growth and reducing GHG emissions; and to county-level agencies for locally designated priorities.

Karl Nielsen

Plan Bay Area Prompts Robust Dialogue on Transportation and Housing

Developing a multibillion dollar, long-range plan for the nine-county San Francisco Bay region is not a simple task. It is a three-year process involving four regional agencies, nine counties, 101 towns and cities, elected officials, planners, community-based organizations, the public and other stakeholders. The many moving parts include statutory and voluntary requirements, goal-setting, financial projections, calls for projects, project evaluation, forecasting, measuring, methodologies and more. Despite all this complexity, public participation is critical to ensure an open, democratic process, in which all interested residents have the opportunity to offer input and share their vision for what a vibrant, livable Bay Area will look like decades from now.

Early on in the development of Plan Bay Area, MTC and ABAG set benchmarks for involving a broad cross-section of the public. With hundreds of meetings completed and thousands of comments logged, the agencies can point to a number of indicators that show an active process. Full details are included in supplementary reports, *Plan Bay Area Public Outreach and Participation Program* (multiple volumes, listed in Appendix 1) and *Government to Government Consultation with Native American Tribes*.

- Three statistically valid telephone polls conducted in 2011, 2012 and 2013 reached out to some 5,200 Bay Area residents from all nine counties.
- Twenty-nine well-attended public workshops or hearings (at least three in each Bay Area county) attracted over 3,000 residents. A vocal contingent of participants at the public meetings expressed strong opposition to regional planning in general and to Plan Bay Area in particular.
- Eight public hearings were held in 2012 and 2013 in conjunction with development and review of the companion Plan Bay Area Draft Environmental Impact Report (DEIR) and drew another 400 participants.
- MTC and ABAG developed partnerships with community organizations in low-income communities and communities of color to conduct community surveys (1,600 completed surveys in spring 2011; 10 focus groups with 150 participants in winter 2012; and an additional 12 focus groups conducted in the spring of 2013 with 180 participants).
- Throughout the planning process, ABAG and MTC hosted meetings with local elected officials, local planning directors and officials from congestion management and transit agencies.
- An active web and social media presence resulted in some 356,000 page views by 66,000 unique visitors to the OneBayArea.org website since its launch in April 2010, and some 1,300 individuals participated in a January 2012 "virtual public workshop." Another 90 comments were submitted on the draft plan via an interactive online comment forum.
- Release of the draft plan and DEIR drew 1,250 residents to county-based meetings that included an "open house" where participants could view displays and ask questions, followed by a public hearing. A total of 385 people spoke, and another 140 completed comment forms provided at the public hearings.
- A total of 587 letters and emails were submitted on the draft plan and DEIR. All correspondence, public hearing transcripts and comment forms can be viewed at **OneBayArea.org**.

2

The Bay Area in 2040

Noah Berger

Noah Berger

Chapter 2

The Bay Area in 2040

The Association of Bay Area Governments and the Metropolitan Transportation Commission track and forecast the region's demographics and economic trends to inform and guide Plan Bay Area investments and policy decisions.

The forecasts highlighted in this chapter reflect the best picture we have of what the Bay Area may look like in 2040, so that today's decisions align with tomorrow's expected transportation and housing needs. These forecasts form the basis for developing the regional land use plan and transportation investment strategy for Plan Bay Area.

This chapter explains the process used to develop the Plan Bay Area growth forecasts, and it describes the most recent planning assumptions used to develop the forecasts, including local general plans and other factors. It also looks at three main demographic categories that informed development of the plan: employment, population and housing.

Transbay Joint Powers Authority

What the Forecasts Tell Us:

- Between 2010 and 2040, the nine-county San Francisco Bay Area is projected to add 1.1 million jobs, 2.1 million people and 660,000 homes, for a total of 4.5 million jobs, 9.3 million people and 3.4 million homes.
- Substantial shifts in housing preferences are expected as the Bay Area population ages and becomes more diverse.
- As the Bay Area continues to recover from the lingering effects of the Great Recession, certain economic trends and indicators will likely rebound. For example, strong job growth is expected in the professional services, health and education, and leisure and hospitality sectors. Early indicators also suggest that the regional housing market is showing signs of recovery.

Forecasting the Region’s Population, Employment and Housing

The Association of Bay Area Governments employed the Center for Continuing Study of the California Economy (CCSCE) to provide national, state and regional employment and population forecasts. The agency also hired Karen Chapple of the University of California, Berkeley, to provide a housing analysis and estimates as inputs to the ABAG housing forecast. The Metropolitan Transportation Commission employed the consulting firm Strategic Economics to provide industry-sector locational preferences, which were used as inputs to the ABAG land use forecast and Sustainable Communities Strategy.

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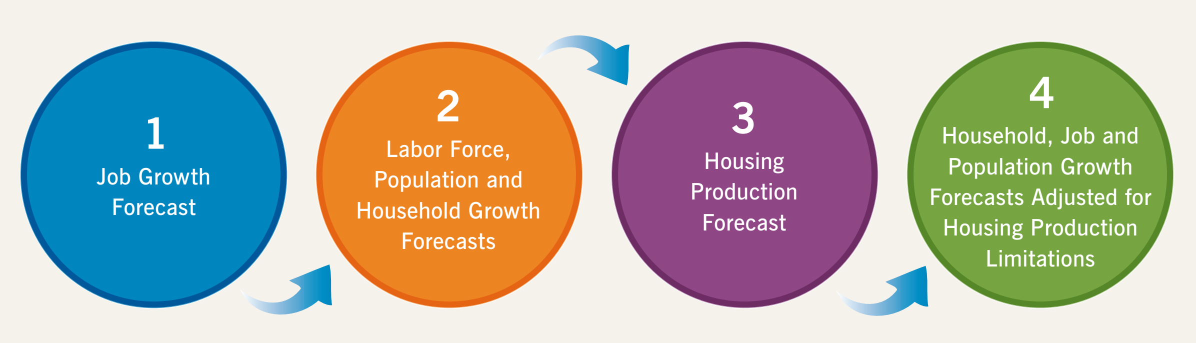
FIGURE 4: **Four-Step Process for Developing Bay Area Demographic Forecasts**



A Four-Step Process

The Association of Bay Area Governments developed the demographic forecasts by following four steps (Figure 4):

1. **Potential Job Growth:** Job growth by 2040 for the Bay Area was estimated as a share of the U.S. Bureau of Labor Statistics’ national growth projections, reflecting the difference in 2010 between national and regional labor force participation in various economic sectors, such as the professional services and retail sectors. This analysis was performed by the Center for Continuing Study of the California Economy.
2. **Potential Population and Household Growth:** The job growth forecast determines the population and number of households, as well as household income levels. ABAG, in consultation with CCSCE, translated the Bay Area job growth projection into labor force, total population and household forecasts. These forecasts were based on labor force participation rates and the number of persons per household by age and race cohorts.
3. **Housing Production:** ABAG, in consultation with Prof. Karen Chapple at UC Berkeley, estimated regional housing production by 2040 based on past housing production levels, projected household income, and new policies and programs to support housing production in Priority Development Areas (PDAs).
4. **Feasible Job, Population and Household Growth:** ABAG adjusted for housing production limitations by 2040 that influence the number of workforce households that can be accommodated in the region. These housing production limitations, in turn, limit job growth in the region and reduce total population growth.

Assumptions

The overall regional growth forecast for Plan Bay Area relies on the following main assumptions:

- The Bay Area and national economies will be healthy, with an average unemployment rate of 5 percent or less and reasonably sufficient housing production for the workforce.
- A stronger link will be made between jobs and housing in locations sought by the workforce.
- Adjustments to the job growth forecast are needed to account for the region’s expected level of housing production given historic trends and the constraints of an infill growth development pattern.
- The region will continue to receive historical levels of public funding for housing production.

For additional technical information on the regional forecasting methodology and distribution, see the Forecast of Jobs, Population and Housing, *listed in Appendix 1.*

Snapshot of the Bay Area, 2010–2040

By 2040 the San Francisco Bay Area is projected to add 2.1 million people, increasing total regional population from 7.2 million to 9.3 million, an increase of 30 percent or roughly 1 percent per year. This growth means the Bay Area will continue to be California's second-largest population and economic center. Two major demographic changes shape the forecast of household and job growth: the increase in the senior population and the increase in the Latino and Asian populations. The number of jobs is expected to grow by 1.1 million between 2010 and 2040, an increase of 33 percent. During this same time period the number of households is expected to increase by 27 percent to 700,000, and the number of housing units is expected to increase by 24 percent to 660,000. (See Table 9.) While robust, this projected rate of growth is actually slower than other metropolitan regions in California and also is slower than the Bay Area's pace of growth in the 1970s and 1980s.

Karl Nielsen

Population Forecast

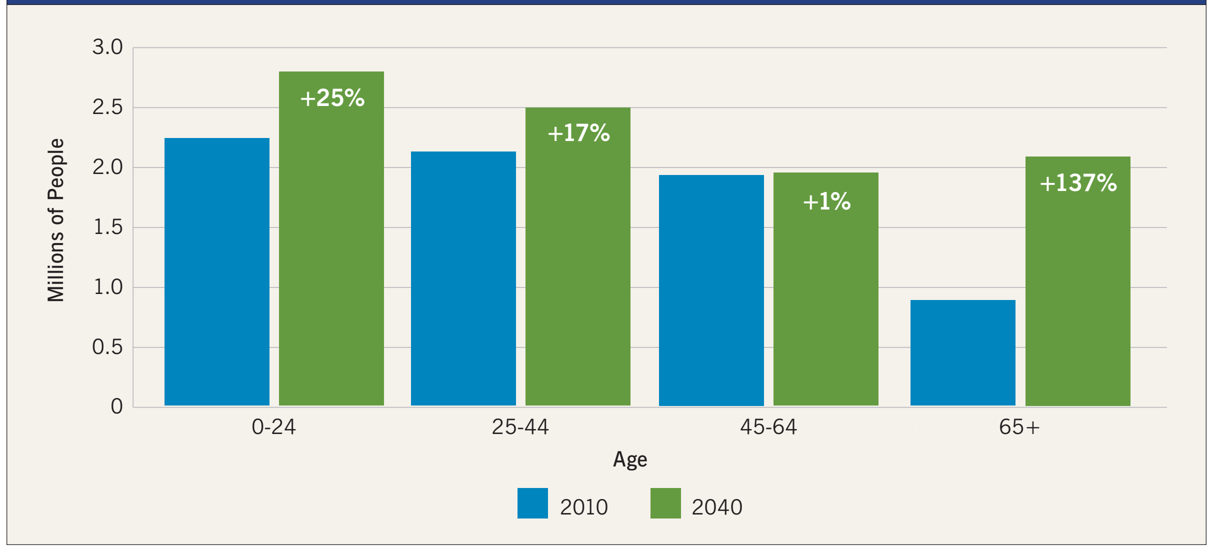
The population forecast was derived from ABAG's job growth forecast. (See "Employment Forecast," page 34.) It also analyzed the existing population and its labor force participation rates by age cohort and race. Beyond births and deaths, it was assumed that the rate of in-migration to the region will remain the same from 2010 to 2040. Incentives to produce housing close to job centers will result in some increases in the number of households and total population. (For population growth by county, see Table 12, page 40.)

TABLE 9: Bay Area Population, Employment and Housing Projections, 2010–2040

Category	2010	2040	Growth 2010–2040	Percent Change 2010–2040
Population	7,150,740	9,299,150	2,148,410	+30%
Jobs	3,385,300	4,505,220	1,119,920	+33%
Households	2,608,020	3,308,110	700,090	+27%
Housing Units	2,785,950	3,445,950*	660,000	+24%

*2010 and 2040 values include seasonal housing units.
Source: ABAG, 2013

FIGURE 5: Bay Area Population by Age, 2010 and 2040



Sources: 2010 Census, California Department of Finance, ABAG

Aging Baby Boomers

Between 2010 and 2040 the Bay Area's population is expected to grow significantly older. Today, people who are 65 and over represent 12 percent of the total population, but by 2040 the share will increase to 22 percent. Put another way, the number of seniors will more than double from under 900,000 today to nearly 2.1 million by 2040. (See Figure 5.) By contrast, the segment of population aged 45–64 will grow by less than 1 percent, and will shrink from 27 percent of the total population today to 21 percent by 2040. The projected increase in the senior population will cause the overall labor force participation rate to fall, even as more people work beyond the age of 65. By 2040, 50 people out of every 100 in the Bay Area are projected to be in the labor force, compared to 52 people out of 100 in 2010.

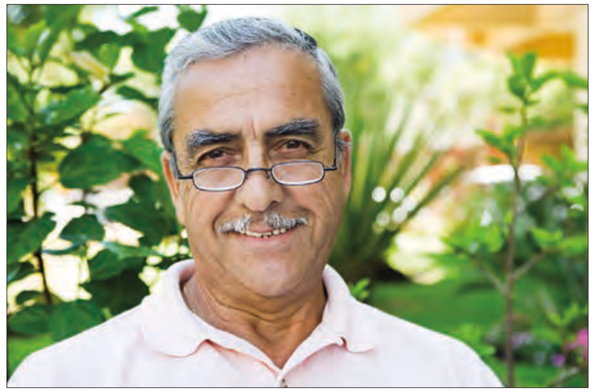


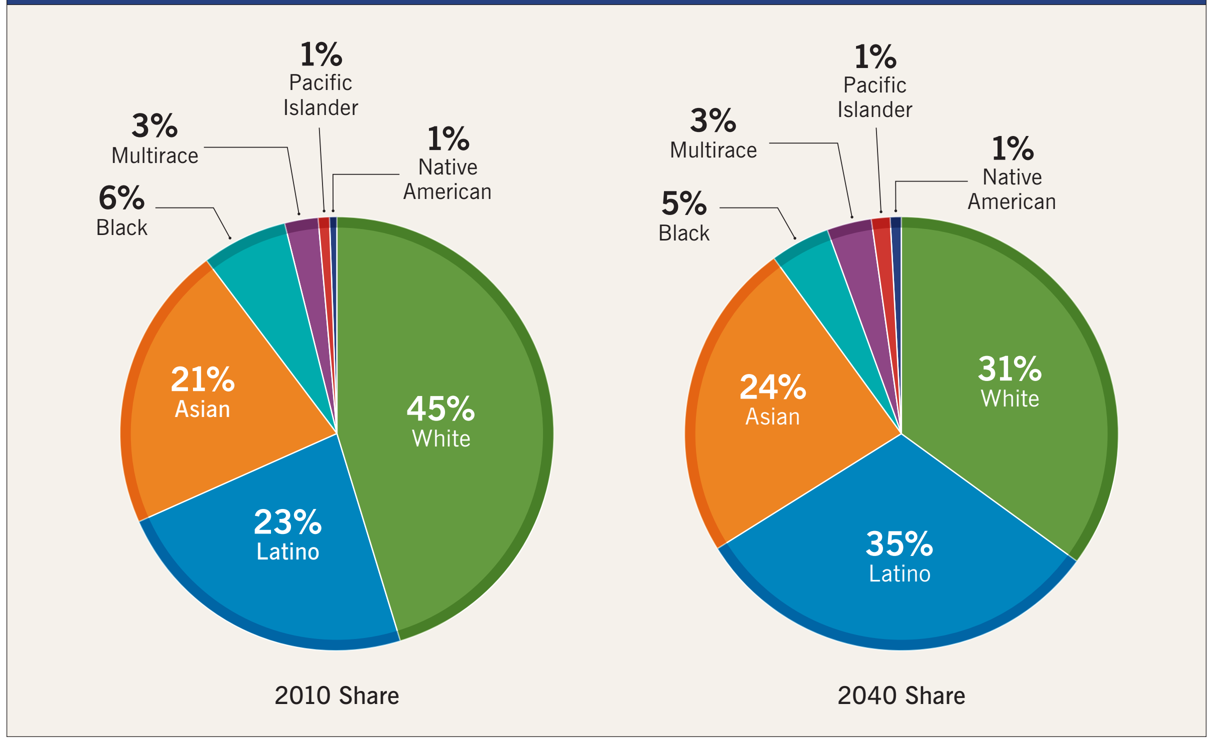
Image Source

Younger-age segments of the population will increase in size substantially, but will represent a slightly smaller share of total population in the future due to the large number of aging baby boomers. The number of people aged 25–44 will increase by 17 percent or nearly 370,000, while the number of people aged 24 and younger will increase by 25 percent or over 550,000.

Increased Racial and Ethnic Diversity

By 2040 the population will become substantially more racially and ethnically diverse. (See Figure 6). Latinos will emerge as the largest ethnic group, increasing from 23 percent to 35 percent of the total population. The number of Asians also will increase, growing from 21 percent to about 24 percent of the population. According to the California Department of Finance, the Latino and Asian populations also form multigenerational households at a higher rate than the general population. (See "Housing Forecast," page 38.)

FIGURE 6: **Bay Area Population by Race/Ethnicity, 2010 and 2040**



Sources: 2010 Census, California Department of Finance, ABAG

In contrast, the share of non-Hispanic whites will drop sharply from approximately 45 percent of today's population, to about 31 percent in 2040. The African-American segment of the population also is expected to decline slightly, dropping from 6 percent to 5 percent, while other demographic groups are expected to maintain a similar share of the population in the future as they do today.

Employment Forecast

The Association of Bay Area Governments forecasted regional employment by industry sector utilizing an analysis of the Bay Area's competitiveness by industry in relation to the state and national growth forecast conducted by CCSCE. The analysis took into account the Bay Area's concentration of knowledge-based industries, research centers and universities; the presence of a highly educated and international labor force; expanding international networks serving the global economy; and the overall diversity of the regional economy.

Lawrence Migdale

These fundamental assets underpinning the Bay Area economy still are strong. While it is true that the region has not recovered all jobs lost since the "dot-com bubble" popped in 2000, the so-called "jobless growth" of the last decade was a national phenomenon not limited to the Bay Area. Furthermore, various parts of the regional economy are on the mend. For example, the Bay Area led California job growth in 2012 with 91,400 new jobs, a nearly 3 percent increase from 2011 and more than twice the nationwide average, according to Bloomberg News ("Google, Facebook lead Bay Area jobs," Jan. 27, 2013). Based on the above factors and strong fundamentals, Bay Area employment is forecast to grow at a slightly faster rate than that of the nation as a whole.

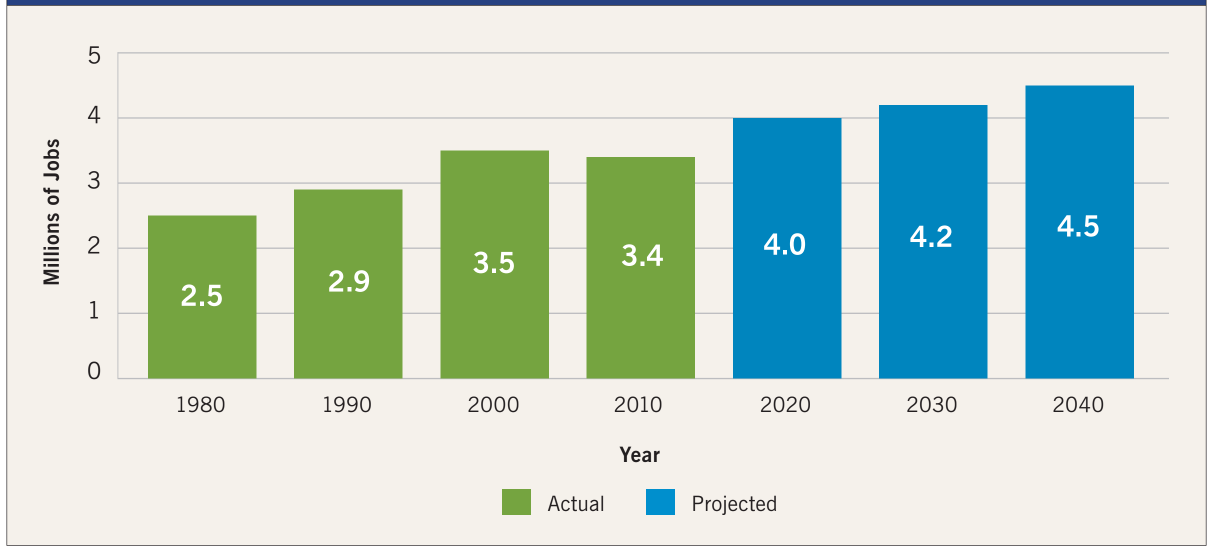
Substantial numbers of jobs are expected to be created between 2010 and 2040 (Figure 7). More than half of the projected 1.1 million new jobs are expected to be created between 2010 and 2020, which includes the recovery of close to 300,000 jobs lost during the Great Recession that began in 2007. The gain of 1.1 million jobs does not translate directly into new office, commercial or industrial construction. About one-third of these jobs could potentially be accommodated within existing offices and facilities, given current vacancy rates. Many of these jobs are expected to be filled by currently unemployed or underemployed individuals. From 2020 to 2040, the rate of job growth is forecast to slow in comparison to the 2010–2020 period.

The job growth forecast was adjusted based on the difficulties in supplying sufficient housing in the Bay Area to meet the need for workforce housing within reasonable commute times. The historic imbalances in the Bay Area housing market have resulted in excessively high housing prices in locations close to job centers. Employers have consistently cited these imbalances as the most difficult aspect of recruiting and retaining high-quality employees in the region.

Employment Growth Highest in Professional Services, Health and Education, and Leisure and Hospitality Economic Sectors

Major industry job trends in the Bay Area over the next 30 years are expected to largely mirror national trends. Nearly 73 percent of total employment growth is projected to be in the professional services,

FIGURE 7: **Total Regional Employment, 1980–2040**



Sources: 1980 Census, California Department of Finance (1990–2000), ABAG (2010–2040)

The Bay Area led California job growth in 2012 with 91,400 new jobs, a nearly 3 percent increase from 2011.

health and education, and leisure and hospitality sectors. The national trends of slower growth in retail and finance are also expected in the Bay Area. Construction jobs are expected to almost regain pre-recession levels by 2020 and to increase by 2040. Although this is a substantial gain compared to 2010, it is driven primarily by a slow return to more normal construction levels in the region. Manufacturing jobs are projected to remain more or less stable through 2040. (See Table 10.)

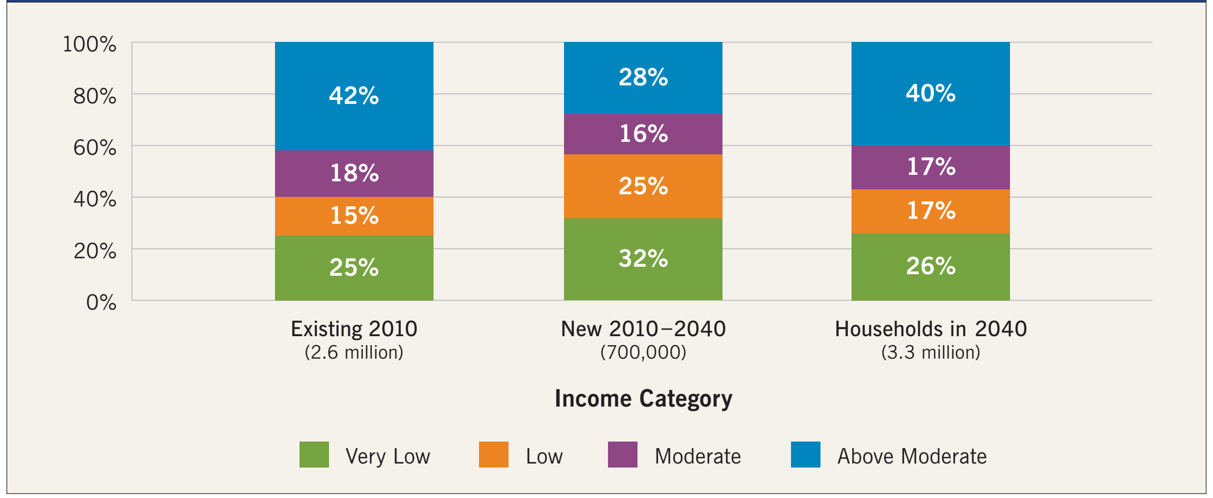
Industry sectors contain a wide spectrum of wages, which correspond to the skill levels and training needed for different occupations. This is especially true for the two sectors with the highest projected growth: professional services and health and education. For example, fewer than half the jobs in professional services require the higher levels of education and specialization that one might consider typical for this sector. The construction, manufacturing and wholesale sectors have significant numbers of jobs in middle-income occupations, while the leisure and hospitality (which includes hotels) and retail sectors have higher shares of low-income jobs. While there are substantial opportunities in fast-growing sectors with large numbers of high-income jobs, these sectors also will create middle- and low-income jobs. For example, the professional services sector will create both high-income jobs, such as a vice president of sales, and lower-income jobs, such as a file clerk.

TABLE 10: Bay Area Employment by Sector, 2010–2040, Ranked by Job Growth

Sector	2010	2040	Growth (Loss) 2010–2040	Percent Change 2010–2040
Professional Services	596,700	973,600	376,900	+63%
Health and Education	447,700	698,600	250,900	+56%
Leisure and Hospitality	472,900	660,600	187,600	+40%
Construction	142,300	225,300	82,900	+58%
Government	499,000	565,400	66,400	+13%
Retail	335,900	384,400	48,500	+14%
Finance	186,100	233,800	47,700	+26%
Information	121,100	157,300	36,300	+30%
Transportation and Utilities	98,700	127,400	28,600	+29%
Manufacturing and Wholesale	460,200	456,100	(4,100)	-1%
Agriculture and Natural Resources	24,600	22,700	(1,900)	-8%
All Jobs	**3,385,300**	**4,505,200**	**1,119,900**	**+33%**

Sources: California Center for Continuing Study of the California Economy, ABAG

FIGURE 8: Bay Area Households by Income Category, 2010–2040



Sources: U.S. Census; Karen Chapple and Jacob Wegmann, *Evaluating the Effects of Projected Job Growth on Housing Demand*, 2012

Household Income Forecast

The household income forecast was based on projected jobs by sector, associated occupations and wages, and trends in the geographic distribution of households by income level over the past several decades. Wages were calculated based on the occupations within each industry group. Other income, such as capital gains from stock market investments, was estimated from state and national forecasts as well as from past regional trends. The geographic distribution of households by income was estimated from the U.S. Census.

Today, about 40 percent of the existing 2.6 million households in the Bay Area (or just over 1 million) fall into the very-low and low-income groups, according to U.S. Census figures. Due to the growth in leisure and hospitality, retail and other low-income jobs (see Table 10), the number of people in very-low and low-income groups is projected to increase from 40 percent of households to 43 percent of households by 2040, while those in the moderate and above-moderate categories will decrease from 60 percent to 57 percent of households (see Figure 8).

Noah Berger

Noah Berger

Housing Forecast

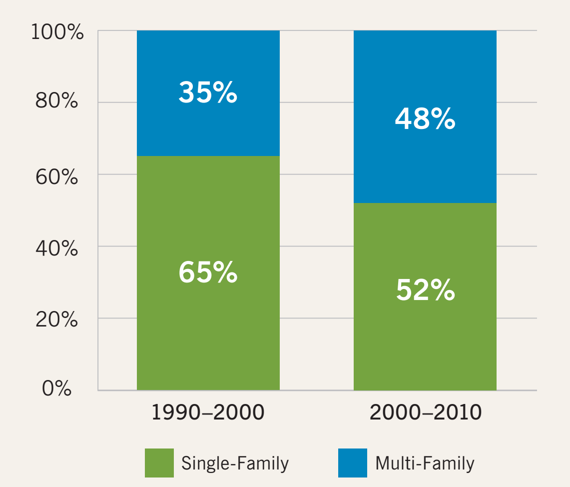
The Association of Bay Area Governments based its housing production forecast on expected household income and demand, past housing production trends, and local plans (including planned zoning changes). It also assumed the following:

- Existing policies and programs to produce housing will be retained and enhanced.
- A replacement mechanism will be found to fund and implement many of the functions that were performed by California redevelopment agencies before Gov. Jerry Brown signed legislation abolishing those agencies in June 2011.
- Some aging baby boomers will move to residential care facilities or other group housing.
- An estimated 40,000 vacant or foreclosed homes will be reabsorbed into the region's housing supply.

Demand for Multi-Unit Housing in Urban Areas Close to Transit Expected to Increase

The Bay Area has produced an average of just over 23,000 housing units annually since the 1980s. Single-family homes represent the majority of housing production in recent decades. Most of these homes were built on undeveloped land in suburban locations that provided housing for the post-war baby boom generation and their families. However, according to the Urban Land Institute's *What's Next? Real Estate in the New Economy* (2011), recent trends suggest that cities once again are becoming centers of population growth, including in the Bay Area. On average, construction of multifamily housing in urban locations in the Bay Area increased from 35 percent of total housing construction in the 1990s to nearly 50 percent in the 2000s (see Figure 9), and in the year 2010 it represented 65 percent of all housing construction.

FIGURE 9: Bay Area Housing Construction By Type, 1990–2010



Source: U.S. Census

Bay Area Housing Market Appreciation

In January 2013 the real estate information service Zillow analyzed 30 metropolitan housing markets nationwide. It predicted that the San Francisco and San Jose metro areas will be among the top markets experiencing home value appreciation in 2013. Zillow ranked the San Francisco metro area (including San Francisco, Marin, San Mateo, Alameda and Contra Costa counties) number four in the country for potential home value appreciation and predicted that median home prices will rise by 7 percent in 2013. Zillow ranked the San Jose metro area number seven and predicted that median home prices will also rise by 7 percent. Although these predicted growth rates are slower than housing market appreciation in 2012, they suggest that Bay Area homeowners will continue to benefit — and Bay Area homebuyers will continue to struggle — due to high housing costs.

TABLE 11: Top U.S. Markets for 2013 Home Value Appreciation

Metro area	Median home value December 2012	Change from December 2011	2013 appreciation forecast
Riverside	$197,400	9.3%	12.5%
Sacramento	225,200	11.7%	11.9%
Phoenix	157,800	22.5%	8.5%
San Francisco*	526,200	14.0%	7.3%
Los Angeles	414,900	7.9%	7.3%
San Diego	373,400	10.0%	6.7%
San Jose	630,800	15.4%	6.6%
Seattle	270,500	6.5%	4.6%
Nationwide	**$157,400**	**5.9%**	**3.3%**

*Includes San Francisco, Marin, San Mateo, Alameda and Contra Costa counties.
Source: *San Francisco Chronicle*, "Zillow expects home values in San Francisco to grow but also slow," January 22, 2013.

Based upon the emerging demographic changes and employment growth forecasts previously discussed, an annual average of approximately 22,000 units or 660,000 new homes are forecast to be constructed by 2040. Demand for multifamily housing is projected to increase as seniors downsize and seek the greater access to shops and services that urban locations provide. Market demand for new homes will tilt toward townhomes, condominiums and apartments in developed areas. These homes are typically closer to transit, shops and services than are homes in the single-family developments of earlier decades.

Market demand for housing near transit also is expected to increase. According to the University of Southern California Population Dynamics Research Group's *The 2010 Census Benchmark for California's Growing and Changing Population* (2011), people aged 55 and over are more likely to prioritize public transportation, walking, access to shops and services, and multifamily housing than do other age groups. Young singles prefer similar locations

TABLE 12: Population Growth by County, 2010–2040

County	2010	2040	Percent
Alameda	1,510,270	1,987,950	32%
Contra Costa	1,049,030	1,338,440	28%
Marin	252,410	285,400	13%
Napa	136,480	163,680	20%
San Francisco	805,240	1,085,730	35%
San Mateo	718,450	904,430	26%
Santa Clara	1,781,640	2,423,470	36%
Solano	413,340	511,600	24%
Sonoma	483,880	598,460	24%
Total*	**7,150,740**	**9,299,150**	**30%**

*Sum of county totals may not match regional totals due to rounding.
Source: ABAG, 2013

with urban amenities, and they prioritize short commutes. These demographic changes represent substantial shifts that are expected to contribute to the Bay Area's recovery from the Great Recession. For example, the regional real estate market already is showing signs of recovery. (See "Bay Area Housing Market Appreciation" sidebar for more detail.)

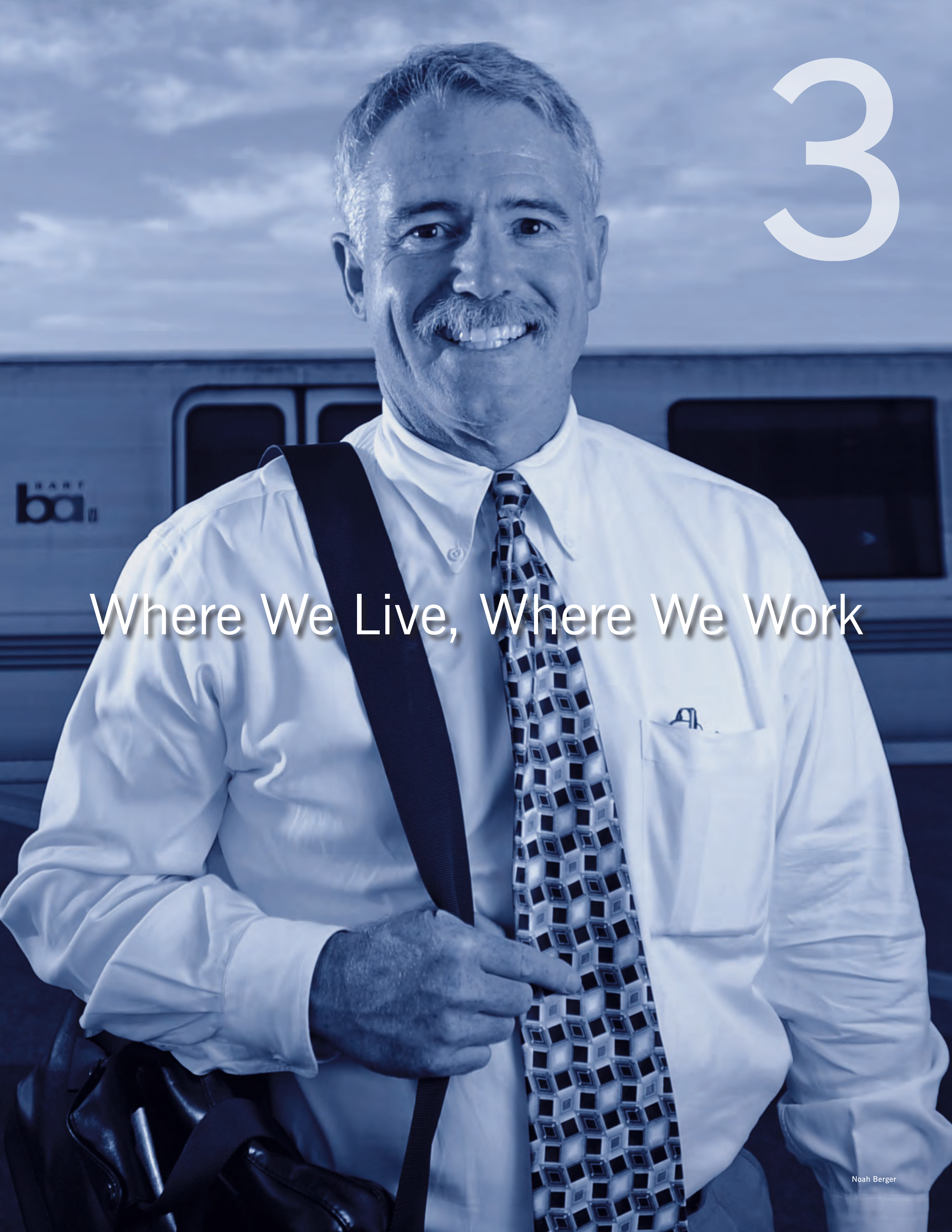
The current single-family housing stock provides a large supply relative to future demand, and an oversupply is projected by 2040. This oversupply is expected to dampen production of multifamily housing, as some households opt instead for single-family homes that are made more affordable due to the excess supply. Despite lower demand for newly constructed single-family homes, some production will occur as the Bay Area housing market gradually adjusts to these changing demographics.

Billy Hustace

Looking Ahead at Providing Housing and Mobility for Our Workforce

The demographic forecasts summarized in this chapter were used to develop the land use distribution discussed in Chapter 3. The population, employment and housing forecasts provide information to help determine how the region will house its new residents looking forward to 2040. It should be noted that Plan Bay Area and its related forecasts will be updated every four years.

The forecasts and future land use distribution also will affect Bay Area travel patterns. These patterns include who is traveling, where travelers are going, and when people are using the region's transportation system. All these factors influence how the region will house its workforce and provide transportation choices that will increase access to people's homes and jobs.



3

Where We Live, Where We Work

Noah Berger


Noah Berger

Chapter 3

Where We Live, Where We Work

ABAG and MTC developed a variety of land use and transportation scenarios that distributed the total amount of growth forecasted for the region to specific locations.

These scenarios sought to address the needs and aspirations of each Bay Area jurisdiction, as identified in locally adopted general plans and zoning ordinances, while meeting Plan Bay Area performance targets adopted by the agencies to guide and gauge the region's future growth.

The framework for developing these scenarios consisted of Priority Development Areas (PDAs) and Priority Conservation Areas (PCAs) recommended by local governments. ABAG and MTC created the scenarios through a transparent, deliberative process, during which public input was sought at every step along the way. After further modeling, analysis and public engagement, the five initial scenarios were narrowed down to a single preferred land use scenario. This scenario and resulting development pattern represent the Sustainable Communities Strategy (SCS) that Plan Bay Area must include in the Regional Transportation Plan, as mandated by Senate Bill 375.

The preferred land use scenario is a flexible blueprint for accommodating growth over the long term. Pairing this development pattern with the transportation investments and policies described in Chapter 4 is what makes Plan Bay Area the first truly integrated land use and transportation plan for the region's anticipated growth.

ABAG Archives

A More Focused Future

As required by SB 375, the land use distribution in Plan Bay Area identifies the locations that can accommodate future growth, including the scale and type of growth most appropriate for different types of locations. In order to meet the Bay Area's greenhouse gas (GHG) emissions reduction and housing targets, and to make progress toward meeting the other adopted performance targets, the plan encourages future job and population growth in established communities with access to existing or planned transportation investments. The land use pattern seeks to achieve four comprehensive objectives:

1. **Create a Network of Complete Communities** — Building on the PDA framework of complete communities that increase housing and transportation choices, the plan envisions neighborhoods where transit, jobs, schools, services and recreation are conveniently located near people's homes.
2. **Increase the Accessibility, Affordability and Diversity of Housing** — The distribution of housing in the Bay Area is critical, given its importance to individuals, communities and the region as a whole. The Bay Area needs sufficient housing options to attract the businesses and talented workforce needed for a robust future economy.
3. **Create Jobs to Maintain and Expand a Prosperous and Equitable Regional Economy** — The plan seeks to reinforce the Bay Area's role as one of the most dynamic regional economies in the United States. It focuses on expanding the existing concentration of knowledge-based and technology industries in the region, which is a key to the Bay Area's economic competitiveness.
4. **Protect the Region's Unique Natural Environment** — The Bay Area's greenbelt of agricultural, natural resource and open space lands is a treasured asset that contributes to residents' quality of life and supports regional economic development.

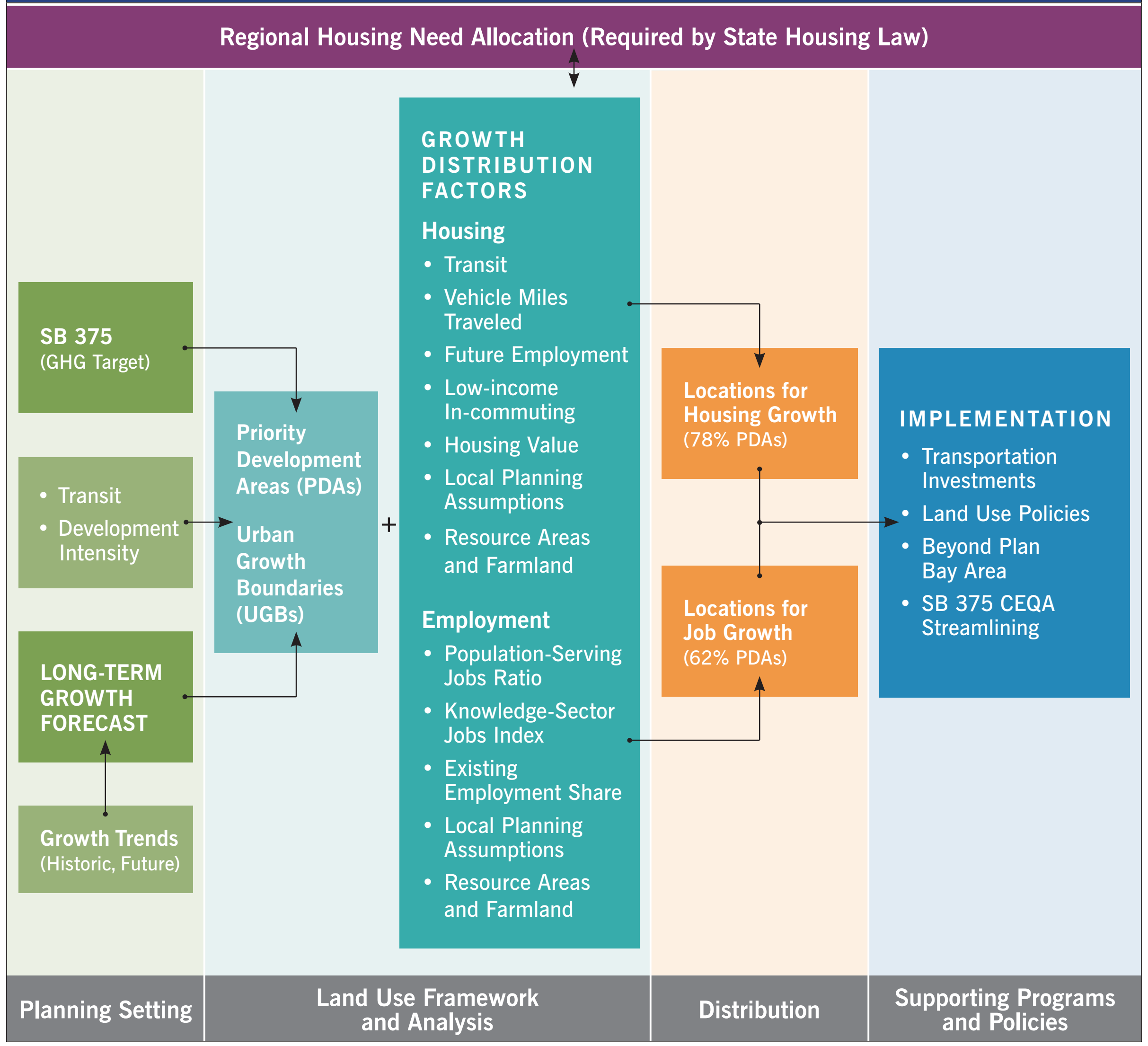
Land Use Distribution Approach

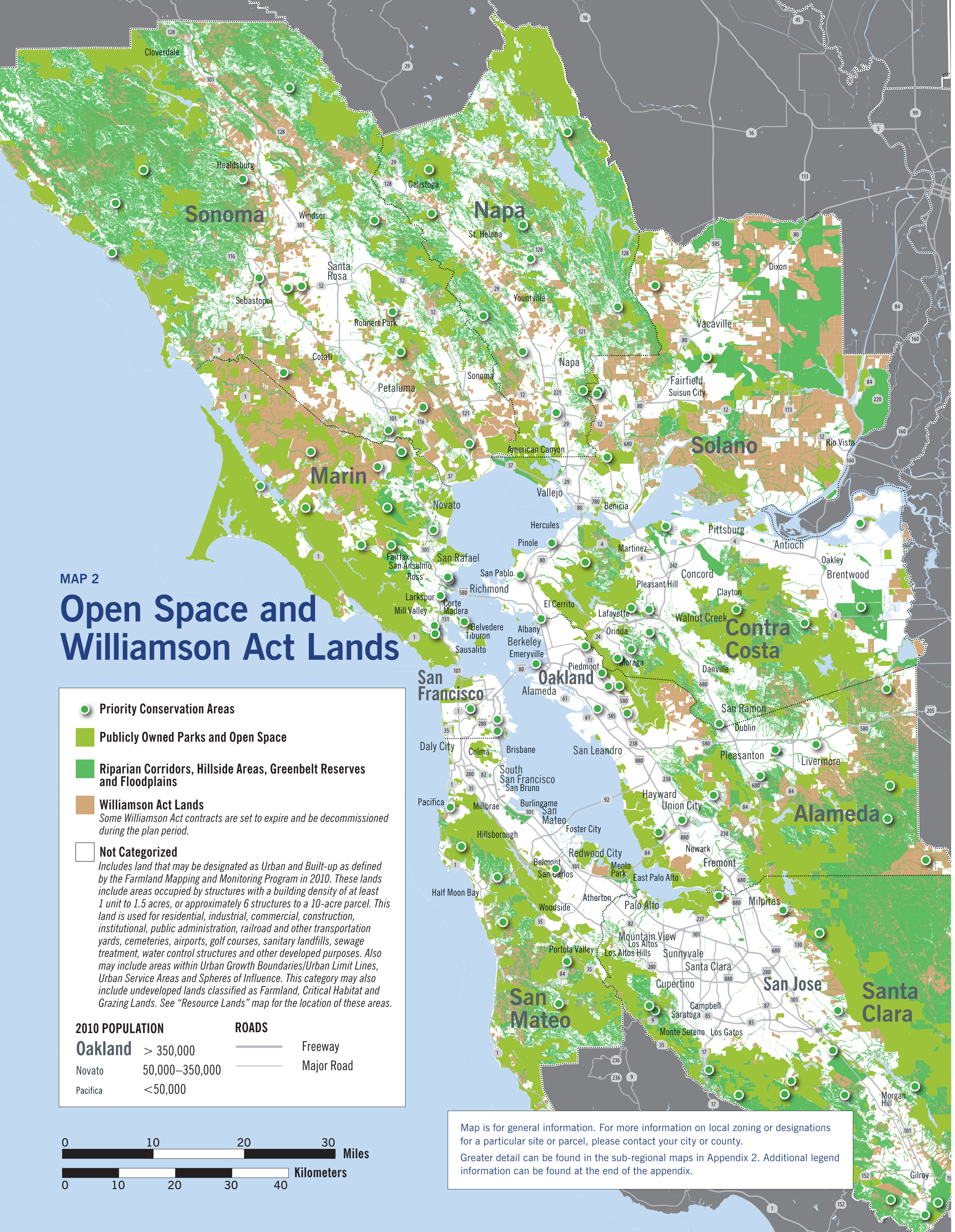
There are two main inputs for the Plan Bay Area land use distribution process (Figure 10). The first input is California Senate Bill SB 375, under which the Bay Area is required to identify a land use pattern that will:

1. **Help the Region Achieve Its GHG Emissions Reduction Target** of reducing per-capita CO_2 emissions from cars and light-duty trucks by 7 percent by 2020 and by 15 percent by 2035; and
2. **House 100 Percent of the Region's Projected 25-year Population Growth** by income level (very-low, low, moderate, above-moderate) without displacing current low-income residents.

The second input is the long-term growth forecast developed using historic and future demographic trends, as described in Chapter 2. In addition to these inputs, the land use distribution emphasizes growth in nearly 200 locally identified Priority Development Areas (PDAs) along the region's core transit network, and accommodates 100 percent of new growth within existing urban growth boundaries

FIGURE 10: Plan Bay Area Land Use Distribution Process





MAP 2

Open Space and Williamson Act Lands

● Priority Conservation Areas

🟩 Publicly Owned Parks and Open Space

🟩 Riparian Corridors, Hillside Areas, Greenbelt Reserves and Floodplains

🟫 Williamson Act Lands
Some Williamson Act contracts are set to expire and be decommissioned during the plan period.

☐ Not Categorized
Includes land that may be designated as Urban and Built-up as defined by the Farmland Mapping and Monitoring Program in 2010. These lands include areas occupied by structures with a building density of at least 1 unit to 1.5 acres, or approximately 6 structures to a 10-acre parcel. This land is used for residential, industrial, commercial, construction, institutional, public administration, railroad and other transportation yards, cemeteries, airports, golf courses, sanitary landfills, sewage treatment, water control structures and other developed purposes. Also may include areas within Urban Growth Boundaries/Urban Limit Lines, Urban Service Areas and Spheres of Influence. This category may also include undeveloped lands classified as Farmland, Critical Habitat and Grazing Lands. See "Resource Lands" map for the location of these areas.

2010 POPULATION
Oakland > 350,000
Novato 50,000–350,000
Pacifica <50,000

ROADS
Freeway
Major Road

0 10 20 30 Miles
0 10 20 30 40 Kilometers

Map is for general information. For more information on local zoning or designations for a particular site or parcel, please contact your city or county.

Greater detail can be found in the sub-regional maps in Appendix 2. Additional legend information can be found at the end of the appendix.

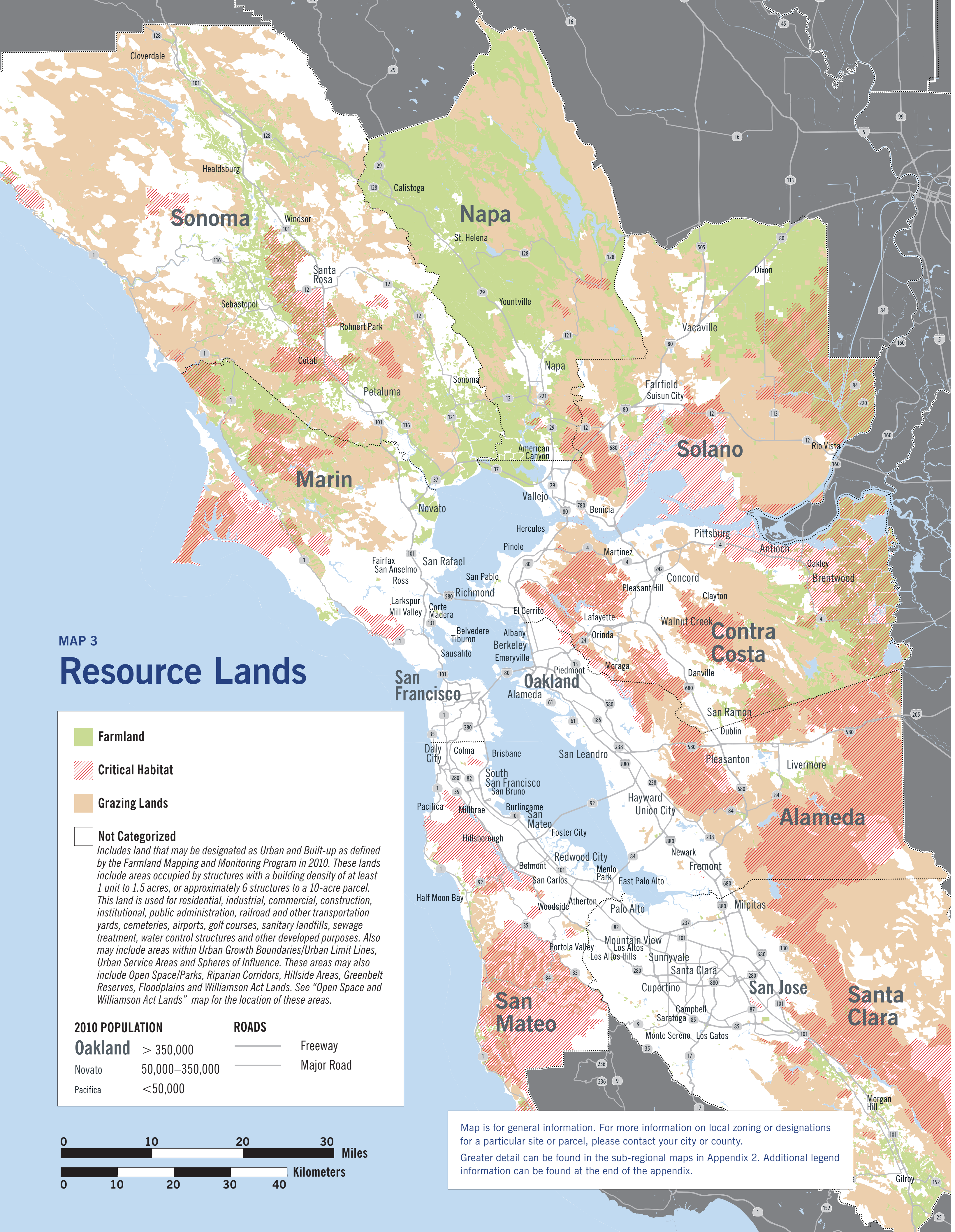
and urban limit lines. It also emphasizes protection for the region's agricultural, scenic and natural resources areas, including Priority Conservation Areas.

The nearly 200 adopted PDAs are existing neighborhoods nominated by local jurisdictions as appropriate places to concentrate future growth that will support the day-to-day needs of residents and workers in a pedestrian-friendly environment served by transit. Emphasizing higher levels of growth in these locations means that many neighborhoods, particularly established single-family home neighborhoods, will see minimal future change. A key part of the PDA strategy is to move away from an unplanned "project-by-project" approach to growth, toward the creation of complete communities that meet the needs of existing and new residents and workers.

Priority Conservation Areas (PCAs) comprise over 100 regionally significant open spaces about which there exists broad consensus for long-term protection, but which face nearer-term development pressures. They are a mechanism for implementing Plan Bay Area — particularly in the North Bay, where they are central to the character and economy of many communities, and they ensure that Plan Bay Area considers farmland and resource areas in keeping with Senate Bill 375. The PCAs and PDAs complement one another: Promoting compact development within PDAs takes development pressure off the region's open space and agricultural lands.

In contrast to past trends that saw the outward expansion of urban growth in the region and spillover growth in surrounding regions, Plan Bay Area directs new growth within locally adopted urban growth boundaries to existing communities along major transit corridors. For decades communities throughout the Bay Area have protected farmland, open space and natural resources using urban growth boundaries and other policies and investment strategies. Because urban growth boundaries and related growth controls constrain the amount of geography available for development, they not only protect valuable open space, they also help ensure that future development will assume a more compact pattern than in past decades. (See "Open Space and Williamson Act Lands" map on page 44 and "Resource Lands" map on page 46.)

ABAG Archives



MAP 3

Resource Lands

🟩 **Farmland**

▨ **Critical Habitat**

🟫 **Grazing Lands**

☐ **Not Categorized**

Includes land that may be designated as Urban and Built-up as defined by the Farmland Mapping and Monitoring Program in 2010. These lands include areas occupied by structures with a building density of at least 1 unit to 1.5 acres, or approximately 6 structures to a 10-acre parcel. This land is used for residential, industrial, commercial, construction, institutional, public administration, railroad and other transportation yards, cemeteries, airports, golf courses, sanitary landfills, sewage treatment, water control structures and other developed purposes. Also may include areas within Urban Growth Boundaries/Urban Limit Lines, Urban Service Areas and Spheres of Influence. These areas may also include Open Space/Parks, Riparian Corridors, Hillside Areas, Greenbelt Reserves, Floodplains and Williamson Act Lands. See "Open Space and Williamson Act Lands" map for the location of these areas.

2010 POPULATION		ROADS	
Oakland	> 350,000	—	Freeway
Novato	50,000–350,000	—	Major Road
Pacifica	<50,000		

0 10 20 30 Miles

0 10 20 30 40 Kilometers

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Greater detail can be found in the sub-regional maps in Appendix 2. Additional legend information can be found at the end of the appendix.

San Francisco Bay Area Job Growth

2040 Employment Distribution Approach and Methodology

Responding to Business Location Trends

Plan Bay Area's distribution of the forecasted jobs throughout the region is informed by changing trends in the locational preferences of the wide range of industry sectors and business place types in the Bay Area. These trends capture ongoing geographic changes, as well as changes in the labor force composition and workers' preferences. Overall, the changing needs of businesses suggest a transition toward a more focused employment growth pattern for the Bay Area. This focused growth takes a variety of forms across the various employment centers throughout the region, as summarized below. The plan's long-range employment forecast is developed for planning purposes only, and it is not intended to pre-determine subsequent transportation funding allocation decisions.

- **Knowledge-Based Jobs, Culture and Entertainment at Regional Centers**
  The growth of the professional services sector is expected to result in more jobs in downtown San Francisco, downtown Oakland and downtown San Jose — assuming an appropriate provision of infrastructure, transit and access to affordable housing. These downtown areas also have attracted international business and leisure travelers, as well as artists and entertainers, fueling the rise of leisure and cultural activities. Similar to the growth of San Francisco's financial district in the 1970s, and Silicon Valley in the 1990s, the Bay Area is attracting new businesses and workers seeking to locate near related firms, services and amenities. These businesses and professionals seek flexible building spaces and require less office space per worker compared to traditional office space expansion in downtown areas.

ABAG Archives

- **Multiple Activities and Transit at Office Parks**
  Office parks are expected to continue to accommodate a growing number of employees. However, given the limited land available for new office parks, available vacant office space, and the preference for walkable, transit-served neighborhoods by growing numbers of employers, office parks are expected to grow at a slower pace than in past decades. Many existing office parks are changing to use less space per worker, provide direct transit access, and even offer housing, services and other amenities. Growing numbers of businesses, particularly in San Mateo and Santa Clara counties, are providing private shuttle services to help their employees commute to work. Increasing and improving transit access to office parks will lessen, but not fully mitigate, increased traffic congestion related to employment growth.
- **Downtown Areas and Transit Corridors Serving Residents**
  Over the last decade, medium and small cities throughout the region have been expanding the range of services and jobs provided in their downtown areas. As described in Chapter 2, the increase in the senior population, combined with the region's changing ethnic profile, is expected to increase the demand for local

services, housing and transportation choices across the region, including in many of these medium and small downtown areas. Many of these locations have been identified as PDAs and have shown increased concentrations of knowledge-based jobs in the arts, recreation, health and education sectors.

- **New Vitality of Industrial Lands**
  Manufacturing and wholesale distribution have experienced declining employment in many of the region's key industrial areas. However, in recent years a different and very diverse mix of businesses has relocated to some of these Bay Area locations. In addition to basic services such as shuttle operations and refuse collection, or traditional uses such as concrete plants, industrial lands are now occupied by food processing, high-tech product development, car repair, graphic design and recycling businesses, among others. The building and space needs of these businesses make traditional industrial lands attractive. These new businesses provide jobs, and also provide essential support to other sectors of the economy and vital services to nearby residents. It is in the region's best interest to ensure that new businesses have access to industrial lands, so that the jobs they create remain in the Bay Area.

Employment Distribution Methodology

The distribution of forecasted employment growth considers job growth by sector and is linked to input from local residents and planning departments. Employment growth is organized under three major groups: knowledge-sector jobs, population-serving jobs and all other jobs. The number of knowledge-sector jobs — such as jobs in information technology companies, legal or engineering offices, or biotechnology firms — is expected to grow based on the current concentrations of these jobs, the specialized skills and experience required to perform these jobs, and past growth in the sector. The number of population-serving jobs, such as those in retail stores or restaurants, is expected to grow in a manner reflecting the distribution of future household growth. The number of jobs in all other sectors, including the government, agriculture and manufacturing sectors is expected to grow according to the existing distribution of jobs in each of these sectors. Finally, the employment growth distribution also is linked to access to transit service, which continues to be a major draw for both employers and employees.

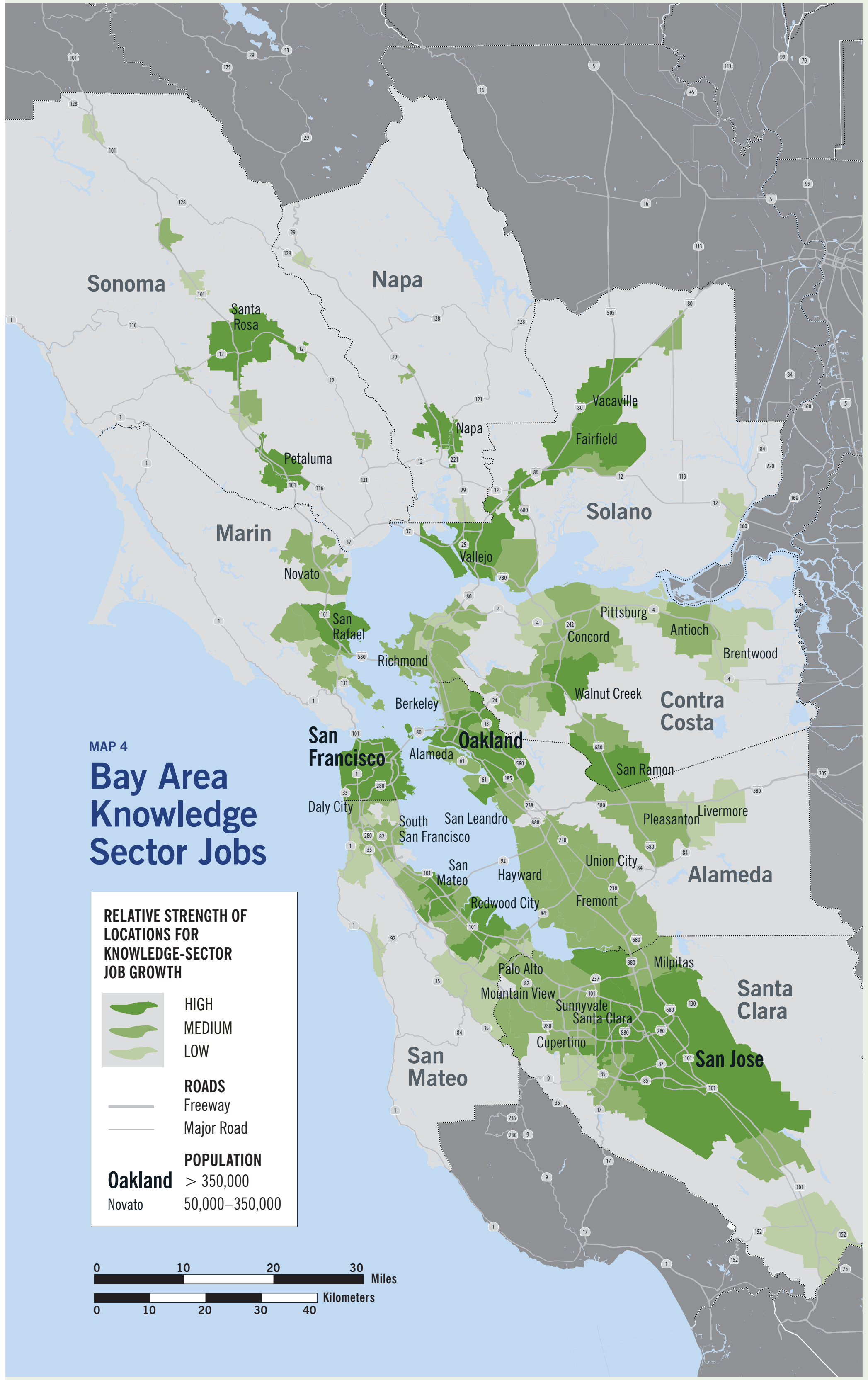
Employment by Economic Sector and County

The first step in the employment distribution was to determine the composition of employment in 2040 by different industry sectors for the region as a whole. This was derived from the Center for Continuing Study of the California Economy's *Bay Area Job Growth to 2040: Projections and Analysis* (February 2012). The next step was to distribute 2040 job numbers among the nine counties for each industry sector based upon county shares of regional employment, as reported in Caltrans' California County-Level Economic Forecast: 2011–2040 (August 2011).

Employment by Jurisdiction and Priority Development Area

The distribution of employment by jurisdiction and Priority Development Area was calculated using five growth distribution factors. The first three distribution factors are based upon the type of job. The fourth and fifth distribution factors are local planning assumptions, and the locations of resource areas and farmlands.

1 **Knowledge-Sector Jobs Index:** For jobs in the professional and business services, information and finance sectors, a "knowledge strength index" was used to weight the distribution of jobs within each county at the jurisdiction level. The index reflects the tendency of these jobs to be located in areas with already high concentrations of similar companies and a shared labor pool. (See "Knowledge-Based Jobs Expected to Lead Bay Area Employment Growth to 2040" on facing page.)


MAP 4

Bay Area Knowledge Sector Jobs

Map is for general information. For more information on local zoning or designations for a particular site or parcel, please contact your city or county.

Knowledge-Based Jobs Expected to Lead Bay Area Employment Growth to 2040

Knowledge-based jobs in the Bay Area include jobs in the professional services, information and finance sectors, as well as some occupations with relatively high educational requirements in the health and education sectors. Many companies in these sectors are expected to continue the historical trend of specializing in the design and development of new products and information. Robust growth in the amount of knowledge-based employment is supported by a highly educated labor pool and provides many high-wage jobs. The map at left shows the weighted knowledge strength index used to distribute knowledge sector jobs within each county.

Compared with other regions, the Bay Area's labor force has the highest share of college graduates (44 percent) in the country and is anchored by educational and research institutions that can continue to deliver high-quality talent. These leading sectors have represented and will continue to represent a high share of the total regional job growth. Although the knowledge-based sectors help define the overall pace of growth for the region, their success is advanced by a very diverse regional economy.

Noah Berger

2 **Population-Serving Jobs Ratio:** For jobs that provide services to households, employment location is dependent upon where people live. As a result, growth of these jobs was distributed based upon the geographic distribution of household growth in the region. Residential construction jobs also were included in this category, as they will be located where new housing is built.

3 **Existing Employment Share for All Other Jobs:** For the remaining sectors, employment growth was distributed based upon the existing distribution in 2010, using data from the National Establishment Times-Series (NETS) database, which provides employment information by location of business establishments.

4 **Local Planning Assumptions:** This information, including locally adopted general plans and neighborhood plans, was supplied by local planning departments.

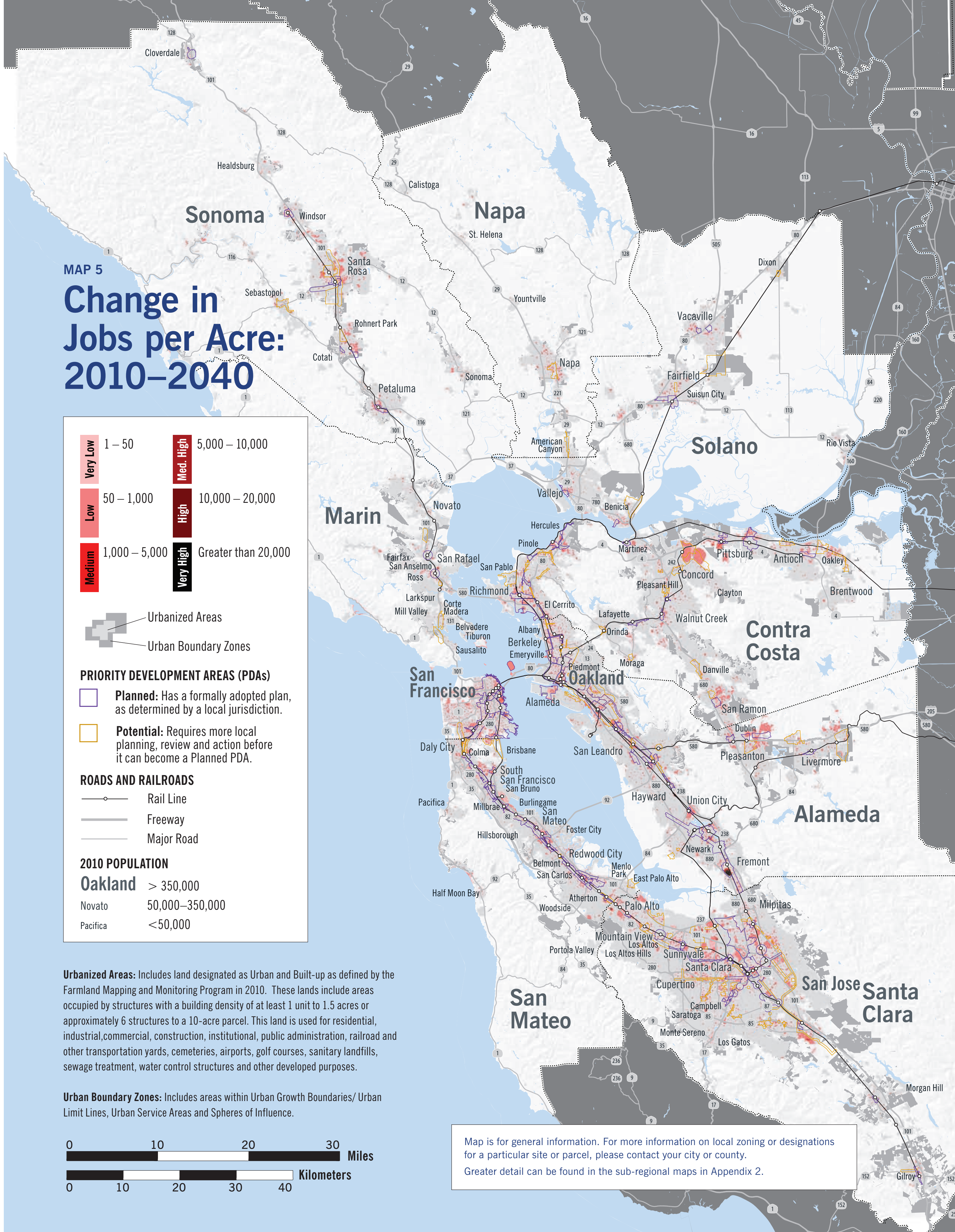
5 **Resource Areas and Farmland:** This information was derived from farmland and resource lands, the locations of Priority Conservation Areas, and the urban growth boundaries.

TABLE 13: Bay Area Job Growth 2010–2040, Top 15 Cities

Rank	Jurisdiction	Jobs		2010–2040 Job Growth	
		2010	2040	Growth	Percentage Growth
1	San Francisco	568,720	759,500	190,780	34%
2	San Jose	377,140	524,510	147,380	39%
3	Oakland	190,490	275,760	85,260	45%
4	Santa Clara	112,890	146,180	33,290	29%
5	Fremont	90,010	120,000	29,990	33%
6	Palo Alto	89,690	119,470	29,780	33%
7	Santa Rosa	75,460	103,940	28,470	38%
8	Berkeley	77,110	99,330	22,220	29%
9	Concord	47,640	69,450	21,810	46%
10	Sunnyvale	74,810	95,600	20,790	28%
11	San Mateo	52,540	72,950	20,410	39%
12	Hayward	68,140	87,820	19,680	29%
13	Redwood City	58,080	77,480	19,400	33%
14	Walnut Creek	41,720	57,380	15,660	38%
15	Mountain View	47,950	63,590	15,640	33%

MAP 5

Change in Jobs per Acre: 2010–2040



Urbanized Areas: Includes land designated as Urban and Built-up as defined by the Farmland Mapping and Monitoring Program in 2010. These lands include areas occupied by structures with a building density of at least 1 unit to 1.5 acres or approximately 6 structures to a 10-acre parcel. This land is used for residential, industrial,commercial, construction, institutional, public administration, railroad and other transportation yards, cemeteries, airports, golf courses, sanitary landfills, sewage treatment, water control structures and other developed purposes.

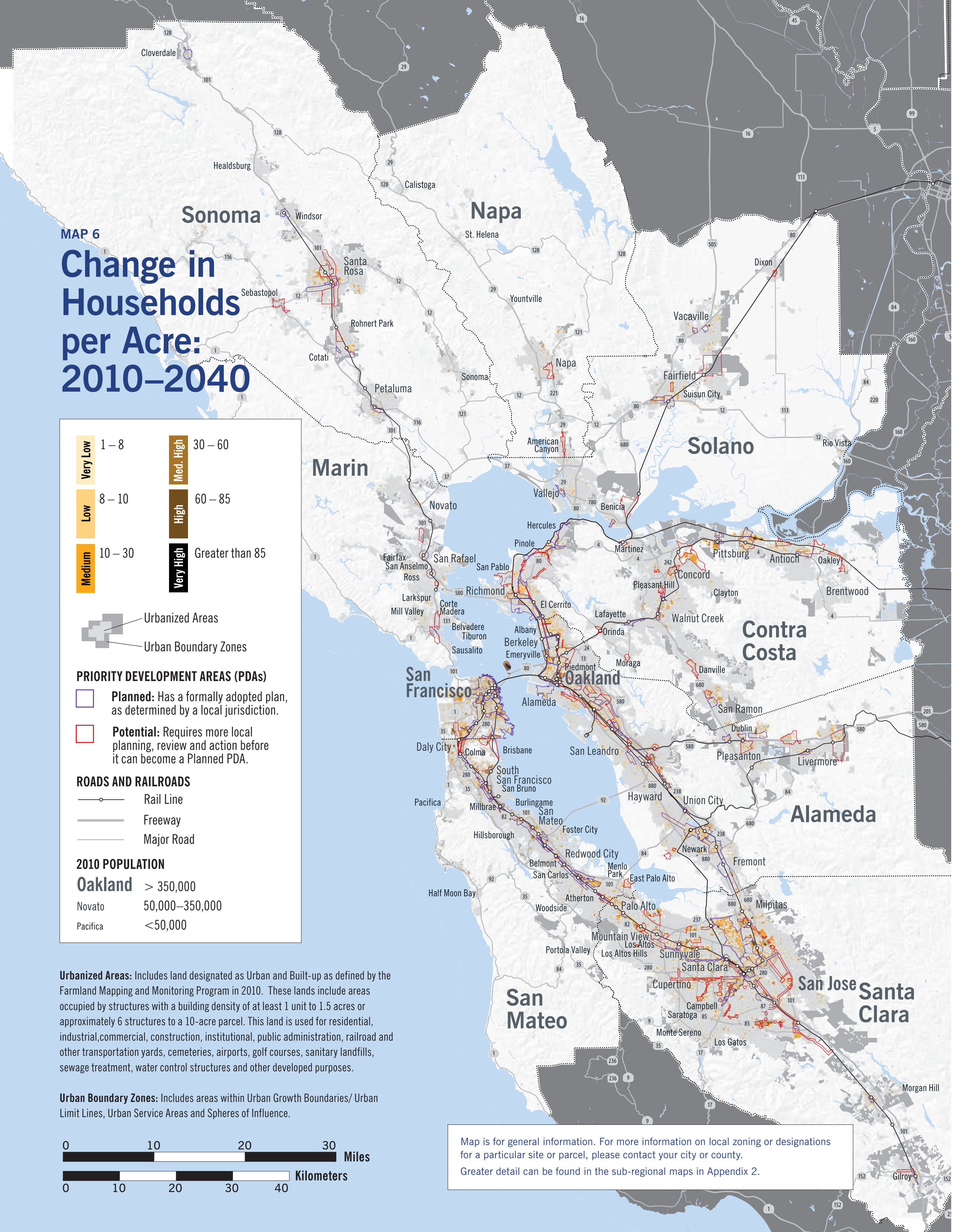
Urban Boundary Zones: Includes areas within Urban Growth Boundaries/ Urban Limit Lines, Urban Service Areas and Spheres of Influence.

Map is for general information. For more information on local zoning or designations for a particular site or parcel, please contact your city or county.

Greater detail can be found in the sub-regional maps in Appendix 2.

MAP 6

Change in Households per Acre: 2010–2040



Urbanized Areas: Includes land designated as Urban and Built-up as defined by the Farmland Mapping and Monitoring Program in 2010. These lands include areas occupied by structures with a building density of at least 1 unit to 1.5 acres or approximately 6 structures to a 10-acre parcel. This land is used for residential, industrial,commercial, construction, institutional, public administration, railroad and other transportation yards, cemeteries, airports, golf courses, sanitary landfills, sewage treatment, water control structures and other developed purposes.

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Map is for general information. For more information on local zoning or designations for a particular site or parcel, please contact your city or county.
Greater detail can be found in the sub-regional maps in Appendix 2.

2040 Employment Distribution Highlights

The combined effect of the growth distribution factors directs job growth toward the region's larger cities and Priority Development Areas with a strong existing employment base and communities with stronger opportunities for knowledge-sector jobs. As a result, almost 40 percent of the jobs added from 2010 to 2040 will be in the region's three largest cities — San Jose, San Francisco and Oakland — which accounted for about one-third of the region's jobs in 2010. Two-thirds of the overall job growth is anticipated to be in PDAs throughout the region. The map on page 51 shows where the region is expected to add jobs during this time period.

Due to the strength of the knowledge sector, nine of the 15 cities expected to experience the greatest job growth are in the western and southern part of the region surrounding Silicon Valley (see Table 13, page 50). The remaining communities expecting high levels of job growth are in the East Bay and North Bay, owing to their strong roles in the current economy, diverse employment base, and their proximity to a large base of workers.

In sum, the 15 cities expected to experience the most job growth will account for roughly 700,000 jobs, or just over 60 percent of the new jobs forecasted in the region by 2040. Through local general plans, communities may aspire to and plan for additional jobs beyond the forecast contained in Plan Bay Area.


Noah Berger

> Almost 40 percent of the jobs added from 2010 to 2040 will be in the region's three largest cities — San Jose, San Francisco and Oakland.

Additional information on employment distribution by location can be found in Forecast of Jobs, Population and Housing *listed in Appendix 1.*

San Francisco Bay Area Housing Growth

2040 Housing Distribution Approach and Methodology

Supporting Equitable and Sustainable Development

The Plan Bay Area housing distribution is guided by the policy direction of the ABAG Executive Board, which voted in July 2011 to support equitable and sustainable development by "maximizing the regional transit network and reducing GHG emissions by providing convenient access to employment for people of all incomes." This was accomplished by distributing total housing growth numbers to: 1) job-rich cities that have PDAs or additional areas that are PDA-like; 2) areas connected to the existing transit infrastructure; and 3) areas that lack sufficient affordable housing to accommodate low-income in-commuters.

Housing Distribution Methodology

As with the 2040 employment distribution, the methodology for distributing new housing throughout the Bay Area involves the use of growth distribution factors (see Figure 10, page 43).

- **Level of Transit Service:** The highest level of transit service in an area was used to group each area into one of three regional transit tiers. Places with high levels of transit service were assigned more growth, with the goal of utilizing the existing transit infrastructure more efficiently and leveraging the region's emphasis on operating and maintaining the current transit system.
- **Vehicle Miles Traveled (VMT) per Household:** Housing growth was directed to locations expected to result in the lowest greenhouse gas emissions. This adjustment was based on a measure of the use of Bay Area freeways and roads called "vehicle miles traveled" (VMT). One vehicle (regardless of the number of passengers) traveling one mile constitutes one "vehicle mile." The number of vehicle miles traveled is highly correlated with greenhouse gas emissions. VMT data was derived from MTC's Regional Travel Demand Model.
- **Employment by 2040:** To link housing growth more closely to job centers, the initial housing distribution was adjusted by an employment factor for each area, based on the total 2040 employment for each jurisdiction.

Places with high levels of transit service and jobs were assigned more growth.

Arlene Finger

- **Low-Wage Workers In-Commuting From Outside the Bay Area:** This factor shifts housing growth to places that are importing many low-income workers. "Longitudinal employment and household dynamics" data from the U.S. Census Bureau was used to determine the number of workers commuting to and from a jurisdiction by income category in 2009 and previous years.
- **Housing Values:** To recognize places with high-quality services (schools, parks, infrastructure, etc.), the initial housing distribution was adjusted by a housing value factor, based on a jurisdiction's median home value in 2010. The 2010 U.S. Census was a data source for this analysis.
- **Local Planning Assumptions:** This information, including locally adopted general plans and neighborhood plans, was supplied by local planning departments.
- **Resource Areas and Farmland:** This information was derived from farmland and resource lands, the locations of Priority Conservation Areas, and the urban growth boundaries.

2040 Housing Distribution Highlights

Santa Clara Valley Transportation Authority

While housing growth is closely linked to local plans, as a result of these growth distribution factors more housing is directed to locations where the transit system can be utilized more efficiently, where workers can be better connected to jobs, and where residents can access high-quality services.

By emphasizing communities with transportation options and strong employment growth, the factors direct substantial housing production to the Peninsula and South Bay, where eight of 15 cities expected to experience the most housing growth are located (Table 14). In total, two-thirds of the region's overall housing production is directed to these 15 cities. This development pattern preserves the character of more than 95 percent of the region by focusing growth on less than five percent of the land. The map on page 52 shows where housing growth is expected to take place.

Additional information is available in Forecast of Jobs, Population and Housing, *listed in Appendix 1.*

TABLE 14: Bay Area Housing Unit Growth 2010–2040, Top 15 Cities

		Housing Units		2010–2040 Housing Unit Growth	
Rank	Jurisdiction	2010	2040	Growth	Percentage Growth
1	San Jose	314,040	443,320	129,280	41%
2	San Francisco	376,940	469,430	92,480	25%
3	Oakland	169,710	221,160	51,450	30%
4	Sunnyvale	55,790	74,820	19,030	34%
5	Concord	47,130	65,200	18,070	38%
6	Fremont	73,990	91,620	17,630	24%
7	Santa Rosa	67,400	83,430	16,030	24%
8	Santa Clara	45,150	58,930	13,780	31%
9	Milpitas	19,810	32,430	12,620	64%
10	Hayward	48,300	60,610	12,320	26%
11	Fairfield	37,180	48,300	11,120	30%
12	San Mateo	40,010	50,200	10,180	25%
13	Livermore	30,340	40,040	9,700	32%
14	Richmond	39,330	49,020	9,690	25%
15	Mountain View	33,880	43,280	9,400	28%

ABAG Archives

Summary of Jobs and Housing Distribution (2010–2040)

Reflecting the distribution growth factors' emphasis on the existing transit network and connecting homes and jobs, San Francisco, San Mateo, Santa Clara and Alameda counties account for the majority of housing growth (77 percent) and job growth (76 percent). (See Table 15.) Within these counties, the Bay Area's three regional centers — San Francisco, San Jose, and Oakland — will accommodate 42 percent of housing growth and 38 percent of total job growth by 2040. Corridors in the inner Bay Area, including El Camino Real/The Grand Boulevard, San Pablo Corridor, and East 14th–International Boulevard, also represent a major share of both housing and job growth, accommodating 19 percent of regional housing and 11 percent of regional job growth.

Contra Costa County accounts for 11 percent of the region's new jobs and 12 percent of its new homes. Concord, Richmond, Pittsburg and Walnut Creek — all with PDAs centered on BART stations — take on the largest shares of the county's housing growth, with 22 percent, 12 percent, 9 percent, and 9 percent respectively. PDAs in the county will take on 64 percent of the housing growth and 57 percent of the job growth.

Major suburban employment centers in Alameda and Contra Costa counties, including Concord, Walnut Creek, and the Tri-Valley communities of Dublin, Pleasanton, Livermore, and San Ramon, account for over 8 percent of the Bay Area's new jobs and nearly 9 percent of its new homes.

With more limited transit access and fewer PDAs, North Bay counties — Marin, Napa, Solano and Sonoma — are expected to take on a much smaller share of regional growth, accounting for 10 percent of new households and 13 percent of new jobs. Much of this growth will be focused in PDAs, such as downtown Santa Rosa, Petaluma, Fairfield and Vallejo. In Marin, 22 percent of new jobs and 38 percent of new housing are expected to be located in PDAs, while the share is 18 percent and 41 percent in Napa County, 33 percent and 63 percent in Solano County, and 45 percent and 62 percent in Sonoma County. By concentrating growth in the inner Bay Area and communities with frequent transit service, this growth strategy will help North Bay communities maintain their rural and small-town character. While accommodating a very limited amount of new growth, rural centers and corridors will enhance the pedestrian environment and access to local services in the traditional downtowns of many of these communities.

TABLE 15: Bay Area County Housing and Job Growth, 2010–2040

	Employment				Housing Units				Households			
			2010–2040 Growth				2010–2040 Growth				2010–2040 Growth	
County	**2010**	**2040**	**Total**	**%**	**2010**	**2040**	**Total**	**%**	**2010**	**2040**	**Total**	**%**
Alameda	694,450	947,650	253,200	36%	582,550	730,540	147,990	25%	545,140	705,330	160,190	29%
Contra Costa	344,920	467,390	122,470	36%	400,260	481,590	81,330	20%	375,360	464,150	88,790	24%
Marin	110,730	129,140	18,400	17%	111,210	118,740	7,530	7%	103,210	112,050	8,840	9%
Napa	70,650	89,540	18,890	27%	54,760	60,830	6,070	11%	48,880	56,310	7,430	15%
San Francisco	568,720	759,500	190,780	34%	376,940	469,430	92,480	25%	345,810	447,350	101,530	29%
San Mateo	345,200	445,080	99,880	29%	271,030	326,070	55,040	20%	257,840	315,090	57,250	22%
Santa Clara	926,260	1,229,530	303,270	33%	631,920	842,350	210,430	33%	604,200	818,390	214,190	35%
Solano	132,350	179,930	47,580	36%	152,700	175,570	22,870	15%	141,760	168,700	26,950	19%
Sonoma	192,010	257,460	65,450	34%	204,570	236,480	31,910	16%	185,830	220,740	34,910	19%
Region*	**3,385,300**	**4,505,220**	**1,119,920**	**33%**	**2,785,950**	**3,445,950†**	**660,000**	**24%**	**2,608,020**	**3,308,110**	**700,090**	**27%**

*Sum of county totals may not match regional totals due to rounding.
†Regional 2040 Housing Units include 4,350 seasonal units that were not distributed by county.
Source: ABAG, 2013

Overall, well over two-thirds of all regional growth by 2040 is allocated within Priority Development Areas. PDAs are expected to accommodate 78 percent (or over 509,000 units) of new housing and 62 percent (or nearly 690,000) of new jobs. As a result, small cities, single-family neighborhoods and rural areas throughout the Bay Area are expected to retain their scale and character.

Noah Berger

Plan Bay Area outlines a growth strategy that makes efficient use of available infrastructure while protecting the region's natural resources and open space. However, this is only half the picture. The second half consists of the transportation investments and policies developed along with this land use pattern to support and complement the region's housing and employment growth. (See Chapter 4.) Both an efficient land use pattern and a sound transportation investment package are needed to have a fully integrated long-term land use development and transportation plan. The performance results of this overall strategy are presented in Chapter 5.

Accommodating the 8-Year Regional Housing Need Allocation

California Housing Element law (Article 10.6 of the California Government Code) requires each jurisdiction to plan for housing at all income levels by ensuring that local zoning and planning support the production of a diverse range of new housing. The Regional Housing Need Allocation (RHNA) is the state-mandated process to identify the share of the state's housing need for which each jurisdiction must plan over an 8-year period. The California Department of Housing and Community Development (HCD) determined that the Bay Area's regional housing need between 2014 and 2022 is 187,990 units.

To develop the RHNA for 2014–2022, ABAG and MTC convened a Housing Methodology Committee comprised of local elected officials, staff and diverse stakeholders from throughout the region, who provided guidance through a series of workshops that began in January 2011. The Association of Bay Area Governments' Executive Board adopted the final RHNA methodology and released draft allocations on July 19, 2012.

California Senate Bill 375 (SB 375) creates an additional overlay by requiring consistency with the Sustainable Communities Strategy in Plan Bay Area. (See "California Senate Bill 375: Linking Regional Plans to State Greenhouse Gas Reduction Goals," in the introduction to this plan.) Both the plan and final RHNA methodology address the overlapping objectives of SB 375 and the California Housing Element law. These objectives include increasing the supply, diversity and affordability of housing; promoting infill development and a more efficient land use pattern; protecting environmental resources; and promoting socioeconomic equity.

TABLE 16: **Regional Housing Need Allocation (Housing Units) by Household Income, 2014–2022**

County	Very Low 0–50%	Low 51–80%	Moderate 81–120%	Above Moderate 120%+	Total Housing Units
Alameda	9,912	6,604	7,924	19,596	44,036
Contra Costa	5,264	3,086	3,496	8,784	20,630
Marin	618	367	423	890	2,298
Napa	370	199	243	670	1,482
San Francisco	6,234	4,639	5,460	12,536	28,869
San Mateo	4,595	2,507	2,830	6,486	16,418
Santa Clara	16,158	9,542	10,636	22,500	58,836
Solano	1,711	902	1,053	3,311	6,977
Sonoma	1,818	1,094	1,355	4,177	8,444
Region	**46,680**	**28,940**	**33,420**	**78,950**	**187,990**

Note: Percentages are of the region's area median income.
Source: http://www.abag.ca.gov/planning/housingneeds/pdfs/Final RHNA (2014–2022).pdf

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The Three Primary Elements of the RHNA Methodology Are:

- **The Sustainability Component** – This element advances the goals of SB 375 and is based on Plan Bay Area's proportional allocation of new housing into Priority Development Areas (PDAs). Seventy percent of the region's housing need is allocated to jurisdictions planning for growth in PDAs, with the remaining 30 percent allocated based on non-PDA growth.
- **The Fair Share Component** – This element is designed to ensure that jurisdictions with PDAs are not asked to shoulder more than their fair share of the Bay Area's total housing need. More housing was allocated to jurisdictions with strong transit networks, many jobs, or poor permitting performance in the 1999–2006 RHNA cycle for very-low and low income units. The methodology also set a minimum threshold for a jurisdiction's allocation based on its expected future growth.
- **The Income Allocation Factor** – This element aims to ensure that each jurisdiction plans for housing at all income levels. The income allocation factor is determined by the difference between the regional proportion of households in an income category and each jurisdiction's proportion for that same category. This shifts the distribution of housing allocated to each jurisdiction across income categories so that jurisdictions that already supply a large amount of affordable housing receive lower affordable housing allocations. It also promotes the state objective to increase the mix of housing types among cities and counties equitably.

To encourage even greater policy alignment, the OneBayArea Grant (OBAG) program criteria account for past RHNA performance, specifically housing production for low- and very-low income households, as well as a jurisdiction's current RHNA allocation. (See Chapter 4.)

For further details on the RHNA methodology and process, see: ***www.abag.ca.gov/planning/housingneeds/index.html***

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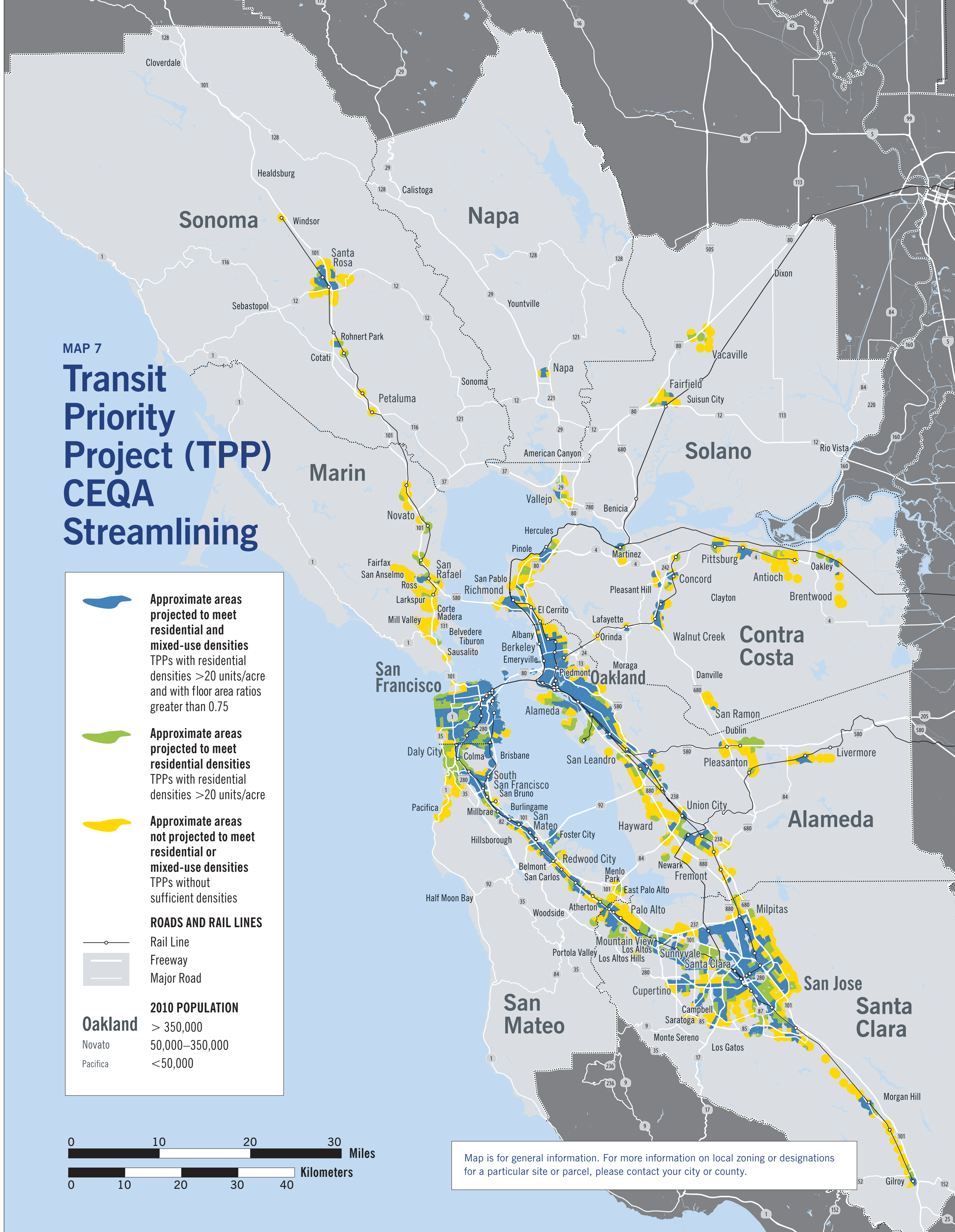
Plan Bay Area: Benefits for Project Development

Adoption of Plan Bay Area will not require any changes to local land use policies or environmental review processes. In concert with Senate Bill 375, the plan provides some jurisdictions with the opportunity to reduce the scope of environmental analysis required under CEQA for certain projects that are consistent with the plan. Agencies that find these “CEQA streamlining provisions” helpful have the opportunity, but are not obligated, to align their local planning decisions with the adopted Plan Bay Area. Projects that use the provisions will still need to obtain discretionary permits or other approvals from the lead and responsible agencies. (See “California Senate Bill 375: Linking Regional Plans to State Greenhouse Gas Reduction Goals,” in the introduction to this plan.)

> Plan Bay Area outlines a growth strategy that makes efficient use of available infrastructure while protecting the region’s natural resources and open space.

A project may qualify for CEQA relief under SB 375 if it is: 1) consistent with the approved Plan Bay Area Sustainable Communities Strategy (SCS), including all land use designations, employment distribution densities, building space intensities and applicable policies; or 2) considered a residential/mixed-use residential project or a transit priority project (TPP).

On the facing page is a map of Transit Priority Project-eligible areas, where certain projects subject to the conditions outlined above may qualify for CEQA relief under SB 375.



MAP 7

Transit Priority Project (TPP) CEQA Streamlining

Map is for general information. For more information on local zoning or designations for a particular site or parcel, please contact your city or county.

Greg Nelson

SB 375 defines TPP-eligible areas as places within one-half mile of a major transit stop or a high-quality transit corridor. To qualify as a residential/mixed use residential project, at least 75 percent of the total building square footage must be dedicated to residential use. To quality as a TPP, the project must also:

- Contain at least 50 percent residential use, based on total building square footage, and if the project contains between 26 percent and 50 percent nonresidential uses, then the floor area ratio (defined as the ratio of building square footage to the parcel square footage) must be 0.75 or more;
- Provide a minimum net density of at least 20 dwelling units per acre; and
- Be located within one-half mile of a major transit stop or high-quality transit corridor included in Plan Bay Area.

TPP-eligible areas were not identified until after the passage of SB 375 in 2008, and they should not be confused with the pre-existing Priority Development Areas (PDAs). Most TPP-eligible areas are within PDAs, while others are within close proximity to transit but are not identified as PDAs.

NOTE: Appendix 2 includes a set of 18 detailed maps of the region showing key resource lands, job and housing growth (2010–2040), and total future housing and job intensities for 2040. For each topic, three close-up maps of different parts of the Bay Area region are included.

4

Investments

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San Francisco-Oakland Bay Bridge, East Span

Barrie Rokeach ©2013

Chapter 4

Investments

In crafting an investment program for Plan Bay Area, MTC and ABAG had to grapple with a number of important, but often competing, questions.

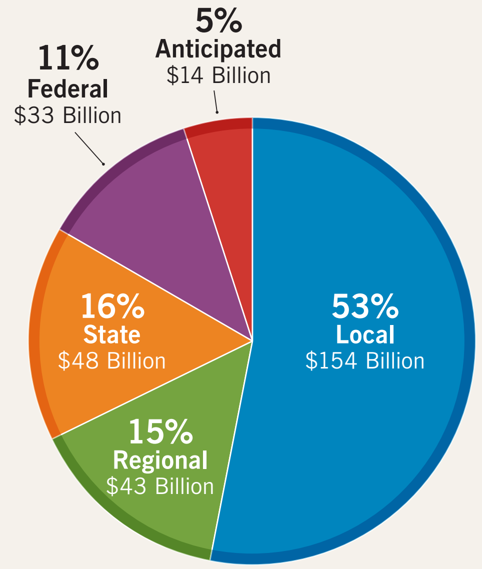
How to best support the expected growth in jobs and housing over the next quarter-century? How much do we invest to maintain, expand and improve the efficiency of our regional transportation system, when the needs exceed available revenue? How should we weigh specific project performance characteristics in assembling a package of investments to address the plan's economic, environmental and equity goals?

Plan Bay Area structures an investment plan in a systematic way to support the region's long-term land use strategy, relying on a performance assessment of scenarios and individual projects. The plan makes investments in the region's transportation network that support job growth and new homes in existing communities by focusing the lion's share of investment on maintaining and boosting the efficiency of the existing transit and road system. Plan Bay Area also takes a bold step with strategic investments that provide support for focused growth in Priority Development Areas, including major new transit projects and the OneBayArea Grant program.

Gauging Our Financial Resources

The Plan Bay Area investment strategy is based on an estimate of available funding through 2040. Although the region continues to feel the impact of a slow recovery on revenues for transportation in the short term, total revenues over the 28-year life of the plan are expected to exceed the long-term revenue estimates prepared for the preceding regional transportation plan, Transportation 2035, which was adopted in April 2009 when various transportation revenues were in decline.

FIGURE 11 **Revenue Forecast $292 Billion (YOE $)***



*YOE = Year of Expenditure

For Plan Bay Area, MTC worked with partner agencies and used financial models to forecast how much revenue will be available for transportation purposes over the 28-year duration of the plan. These forecasts are used to plan investments that fit within the "financially constrained" envelope of revenues that are reasonably expected to be available.

Plan Bay Area revenue forecasts total $292 billion over the 28-year period, reckoned in year of expenditure (YOE) dollars. As shown in Figure 11, over two-thirds (68 percent) of these funds are from regional and local sources, primarily transit fares, dedicated sales tax programs, and bridge tolls.

Making up the remainder of the pie are state and federal revenues (mainly derived from fuel taxes), and "Anticipated" revenues, which are unspecified revenues that reasonably can be expected to become available within the plan horizon. Although federal and state funding for transportation is critical, it is insufficient to cover growing needs. Annual revenues from local sources dwarf the revenues local jurisdictions receive in state transportation infrastructure funding.

The Great Recession also had a severe impact on the budgets of state and local jurisdictions in California. Bay Area communities seeking to support focused growth and increase the amount of affordable housing were particularly hard hit by the elimination of redevelopment agencies and related funding in 2010. In the Bay Area, these agencies generated $1 billion annually before they were dissolved by the Legislature and the funding programs eliminated.

Financial Assumptions

The complete financial assumptions and amounts for the financially constrained Plan Bay Area are provided in *Plan Bay Area Financial Assumptions,* listed in Appendix 1. The estimated revenues in Plan Bay Area assume an inflation rate of 2.2 percent and are reported in year of expenditure dollars. Key highlights are as follows:

- The federal highway and transit programs are assumed to continue in their current form and grow at a rate of 3 percent annually. Base year revenue is set at the nationally authorized level for fiscal year (FY) 2009–10, and the Bay Area is projected to receive its historically proportionate share of these programs.
- The state funding sources — primarily fuel tax-based — are assumed to maintain their structure and distribution formulas over the 28-year period, starting from FY 2009–10 base levels. Assumptions concerning fuel price and consumption growth assume that state gasoline consumption will decline at an increasing rate until 2020 and then grow slowly at a constant long-term rate. For the 2006 voter-approved Proposition 1B, the revenue forecast includes the Bay Area's remaining share beyond FY 2011–12.
- Regional bridge toll revenues are based on projected travel demand on the region's seven state-owned toll bridges. Further, it was assumed that in FY 2018–19, there would be a $1 increase in the non-carpool vehicle toll on all state-owned bridges. The Regional Express Lane Network revenues included in the financially constrained plan represent projected gross toll revenue for express lanes including toll revenues from express lanes in Santa Clara County.
- Local revenues, sales taxes such as Transportation Development Act (TDA) and Assembly Bill 1107 (1977) are assumed to grow at rates that take into account demographic and economic factors such as median income, regional employment and population growth.
- County and transit district transportation sales tax revenues in Alameda, Contra Costa, Napa, Marin, San Francisco, San Mateo, Santa Clara and Sonoma counties are based on estimates provided by the respective sales tax authorities in those counties. Measures that are set to expire within the 28-year period are assumed to be renewed and/or augmented.
- Transit operator-specific revenue projections including transit fares, tolls, property and parcel taxes, and other sources have been provided by the respective operators. Projections of local streets and roads revenue are based on information provided to MTC by local agencies.
- Revenues forecasted to become available for high-speed rail include approximately $1.5 billion from California's Proposition 1A (2008), the Safe, Reliable High-Speed Passenger Train Bond Act. It was also assumed that the region would receive 12.5 percent, or $1.5 billion, of federal revenues that are expected to become available to finance the project.
- Plan Bay Area assumes $3.1 billion dollars in Cap and Trade revenue. These funds represent the Bay Area's share of funds that are expected to be administered by the state's metropolitan planning organizations.
- The inclusion of "Anticipated" revenues in the financially constrained plan strikes a balance between the past practice of only including specific revenue sources currently in existence or statutorily authorized, and the more flexible federal requirement of revenues that are "reasonably expected to be available" within the plan period.

Karl Nielsen

MTC performed a retrospective analysis of projections for previous long-range plans, including a review of unexpected revenues that had come to the region but had not been anticipated or included in those projections. Over a 15-year analysis period, the San Francisco Bay Area received an annualized amount of roughly $400 million (in 2011 dollars) from these "unanticipated" fund sources. MTC generated an estimate of these anticipated revenues by projecting the $400 million figure forward at a 3 percent annual growth rate. These revenues are not assumed in the first five years of the plan.

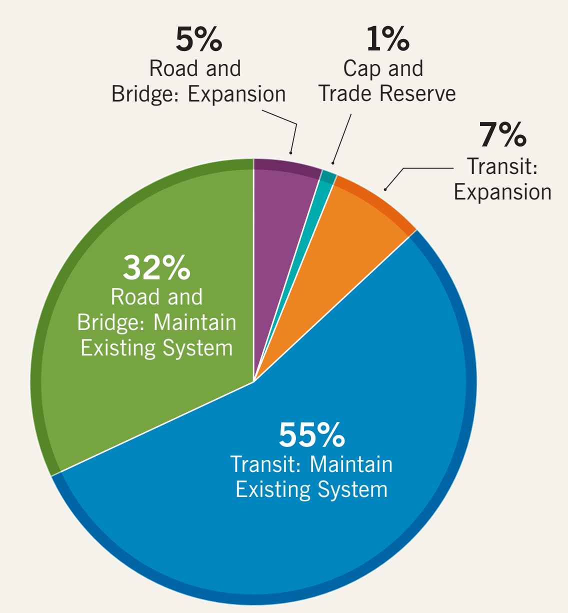
Plan Bay Area Investments— Committed and Discretionary Funds

Revenues for Plan Bay Area are either committed to existing purposes or considered discretionary and available for new projects and programs. Committed funds may be designated by law for a specific purpose or are reserved by action of a governing board (such as MTC, a transit agency, a congestion management agency, etc.). Discretionary revenues are those that are available for assignment to projects or programs through the plan. In spring 2011, MTC determined that if any transportation project/program met one of the following criteria, the project would be considered "Committed" for Plan Bay Area (consistent with Senate Bill 375):

- Project is under construction with a full funding plan, or a regional program that is currently under contract.
- Project is funded with dollars designated by statute for a specific purpose, or dollars are locally generated and locally administered.

Additional funding was deemed committed to transit operating and maintenance in Spring 2012. Based on these conditions, $60 billion of the $292 billion in total revenue forecasted for Plan Bay Area is available for discretionary investments.

FIGURE 12 Total Investments* by Function $292 Billion (YOE $)



*Committed and discretionary

As summarized in Table 17, the investment strategy totals $292 billion in committed and discretionary funds. This combined investment strategy focuses 87 percent of the funding over the life of the plan on taking care of our existing transportation system. (See Figure 12.) The remaining 13 percent funds key transit and road expansion projects. Bicycle and pedestrian projects and programs are included with road maintenance and expansion due to the region's policies to ensure roads are built or modified to be accessible for all users, so-called "complete streets."

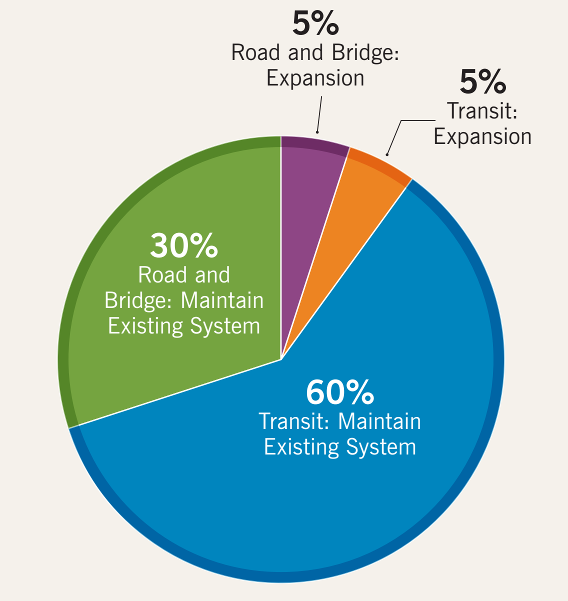
TABLE 17: Plan Bay Area Investments by Function (in billions of YOE $)

Function	Committed	Discretionary	Total
Transit: Maintain Existing System	$139	$20	$159
Road and Bridge: Maintain Existing System	$69	$25	$94
Transit: Expansion	$13	$8	$21
Road and Bridge: Expansion	$11	$4	$15
Cap and Trade Reserve	$0	$3	$3
Total	**$232**	**$60**	**$292**

Committed Revenues

Seventy-nine percent ($232 billion) of all the revenues forecast for Plan Bay Area are deemed "Committed." Examples of committed funds include existing sales tax measure revenues, which have been assigned through a voter-approved expenditure plan, and State Transportation Improvement Program (STIP) funds that have already been designated for specific projects by the California Transportation Commission. Figure 13 provides a breakdown by functional category of how committed funds will be expended over the course of the plan.

FIGURE 13 Committed Investments $232 Billion (YOE $)



Funding for "Committed" projects is included in Plan Bay Area in order to provide a complete picture of the regional investments and so that these critical efforts can continue to advance. Included in this group are several large projects that are under construction, such as the new eastern span of the San Francisco-Oakland Bay Bridge; the Bay Area Rapid Transit (BART) extensions to Warm Springs and Eastern Contra Costa County (eBART); the BART Airport Connector to Oakland International Airport; the San Francisco Municipal Railway Central Subway; the Sonoma-Marin Area Rail Transit (SMART) Initial Operating Segment from Santa Rosa to San Rafael; and the Caldecott Tunnel Fourth Bore project.

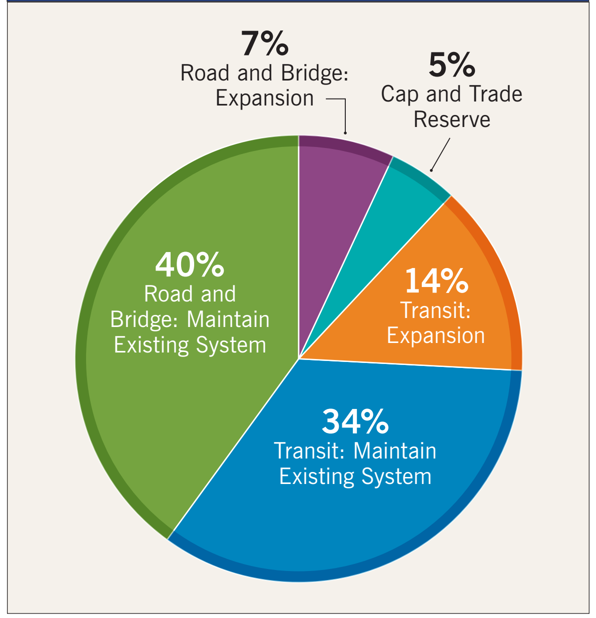
Noah Berger

The allocation of committed funds supports growth in our established rural, suburban and urban communities by directing 90 percent of these funds to the region's existing transit and road systems as shown in Figure 13. These investments, totaling more than $200 billion of the committed funds, ensure that the buses and trains can serve today's and tomorrow's passengers, and that our roads and sidewalks can carry current and future residents on their way to work or school. More detailed information on the committed investments can be found in the Online Project Database, listed in Appendix 1.

Discretionary Revenues

The 21 percent of Plan Bay Area revenues that are discretionary ($60 billion) are assigned to projects or programs to support the plan's land use and transportation investment strategy. While the funds may be discretionary in that they have not yet been assigned to a project or program, they may be subject to rules associated with how they can be spent. For example, federal New Starts funds are discretionary because they have not been assigned to a particular project; however, those funds can only be used for new transit projects. Surface Transportation Program funds can be used across different modes of transportation, but they can only be used for capital improvements and not for operating purposes. Figure 14 provides a breakdown by functional category of how discretionary revenues will be invested through Plan Bay Area.

FIGURE 14 Discretionary Investments
$60 Billion (YOE $)



Cap and Trade Revenues

This investment strategy is complemented by a $3.1 billion dollar reserve from future Cap and Trade funding included in the plan. The expected eligible uses include but are not limited to transit operating and capital rehabilitation/replacement, local street and road rehabilitation, goods movement, and transit-oriented affordable housing — consistent with the focused land use strategy outlined in Plan Bay Area. The share of funds reserved for these purposes, the specific project sponsors and investment requirements will be subject to further deliberation with partner agencies and public input following adoption of Plan Bay Area.

Cap and Trade revenues will be allocated to specific programs through a transparent and inclusive regional public process. That process will specifically ensure that at least 25 percent of these revenues will be spent to benefit disadvantaged communities in the Bay Area, and to achieve the goals of Plan Bay Area.

Investment Strategies

The discretionary funds provide the opportunity to address six key investment strategies to support both the future land use pattern outlined in the previous chapter and the performance targets adopted for the plan as discussed in Chapter 1. The following section details the region's six primary investment strategies to address the key issues identified during the Plan Bay Area process.

At the end of this chapter, key road and transit projects are highlighted in a series of maps. Additional detail on the proposed Plan Bay Area-funded projects and programs is available in the Online Project Database, listed in Appendix 1.

Noah Berger

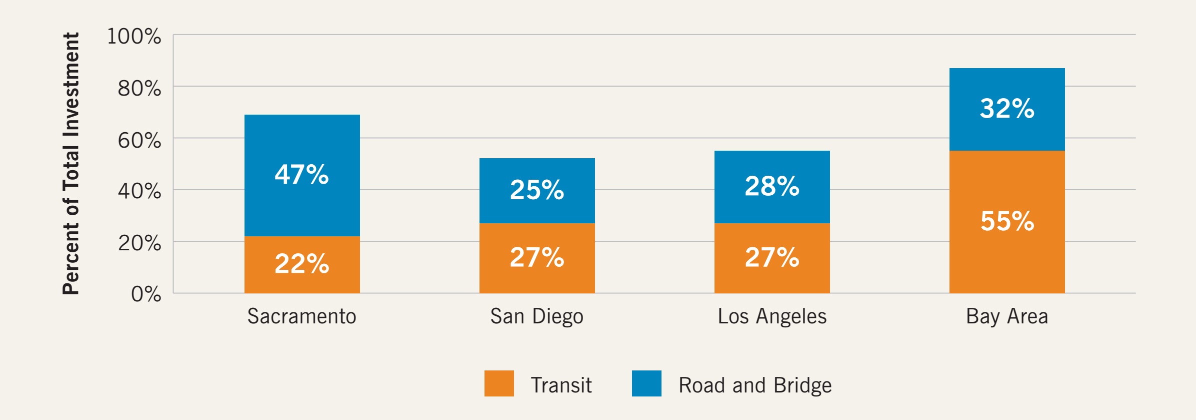
Investment Strategy 1

Maintain the Existing Transportation System

Plan Bay Area continues to support the "fix it first" emphasis from 2009's Transportation 2035 Plan to ensure that the region directs a majority of funding to maintain existing transportation assets, while also supporting focused growth in areas served by the transportation system over the life of the plan. A well-maintained multimodal transportation system is fundamental to the success of the more compact future land use outlined in Chapter 3. Plan Bay Area fully funds operating needs for existing transit services and timely transit vehicle replacement while funding 76 percent of remaining high-priority transit capital needs. Furthermore, this investment strategy invests scarce resources in state bridge rehabilitation and retrofit.

Plan Bay Area dedicates 87 percent of all available funds to keeping the current transportation network in working order as shown in Figure 12. Roughly three-quarters of the draft plan's discretionary funds and 90 percent of the committed funds are dedicated to funding transit operations, maintaining transit

FIGURE 15: System Maintenance and Management Share of Total Investment: California's Largest Regions' Long-Range Plans



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capital assets, repairing and replacing bridges, and maintaining complete streets. This includes complementary funding in the OneBayArea Grant investment strategy (see page 77) and County Investment Priorities strategy (see page 86).

Plan Bay Area makes a greater financial commitment to system maintenance and management than do the plans of California's other large metropolitan regions. Approximately 87 percent of total Plan Bay Area funding goes toward sustaining the existing system, while other metropolitan regions in the state dedicate substantially smaller shares of funding for this purpose (see Figure 15). There are several reasons for the difference in priorities:

- The Bay Area has some of the oldest transportation systems in the state (and even in the country) — and old infrastructure requires more funding to maintain, renovate and replace than newer systems. San Francisco's Municipal Railroad recently celebrated its 100th anniversary, and BART operates the oldest railcar fleet in the country.
- Our region's greater reliance on rail services results in higher costs to maintain these capital-intensive modes. Plan Bay Area includes nearly $3 billion for replacing BART's and Caltrain's aging fleets over the next decade.
- The Bay Area is relatively built-out compared to other newer, faster-growing urban areas, and our transportation system is correspondingly more fully developed. That means there is relatively less need to invest in new highways and transit lines, and relatively more existing infrastructure to maintain here than in other areas. Even so, all four of California's major metropolitan areas devote more than 50 percent of their future transportation budgets to upkeep of their current road and transit networks.

Investment in the Transit System

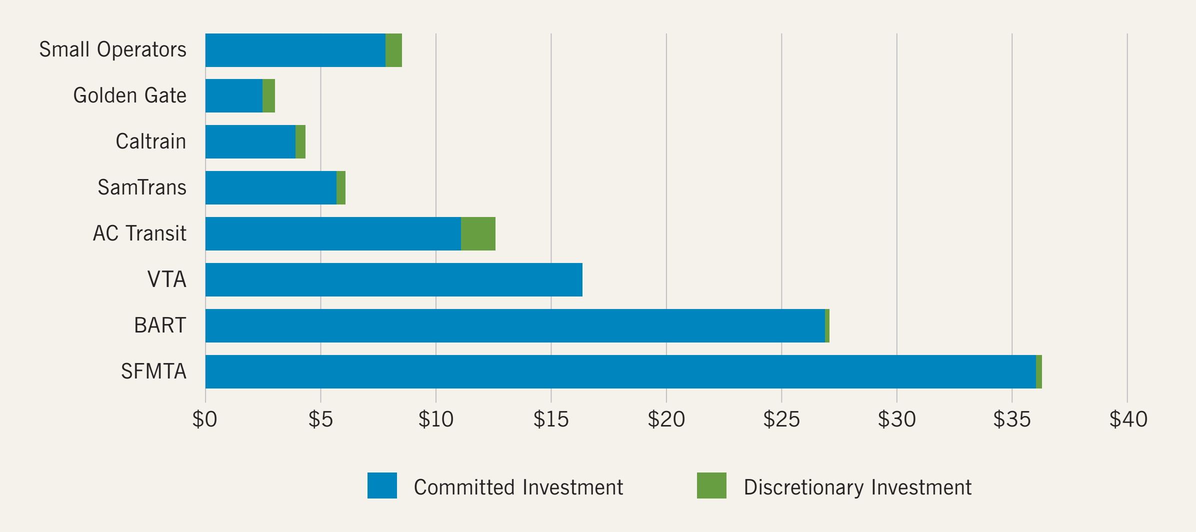
Operating and Maintaining Transit: A Key Challenge

Buses, trains, ferries, light-rail vehicles, cable cars and streetcars not only provide mobility for people without cars — including those who are low-income, elderly, disabled or too young to drive — they also provide a viable alternative to driving for hundreds of thousands of area residents who do own cars. By reducing the number of vehicles on the roads, public transit helps to fight congestion and curb greenhouse gas emissions. It is also the essential transportation complement to Plan Bay Area's distribution of housing and employment in key locations throughout the region.

TABLE 18: Plan Bay Area Transit Investment Strategy (in billions of YOE $)

	Total Need 2013–2040	Committed Investment	Discretionary Investment	Remaining Need
Transit Operations	$114	$110	$4	$0
Transit Capital	$47	$21	$9	$17
Total	**$161**	**$131**	**$13**	**$17**

FIGURE 16: Transit Operating Funding by Operator, 2013–2040 (in billions of YOE $)



Yet despite the importance of transit to the Bay Area and its economy, maintaining and sustaining the network is an ongoing challenge. The cost of buying the fuel and paying the drivers, mechanics, dispatchers and other workers needed to operate a transit system — and paying for the replacement of buses, train cars, tracks, fare machines and other capital equipment — can outpace available funds. Delayed maintenance of the transit system leads to even costlier rehabilitation down the road. Plan Bay Area thus places a high priority on funding for transit operations and equipment.

Over the next 28 years, operating and capital replacement costs for Bay Area transit providers are projected to total $161 billion. This includes $114 billion in operating costs plus $47 billion for capital replacement to achieve an optimal state of repair. Committed revenues over the same period are expected to total only $131 billion ($110 billion for operations and $21 billion for capital). The result is $30 billion in initial unfunded needs, approximately $26 billion of which is needed to bring our capital assets up to an optimal state of repair.

To address transit operating and capital needs, Plan Bay Area invests a total of $13 billion in discretionary revenues. This includes more than $2 billion in discretionary revenue plus almost $2 billion in revenues that are expected to come from a future extension of the transportation sales tax in Alameda County to eliminate the $4 billion forecasted operating shortfall over the plan period. Another $9 billion in discretionary revenue will be invested in transit capital, leaving unfunded capital needs of $17 billion to achieve a state of optimal repair that the region must take into account when pursuing new funding resources, as discussed in Chapter 6.

As illustrated in Figure 16, some transit agencies have operating needs that exceed the forecasted level of committed revenue — such as AC Transit, Golden Gate Transit, SamTrans, Caltrain and the small operators. The variability of the operating needs across the region results from the uniqueness of each system's forecasted cost growth and revenue availability. For example, on the revenue side, some transit operators have access to permanent sales taxes or are supported by general fund contributions, while others are not and are more reliant on fare revenues. As part of the investment strategy, MTC shored up the operating funding plan so that operations for existing services for all transit operators are fully funded through committed and discretionary revenues over the plan period.

Transit Sustainability Project Helps Bend Operating Cost Curve

The region's operating cost projections assume a continuation of existing levels of service and also take into account the increased operating costs associated with committed transit expansion projects. Plan Bay Area reflects the recommendations of MTC's Transit Sustainability Project (TSP), a series of actions to complement recent individual transit agency efforts to control costs, improve service and attract new riders. By establishing performance metrics and targets, new investment and incentive programs, and additional focused efforts related to cost, service and institutional arrangements, the recommendations set a course toward a more sustainable transit system. The operating cost projections associated with implementing the Transit Sustainability Project recommendations assume a five percent drop in operating costs by 2018, then indexing those costs to inflation. Over the life of the plan, this results in billions of dollars of savings.

More information on the TSP can be found in Investment Strategy 4, "Boost Freeway and Transit Efficiency."

Lifeline Transportation Program Improves Mobility and Accessibility

Plan Bay Area reaffirms the importance of addressing the mobility and accessibility needs of seniors, persons with disabilities, and residents in low-income communities throughout the region. The plan adds approximately $800 million in discretionary funding for MTC's Lifeline Transportation Program over the 28-year period of the plan. In addition to continuing the types of projects that are currently being funded, an area of possible focus for the future is "mobility management," a strategic approach to connecting people to transportation resources within a community including services provided by human services agencies and other community sponsors. This strategy is especially key to the region's ability to address growth in the Bay Area's senior population and persons with disabilities. Through partnerships with many transportation service providers, mobility management enables communities to monitor transportation needs and links individuals to travel options that meet their specific needs, are appropriate for their situation and trip, and are cost efficient. The Lifeline program, which implements locally crafted Community Based Transportation Plans funded by MTC, has already invested over $170 million in a diverse mix of projects to support high-need travelers. (See Figure 17.) In addition to mobility management projects, Lifeline has invested in additional fixed-route transit, shuttles, and non-motorized safety and access improvements.

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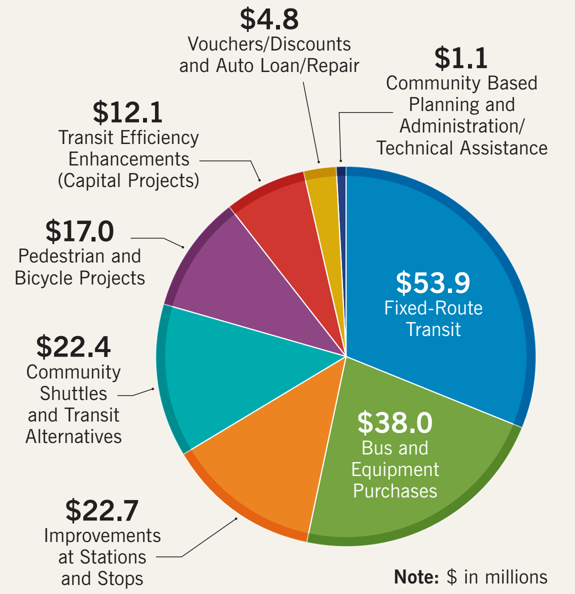
FIGURE 17 Lifeline Transportation Program Project Types, 2006–2012 $172 Million



Note: $ in millions

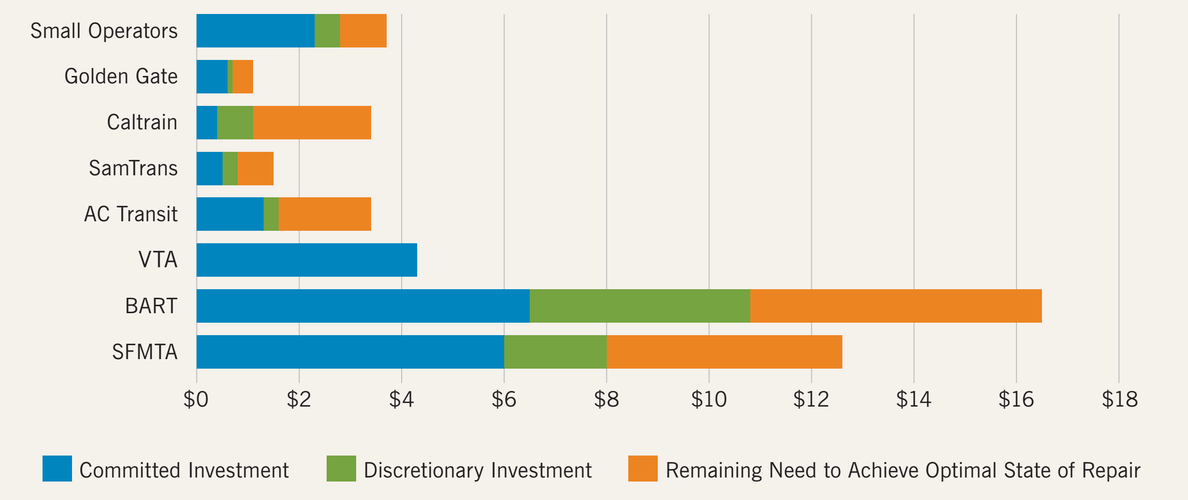
Transit Capital Replacement and Rehabilitation: A Big Hole to Fill

On the capital side, Plan Bay Area assures that all vehicles are replaced at the end of their useful lives and receive all required rehabilitation on schedule, though large capital needs remain for other assets such as maintenance facilities and station upgrades to ensure the long-term health of the region's transit operations. (See Figure 18.) In particular, a robust and efficient public transit network, anchored by expanded local service, is a linchpin of Plan Bay Area's land use strategy to promote future development around existing and planned transit nodes. The plan falls short in achieving two voluntary performance targets that are key indicators of a sustainable transit system: fully funded maintenance and state of good repair of existing capital assets; and transit operating funding necessary to meet the projected growth in non-auto mode share to 26 percent of all trips.

Consistent with MTC's Transit Capital Priorities Policy, high-priority transit capital investments include revenue vehicles (buses, railcars and ferries) — which are Plan Bay Area's first priority for transit capital funds — as well as "fixed guideway" infrastructure (track, bridges, tunnels and power systems) and communications equipment to ensure the safe, reliable, and timely delivery of transit service throughout the region.

Nearly $20 billion of the projected transit capital replacement and rehabilitation needs of the Bay Area's transit systems through 2040 are unfunded under the plan. Plan Bay Area will dedicate a significant portion of the revenue generated from Cap and Trade to these unmet transit needs. In addition, promptly after adoption of the plan, MTC will work with the region's operators and other stakeholders to develop a plan to address the gap in funding for transit capital replacement and rehabilitation needs, and to expand the funding available to support future increases in transit service.

FIGURE 18: Transit Capital Funding and Remaining Needs, 2013–2040 (in billions of YOE $)



Plan Bay Area's total capital investment of $30 billion in committed and discretionary revenues will be sufficient to fund all revenue vehicle replacements and 76 percent of fixed guideway and other high-priority needs, a substantial improvement over the 60 percent funded in the Transportation 2035 Plan. Chapter 6 outlines priorities for the region to cover the remaining capital needs, totaling $17 billion, to achieve our performance target.

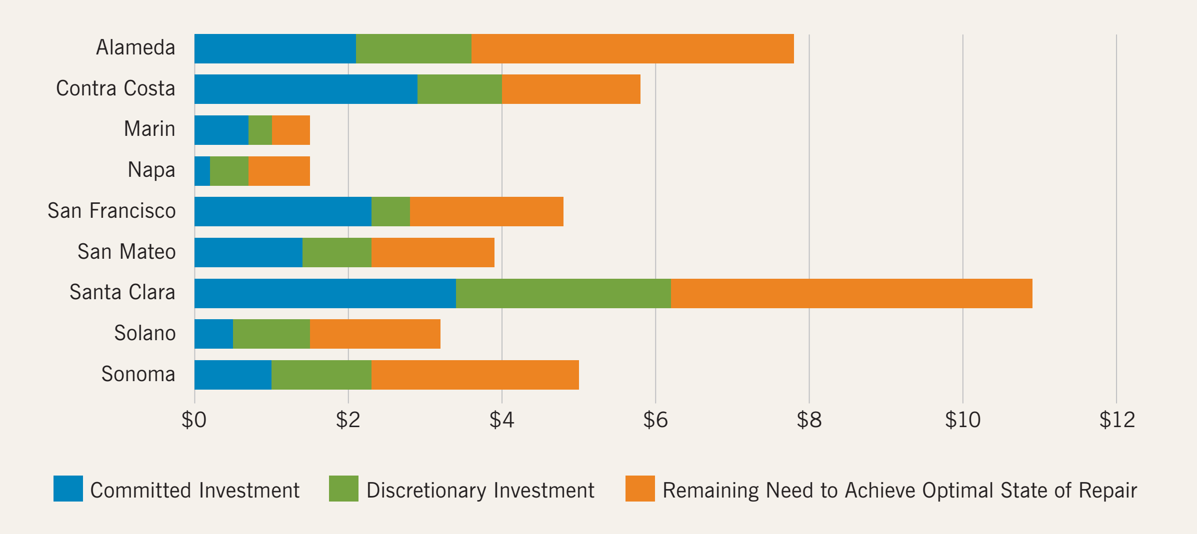
Investment in Local Streets and Roads

A critical component of the OneBayArea Grant (OBAG) investment strategy discussed later in this chapter is the investment of discretionary funds for the purpose of preserving the existing local street and road network. While congestion management agencies have the flexibility to spend their OBAG county shares on any eligible OBAG programs, Plan Bay Area provides sufficient funding within the program to reaffirm the commitment to maintain the region's pavement conditions at existing levels.

The 42,000 lane-miles of local streets and roads interconnect in a way that knits the region together, and they form the foundation of the region's transportation system. They are the conduits to the highways, ports and farmlands that are vital to the economic vitality and sustainability of the San Francisco Bay Area. All trips begin and end on a local street and road, and all modes of surface travel rely on the local street and road infrastructure. In addition to pavement, the local street and road system includes all of the safety and accessibility infrastructure that makes a functioning network possible — sidewalks, curbs and gutters, storm drains, signs and signals, and so forth.

The typical life cycle of a pavement is about 20 years. Over the first three-quarters of its life, the pavement will deteriorate slowly, resulting in a 40 percent drop in condition. Past that point, pavement will begin to deteriorate rapidly. It costs five to ten times more to rehabilitate or reconstruct a roadway that has been allowed to deteriorate, than it costs to maintain that roadway in good condition. Through the OneBayArea Grant program, Plan Bay Area invests $10 billion in discretionary funding to maintain the region's existing pavement condition, currently at a regional average of 66 on a pavement condition index (PCI) scale of 0 to 100. Even with an infusion of discretionary funds, sizable funding gaps remain in each county to bring pavement up to a state of good repair, as shown in Figure 19.

FIGURE 19: Local Streets and Roads Investments and Remaining Needs by County, 2013–2040 (in billions of YOE $)



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The total amount of funding needed for the Bay Area to achieve a PCI of 75 (the plan's adopted performance target, as discussed in Chapter 5) over the Plan Bay Area period is $45 billion. Committed revenues over the same period of time are expected to cover $15 billion, or about one-third of the need. Add in the $10 billion in discretionary funds, and the region still falls $20 billion short of the revenue needed to achieve the plan's performance target, with the biggest shortfalls occurring in the region's largest counties, as shown in Figure 19. Chapter 6 discusses ways to pursue the revenues that will allow the region to meet its targets for roadway preservation.

Funding Active Transportation

Plan Bay Area makes a significant commitment to increase the convenience and safety of walking and bicycling by delivering complete streets for all users. State Transportation Development Act (TDA) and local sales tax funds committed to bicycle and pedestrian improvements total $4.6 billion during the plan period. In addition, the OneBayArea Grant program discussed in the next section includes $14.6 billion over the life of the plan. These funds may be used for complete streets projects, including stand-alone bicycle and pedestrian paths, bicycle lanes, pedestrian bulb-outs, lighting, new sidewalks, and Safe Routes to Transit and Safe Routes to Schools projects that will improve bicycle and pedestrian safety and travel.

Investment in State Bridges

The bridges that span San Francisco Bay are critical transportation links for the region. It is vital to the economic health of the region and quality of life of its residents that these essential structures be kept in a state of good repair. Currently, existing toll revenues are used to strengthen, reinforce and maintain bridge structures and roadways on all of the seven state-owned Bay Area bridges; this includes replacing the eastern span of the San Francisco-Oakland Bay Bridge.

Plan Bay Area assumes a single one-dollar toll increase on all state-owned bridges, beginning in the year 2019. These new bridge tolls are considered a source of regional discretionary funds and total $2.7 billion over the course of the plan.

Due to the important role that our toll bridges play in the ability of the region's transportation network to function smoothly, Plan Bay Area assumes that approximately $1 billion, or about one third of the $2.7 billion in estimated new bridge toll funds, will be needed for additional maintenance or unforeseen repairs to the Bay Area's bridges.

Investment in State Highways

California's 50,000 lane-mile state highway system is an essential contributor to the state's economic vitality, linking people and goods with intermodal

> "MTC's new OneBayArea Grant program is an innovative way to use transportation funding to promote coordinated and environmentally responsible regional planning for jobs and housing. All Californians will benefit from such efforts to put SB 375's sustainability principles into practice."
>
> — *Senator Darrell Steinberg, President Pro Tempore, California Senate*

transportation facilities, growing metropolitan centers, and major international airports and ports. The value of this important transportation resource is reckoned at more than $300 billion. Of the total mileage, 6,500 lane-miles are within the nine-county Bay Area, giving residents a network of interstate, freeway, highway and arterial routes maintained and managed by Caltrans. These lane-miles carry more than one-third of our region's vehicle miles traveled.

State law requires Caltrans to prepare a 10-year plan for the State Highway Operation and Protection Program (SHOPP). The SHOPP identifies the various needs for all state-owned highways and bridges. Bay Area highway maintenance needs over the 28-year life of this plan are forecasted to total about $22 billion. Projected revenues over the same period are expected to cover only $14 billion. Plan Bay Area has not yet identified any new funding sources for the $8 billion in unfunded needs, despite its heavy emphasis on maintaining our current transportation system. The magnitude of the Bay Area's highway rehabilitation needs and lack of available funding suggests that maintenance will have to be delayed or deferred on some highways. New state funding, as discussed later in Chapter 6, will need to be secured in order to ensure the long-term health of today's system.

Investment Strategy 2
Support Focused Growth

To encourage more development near high-quality transit and reward jurisdictions that produce housing and jobs, Plan Bay Area proposes to target transportation investments in Priority Development Areas (PDAs), support planning efforts for transit-oriented development in PDAs, and support Priority Conservation Areas.

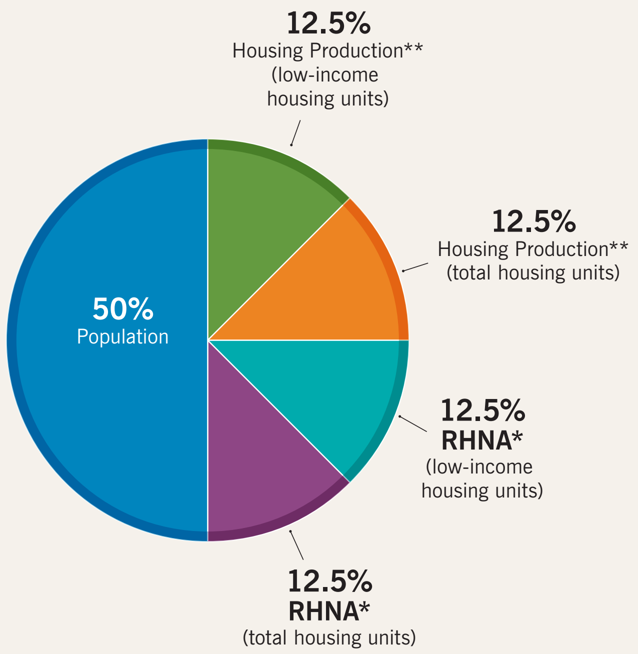
In May 2012, MTC approved a new funding approach that directs specific federal funds to support more focused growth in the Bay Area. The OneBayArea Grant (OBAG) program commits $320 million over the next four years ($14.6 billion over the life of the plan), from federal surface transportation legislation currently known as MAP-21 (Moving Ahead for Progress in the 21st Century). OBAG is designed to support jurisdictions that focus housing growth in Priority Development Areas through their planning and zoning policies, and the production of housing units. Specifically the program rewards jurisdictions that accept housing allocations through the Regional Housing Need Allocation (RHNA) process. The distribution of OBAG funds to counties is based on the following factors: population, past housing production and future housing commitments, and efforts to produce low-income housing.

Focus on Priority Development Areas

As outlined in Chapter 3, Priority Development Areas (PDAs) are transit-oriented, infill development opportunity areas within existing communities that are expected to host the majority of future development. The OBAG program allows communities flexibility to invest in transportation infrastructure that supports infill development by providing funding for bicycle and pedestrian improvements, local street repair, and planning activities, while also providing specific funding opportunities for Safe Routes to Schools projects and Priority Conservation Areas. By promoting transportation investments in PDAs, the OBAG program supports the Sustainable Communities Strategy for the Bay Area.

Per OBAG requirements, congestion management agencies (CMAs) will develop a PDA Investment and Growth Strategy for their respective counties; this will be used to guide future transportation investments that are supportive of PDA-focused development. The growth strategy also will consider strategies and plans to increase the production of affordable housing in PDAs, as well as ways to preserve existing affordable housing opportunities. The CMAs in larger counties (Alameda, Contra Costa, San Mateo, San Francisco and Santa Clara) must direct at least 70 percent of their OBAG investments to the PDAs. For North Bay counties (Marin, Napa, Solano and Sonoma) the requirement is 50 percent.

FIGURE 20: OneBayArea Grant Distribution Formula: FY 2012–13 through FY 2015–16



OBAG County Fund Distribution (millions $, rounded)

County	Total Funds
Alameda	$63
Contra Costa	$45
Marin	$10
Napa	$6
San Francisco	$38
San Mateo	$26
Santa Clara	$88
Solano	$18
Sonoma	$23
Total	**$320**

*RHNA 2014–2022
**Housing Production Report 1996–2006, ABAG

The OneBayArea Grant distribution formula is based on the following factors: population, past housing production and future housing commitments. This includes weighting to acknowledge jurisdiction efforts to produce low-income housing. The county congestion management agencies (CMA) are responsible for local project solicitation, evaluation and selection.

Renee Goodard

A project lying outside the limits of a PDA may count toward the minimum provided that it directly connects to or provides proximate access to a PDA. A zoomable map of PDAs in the Bay Area is available at http://geocommons.com/maps/141979. The counties are expected to conduct an open decision process to justify projects that geographically fall outside of a PDA but are considered directly connected to (or provide proximate access to) a PDA.

To complement these locally administered funds, OBAG also directs additional funds to support the region's Priority Conservation Areas and Priority Development Areas. The first round of OBAG funding directs an additional $10 million to the Bay Area's Transit Oriented Affordable Housing (TOAH) Fund. These funds will see TOAH grow from a $50 million pool today to at least a $90 million pool by 2014. TOAH will help finance affordable housing projects in transit-rich locations and target neighborhood-stabilization investments, including housing acquisition and rehabilitation, small-site acquisition and land banking in the region's PDAs. OBAG also includes $30 million for the PDA Planning Program to assist cities and counties planning for employment and housing growth in their city centers and transit-served corridors. In addition, these funds will continue to facilitate the entitlement of affordable housing. Finally, the first round of OBAG commits $10 million to support the Priority Conservation Areas with funding for planning, farm-to-market projects, and to support strategic partnerships that seek to purchase conservation lands for long-term protection and use by Bay Area residents.

The OneBayArea Grant Program will provide a solid platform to advance Priority Development Areas as walkable, amenity-rich "complete communities," and to protect our Priority Conservation Areas for future generations. However, as outlined in Chapter 6, realizing the plan's full potential will require a concerted, collaborative effort on the part of federal and state agencies.

Performance and Accountability Policies

In addition to providing funding to support Priority Development Areas, OBAG requires each jurisdiction to adopt policies to support complete streets and planning and zoning policies that are adequate to provide housing at various income levels, as required by the Regional Housing Need Allocation (RHNA) process. These requirements must be met before a jurisdiction is eligible for OBAG funding:

- **Complete Streets Policy Resolution:** In addition to meeting MTC's 2005 complete streets requirements, a jurisdiction will now need to adopt a complete streets resolution. A jurisdiction can also meet this requirement by having a general plan that complies with the California Complete Streets Act of 2008. All jurisdictions seeking future rounds of OBAG funding will be required to have the updated general plan language adopted.
- **RHNA-Compliant General Plan:** A jurisdiction is required to have its general plan housing element adopted and certified by the State Department of Housing and Community Development (HCD) to be eligible for OBAG funding.

Investment Strategy 3
Build Next-Generation Transit

As discussed in Chapter 5, Plan Bay Area relied on a transportation Project Performance Assessment, which, together with public involvement, helped identify priorities for the next generation of transit investments. These include improvements to the region's core transit systems, new bus rapid transit lines in San Francisco and Oakland, rail extensions that support and rely on high levels of future housing and employment growth, and an early investment strategy for high-speed rail in the Peninsula corridor. MTC's Resolution 3434, a 2001 framework that identified regional priorities for transit expansion projects, has served the region well.

TABLE 19: MTC Resolution 3434 Project Status

Project	Project Cost* (in millions of YOE $)	Status
Caltrain Express: Baby Bullet	$128	Open for Service
Regional Express Bus	102	
BART to Warm Springs	890	In Construction
East Contra Costa BART Extension (eBART)	493	
Transbay Transit Center: Phase 1	1,589	
BART/Oakland Airport Connector	484	
Sonoma-Marin Rail Initial Operating Segment	360	
Expanded Ferry Service to South San Francisco (Berkeley, Alameda/Oakland/Harbor Bay, Hercules and Richmond, and other improvements)	180	
MUNI Third Street Light Rail Transit Project – Central Subway	1,578	
BART: Warm Springs to Berryessa	2,330	
BART: Berryessa to San Jose/Santa Clara	3,962	Environmental Docs Approved
Transbay Transit Center/Caltrain Downtown Extension: Phase 2	2,596	
AC Transit Berkeley/Oakland/San Leandro Bus Rapid Transit	218	
Downtown to East Valley; Light Rail & Bus Rapid Transit Phases 1 & 2	559	
Caltrain Electrification	785	Environmental Docs in Process
Caltrain Express: Phase 2	427	
Van Ness Avenue Bus Rapid Transit	126	
Tri-Valley Transit Access Improvements to/from BART	168	
AC Transit Enhanced Bus: Grand-MacArthur corridor	41	
Dumbarton Rail	701	
ACE Right-of-Way Acquisition for Service Expansion	150	
Capitol Corridor: Phase 2 Enhancements	254	
Total	**$18,121**	

*Full project cost may not be included in Plan Bay Area.

TABLE 20: New Starts and Small Starts – Plan Bay Area "Next Generation" Projects
(in millions of YOE $)

Project	Cost	Previously Committed Funding	New Starts/ Small Starts	Other Funding from Plan Bay Area
BART: Berryessa to San Jose/ Santa Clara	$3,962	$1,355	$1,100	$1,507
Transbay Transit Center/Caltrain Downtown Extension: Phase 2	2,596	639	650	1,307
AC Transit Enhanced Bus/BRT: Grand-MacArthur corridor	41	0	30	11
Van Ness Avenue Bus Rapid Transit Project	126	66	30	30
AC Transit Berkeley/Oakland/ San Leandro Bus Rapid Transit	218	179	28	11
New Starts and Small Starts Reserve	660	—	660	—
Total	**$7,603**	**$2,239**	**$2,498**	**$2,866**

Roughly half of the projects are in service or under construction. Many of the others are reconfirmed as priorities for continued funding, or are included in the plan for early phases of work as the projects are being developed.

Resolution 3434 established the region's priority projects for federal New Starts and Small Starts funds (see Table 19), creating a unified regional strategy to secure commitments from this highly competitive national funding source. In 2012, the Bay Area secured commitments for nearly $2 billion in federal funding for its two most recent New Start projects — San Francisco's Central Subway and the extension of BART to Berryessa in Santa Clara County. These successes pave the way for a new generation of projects that can leverage current and future development patterns to create financially stable transit service in these corridors.

Plan Bay Area assumes that the region can attract approximately $2.5 billion in additional federal New Starts and Small Starts funding through 2040.

Building on the successful delivery of Resolution 3434, and the results of the Performance Assessment and transit-specific project evaluation, Plan Bay Area's priorities for the next generation of federal New Starts and Small Starts funding include major rail and bus rapid transit (BRT) investments, as summarized in Table 20. Along with identifying these significant future transit investments, Plan Bay Area also retains $660 million in financial capacity for projects that are in the planning stages. The $660 million New and Small Starts reserve, or a regional investment equivalent, is proposed to support transit projects that are located in or enhance transit service in the East and North Bay counties, subject to future assessments of feasible alternatives, evaluation for cost-effectiveness, and for performance against MTC's Transit-Oriented Development Policy.

Reference maps of key local and regional transit projects are included at the end of this chapter.

Investment Strategy 4
Boost Freeway and Transit Efficiency

The Bay Area consistently ranks as one of the most congested metropolitan areas in the nation. In the Texas A&M Transportation Institute's 2012 Urban Mobility Report (http://mobility.tamu.edu/ums/report/), San Francisco Bay Area ranked as the third most congested region in hours of delay caused by congestion. The same report estimated that congestion cost our region's peak-commute drivers an average of more than $1,200 per year. A decade or two ago, the response to congestion might have been simply to add additional roadway capacity. With today's mature system of roadways and increased demands on available financial resources, it is no longer possible to build our way out of congestion. Instead, the region must find ways to operate our existing highway and transit networks more efficiently, and target expansion projects that will provide long-term and sustainable congestion relief.

Bill Hall, Caltrans

Plan Bay Area includes a discretionary funding commitment of $3.9 billion over the next 28 years to support projects and programs that will boost system efficiency. These include the Freeway Performance Initiative (FPI) and the Transit Performance Initiative (TPI) that aim to use low-cost technology upgrades to dramatically improve the speed and reliability of roadways and transit service. In addition, efforts like San Francisco's cordon pricing program and the Regional Express Lane Network will leverage revenues generated from pricing to improve the efficiency of the existing system while expanding travel choice.

TABLE 21: Freeway Performance Initiative

Program Elements	Description & Benefits
Ramp Metering	Activate 300 additional ramp-metering locations on freeways.
Intelligent Transportation Systems Infrastructure	Install and maintain traffic cameras, changeable message signs, speed sensors and other related infrastructure to improve travel-time reliability on freeways.
Arterial Operations	Implement traffic signal coordination, transit-priority timing and incident/emergency clearance plans on regionally significant routes.
Incident and Emergency Management	Maintain the Freeway Service Patrol and Call Box programs, and enhance transportation agencies' and first responders' capabilities to clear traffic incidents and respond to major emergencies through integrated corridor management.
Traveler Information/511	Collect, consolidate and distribute accurate regional traffic, transit and parking data for trip-planning and real-time traveler information.
Operations & Maintenance	Maintain existing and future arterial and freeway technology improvements.

Freeway Performance Initiative

Plan Bay Area supports MTC's Freeway Performance Initiative (FPI), which is designed to maximize the efficiency and improve the operations and safety of the existing freeway, highway and arterial network.

Owing to investments made through the Transportation 2035 Plan, FPI expanded the number of metered ramps throughout the Bay Area, directly resulting in reduced travel times and improved safety on major freeway corridors while managing the impact on local arterial operations. FPI investments also support the Program for Arterial System Synchronization (PASS), through which an average of 500 traffic signals are re-timed each year to improve coordination across jurisdictions, and provide priority signal timing for transit vehicles.

FPI funding for the Freeway Service Patrol and call boxes has enhanced the region's ability to quickly identify and respond to planned and unplanned freeway incidents. Currently, FSP includes 78 tow trucks that cover 552 miles of Bay Area freeways and respond to an average of 130,000 incidents per year. The 2,200 call boxes in place along the region's freeways and bridges receive an average of 22,000 calls per year.

Plan Bay Area calls for an investment of approximately $2.7 billion in discretionary regional funds over the next 28 years to implement the FPI.

Noah Berger

Transit Performance Initiative

The Transit Performance Initiative (TPI) makes a regional investment in supportive infrastructure to achieve performance improvements in major transit corridors where current and future land use supports high-quality transit. The TPI also provides incentives to reward agencies that achieve improvements in ridership and service productivity. Plan Bay Area dedicates $500 million over the plan period to support this initiative, which is expected to result in reduced emissions and vehicle miles traveled, as well as an increase in the non-auto mode share of all trips.

MTC approved the first round of capital investment projects in the spring of 2012, providing over $27 million to reduce travel times and enhance the passenger experience on major corridors served by AC Transit, San Francisco Municipal Transportation Agency (SFMTA), and Santa Clara Valley Transportation Authority (VTA). (See Table 22.) These busy routes offer the potential to improve service quality, speed, and reliability, ultimately reducing travel times and increasing ridership.

TABLE 22: Transit Performance Initiative Investments – Spring 2012

Sponsor	Project	Investment (millions $)
AC Transit	Line 51 Corridor Speed Protection and Restoration	$10.1
SFMTA	Mission Customer First	$7.0
SFMTA	N-Judah Customer First	$3.7
SFMTA	Bus Stop Consolidation and Roadway Modifications	$4.1
VTA	Light Rail Transit Signal Priority Improvements	$1.6
VTA	Stevens Creek – Limited 323 Transit Signal Priority	$0.7

MTC has also created an incentive program to reward transit agencies that achieve ridership increases and productivity improvements, and will allocate funds on the basis of performance, thereby encouraging all of the region's transit operators to continuously improve their service and attract more riders. In winter 2013, the first round of funding for the TPI Incentive program awarded over $13 million to eight projects focused on increasing ridership and/or productivity, including youth and low-income pass programs.

Regional Express Lane Network

Express lanes, otherwise known as high-occupancy toll (HOT) lanes, are carpool lanes that give solo drivers the option of paying a fee to use the uncongested carpool lane, while carpools and buses may use the express lane free of charge. Express lanes make better use of carpool lanes that often sit empty while solo drivers are stuck in traffic. Opening up the express lane to solo drivers has been proven effective across the nation in moving cars out of traffic. Fewer cars in general-purpose lanes reduce traffic even for those who do not choose to use the express lane.

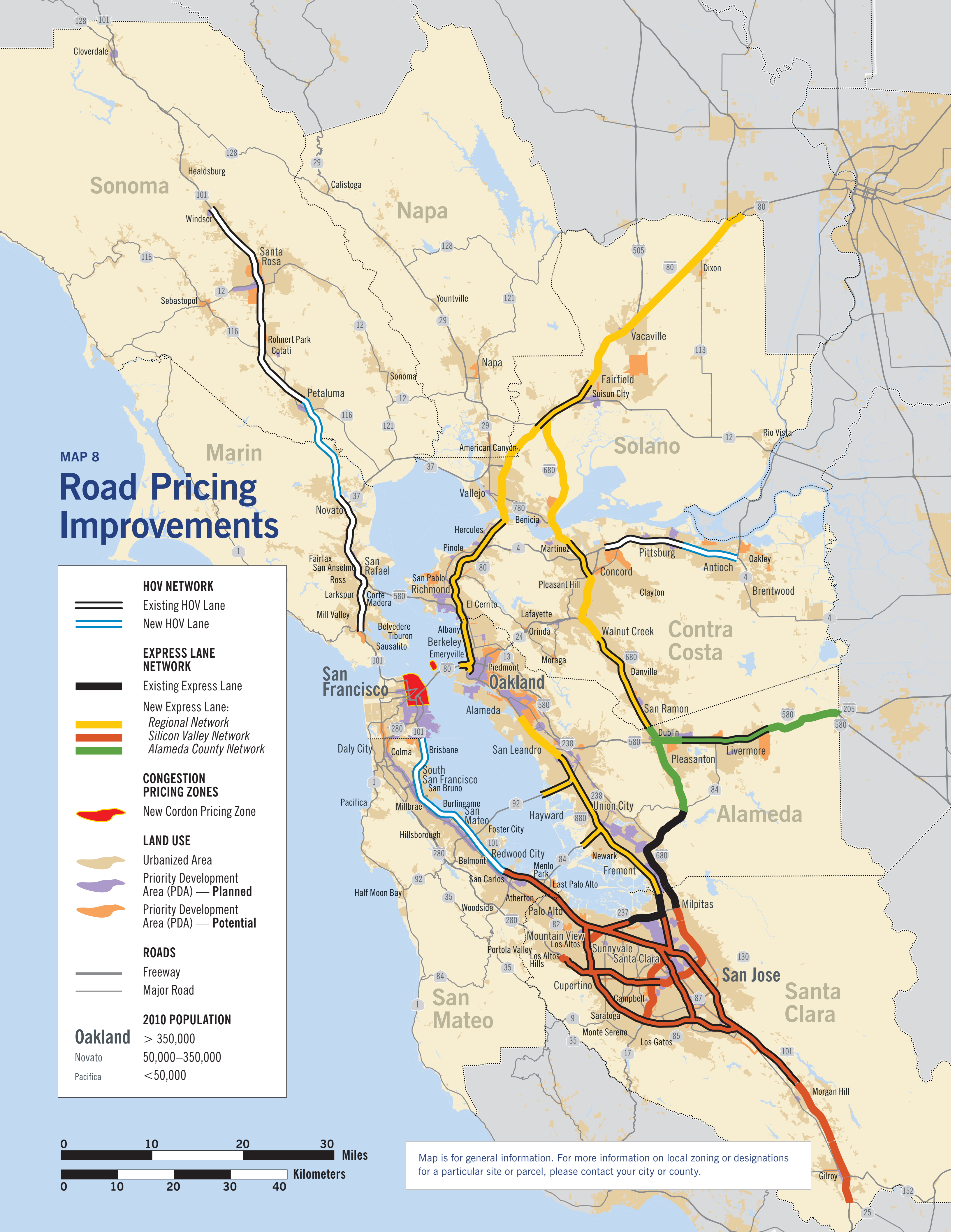
Express lane tolls vary based on levels of congestion. They are priced low enough to attract drivers out of slow traffic in the regular lanes, but high enough to ensure a free flow of cars in the express lane at all times. Drivers pay based on distance traveled in the express lane. Tolls are collected through the FasTrak® electronic toll collection system.

Noah Berger

In October 2011, the California Transportation Commission (CTC) approved MTC's plan to add 270 miles of express lanes on I-80 in Solano, Contra Costa and Alameda counties, I-880 in Alameda County, I-680 in Solano and Contra Costa counties, and the approaches to the Bay Bridge, San Mateo-Hayward Bridge and the Dumbarton Bridge. These will be operated by MTC in tandem with express lanes operated by county agencies on I-580 and I-680 in Alameda County and throughout Santa Clara County to form a seamless system of express lanes throughout the region. Of the proposed network, 150 miles would involve converting existing carpool lanes, or high-occupancy vehicle (HOV) lanes, to express lanes, and 120 miles would involve widening freeways to create new HOV/express lanes in both directions to close gaps in and extend the existing HOV system.

MAP 8

Road Pricing Improvements



Map is for general information. For more information on local zoning or designations for a particular site or parcel, please contact your city or county.

The goals of the Regional Express Lane system remain the same as they were in the Transportation 2035 Plan:

- **Connectivity** – Use express lane toll revenue to close gaps within the HOV lane system and to increase travel-time savings for carpools and buses. Without express lane toll revenue, the region's HOV system will remain fragmented for the foreseeable future.
- **Efficiency** – Optimize throughput on freeway corridors to better meet current and future traffic demands, using excess capacity in the existing HOV system to reduce travel time for all travelers.
- **Reliability** – Provide a reliable, congestion-free transportation option.

Express lane toll revenue will be used first and foremost to fund the operations and maintenance of the express lanes. Plan Bay Area invests $600 million in discretionary revenue in order to complete the financing package for construction of the Regional Express Lane Network in Solano, Contra Costa and Alameda counties. Conversions of existing HOV lanes will be built first. Revenues from those early express lanes will be used to bond-finance the gap closures first, and, eventually, the extensions. Express lanes in Santa Clara County will be financed by bonds that are fully supported by committed express lane toll revenue.

All project-level environmental clearances will comply with applicable requirements for environmental justice, and focused outreach will be conducted with low-income communities as part of the express lane network development and implementation. Furthermore, MTC will study the potential benefits and impacts of converting general purpose lanes to express lanes in order to inform implementation of the express lane network.

A map of other critical roadway improvements proposed in the Plan Bay Area investment strategy is included at the end of this chapter.

Proposed congestion pricing locations in downtown San Francisco and Treasure Island.

San Francisco Congestion Pricing

Congestion pricing involves charging drivers a fee to drive in congested areas, and using the revenue generated to fund transportation improvements — such as better transit service, signal coordination, and bicycle and pedestrian projects — that improve travel options and traffic flow. Congestion pricing is being advanced in San Francisco through a demonstration project as a part of the Treasure Island development project, and through ongoing planning for congestion pricing in downtown San Francisco.

Treasure Island

In June 2011, the city of San Francisco approved development plans for Treasure Island (a Priority Development Area), including 8,000 residential units, along with retail and commercial uses. The Treasure Island Transportation Implementation Plan, adopted as part of the development project's approval, calls for an integrated approach to managing traffic and improving mobility management, including a congestion fee to be assessed for residents traveling by private automobile on or off the island during peak hours. The congestion fee, in combination with parking charges and a pre-paid transit voucher for each household, will help fund a comprehensive suite of transportation services including new ferry service to San Francisco and enhanced East Bay bus services.

London congestion pricing

The Guardian UK

Downtown San Francisco

During rush hours, congestion in the greater downtown area results in average bus transit and automobile speeds below 10 miles per hour. Congestion is already a problem, and the city has ambitious growth plans for the future. Unless bold measures are taken, downtown San Francisco streets will be unable to accommodate expected levels of housing and job growth, and gridlocked conditions will threaten the city's and region's economic development plans. A recent study found congestion pricing in downtown San Francisco to be a feasible and potentially effective way to manage and grow the transportation system while supporting new businesses and residents. The mobility and pricing program could result in:

- 12 percent fewer peak-period vehicle trips and a 21 percent reduction in vehicle hours of delay
- 5 percent reduction in greenhouse gases citywide
- $60–80 million in annual net revenue for mobility improvements
- 20–25 percent transit speed improvement and 12 percent reduction in pedestrian incidents

Plan Bay Area supports the implementation of these congestion pricing projects in San Francisco with a $150 million investment over the plan period.

Investment Strategy 5
County Investment Priorities

The county congestion management agencies have identified key local transportation priorities during the development of their county transportation plans. This process resulted in $29 billion in discretionary funding requests, which is nearly twice the $16 billion that is expected to be available over the life of the plan. Overall, the county funding priorities are closely aligned with the investment strategy, including an investment of 66 percent of these funds dedicated to maintaining and sustaining current transportation systems. Their priorities complement a number of the regional discretionary investment strategies including the OneBayArea Grant, Build Next Generation Transit, and Freeway and Transit Efficiency strategies. The county programs also include complete streets programs that will deliver substantial bicycle and pedestrian improvements. Figure 21 summarizes the counties' investment priorities; more details can be found in the Online Project Database, listed in Appendix 1.

FIGURE 21: County Investment Priorities $16 Billion (YOE $)

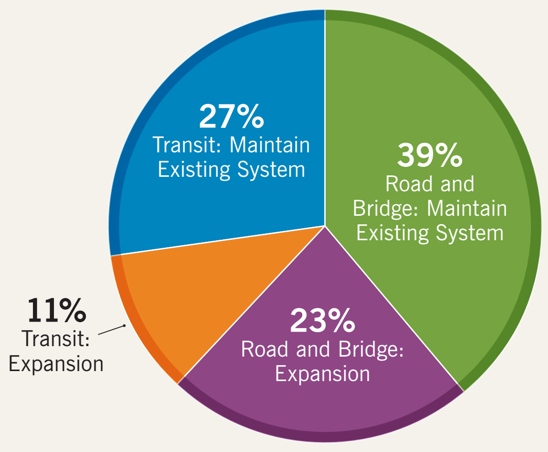


TABLE 23: Summary of Climate Initiatives Program

Policy Initiative (from most to least cost-effective)	**Cost** (in millions of YOE $)	**Per Capita CO$_2$ Emissions Reductions in 2035**
Commuter Benefit Ordinance	$0	–0.3%
Car Sharing	$13	–2.6%
Vanpool Incentives	$6	–0.4%
Clean Vehicles Feebate Program	$25	–0.7%
Smart Driving Strategy	$160	–1.5%
Vehicle Buy-Back & Plug-in or Electric Vehicle Purchase Incentive	$120	–0.5%
Regional Electric Vehicle Charger Network	$80	–0.3%
Climate Initiatives Innovative Grants	$226	TBD
Total	**$630**	**–6.3%**

Investment Strategy 6
Protect Our Climate

Pursuant to SB 375, the California Air Resources Board in 2011 assigned the Bay Area a per capita greenhouse gas (GHG) emissions reduction target of 7 percent by 2020 and 15 percent by 2035. These are aggressive targets that we are determined to meet and possibly exceed. In terms of its development, the Bay Area is a relatively mature region, with a well-established transportation system and a large population already in place. While it can focus the pattern of future growth, Plan Bay Area does not significantly rearrange the development pattern that already exists. So in harmony with our multimodal transportation network and focused land use plan, we have to invest in technology advancements and provide incentives for travel options to help meet these emissions targets. The Plan Bay Area climate initiative invests $630 million in the eight programs highlighted in Table 23.

Commuter Benefit Ordinance

Senate Bill 1339 authorizes the Bay Area Air Quality Management District (BAAQMD) and MTC to jointly adopt a regional commuter benefit ordinance as a means to reduce GHG emissions and to improve air quality. Commuter benefits would include pre-tax benefit programs, employer-provided subsidies, free shuttles or vanpools, or an employer-chosen alternative that would provide an equal or greater benefit in terms of reducing GHG emissions. The agencies are required to report to the Legislature in 2016 on the results of the program, including vehicle miles reduced and greenhouse gases reduced.

Car-Sharing

Car-sharing services have been available in the Bay Area since 2001, and in that time the number of vehicles available and the number of subscribers has grown. Bay Area wide, there were an estimated 60,500 members in 2012 and fleets with hundreds of cars to serve those customers. Car-sharing allows people to rent cars by the hour, for as short a time as 30 minutes up to a full weekend. Car-sharing saves families and individuals hundreds of dollars every month in car payments, insurance, gas, registration and repairs. This investment strategy proposes to invest $13 million to expand car-sharing services to ensure vehicles are available at high-demand locations, and to expand services in suburban communities.

Noah Berger

Vanpool Incentives

The Bay Area has had an organized vanpool program since 1981. Currently managed by local, county and regional partners including MTC's 511 program, the region's vanpool service helps people with long commutes that are not well-served by transit. This strategy will enhance the appeal of vanpooling by dedicating $6 million to reduce the cost of van rentals. Encouraging more people to participate in the vanpool program can help to remove personal cars from crowded freeways and reduce overall emissions.

Clean Vehicles Feebate Program

A "feebate" charges a fee to one user, and that fee is used to provide a discount to another user. The feebate program in Plan Bay Area would charge a one-time, point-of-purchase fee on new vehicles with low miles-per-gallon ratings to help purchase fuel-efficient vehicles that emit much less pollution.

Although the fees and subsidies from the program are revenue-neutral, this strategy still includes $25 million to pay for the administrative costs of the program over the period of the plan.

Smart Driving Strategy

Despite Plan Bay Area's targeted efforts to incentivize the purchase of fuel-efficient vehicles, many of the cars currently on the road fall short of current and future emission or fuel-efficiency standards, yet they work well and are not ready to be retired. Smart driving tactics are easy-to-implement actions (e.g., change in driving style, more-frequent vehicle maintenance, etc.) that any driver can do to save gas and reduce emissions. Plan Bay Area provides a total of $160 million to develop a public education campaign for the region's drivers and to provide rebates for in-vehicle, real-time fuel efficiency gauges.

Vehicle Buy-Back/Purchase Incentive Program for Plug-ins or Electric Vehicles

While the federal government and the state are offering incentives for the purchase of electric vehicles, most EVs still cost more than many gas vehicles at the time of purchase. Typically when consumers buy new cars, their older, less-efficient vehicles are re-sold rather than being removed from the fleet. As long as older vehicles are still on the road polluting, it is hard to significantly reduce emissions. Plan Bay Area sets aside a total of $120 million for a voluntary incentive program to accelerate the removal of low-mpg vehicles from the region's roads. In return for trading in their car, which is retired from service, people can receive a cash incentive towards the purchase of a new plug-in hybrid or electric vehicle.

Regional Electric Vehicle Charger Network

BAAQMD, in partnership with regional and local partners, and auto manufacturers and service providers, is charting the Bay Area path for electric vehicle use in the Bay Area. The Electric Vehicle (EV) Readiness Plan, completed in late 2012, sets forth short-term strategies to increase EV usage. A long-term strategy is currently under development. Plan Bay Area supports this initiative with supportive strategies to help clean our air and cut the region's GHGs.

The Bay Area is expected to be a successful clean-vehicle market, but due to the limited range of today's all-electric vehicles (EVs) it is projected that many EV purchases will be plug-in hybrid electric vehicles (PHEVs) that can switch over to a gasoline engine once they have used up the energy in their batteries. Plan Bay Area allocates $80 million to install more EV chargers at Bay Area workplaces. The proposed investment will allow vehicles to be charged during the day, ready to make the drive back home without using the gasoline engine.

Peter Beeler

Noah Berger

Climate Initiatives Innovative Grants

With the adoption of the Transportation 2035 Plan, MTC created a new Climate Initiatives Innovative Grant program and invested $33 million in innovative and creative pilot grants to reduce greenhouse gas (GHG) emissions from the transportation sector. The grant categories included: Safe Routes to Schools, which encourages children to bike and walk to school; Parking Pricing; Transportation Demand Management, which includes strategies to reduce travel demand or shift demand in order to relieve congestion; and Showcase Projects, for creative ideas that did not fit neatly into the other categories. These grants are still being implemented and evaluated, but many of the pilot projects show promise in their potential to reduce GHG emissions. Plan Bay Area sets aside $226 million to invest in the expansion of the most successful strategies identified in the innovative grants program.

Key Transit and Road Improvements

The following maps show priority transit and road projects from the Plan Bay Area investment strategy. These projects reflect a mix of committed and discretionary investments, with local, state and federal investments all in support. The maps show key road and highway improvements, local transit projects, and regional transit projects. More details on these and other Plan Bay Area-funded projects and programs are available in the Online Project Database, listed in Appendix 1.

Caltrain

Peter Beeler

Regional Transit System Improvements*

BART Projects

1. BART Extension to San Jose/Santa Clara

Commuter Rail Projects

2. Caltrain Electrification & Frequency Improvements
3. Caltrain Downtown Extension (4th & King to Transbay Transit Center)
4. eBART to Antioch
5. SMART Commuter Rail (Larkspur to Windsor)

Infill Stations & Bus Terminals

6. Transbay Transit Center
7. Irvington BART Station
8. Union City Commuter Rail Station
9. Hercules Commuter Rail Station

Ferry

10. New Ferry Routes: Treasure Island, Berkeley, Richmond, Hercules, Redwood City

* For clarity, only major expansion projects or operational improvements with costs exceeding $50 million are depicted.

MAP 9

Regional Transit System Improvements

Map is for general information. For more information on local zoning or designations for a particular site or parcel, please contact your city or county.

Local Transit Improvements*

Bus Rapid Transit (BRT) Projects

① Van Ness BRT
② Geary BRT
③ Geneva-Harney BRT
④ East Bay BRT
⑤ Grand-MacArthur BRT
⑥ Alameda-Oakland BRT
⑦ El Camino BRT
⑧ Santa Clara-Alum Rock BRT
⑨ Stevens Creek BRT
⑩ King Road Rapid

Light Rail (LRT) Projects

⑪ Central Subway (Chinatown to Caltrain)
⑫ Embarcadero Streetcar (Fort Mason to Caltrain)
⑬ Parkmerced Light Rail Extension
⑭ Bayshore Light Rail Extension
⑮ Oakland Airport Connector
⑯ San Jose Airport People Mover
⑰ Vasona Light Rail Extension
⑱ Capitol Expressway Light Rail Extension

Other Projects

⑲ Transit Effectiveness Project
⑳ Dumbarton Express Bus Frequency Improvements

* For clarity, only major expansion projects or operational improvements with costs exceeding $50 million are depicted.

Future Oakland Airport Connector

BART

MAP 10

Local Transit Improvements

Map is for general information. For more information on local zoning or designations for a particular site or parcel, please contact your city or county.

Highway System Improvements*

US-101 Corridor

① Widening from Story Road to Yerba Buena Road

② Operational Improvements along Presidio Parkway/Doyle Drive and in the Twin Cities/ Greenbrae Corridor

③ New Auxiliary Lanes from Oyster Point to San Francisco county line and from Marsh Road to Embarcadero Road

④ Interchange Improvements at: Petaluma Boulevard, Greenbrae, Candlestick Point, Produce Avenue, Broadway, SR-92, Woodside Road, Willow Road and Oregon Expressway

⑤ New Interchanges at: Zanker Road/Skyport Drive and Mabury Road/Taylor Street

I-80 Corridor

⑥ Widening from I-680 to Airbase Parkway

⑦ Integrated Corridor Management (Emeryville to Crockett)

⑧ Interchange Improvements at: I-680/SR-12, San Pablo Dam Road, Ashby Avenue, and Yerba Buena Island

I-280 Corridor

⑨ Interchange Improvements at: SR-85 and Senter Road

I-580 Corridor

⑩ Widening from Greenville Road to North Flynn Road

⑪ Interchange Improvements at: Vasco Road and Greenville Road

I-680 Corridor

⑫ Interchange Improvements at: SR-84 and SR-4

⑬ New Interchange at: Norris Canyon Road

I-880 Corridor

⑭ Interchange Improvements at: Jackson Street, 23rd Avenue, 29th Avenue, A Street, Industrial Parkway, Whipple Road, and SR-262

SR-4 Corridor

⑮ Widening from Somersville Road to SR-160 and from Lone Tree Way to Balfour Road

⑯ Interchange Improvements at: SR-160/ Phillips Lane

SR-12 Corridor

⑰ Jameson Canyon Widening

⑱ New Interchange at: Fulton Road

Other Projects

⑲ Willow Road Expressway (SR-84 to US-101)

⑳ SR-84 Widening (I-680 to Jack London Boulevard)

㉑ SR-262 Widening (I-680 to I-880)

㉒ SR-1 Widening (Fassler Avenue to Westport Drive)

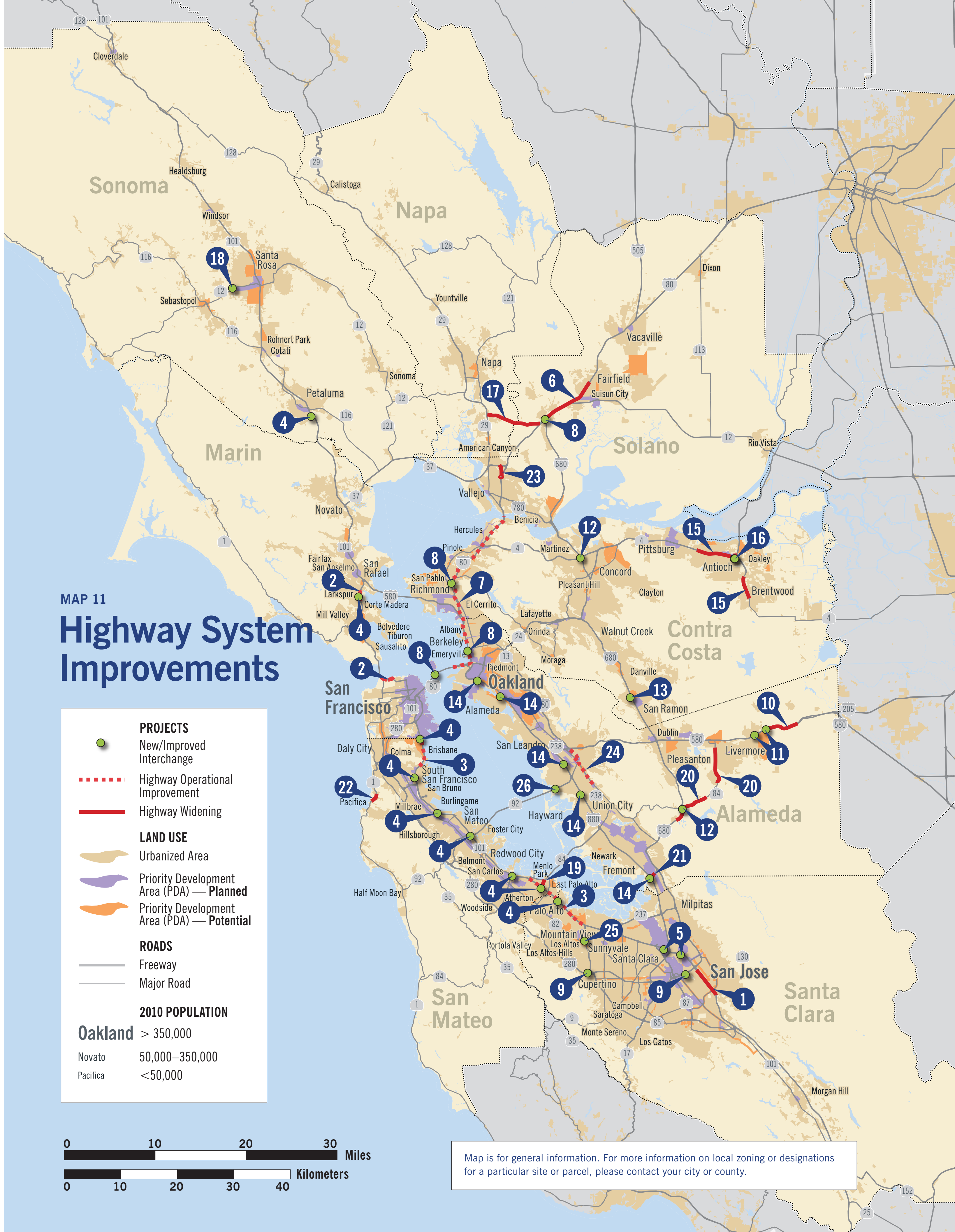
㉓ Redwood Parkway/Fairground Drive Widening

㉔ SR-238 & SR-185 Operational Improvements

㉕ SR-85/SR-237 Interchange Improvements

㉖ SR-92/Clawiter Road/Whitesell Street Interchange Improvements

* For clarity, only major expansion projects or operational improvements with costs exceeding $50 million are depicted.



MAP 11

Highway System Improvements

Map is for general information. For more information on local zoning or designations for a particular site or parcel, please contact your city or county.

TABLE 24: Plan Bay Area Investment Strategy Summary – Discretionary Revenues
(in billions of YOE $)

Strategy	Investment	% of Total
1 **Maintain Our Existing System**	$15	25%
2 **Build Next Generation Transit***	$7	12%
3 **Boost Freeway and Transit Efficiency**	$4	7%
4 **Support Focused Growth – OBAG**	$14	23%
5 **County Investment Priorities**	$16	27%
6 **Protect Our Climate**	< $1	1%
7 **Reserve**	$3	5%
Total	**$60**	**100%**

*Includes $2 billion in funds retained for future New/Small Starts and High-Speed Rail projects.

Summary

The investment strategies for the $60 billion in discretionary revenue support key priorities that will help our region to surpass our per-capita greenhouse gas target, deliver the long-term land use strategy, maintain the infrastructure investments made by past generations, and provide for future economic growth. Table 24 above summarizes the investment strategies and their respective funding levels of discretionary revenue in Plan Bay Area.

Plan Bay Area also sets a path for the region to participate in and inform the California Transportation Plan (CTP 2040). This plan, scheduled for completion by the end of 2015, will integrate regional planning efforts from around the state into a comprehensive plan. CTP 2040 will address the state's mobility, reduce greenhouse gas emissions from the transportation sector, and define performance-based goals, policies and strategies to plan, enhance and sustain California's statewide, integrated, multimodal transportation system.


Vallejo Transit Center

Karl Nielsen

5

Performance

Noah Berger

Noah Berger

Chapter 5

Performance

At both the scenario and project levels, Plan Bay Area has been tested against rigorous performance targets.

Because of this, MTC and ABAG have been able to craft a plan that emphasizes the most effective strategies to achieve regional objectives. Even so, some targets remain stubbornly out of reach.

Plan Bay Area achieves the greenhouse gas emissions reduction target required by state law through a more efficient land use pattern, key transportation investments and initiatives such as accelerated electric vehicle deployment. It also achieves the housing target required by state law to provide housing for all of the region's population over the next three decades, relying on local communities' support for policies that direct the lion's share of housing growth into Priority Development Areas.

At the same time, Plan Bay Area struggles to achieve many of the region's ambitious voluntary targets. Thanks to investments in transportation alternatives, the plan moves in the right direction when it comes to increasing active transportation and reducing the number of automobile miles driven per capita, though it falls short of the "aspirational" goals set in these areas. While the plan allocates funds and introduces policies to address them, roadway safety, transportation and housing for low-income persons, and the transportation system's state of good repair remain vexing problems that the region must redouble our efforts to confront.

How Does Plan Bay Area Perform?

As has been the case in past long-term transportation plans, no single strategy is able to achieve all the plan's performance targets, and Plan Bay Area clearly bears this out. Some targets — including the key greenhouse gas emissions and housing targets — are met or even exceeded. In other cases, the plan makes progress toward achieving a target, but falls short of full attainment. And in other cases, the plan actually loses ground against some metrics.

Here is a target-by-target breakdown of how well Plan Bay Area performs. (See Chapter 1 for background on the performance targets.) Given the plan's 2040 horizon year, target results reflect year 2040 performance in comparison to year 2005 baseline conditions, unless noted.

Additional analysis of target performance can be found in the Performance Assessment Report, *listed in Appendix 1.*

Required Performance Targets

Climate Protection

Target #1:
Reduce per-capita CO_2 emissions from cars and light-duty trucks by 15 percent.

Plan meets and exceeds target; reduces per-capita emissions of CO_2 by 18 percent (by 2040).

Reducing the transportation sector's emission of greenhouse gases responds to the threat of climate change and helps to address the threat to the region from sea level rise.

Through combinations of denser land use patterns focused in Priority Development Areas, increased investments in the region's public transit infrastructure, and enhanced funding of climate initiatives such as electric vehicle adoption incentives, Plan Bay Area not only meets but exceeds its greenhouse gas (GHG) emissions reduction target. By 2040, the typical Bay Area resident is expected to reduce his or her daily transportation CO_2 emissions by 18 percent compared to 2005 conditions.

Kit Morris

Senate Bill 375 mandates per-capita GHG target achievements for years 2020 and 2035 as established by the California Air Resources Board. For 2035, the plan leads to a 16 percent per-capita reduction (surpassing the 15 percent target), and for 2020, the plan leads to a 10 percent per-capita reduction (also surpassing an interim 7 percent target).

While MTC has considered the effects of transportation investments on GHG emissions in prior regional transportation plans, Plan Bay Area is the first regional effort with an aggressive and achievable emission reduction goal. By accelerating efforts to emphasize infill growth and to boost funding for public transit, this plan represents a bold step for the region in this era of climate change.

Adequate Housing

Target #2:
House 100 percent of the region's projected population growth by income level (very-low, low, moderate, above-moderate) without displacing current low-income residents.

Plan meets target; houses 100 percent of population growth.

It's no secret that the Bay Area is one of the most expensive places to live in the United States. For decades this has caused an ever-increasing number of people who work in the Bay Area to look for more affordable housing in the Central Valley or other surrounding regions. The resulting longer-distance commutes increase emissions while also raising transportation costs for the residents who must venture so far afield in search of more affordable housing. This places a greater burden on lower-income residents and further increases the divide between the region's more-affluent and less-affluent residents. The region's businesses also suffer, since the dispersal of workers tends to constrain the supply of labor they can draw on.

MTC Archives

SB 375 requires regions to plan for housing that can accommodate all projected population growth, by income level, so as to reduce the pressures that lead to in-commuting from outside the nine-county region. In November 2010, ABAG adopted a methodology to define this figure. This target is also intended to limit the displacement of low-income residents, defined as the outward movement of current low-income residents from locations in the region's urban core to locations with lower accessibility to transportation options and limited services as a result of new development pressures. This target complements the Regional Housing Need Allocation (RHNA), as discussed in Chapter 3.

Plan Bay Area succeeds in identifying housing opportunities for all of the region's population. Working with cities and counties to underscore the importance of achieving this target, MTC and ABAG are putting forward a plan that provides sufficient housing for the number of new jobs created in the region. The focus on spurring housing in locally supported Priority Development Areas and high-quality transit corridors allows the plan to meet this target, and also helps to achieve the GHG emissions reduction target (see above).

Voluntary Performance Targets

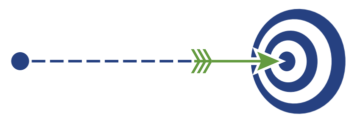
Healthy and Safe Communities

Reduce Particulate Matter

Target #3:
Reduce premature deaths from exposure to particulate emissions:

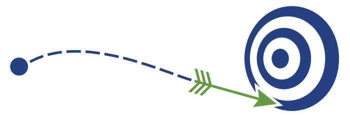
Target #3a:
Reduce premature deaths from exposure to fine particulates ($PM_{2.5}$) by 10 percent.

Plan meets and exceeds target; reduces premature deaths from exposure to fine particulates by 71 percent.



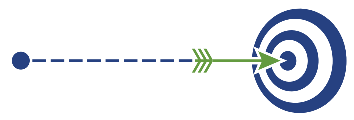
Target #3b:
Reduce coarse particulate emissions (PM_{10}) by 30 percent.

Plan reduces coarse particulate emissions by 17 percent, but falls short of target.



Target #3c:
Achieve greater reductions in highly impacted areas.

Plan meets target; achieves greater particulate emission reductions in highly impacted neighborhoods.

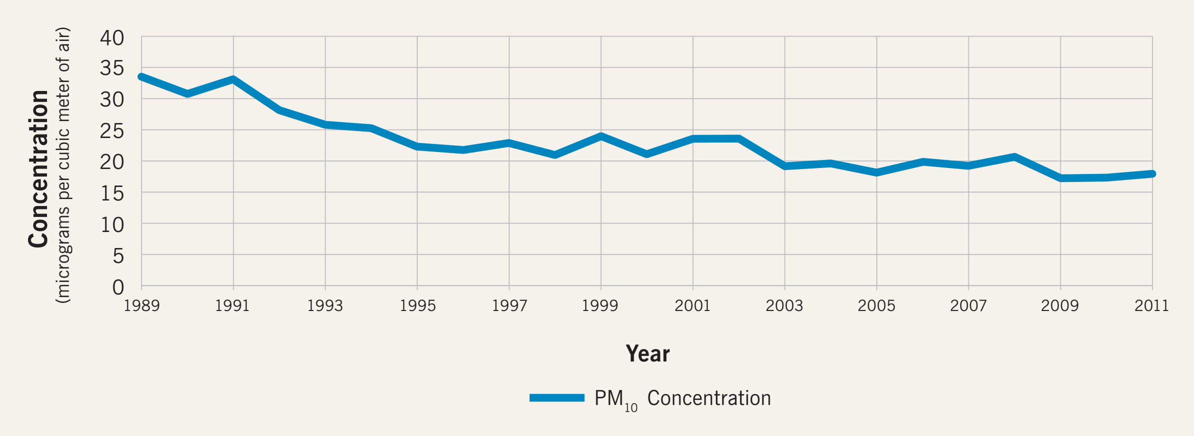


Particulate matter (PM) consists of very small particles that can pass through the throat and nose and into the lungs, and may even enter the bloodstream. Over time this can affect the heart and lungs and lead to serious health effects such as heart attacks or asthma, and can even contribute to premature death. While particulate matter is directly linked to vehicle miles traveled, the approach taken with this target moves from simply measuring vehicle use to measuring healthy outcomes for the region's residents.

The Bay Area does not meet the federal standard for fine particulate matter ($PM_{2.5}$), which is extremely hazardous to health. The goal of a 10 percent reduction in premature deaths due to $PM_{2.5}$ reflects the expected benefit from meeting the federal standard, assuming each emission sector (both mobile and non-mobile sources) takes on similar emission reduction shares. The region, like all major metropolitan regions in the state, also does not yet attain the state standard for the coarser PM_{10}, which also causes health impacts. The 30 percent reduction goal for PM_{10} is consistent with the reduction needed to meet the state standard.

There has been substantial progress in reducing Bay Area PM levels in recent years[1]. The state and the Bay Area Air Quality Management District have taken major steps to address pollution impacts of Bay Area traffic — primarily, to clean up truck engines and fuel, the chief sources of particulate emissions. New regional and state regulations are expected to reduce premature deaths by 71 percent by 2040, saving 159 lives per year compared to the 2005 baseline. This projection far exceeds the 10 percent reduction target for Plan Bay Area. Coarse particulates, known as PM_{10}, also represent a major threat to air quality and public health; in 2005, Bay Area vehicles emitted 15 tons (approximately the weight of seven passenger vehicles) of particulate matter every day. While the historical trend has been favorable (see Figure 22), and aforementioned regulations help move us in the right direction with regard to this ambitious target (reducing emissions by 17 percent by 2040), they still fall short of achieving the 30 percent target established for Plan Bay Area.

FIGURE 22: **Bay Area Annual Mean PM_{10} (Quarterly Averaged, 9-site Mean, 1989–2011)**



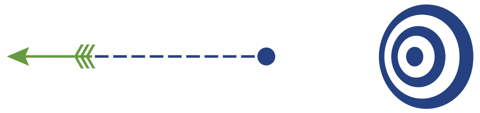
Source: Bay Area Air Quality Management District

Despite more stringent controls on tailpipe emissions and fuels, meeting the PM_{10} target will be difficult given the region's long-term mobility needs. To achieve the public health benefits of this target, it will be necessary to reduce auto trip distances and to promote the use of alternative modes of transportation such as transit, biking and walking. While Plan Bay Area offers more individuals new public transit options and supports the trend toward shorter-distance commutes, regional growth will lead to more vehicles (and more vehicle miles) than ever before.

Reduce Injuries and Fatalities From Collisions

Target #4:
Reduce by 50 percent the number of injuries and fatalities from all collisions (including bike and pedestrian).

Plan moves in opposite direction from target; injury and fatality collisions are projected to increase during plan period by 18 percent.



Making the Bay Area safer for motorists, pedestrians and bicyclists is an important and ongoing priority. This target reflects an emphasis in Plan Bay Area to enhance safety for all travel modes across the Bay Area. The target is adapted from the state's Strategic Highway Safety Plan (2006), and also reflects a long-standing regional goal of making streets, highways and transit service safer.

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[1] Air quality monitoring data shows that the Bay Area met the national 24-hour $PM_{2.5}$ standard during the 2008–2012 period. However, the Bay Area is still formally designated a non-attainment area for the national 24-hour $PM_{2.5}$ standard.

Approximately 39,000 individuals were injured or killed in collisions on Bay Area roads during the year 2005, highlighting the critical need to improve roadway safety. Unfortunately, as a result of the region's growth in total population and in total vehicle miles traveled, we lose ground against this target over the course of the plan. Although as a region we continue to invest in safer roads for all modes of transport, over 46,000 individuals are forecasted to be injured or killed in collisions in year 2040, an 18 percent increase in roadway tragedies compared to 2005. While it is some comfort to know that the per-capita rate of collisions is projected to decline by 10 percent during the plan period, the sheer number of people traveling on the network — combined with the certainty of occasional human error — overwhelms the safety improvements for which the plan allocates funding.


John J. Kim

Encourage Active Transport

Target #5:
Increase the average daily time walking or biking per person for transportation by 70 percent (for an average of 15 minutes per person per day).

Plan boosts per-person active transportation by 17 percent, but falls short of target.

The U.S. Surgeon General recommends at least 30 minutes of physical activity per day to lower the risk of chronic disease and increase life expectancy. While Bay Area residents are more physically active than residents in most other parts of the country, the current measure of Bay Area residents' average daily physical activity still falls well short of the Surgeon General's recommendation. The average time Bay Area residents spent walking and biking for transportation was about 9 minutes per person in 2005. There is no accepted standard for the amount of activity people should get through day-to-day transportation compared to other activities. However, in order to increase the health of our communities, Plan Bay Area set out to bring the average up to 15 minutes per person per day by encouraging people to spend more time walking or biking.

In order to improve public health in the light of rising obesity rates, it is essential to construct and improve facilities to allow for walking and bicycling during one's daily routine. The plan invests in complete streets, local streetscape improvements, and new bike and pedestrian paths, with an objective of providing new opportunities for Bay Area residents to walk and bike to daily destinations.


YinYang, iStock

Unfortunately, while these investments will boost the amount of time individuals spend walking and biking, the region continues to fall short of this public health target. The typical Bay Area resident spent about 9 minutes per day walking or biking for transportation purposes in the year 2005, while Plan Bay Area will increase the average amount to 10 minutes per day in year 2040 (a 17 percent increase).

While many people who make the effort to exercise regularly do so by going to the gym or playing on a sports team, transportation-related exercise could play a crucial role in boosting regional health. Unless additional efforts are initiated to encourage walking and biking for daily commutes or daily errands, exercise from walking and biking is expected to only increase slightly as a result of Plan Bay Area.

Open Space and Agricultural Land

Target #6:
Direct all non-agricultural development within the year 2010 urban footprint (existing urban development and urban growth boundaries).

Plan meets target; directs all non-agricultural development within the existing urban footprint.

SB 375 requires consideration of open space and natural resource protection and supports accommodating new housing and commercial development within existing areas designated for urban growth. This is of particular importance to the Bay Area, where so much of the region's spectacular natural setting has been preserved as open space. And whether it is the scenic wine country or the small farms that supply thriving farmers markets with local produce, agricultural lands also merit special protection.

The intent of this target, therefore, is to support infill development in established communities while protecting the Bay Area's agriculture and open space lands.

To ensure that the Bay Area retains the landscapes that its residents value so highly, Plan Bay Area aims to protect open space and agricultural land by directing 100 percent of the region's growth inside the year 2010 urban footprint, which means that all growth occurs as infill development or within established urban growth boundaries or urban limit lines. As the plan assumes that all urban growth boundaries/urban limit lines are held fixed through the year 2040, no sprawl-style development is expected to occur on the region's scenic or agricultural lands. This will help preserve the natural beauty of the Bay Area for future generations to enjoy.

Equitable Access

Target #7:
Decrease by 10 percentage points (to 56 percent, from 66 percent) the share of low-income and lower-middle income residents' household income consumed by transportation and housing.

Plan moves in wrong direction; the share of household income needed to cover transportation and housing costs is projected to rise by 3 percentage points to 69 percent for low-income and lower-middle income residents during the Plan Bay Area period.


Sergio Ruiz

Not only have housing costs increased over the years, but gasoline costs have crept (and sometimes leapt) up as well. Higher gas prices disproportionately burden low-income residents who drive, and in the Bay Area most low-income residents own and drive cars. In 2005, low-income and working class families in the Bay Area spent 66 percent of household income on housing and transportation, which is about 10 percentage points higher than similar families in other major U.S. metropolitan areas, and a significant cost burden.

This target addresses this situation by setting a goal of reducing the share of household income that poorer residents must devote to housing and transportation. It aims to bring the Bay Area in line with the national average and help ensure that low-income residents are able to continue to live and work in the region.

However, expected increases in gasoline prices, combined with forecasts of a regional housing market recovery, are expected to disproportionately affect those at the lower end of the income spectrum — a challenge that will face not only the Bay Area, but the nation as a whole. For this group, transportation and housing costs are likely to rise faster than household incomes during the Plan Bay Area period. On the plus side, Plan Bay Area policies should help to stabilize the length and duration of commute trips for lower-income residents — which provides benefits in terms of overall quality of life.

Economic Vitality

Target #8:
Increase gross regional product (GRP) by 110 percent — an average annual growth rate of approximately 2 percent (in current dollars).

Plan meets and exceeds the economic growth target; 119 percent increase in GRP is forecasted over the life of the plan.

Past long-range transportation plans have not included an analysis of economic impacts, even though they have directed the spending of billions of dollars of transportation funds. Of course, past transportation investments — such as transit expansion projects and freeway improvements — have certainly provided significant benefits to the Bay Area economy, but those benefits were not quantitatively estimated during plan development. Plan Bay Area takes the first step to directly address this issue through a quantitative performance target.

Gross regional product (GRP) reflects overall economic output of the region's residents and businesses. While the Bay Area economy is affected by global and national trends, regional land use patterns and transportation system efficiency also affect freight mobility and general productivity.

Between 2005 and 2040, taking Plan Bay Area into account, the region's gross regional product is forecasted to increase by 119 percent, slightly exceeding the region's historical growth rate of approximately 2 percent per year. Forecasted job growth and population growth play a primary role in the expected rise in GRP; as more households and employers decide to locate in the Bay Area, regional economic activity tends to grow by a proportionate amount.

In addition, plan investments in congestion relief projects improve workers' mobility across the region, benefitting the economy as a whole. The planned land use pattern, which emphasizes growth in high-density job centers, boosts regional economic productivity and supports overall economic growth. By boosting the efficiency of the region's land use pattern and transportation network, Plan Bay Area works to enhance the region's economic competitiveness on both national and international levels.

For more information, see the Economic Impact Analysis for Future Regional Plans, *listed in Appendix 1.*

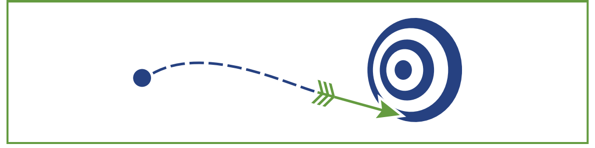
Peter Beeler

Transportation System Effectiveness

Increase Non-Auto Mode Share and Reduce VMT per Capita

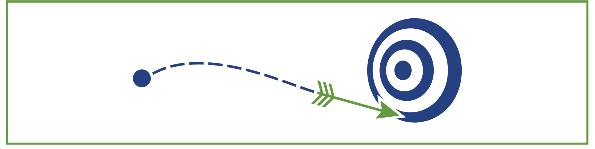
Target #9a:
Increase non-auto mode share by 10 percentage points (to 26 percent of trips).

Plan boosts non-auto mode share to 20 percent of trips, but falls short of target.



Target #9b:
Decrease automobile vehicle miles traveled (VMT) per capita by 10 percent.

Plan reduces VMT per capita by 9 percent, but falls short of target.



In order to reduce emissions and improve public health, Plan Bay Area sets goals to increase non-auto mode share and reduce VMT per capita. These targets are a reflection of how effective the transportation system is in providing easier, faster access to individuals' travel destinations. Plan Bay Area strives to achieve these targets by making alternatives to the private automobile more convenient, more frequent and more appealing. Supportive land use patterns also play a role; if destinations are closer to home, non-auto modes become more competitive and all trip lengths become shorter.

While Plan Bay Area increases the proportion of Bay Area travelers who walk, bike or utilize public transit, and decreases the daily miles traveled by the average Bay Area resident, it falls slightly short on both measures. Sixteen percent of Bay Area trips did not require an automobile in the year 2005; the region's target envisioned growing that share by 10 percentage points (to 26 percent) by the year 2040. Plan Bay Area's achievement of a 20 percent non-auto mode share means that one in five Bay Area trips would be expected to be car-free by year 2040, thanks to investments in transit, bike and pedestrian infrastructure that makes these modes more attractive.

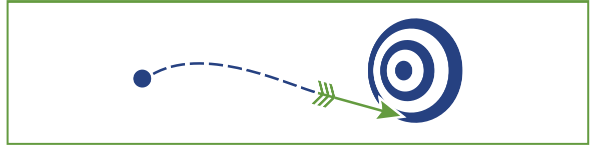
This shift, when combined with reduced average distances between home, work and retail locations, also leads to a reduction in per-capita VMT. The average Bay Area resident traveled about 22 miles by car on a typical weekday in 2005; by 2040, the average resident is expected to travel only 20 miles per day, a reduction of 9 percent. This near-achievement of the per-capita VMT target reflects the carefully targeted locations of envisioned housing and commercial development in Priority Development Areas with excellent transit service.

Maintain the Transportation System in a State of Good Repair: Local Road, Highway and Transit Maintenance

MTC has a long-standing commitment to a "fix-it-first" policy in the realm of transportation. This means that, as a region, we should strive to maintain our streets, highways and transit system before investing in system expansions. However, the Bay Area's extensive network of roads and highways is extremely expensive to maintain. Some of our cities and counties receive poor pavement ratings year after year, and the average PCI score for local pavement is currently 66, which is only "fair" in qualitative terms. The state highway system in the region faces similar challenges. Furthermore, our extensive transit system is rapidly aging and reaching the point where many of our assets are due for replacement at once. Failure to maintain the existing system at all levels would result in increased future maintenance costs, unreliable service and increased costs to travelers.

Target #10a:
Increase local road pavement condition index (PCI) to 75 or better.

Plan improves pavement condition of local roads to a PCI of 68, but falls short of target.



While the region has made progress on local road conditions over the past decade (increasing its pavement condition index from 63 in 2005 to 66 today), Bay Area road conditions remain in the "Fair" category. Thus, the targeted improvement to a "Good" PCI of 75 was clearly an ambitious objective.

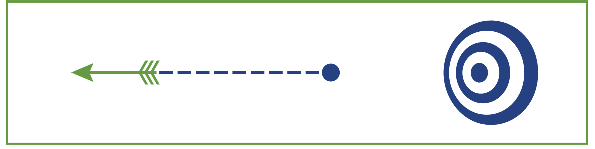
Even though approximately one-third of Plan Bay Area funding is directed toward maintaining and operating our existing road network, average PCI is only expected to increase to 68 by year 2040. This represents an 8 percent improvement in local road conditions over year 2005. Given the costs of maintaining the region's aging infrastructure, this is still a notable achievement, especially considered relative to the degradation of state highway and transit assets over the plan's lifespan (see below).

Sergio Ruiz

This target's performance is aided by voter-approved local sales tax measures, which have boosted the funding available for preserving and maintaining local streets and roads. Yet even this funding is not adequate to enable most local roads to reach a "Good" PCI of 75. Without increased funding from a regional gas tax or a shift to a vehicle miles traveled tax, it will continue to be a challenge to achieve this ambitious target.

Target #10b:
Decrease distressed lane-miles of state highways to less than 10 percent of total lane-miles.

Plan moves in opposite direction from target; the percentage of distressed state highway lane-miles in the region will rise to 44 percent of the regional highway system by year 2040.



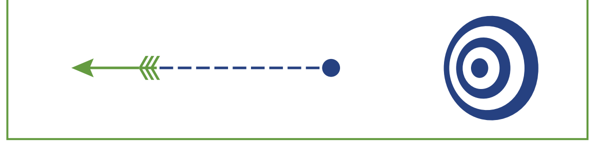
Given the state's ongoing budget constraints, the state highway system continues to suffer from deferred maintenance and worsening roadway conditions. As the highway system is owned and maintained by Caltrans, the system's safety and upkeep lies with them. If current budget constraints continue over the coming decades, the share of distressed lane-miles is expected to increase from 27 percent of the overall Bay Area highway network to 44 percent of the network.

Plan Bay Area does not allocate any discretionary funding toward the maintenance of the state highway system, given that the state is responsible for its preservation. Additional statewide funding for roadway maintenance would be the most direct approach to address this target's degradation over the lifespan of the plan.

Transit Maintenance

Target #10c:
Reduce the share of transit assets past their useful life to 0 percent.

Plan moves in opposite direction from target; the share of transit assets past their useful life is projected to increase to 24 percent of all assets during the Plan Bay Area period.



Bay Area transit riders depend on well-maintained vehicles, stations and trackways in order to ensure system reliability and performance. While all transit agencies would prefer to retire transit vehicles at the end of their prescribed life, the high cost of such vehicles delays their replacement, leading to more vehicle breakdowns and systemwide delays. In 2012, approximately 13 percent of all Bay Area transit assets were past their useful life; by 2040, 24 percent of transit assets are expected to be past their useful life, even though the plan allocates over half the region's funding to operate and maintain the existing transit system.

Given that almost one in four transit assets is expected to exceed its useful life in year 2040, passenger comfort is expected to degrade, along with customer satisfaction in the system's reliability, safety and speed. Of course, transit assets do not need to be in an ideal state of repair for transit service to be provided successfully. However, as the state of repair declines, the negative effects on equipment availability and reliability will eventually reach the point of impairing service levels, and would likely impede transit agencies' efforts to boost ridership. That said, it should also be noted that transit asset management is a relatively new and evolving field, and there have been no established guidelines for a minimum required state of repair, or for how to evaluate whether the state of repair is sufficient to sustain transit services. New transit asset management requirements contained in the recently enacted federal law known as MAP-21 will help focus attention on this long-term issue, but in the long run, greater financial support from the federal or state levels will be needed to bring the Bay Area transit network into an ideal state of good repair.

Sergio Ruiz

Summary of Performance

TABLE 25: Results of Plan Bay Area Target Assessment

Plan Meets or Exceeds Target			
Climate Protection	**Target #1:** Reduce per-capita CO_2 emissions from cars and light-duty trucks by 15 percent.	Plan meets and exceeds target; reduces per-capita emissions of CO_2 by 18 percent (by 2040).	◎
Adequate Housing	**Target #2:** House 100 percent of the region's projected growth by income level (very-low, low, moderate, above-moderate) without displacing current low-income residents.	Plan meets target; houses 100 percent of population growth.	◎
Healthy and Safe Communities Reduce Particulate Matter	**Target #3a:** Reduce premature deaths from exposure to fine particulates ($PM_{2.5}$) by 10 percent.	Plan meets and exceeds target; reduces premature deaths from exposure to fine particulates by 71 percent.	◎
	Target #3c: Achieve greater reductions in highly impacted areas.	Plan meets target; achieves greater particulate emission reductions in highly impacted neighborhoods.	◎
Open Space and Agricultural Land	**Target #6:** Direct all non-agricultural development within the year 2010 urban footprint (existing urban development and urban growth boundaries).	Plan meets target; directs all non-agricultural development within the existing urban footprint.	◎
Economic Vitality	**Target #8:** Increase gross regional product (GRP) by 110 percent — an average annual growth rate of approximately 2 percent (in current dollars).	Plan meets and exceeds the economic growth target; 119 percent increase in GRP is forecasted over the life of the plan.	◎
Plan Makes Progress Toward Target			
Healthy and Safe Communities Reduce Particulate Matter	**Target #3b:** Reduce coarse particulate emissions (PM_{10}) by 30 percent.	Plan reduces coarse particulate emissions by 17 percent, but falls short of target.	◎
Active Transport	**Target #5:** Increase the average daily time walking or biking per person for transportation by 70 percent (for an average of 15 minutes per person per day).	Plan boosts per-person active transportation by 17 percent, but falls short of target.	◎
Transportation System Effectiveness Increase Non-Auto Mode Share	**Target #9a:** Increase non-auto mode share by 10 percentage points (to 26 percent of trips).	Plan boosts non-auto mode share to 20 percent of trips, but falls short of target.	◎
Reduce VMT per Capita	**Target #9b:** Decrease automobile vehicle miles traveled (VMT) per capita by 10 percent.	Plan reduces VMT per capita by 9 percent, but falls short of target.	◎
Local Road Maintenance	**Target #10a:** Increase local road pavement condition index (PCI) to 75 or better.	Plan improves pavement condition of local roads to a PCI of 68, but falls short of target.	◎

Table continues on following page

TABLE 25: Results of Plan Bay Area Target Assessment *(continued)*

Plan Moves in Opposite Direction From Target			
Reduce Injuries and Fatalities from Collisions	**Target #4:** Reduce by 50 percent the number of injuries and fatalities from all collisions (including bike and pedestrian).	Plan moves in opposite direction from target; injury and fatality collisions are projected to increase during plan period by 18 percent.	⊗
Equitable Access	**Target #7:** Decrease by 10 percentage points (to 56 percent from 66 percent) the share of low-income and lower-middle income residents' household income consumed by transportation and housing.	Plan moves in wrong direction; the share of household income needed to cover transportation and housing costs is projected to rise to 69 percent for low-income and lower-middle income residents during the Plan Bay Area period.	⊗
Transportation System Effectiveness Highway Maintenance	**Target #10b:** Decrease distressed lane-miles of state highways to less than 10 percent of total lane-miles.	Plan moves in opposite direction from target; the percentage of distressed state highway lane-miles in the region will rise to 44 percent of the regional highway system by year 2040.	⊗
Transit Maintenance	**Target #10c:** Reduce the share of transit assets past their useful life to 0 percent.	Plan moves in opposite direction from target; the share of transit assets past their useful life is projected to increase to 24 percent of all assets during the Plan Bay Area period.	⊗

Key Targets Achieved in Solid Overall Effort, But Breakthrough Strategies Needed for Some Targets

As has been the case in past long-term transportation plans, no single strategy is able to achieve all the plan's performance targets. A review of the performance results for the 10 main targets and five sub-targets (for a total of 15 performance measures) clearly bears this out. Specifically, Plan Bay Area meets or exceeds six targets, including the statutory greenhouse gas emissions and housing targets, narrowly misses three targets, falls well short of two targets and moves in the wrong direction on four of the targets. In other words, the plan makes great progress on nine of 15 performance measures, which represents a solid first effort. MTC and ABAG will need to focus future attention on conceptualizing breakthrough strategies to achieve the four targets where we are falling behind.

Noah Berger

Key Equity Analysis Findings

With respect to the separately conducted analysis of the plan's social equity impacts (see Chapter 1 for background on the Equity Analysis), most of the measures studied do not show improvements for either "communities of concern" or the rest of region relative to conditions in 2010. However, Plan Bay Area does perform better than the year 2040 baseline forecast across most measures. This is notable in the case of the Housing and Transportation Affordability measure.

One of the most notable findings in the Equity Analysis is in the Potential for Displacement measure, where the focused concentration of growth in Plan Bay Area overlaps with a larger share of today's rent-burdened households than in the baseline forecast. This measure reflects Plan Bay Area's support for investment and development in communities of concern, while also flagging the potential for market-based displacement due to rising rents as these neighborhoods improve. The plan responds with increased emphasis on funding to support the provision of affordable housing, requires the adoption of local housing elements

TABLE 26: Results of Plan Bay Area Equity Analysis, 2010–2040

	Equity Performance Measure	Target Population	2010	2040 (Baseline Forecast)	2040 (Plan Bay Area)
1	**Housing and Transportation Affordability** Percentage of income spent on housing and transportation by low-income households	Low-Income Households	72%	80%	74%
		All Other Households	41%	44%	43%
2	**Potential for Displacement** Percentage of rent-burdened households in high-growth areas	Communities of Concern	n/a	21%	36%
		Remainder of Region	n/a	5%	8%
3	**Healthy Communities** Average daily vehicle miles traveled per populated square mile within 1,000 feet of heavily used roadways	Communities of Concern	9,737	11,447	11,693
		Remainder of Region	9,861	11,717	11,895
4	**Access to Jobs** Average travel time in minutes for commute trips	Communities of Concern	25	26	26
		Remainder of Region	27	29	27
5	**Equitable Mobility** Average travel time in minutes for non-work-based trips	Communities of Concern	12	13	13
		Remainder of Region	13	13	13

Communities of Concern

The definition of “communities of concern” for Plan Bay Area is intended to represent a diverse cross-section of populations and communities that could be considered disadvantaged or vulnerable in terms of both current conditions and potential impacts of future growth. (See the map on facing page, which shows the locations of these communities of concern.) For purposes of the Equity Analysis, communities of concern are defined as those neighborhoods with notably high concentrations of four or more of the following: minority persons; low-income individuals; persons who are Limited English Proficient; seniors age 75 and over; persons with disabilities; households without cars; single-parent households; and renters paying more than 50 percent of household income on rent. Under this definition, about one-fifth of today’s total regional population lives in areas defined as communities of concern. The Equity Analysis attempts to determine how the plan’s proposed investments distribute benefits and burdens to these communities relative to the remainder of the region.

Peter Beeler

Evelyn Johnson

to receive key funds, and sets forth a requirement for PDA Investment and Growth Strategies that will examine key housing policy issues.

Several other findings of significance emerged from the Equity Analysis.

- Alongside displacement pressures, housing and transportation affordability are forecast to continue to be key challenges for low-income households in the future.
- While air quality will improve in the region overall with improved technologies, increased vehicle traffic and congestion in communities of concern raise safety concerns for those areas where walking and biking are more common modes of travel.
- Travel times to jobs and other destinations will increase slightly for communities of concern compared to today, due to higher levels of congestion in the urban core and some trips shifting from driving to transit, walking and biking.

The key findings of the Equity Analysis are displayed in Table 26.

More information and detailed results, including all other alternatives studied, are included in the Plan Bay Area Equity Analysis Report listed in Appendix 1.

MAP 12

Communities of Concern

Map is for general information. For more information on local zoning or designations for a particular site or parcel, please contact your city or county.

Project-Level Performance Assessment of Transportation Projects

Much effort in long-range planning is spent on big-picture questions: Should the region focus on expanding the transportation system or on maintaining what we have already built? Should the region invest more in transit for future generations or emphasize highway projects to improve the lives of today's drivers? While planners can address these questions at the scenario level, Plan Bay Area is also based on MTC's commitment to evaluate individual projects to make sure dollars are being allocated to the most cost-effective projects that support a more sustainable future for the region.

In order to take a closer look at major transportation projects, MTC performed a project performance assessment, examining billions of dollars of potential transportation projects to identify the highest-performing investments across the region. Each major project was evaluated based on two criteria: benefit-cost ratio (which captures the project's cost-effectiveness); and a "target" score (which measures the contribution the project makes toward achieving Plan Bay Area's 10 adopted performance targets). Figure 23 displays the results of this analysis by transportation project type. Since all projects were analyzed across the region consistently using the regional travel demand model, high-performing projects were able to be prioritized for regional funding opportunities.

For more information about the specific scoring criteria, please refer to the Performance Assessment Report*, listed in Appendix 1.*

As shown in Table 27, most of the high-performing projects in the region are focused on leveraging existing assets and improving their efficiency.

Sergio Ruiz

Notable projects include BART Metro, which will increase service frequencies on the highest-demand segment of the BART system, and San Francisco's congestion pricing initiatives, under which vehicles entering downtown (or Treasure Island) will be charged a toll, with the proceeds being used to pay for more frequent transit services.

To further ensure that Plan Bay Area advances the most cost-effective and beneficial projects, MTC required a second level of project review. Any project with a benefit-cost ratio less than 1 or an "adverse" score on the targets assessment had to submit a compelling case to policy-makers for inclusion in the plan. Over 30 projects were identified as low-performers as a result of this process, and the vast majority of these are not included in this plan. The handful of low-performing projects that remain in the plan tend to demonstrate their positive impact on social equity and low-income neighborhoods — an issue not fully captured in the benefit-cost ratio or targets score.

Not only did the project performance assessment help identify regional funding priorities and remove ineffective projects, but it has informed the tradeoffs among competing priorities. When combined with input from transportation partners and stakeholders on the vast majority of projects that were neither high- nor low-performing, the project-level assessment has significantly influenced this plan.

FIGURE 23: Project-Level Performance Assessment: Results by Transportation Project Type

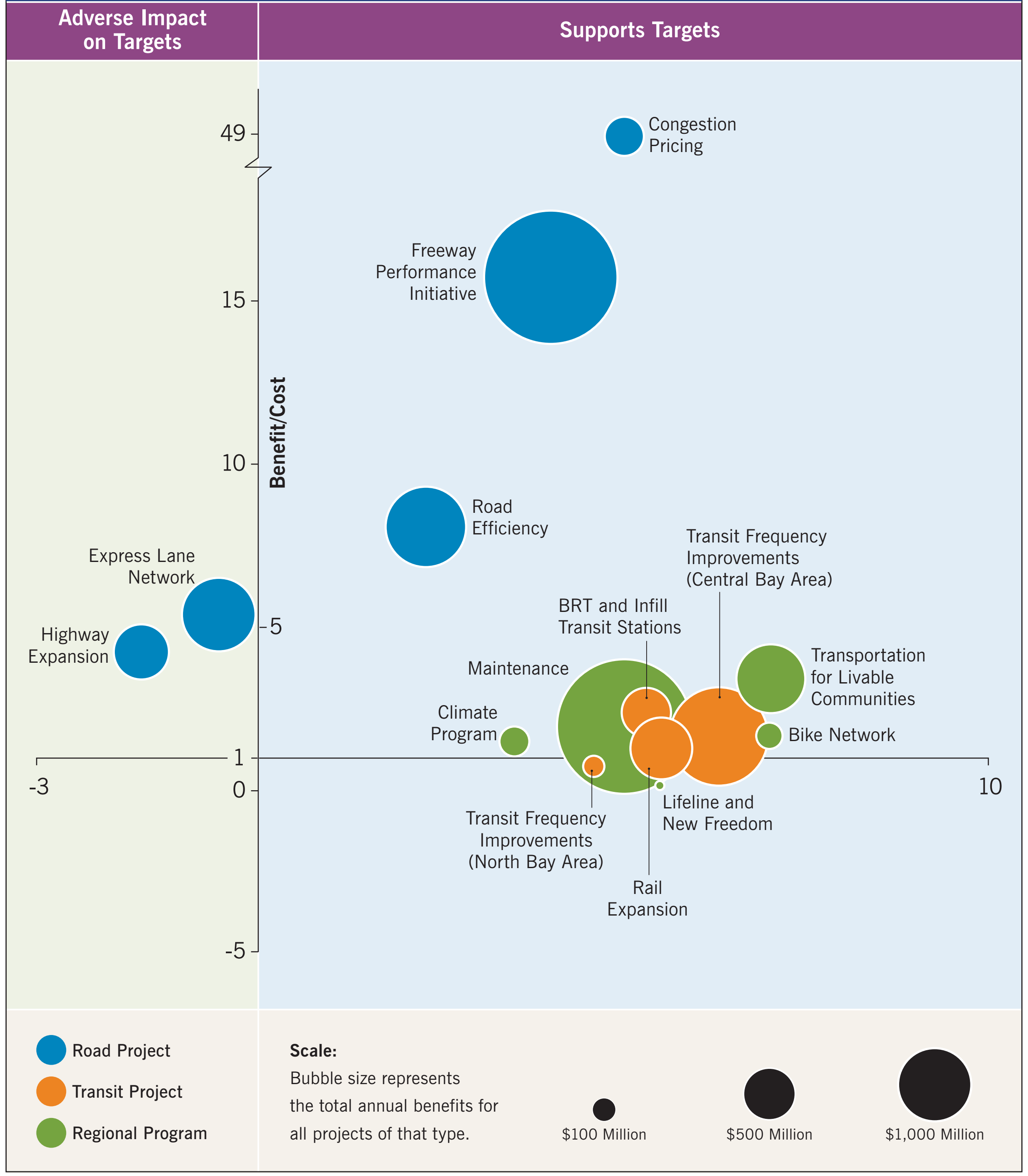


TABLE 27: Highest-Performing Transportation Projects, Ranked by Benefit/Cost (B/C) Ratio and Target Score

	Project Name	County	Benefit/ Cost Ratio	Overall Targets Score	Project Capital Costs* (Million $)	Project Description
1	BART Metro Program (including Bay Fair Connection & Civic Center Turnback)	Multi-County	>60	8.5	650	Increases the efficiency of BART in the urban core by constructing new turnbacks and providing new express train service.
2	Treasure Island Congestion Pricing	San Francisco	59	4.0	59	Charges a $5 toll for residents to enter/exit Treasure Island during peak hours; net revenues designated for transit service.
3	Congestion Pricing Pilot	San Francisco	45	6.0	102	Charges a $3 toll to enter/exit the northeast quadrant of San Francisco during peak hours; net revenues designated for transit service.
4	AC Transit Grand-MacArthur Bus Rapid Transit (BRT)	Alameda	18	5.5	36	Constructs a bus rapid transit line along the Grand Avenue and MacArthur Avenue corridors in Oakland, providing faster service for AC Transit Line NR.
5	Freeway Performance Initiative	Regional	16	4.0	2,991	Maximizes the efficiency of the roadway network through arterial signal coordination and freeway ramp metering.
6	Intelligent Transportation System (ITS) Improvements in San Mateo County	San Mateo	16	4.0	66	Maximizes the efficiency of the roadway network through arterial signal coordination and freeway ramp metering.
7	ITS Improvements in Santa Clara County	Santa Clara	16	4.0	320	Maximizes the efficiency of the roadway network through arterial signal coordination and freeway ramp metering.
8	Irvington BART Station	Alameda	12	5.5	123	Constructs a new infill BART station in the Irvington district of Fremont.
9	SFMTA Transit Effectiveness Project	San Francisco	11	7.5	157	Improves reliability and reduces travel times on key Muni bus corridors through signal prioritization and bus lanes.
10	Caltrain Service Frequency Improvements (6-Train Service during Peak Hours) + Electrification (SF to Tamien)	Multi-County	5	7.5	848	Electrifies the Caltrain line and purchases additional train vehicles to provide faster, more frequent service during peak hours.
11	BART to San Jose/Santa Clara (Phase 2: Berryessa to Santa Clara)	Santa Clara	5	7.0	4,094	Extends BART from the Phase 1 terminus in Berryessa (North San Jose) through a new BART subway to Alum Rock, Downtown San Jose, Diridon Station, and Santa Clara.
12	Van Ness Avenue BRT	San Francisco	6	6.5	140	Constructs a bus rapid transit line with dedicated lanes along the Van Ness corridor in San Francisco (from Lombard to Mission).
13	Better Market Street	San Francisco	6	6.0	200	Increases transit speeds along San Francisco's Market Street between the Embarcadero & Octavia by restricting auto traffic on the corridor.

*Project costs as analyzed (in year of expenditure $).

6

A Plan to Build On

Noah Berger

Karl Nielsen

Chapter 6

A Plan to Build On

Plan Bay Area is a work in progress that will be updated every four years to reflect new initiatives and priorities.

It builds upon the work of previous initiatives, complements ongoing work and lays the groundwork for closer examination of certain critical issues that can further prepare the region to meet the future head-on. The plan highlights the relationship between transportation investments and land use decisions, and represents the region's best effort to position itself to make the most of what the future will bring.

No single level of government can be expected to address all the critical components needed to create a stronger and more resilient Bay Area. It will take a coordinated effort among diverse partners to promote regional economic development, adapt to climate change, prepare for natural disasters, get creative about how to provide affordable housing for all Bay Area residents, ensure clean and healthy air for our communities, and prepare for emerging technologies that will change the way people work and get around. Here we take a look at the complementary initiatives under way in those areas.

In some cases, new legislation, updated regulations or additional resources will be needed to fully realize the Plan Bay Area vision and implement the plan's policies and programs. This chapter identifies the most important of these challenges, and proposes steps to address them.

A Vibrant Economy

The Bay Area economy has seen massive swings in employment over the last 20 years. While job growth is once again on the rise, MTC and ABAG — through the Joint Policy Committee in partnership with the Bay Area Air Quality Management District (BAAQMD) and the San Francisco Bay Conservation and Development Commission (BCDC) — will work with regional business interests and stakeholders to make sure the region fosters the conditions for a healthy economy for all.

Improve Permitting Process

A major impediment to infill development in the Bay Area is the often lengthy project entitlement process. This further increases Bay Area housing prices, which rank among the highest in the nation, and impedes the region's ability to provide adequate amounts of affordable housing. The amount of time required for planning and environmental review can cause projects to miss the economic cycle when demand exists for new housing or commercial space. ABAG and MTC will work with local jurisdictions to implement proven strategies for advancing infill development in Priority Development Areas (PDAs). Among these strategies are specific plans, neighborhood-appropriate parking requirements, expedited permit processing, and programmatic Environmental Impact Reports (EIRs) that eliminate the need for individual project EIRs. ABAG and MTC will continue to support these efforts through PDA planning grants and technical assistance, including supporting community engagement throughout the planning process.

Improve the Bay Area's Economic Prosperity

MTC and ABAG are currently undertaking a three-year initiative funded by a $5 million grant from the U.S. Department of Housing and Urban Development (HUD), in conjunction with the U.S. Environmental Protection Agency and the U.S. Department of Transportation. The initiative — the Bay Area Regional Prosperity Plan — is intended to identify strategies to improve the region's economic prosperity by encouraging stronger, more sustainable communities, integrating housing and jobs planning, fostering local innovation in support of new jobs, and building a healthy regional economy for all. Over $2 million in grants will be awarded to pilot projects to expand economic opportunities for low- and moderate-income workers and improve housing affordability near transit. The three-pronged planning effort includes the Economic Opportunity Strategy, a Housing the Workforce Initiative and an Equity Collaborative that together will implement this program. Recommended strategies from this effort will be considered by MTC and ABAG in implementing Plan Bay Area and as input to the update of the plan.

FIGURE 24: **Bay Area Employment, 1990–2011**

Source: California Economic Development Department; calculations by Bay Area Council Economic Institute

In addition to the Prosperity Plan, Bay Area economic development organizations are preparing strategies to strengthen the regional economy. MTC and ABAG will consider these two efforts and conduct additional research to identify job creation and career pathway strategies including local best practices on apprenticeship programs, and local hire and standard wage guidelines. This research can be utilized in the implementation of the current Plan Bay Area, shared with local jurisdictions in the Bay Area and considered for the next update of Plan Bay Area.

For more information, visit: http://onebayarea.org/regional-initiatives/Bay-Area-Prosperity-Plan.html

Link Housing, Transportation and Economic Development

Understanding the role of housing and transportation investment in supporting the region's economy was a key theme that ABAG and MTC heard from the public, in polls and from business advocates throughout the development of Plan Bay Area. At the urging of Bay Area business and housing industry leaders, ABAG and MTC — along with BCDC and the BAAQMD — commissioned an economic impact white paper to consider how land use patterns and transportation investments affect the region's economy. The analysis looked at best practices around the country to integrate long-range planning with regional economic development, the tradeoffs between maintaining the existing system versus investing in new infrastructure to address growth, the impact of various pricing mechanisms to manage demand for transportation facilities, as well as housing policies and goods movement. Findings from this review will set the stage for more detailed economic analysis when Plan Bay Area is updated in 2017. Regional agencies will also develop land use guidelines for growing industries, as well as place-based strategies to support the growth of different types of PDAs and job centers, including small towns, mixed-use corridors and existing office parks.

More information is available in the Economic Impact Analysis for Future Regional Plans, *listed in Appendix 1.*

Goods Movement and Industrial Land, and Inter-Regional Coordination

The nine-county Bay Area is closely connected with its adjacent counties and metropolitan areas. Alameda, Solano, Contra Costa and Santa Clara counties are especially affected by decisions in neighboring counties outside of the nine-county Bay Area related to inter-regional commuting and land use patterns, housing needs and job access. ABAG and MTC recognize the need to encourage more coordinated planning and, in some cases, more coordinated state and local investment strategies to ensure that the Bay Area's inter-regional challenges

Tom Tracy

are adequately addressed. ABAG and MTC will work with local jurisdictions and the county congestion management agencies to advance coordinated planning and modeling efforts with neighboring metropolitan planning organizations such as SJCOG (San Joaquin), SACOG (Sacramento), and AMBAG (Monterey/Santa Cruz).

The movement of freight, and the protection of production and distribution businesses, have important environmental, economic and equity implications for the region. The region is home to the fifth-busiest maritime port in the nation, the Port of Oakland, which serves not only Bay Area residents and industries but also provides a critical link to national and international markets for North Bay and Central Valley agriculture.


Port of Oakland

MTC's *Regional Goods Movement Study,* last updated in 2009, found that manufacturing, freight transportation and wholesale trade account for nearly 40 percent of regional output, and that Bay Area businesses spend over $6.6 billion on transportation services. Goods movement businesses also create over 10 percent of regional employment, including many high-paying blue- and green-collar jobs accessible to those without higher levels of education. However, continued land development pressure is placing many industrial and manufacturing land uses at risk, and the activities at these places could shift to other locations, as documented in MTC's 2008 *Goods Movement/ Land Use Study.* MTC and ABAG will work with the business community and local jurisdictions and stakeholders to explore economic development best practices for goods movement and industrial businesses, and to identify funding to assess the role of goods movement businesses and industrial land in the regional economy.

Air quality considerations related to goods movement activities are an important part of the larger goods movement and industrial lands discussions. The Bay Area Air Quality Management District manages a number of programs related to goods movement, including initiatives to support cleaner trucks within the region, and specifically at the Port of Oakland.

MTC is currently working with Caltrans District 4 and county congestion management agencies to update the information from the 2004 and 2009 studies and to identify key goods movement issues for the region to address in the coming years. This work will help inform the region's input to the California Freight Mobility Plan and implementation of the newest federal transportation bill, MAP-21, which addresses the performance of the national freight network and supports investment in freight-related surface transportation projects.


David Baker + Partners, Architects

In addition to the regional analysis conducted for Plan Bay Area, MTC and ABAG will undertake sub-regional studies (e.g. Solano County, Tri-Valley) to analyze goods movement at a more local level, including truck flows on I-80, I-580 and I-880 corridors, and passenger (Capitol Corridor, ACE) and freight rail. These studies will be conducted in coordination with local jurisdictions, CMAs and the Bay Area Air Quality Management District, as appropriate.

Increase Housing Choices and Community Stability

To achieve the goals of Plan Bay Area — to retain and improve the region's quality of life, accommodate future growth and strengthen the economy by providing homes for a diverse workforce — the region must retain and increase the availability of affordable housing and support the vitality of our existing neighborhoods. Priority Development Areas (PDAs) provide a policy framework that can support investments and stability in disadvantaged communities, as well as encourage housing production in communities with access to employment and educational opportunities based on regional and local collaboration.

Affordable Housing

The loss of local redevelopment funding, combined with reduced funding at the state and federal level, has created a structural financing gap that reduces affordable housing production that would otherwise occur. Given housing production costs in the Bay Area and the complexity of building in locations near transit, additional resources are needed to preserve, rehabilitate and construct new affordable homes.

Plan Bay Area aligns funding from the new One-BayArea Grant (OBAG) program with PDAs and the development of housing including affordable housing in PDAs. The OBAG program requires that 50 to 70 percent of funding, depending on the county, be invested in PDAs. To be eligible for OBAG funding, all local jurisdictions must have certified housing elements, and congestion management agencies are required to develop PDA Investment and Growth Strategies that include a consideration of housing affordability and affordable housing policies. The plan links funding from an expanded Transit-Oriented Affordable Housing (TOAH) loan fund to PDAs, and identifies transit-oriented affordable housing as an eligible use for Cap and Trade revenues. This funding can effectively leverage local

Noah Berger

government, private and foundation resources. Production, acquisition and rehabilitation of affordable housing also will require local planning and entitlement processes that support this effort. Provision of incentives for local jurisdictions and coordination with congestion management agencies (CMAs) will be essential. MTC and ABAG will continue to use PDA Planning Grants to facilitate the entitlement of affordable housing in transit corridors. Through the Bay Area Regional Prosperity Plan, the regional agencies are working with a consortium of local jurisdictions and community-based organizations to identify strategies and pilot projects to build different types of housing and identify new alternative housing funds.

Potential for Displacement

The plan addresses the potential for displacement by increasing resources for the creation and preservation of affordable housing, and improving economic opportunities for current residents. The task is to support investments in low-income neighborhoods that can expand the range of services and amenities, and provide economic opportunity to local workers.

Local and regional initiatives will need to recognize the unique qualities of individual neighborhoods and the need for locally defined policy interventions. ABAG and MTC will work with local and county agencies to provide a menu of neighborhood stabilization and anti-displacement policies where a jurisdiction deems necessary, as well as affordable housing policies for consideration relative to future funding opportunities. MTC and ABAG also will link OBAG funding to jurisdiction-level approval of affordable housing planning, production, acquisition and rehabilitation. Best practices from the HUD-funded Bay Area Regional Prosperity Plan, including capacity building, knowledge sharing, policy development and funding, will be an important source of input to inform future programs.

Cleaning Our Air

Healthy Infill Development

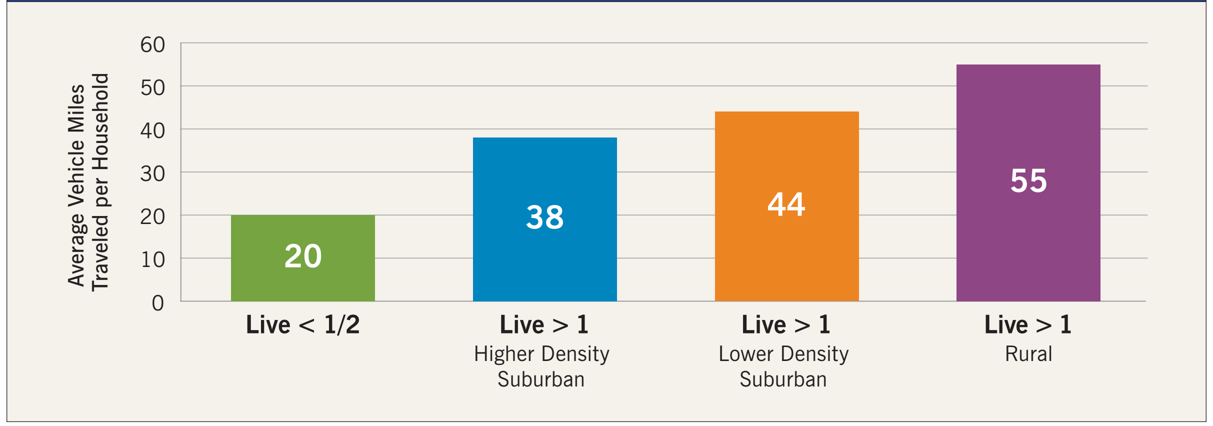
One of the main goals of both Plan Bay Area and the Bay Area Air Quality Management District's *2010 Clean Air Plan* is to reduce greenhouse gas emissions from cars and trucks by focusing future land development in existing urban areas that are easily accessible to transit, jobs, shopping and other services. Compact infill development can reduce vehicle use and vehicle miles traveled by 20 to 60 percent when compared to traditional suburban developments. (See Figure 25.) In addition, compact development preserves open space, forests and other carbon sinks that remove greenhouse gases from the atmosphere. It also encourages more walkable communities, which can help to reduce obesity and diabetes. Further, infill buildings are typically more energy-efficient, which reduces the amount of greenhouse gas emissions from power plants.

However, people who live or work near major freeways, ports, distribution centers, gas stations or other local sources of toxic air contaminants (TAC) and particulate matter (PM) may be disproportionately exposed to higher concentrations of these pollutants and therefore face a greater risk to their health. It would seem, then, that reducing the public's exposure to TACs and PM and protecting public health conflicts with the regional goal to increase compact infill development.

That is not necessarily the case, as there are effective ways the region can plan for compact infill development within existing urban and transit corridors that both protect public health and reduce greenhouse gases. The compact land use patterns envisioned in Plan Bay Area can be readily accomplished through the implementation of various health-protective measures in most infill locations. The regional agencies are collaborating on a comprehensive set of best practices, or guidance, for local governments on how to best address local pollutants in their planning and development decisions.

Best practices for compact infill development can ensure that health-protective strategies are available to mitigate or lessen the potential health risks in areas that have high TAC and PM emission sources. The most effective strategy, or best practice, is to always provide as much distance as possible between sensitive land uses and major sources of TAC and PM emissions.

FIGURE 25: Average Daily Vehicle Miles Traveled, by Proximity to Rail or Ferry Stops*



*Distance in miles from rail or ferry stops

Evolving Transport

From driverless cars to informal ridesharing networks to private shuttles that whisk workers from their homes to high-tech companies in Silicon Valley and beyond, a number of start-up methods are redefining how we get from Point A to Point B. Here are some of the innovative programs transportation planners will be watching with keen interest in years to come.


Google

Autonomous Vehicles

Once the subject of science fiction, driverless cars have now logged over 300,000 miles of autonomous operation, much of it on Bay Area roads. Mountain View-based Google, eager to set an international standard, has been the force behind these early efforts. In late 2012, California, Florida and Nevada cleared some early legal hurdles by directing their state departments of motor vehicles to adopt rules regarding safe operations, insurance and privacy. Elements of driverless technology are also being researched with regard to transit vehicles, with a focus on enhancing safety of bus rapid transit (BRT) systems.

Noah Berger

Corporate Shuttles

As high-tech firms continue their quest to attract world-class talent, the lack of fast and convenient public transportation between home and the office is viewed as an increasing liability. The solution: major companies such as Google, Facebook and Genentech now offer private shuttles to and from dozens of Bay Area communities to their suburban campuses. A recent study carried out by a graphic design firm estimated that the shuttles carry nearly 14,000 people per day to the Silicon Valley, or about 33 percent of Caltrain's weekday ridership.

Not only do the shuttles remove private vehicles from congested freeways — reducing pollution and greenhouse gases — they also assist commuters by offering on-board Wi-Fi access.


Lyft

Ride-sharing Networks

Pink mustaches have become the hottest new trend in San Francisco. Or rather, pink mustaches affixed to the fronts of cars, a trademark of the informal ride-sharing service known as Lyft. Lyft, WeGo Rideshare and Sidecar, alongside other services such as Uber that utilize excess capacity from livery car companies, have effectively increased the region's ridesharing capacity through crowd sourcing. All four companies use smart phone technology to connect vehicles to riders, and in the case of Lyft, WeGo Rideshare and Sidecar, anyone with a private vehicle and a clean driving record can sign up to be a driver.

Curbing Greenhouse Gases

In December 2009 MTC programmed $80 million to implement the Climate Initiatives Program, a multi-faceted program aimed at reducing transportation-related emissions and vehicle miles traveled (VMT), while also informing the region as to the most effective strategies to reduce emissions. Since then, the program has funded innovative pilot projects to test the effectiveness of reducing emissions through incentives for alternative fuels and vehicles, creation of electric vehicle and bike-sharing programs, and removal of barriers to walking and biking for youth and their families, and other projects.

Building on results to date, new and refined demonstration projects will be introduced in years to come as outlined in the proposed investments in Chapter 4, including:

- Launch of a regional bike-sharing pilot, led by the Bay Area Air Quality Management District and focused along the Caltrain corridor from San Francisco to San Jose. The initial launch, anticipated in late 2013, includes 1,000 bikes with plans for future expansion.
- An educational campaign to increase demand among Bay Area residents for plug-in electric and plug-in hybrid electric vehicles. The campaign is aimed at building awareness and demand for electric vehicles through targeted marketing.
- Enhancements to the Spare the Air Youth program based on results from past demonstration projects. Projects that best reduce emissions and are most suited for regional application will be introduced in 2013–2015.
- Launch of a "smart driving" pilot program that will assess whether in-vehicle devices and education about driving behavior will assist drivers in maximizing fuel economy and lowering emissions.

Planning for Resilience

Climate Adaptation and Sea Level Rise

Given the significant number of residential, commercial and industrial structures situated on the San Francisco Bay's shorelines and low-lying areas — not to mention many miles of freeways, airports, port facilities and other transportation infrastructure adjacent to the Bay — our region is especially vulnerable to future sea level rise (see Map 13). In a 2009 report, the Bay Conservation and Development Commission identified 671 miles of existing and 337 miles of future road, rail, air and other infrastructure at risk of being affected by sea level rise. MTC is now partnering with BCDC, the California Department of Transportation (Caltrans), the National Oceanic Atmospheric Administration Coastal Services Center, ABAG and Bay Area communities to increase preparedness and resilience to sea level rise and storm events while protecting critical ecosystem and community services. The project, known as Adapting to Rising Tides, is a collaborative planning effort that addresses two questions:

> The San Francisco Bay Area is especially vulnerable to future sea level rise.

- How will climate change impacts of sea level rise and storm events affect the future of communities, infrastructure, ecosystems and the economy in the Bay Area?
- What strategies can we pursue, both locally and regionally, to reduce and manage these risks?

The project includes a comprehensive inventory of potentially vulnerable transportation assets along a section of the Alameda County shoreline. The effort also measures the relative importance of these assets to the health of the transportation network as a whole. Next steps in the project include development and analysis of adaptation strategies. While the specific policy recommendations that emerge from this effort have not yet been identified, we anticipate that sea level rise preparedness — as well as climate change adaptation generally — will be a prominent feature of the planning strategies of MTC, ABAG, BCDC and the BAAQMD over the next several decades.

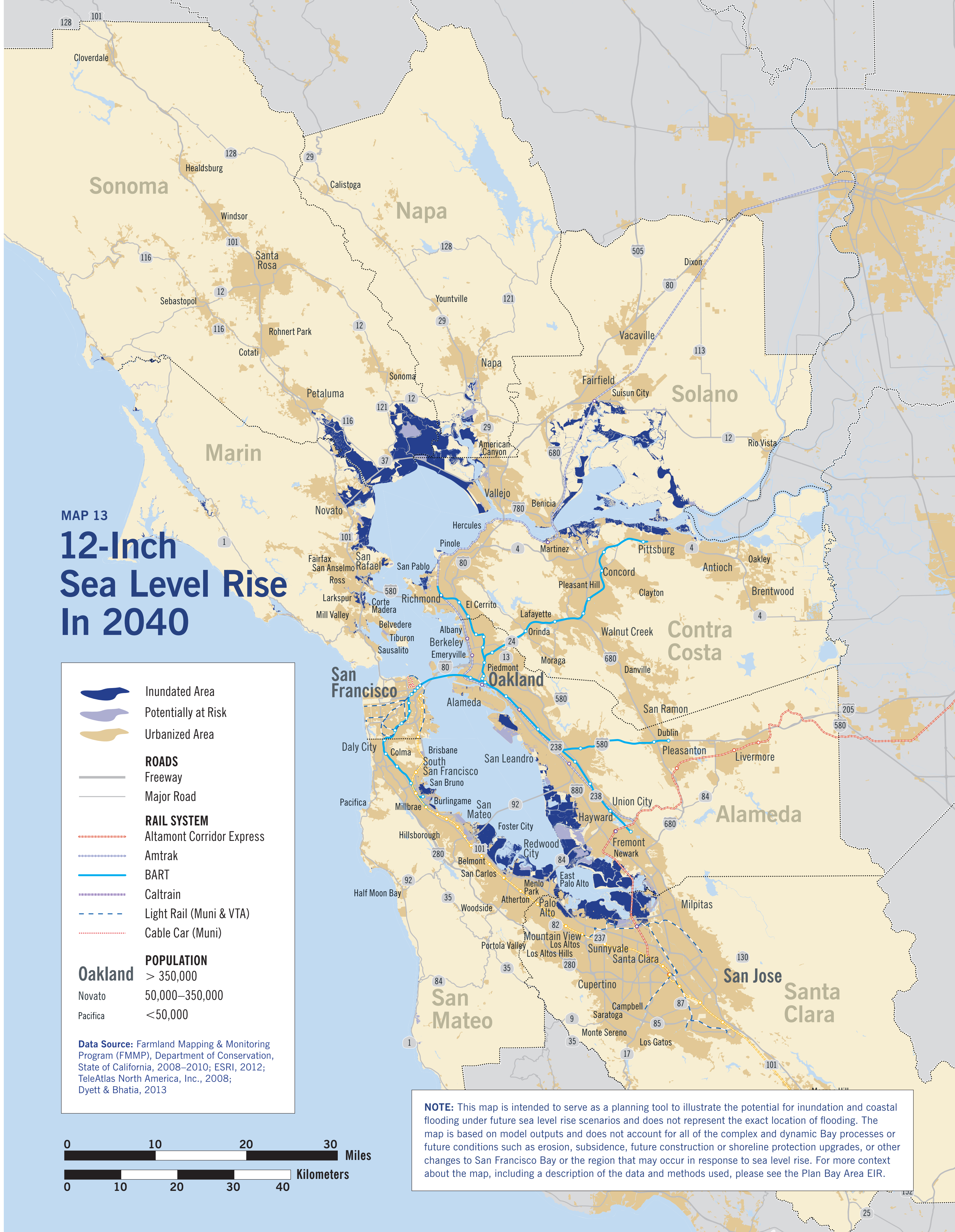
While some parts of the region designated as priority development areas could be affected by climate change, adaptation measures will protect homes, businesses and infrastructure in harm's way.

Earthquake Mitigation and Recovery

Plan Bay Area seeks to provide more housing options to accommodate our growing region. Yet we are also aware that some of the region's existing housing stock is vulnerable to damage in an earthquake. The United States Geological Survey has estimated there is a 63 percent chance that the region will experience an earthquake of magnitude 6.7 or greater in the next 30 years. ABAG models predict that a major earthquake on the San Andreas or Hayward faults will leave 150,000 homes — 5 percent of the region's housing stock — uninhabitable. This scenario could displace 350,000 people for an extended period of time and disrupt our economy for many years. Much of the infrastructure along the Bay shorelines and low-lying areas that is vulnerable to sea level rise is also vulnerable to liquefaction damage in an earthquake. The region has already made great strides in improving our resilience to natural disasters. The Bay Area is a national model for earthquake planning and research, and many of our public agencies have made major investments to strengthen their infrastructure against seismic risks. BART has retrofitted its elevated tracks and stations; Caltrans has retrofitted or replaced all the toll bridges and freeway overpasses; water districts have retrofitted their major transmission lines crossing faults; local governments across the region have retrofitted or replaced vulnerable city halls, fire stations and critical facilities; regional hazard mitigation planning is ongoing; and investment in emergency response planning has been significant in recent years.

USGS

Damage from the 1989 Loma Prieta earthquake in San Francisco's Marina District



MAP 13

12-Inch Sea Level Rise In 2040

Data Source: Farmland Mapping & Monitoring Program (FMMP), Department of Conservation, State of California, 2008–2010; ESRI, 2012; TeleAtlas North America, Inc., 2008; Dyett & Bhatia, 2013

NOTE: This map is intended to serve as a planning tool to illustrate the potential for inundation and coastal flooding under future sea level rise scenarios and does not represent the exact location of flooding. The map is based on model outputs and does not account for all of the complex and dynamic Bay processes or future conditions such as erosion, subsidence, future construction or shoreline protection upgrades, or other changes to San Francisco Bay or the region that may occur in response to sea level rise. For more context about the map, including a description of the data and methods used, please see the Plan Bay Area EIR.

But more can be done, especially to help ensure an effective recovery of housing, businesses, infrastructure, and the supply chains and delivery systems for essential goods and services. This is the focus of ABAG's Regional Disaster Resilience Initiative. Begun in late 2011, it has brought together businesses, local governments, community leaders, major institutions and infrastructure agencies to determine roles, responsibilities and decision-making structures in the aftermath of a major disaster. In partnership with emergency response agencies, regional partners and local governments, the initiative will build on findings from four workshops to develop an Action Plan that summarizes and prioritizes actions for jurisdictions and organizations, and develops a cohesive regional policy platform. The Action Plan will prime the region to launch into the next steps needed for a resilient Bay Area.

Regional Open Space and Agricultural Land Preservation

Plan Bay Area sets the stage for the integration of land use, open space and transportation planning by focusing growth and investment in Priority Development Areas, and by seeking to protect habitat, recreational and agricultural land in Priority Conservation Areas (PCAs). Regional efforts include a $10 million pilot program to support transportation and conservation projects aimed at protecting PCAs (part of the OneBayArea Grant program). Open space preservation and agricultural vitality remain long-term challenges that will require a continued commitment to regional coordination.

Following adoption of Plan Bay Area, ABAG will update the PCA guidelines to further define the role of different kinds of PCAs to support habitat, agriculture, recreation and other ecological functions. Updates to individual PCAs will be made in consultation with local jurisdictions. ABAG and MTC will draw upon best practices and lessons learned from the OBAG PCA Pilot Program as well as the resources of open space agencies, local jurisdictions, state and county farm bureaus, non-profit organizations, foundations, and state and federal agencies.

The California Coastal Trail (CCT) is a network of public trails for walkers, bikers, equestrians, wheelchair users and others along the 1,200-mile California coastline. Many of the CCT segments in the Bay Area overlap with the region's Priority Conservation Areas (PCAs) and will be considered in ABAG's update of the PCA guidelines.

A Platform for Advocacy

Plan Bay Area advances projects and lays out a development framework to bolster our region's economy, protect its environment, and improve housing and transportation choices for our residents. A reliable, efficient transportation network and a housing market with a range of price options for our workforce are absolutely vital to growing our economy. We need to take steps now in order to preserve what we value about our region and to build a Bay Area that we are proud to pass along to future generations.

For example, to keep our roads, bridges and transit network in a state of good repair as well as make strategic improvements, we need cooperation from Congress and the state Legislature to increase funding to maintain the infrastructure currently in place. The state also should prioritize job creation and speed much-needed housing and transportation projects by updating the 43-year-old California Environmental Quality Act, or CEQA, to provide for more timely review of projects.

Plan Bay Area is but a beginning. ABAG and MTC look forward to working with policy-makers at all levels of government to create a statutory and regulatory framework that preserves what we cherish about our region, while taking some prudent steps to make it more livable in the coming years.

Tom Meyers

Land Use

In order to make progress toward Plan Bay Area land use performance targets, MTC and ABAG have identified four legislative advocacy objectives that seek changes in both federal and state law.

Support PDA Development With Locally Controlled Funding

Until last year, Bay Area jurisdictions could count on redevelopment programs for over $1 billion per year in tax-increment financing to support affordable housing projects, critical infrastructure improvements, and economic development projects in designated areas of many cities and counties. This funding stream was lost in 2012 as a result of the elimination of redevelopment agencies throughout the state. ABAG and MTC will work to strategically replace this revenue source with new, locally controlled funding tools. A top priority should be a newly authorized tax-increment financing authority that specifically supports housing construction and infrastructure improvements near existing and planned public transit service as called for in this plan.

Modernize the California Environmental Quality Act (CEQA)

MTC and ABAG strongly support the original goals of the California Environmental Quality Act (CEQA). Over the four decades since it was enacted, CEQA has undoubtedly helped to improve environmental quality in California. At the same time, it is commonly used as a tool by project opponents who are more interested in halting a project than minimizing its harm to the environment. Sensible CEQA reform is needed to create a more economically vibrant state and region.

MTC and ABAG will support efforts to update CEQA to encourage and expand infill development opportunities that can help reduce urban sprawl consistent with Plan Bay Area and California Senate Bill 375.

Stabilize Federal Funding Levels

As the region grows, so will its need for workforce housing, especially to meet Plan Bay Area's goal of housing employment growth within the region. Deep funding cuts for two of the most important affordable housing programs at the U.S. Department of Housing and Urban Development — the HOME Investment Partnership Program and the Community Development Block Grant (CDBG) program — have significantly affected the allocation of funds to Bay Area jurisdictions. CDBG budget allocations to the region fell 27 percent (from $86 million to $63 million) from 2010 to 2012, and Bay Area allocations from the HOME program dropped by 51 percent ($38 million to $18 million) from 2009 to 2012. In order to increase the supply of

CEQA's Impact on Infill

While it can take years to prepare a detailed environmental impact report (EIR) — which evaluates a project's various potential significant impacts — lengthy document preparation and its associated costs are not the main challenges that the California Environmental Quality Act (CEQA) presents for cities and project sponsors seeking to build new housing or commercial buildings. The primary challenge is the uncertainty created by potential litigation on the project and subsequent delays.

Research sponsored by the Silicon Valley Leadership Group looked at which types of projects are most often the target of lawsuits filed under CEQA. The review found that CEQA litigation is aimed more often at infill than greenfield projects, and even when a project undergoes an extensive EIR analysis, the project is rejected 50 percent of the time when a court challenge is brought under CEQA, resulting in major revisions, increased costs and project delay.

What Kinds of Projects Are Most Often Tied Up in CEQA Litigation?

59 percent of challenged projects identified as either infill or greenfield were infill projects.

36 percent of projects challenged were public projects rather than private development.

38 percent of challenged projects were infrastructure projects (19 percent) or mixed-use developments (19 percent).

a variety of workforce housing options, key federal programs need to deliver increased financial certainty for local jurisdictions and developers.

In addition to funding, incentives in the tax code for multifamily development should be established for the long run so cities and developers can plan with certainty. While real estate market research shows strong unmet demand for multifamily living, particularly in close proximity to public transit and walkable neighborhoods, the market is not yet meeting the demand. One of the side effects of the Tax Reform Act of 1986 was a dramatic reduction in the incentives embedded in the federal tax code for private investment in multifamily housing.

"Defiscalize" Land Use Decision-Making

The structure of property taxes in California is a major obstacle to creating a balanced regional growth pattern. The current approach to taxation creates incentives to attract development that maximizes sales tax revenues rather than a more balanced approach of both retail and residential land uses. This trend — the so-called "fiscalization of land use" — has discouraged housing development and small business growth in many communities. ABAG and MTC would support a long-term adjustment to commercial or residential tax structures to balance the financial incentives for new development.

Transportation

To support the transportation investment strategy contained in Plan Bay Area, MTC and ABAG will seek the following three state and federal legislative changes.

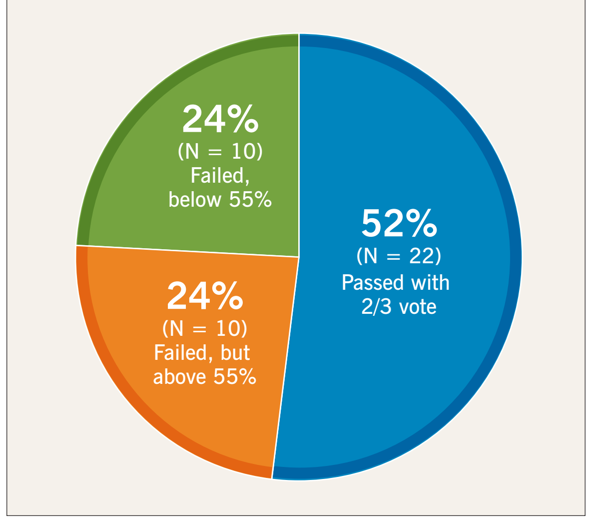
Support Local Self-Help

Local taxes now generate about two-thirds of the state's total transportation funding. Yet passage of new local taxes is exceedingly difficult due to the two-thirds supermajority requirement. This undermines local initiatives, leaving California residents more dependent upon Sacramento and Washington, D.C., for assistance. MTC and ABAG will strongly support efforts to lower the vote threshold for local and regional transportation tax measures from two-thirds to 55 percent. Lowering the voter approval threshold is a major step toward preserving and expanding our existing roadway and public transportation infrastructure and helping them run more efficiently.

The impact of lowering the vote threshold requirement for school bonds in California has been striking — more than half of those passed in 2012 would have failed under the two-thirds requirement. Had the 55 percent threshold been applicable to transportation since 2002, an additional 10 local transportation measures would have passed statewide (see Figure 26).

While eight of the Bay Area's counties have managed to pass transportation sales taxes under current law, success has repeatedly eluded Solano County, home to one of the region's worst bottlenecks at the Interstate 80/680 interchange. Most recently, the 2012 election dealt a serious blow to Alameda County's effort to extend and increase their transportation sales tax measure; with 66.53 percent of voters supporting the measure, it fell short of passage by a mere 0.14 percent. A 55 percent voting standard also could aid the passage of a regional gasoline tax that MTC is already authorized to place on the ballot.

FIGURE 26: Missed Opportunities: Local Transportation Measures in California Since 2002



Source: Move LA

John Huseby, Caltrans

Seek Reliable Federal Transportation Funding Levels and Flexibility

Over the last 50 years transportation funding has been characterized by a federal/state/local partnership. And whether it be restoring the Interstate Highway System to a state of good repair or removing bottlenecks in key freight corridors, the federal government continues to have a vital role to play with respect to transportation. The current federal surface transportation bill, Moving Ahead for Progress in the 21st Century (MAP 21), provides funding through fiscal year 2014 only by relying on support from the nation's beleaguered general fund. MTC and ABAG will urge Congress to identify a long-term, user-based funding source for transportation in the successor to MAP 21. That bill should build on the streamlined structure and performance-based framework established by MAP 21 and provide flexibility for the region to respond to its diverse transportation needs.

The next authorization should place a stronger emphasis on metropolitan areas, the economic engines of our nation. Metro areas with a population over 1 million include 65 percent of the

Local Transportation Revenues: Bay Area Experience

It has been nearly three decades since Santa Clara County voters passed Measure A, a local half-cent sales tax dedicated to transportation. This vote, which took place in 1984, ushered in a new era. Today, eight counties in the region have a sales tax dedicated to transportation purposes, including every Bay Area county except Solano County, which twice has failed to meet the two-thirds vote requirement.

In 2012, State Transportation Improvement Program funds for the Bay Area were $100 million, while revenue from the region's sales tax measures was five times larger and totaled $530 million.

Noah Berger

nation's population, yet contribute 75 percent of the nation's wealth, as measured by gross domestic product. They also endure 97 percent of the nation's traffic congestion and carry 97 percent of public transit passenger miles. Yet, rather than investing a larger share of federal transportation funds in the areas where the vast majority of the population lives and works, MAP 21 actually shifts some funds away from such areas.

Grow State Transportation Funding

MTC/ABAG will urge the Bay Area's state legislative delegation to create a new, permanent revenue source for transportation to better maintain and increase the efficiency of the existing network, and to invest in high-performing network improvements that further the goals and performance metrics of Plan Bay Area. One such source is the state's new Cap and Trade permitting system, where the revenue raised is directly linked to greenhouse gas emission reductions.

Previous generations of Californians stepped up to build a network of highways that were the envy of the world and that made possible the Bay Area's phenomenal economic growth and prosperity. But our transportation infrastructure has matured and deteriorated in recent decades due to the simple fact that the user-based mechanisms designed to build it and keep it in good repair — state and federal gas taxes — have not kept pace with inflation and have eroded in value by some 40 percent in the past two decades.

Any new state funds should be constitutionally dedicated to transportation so as to avoid the diversion of funds that plagued transportation over the last decade. Consistent with Plan Bay Area's "fix it first" policy, MTC and ABAG will advocate that the majority of revenues from any new statewide transportation fund source be focused on preservation of the existing state highway, local street and road, and public transit network.

Appendices

Supplementary Reports, Additional Resources and Maps

Noah Berger

Appendix 1

Supplementary Reports and Additional Resources

The Plan Bay Area materials listed below can be found at:
http://onebayarea.org/regional-initiatives/plan-bay-area/final-plan-bay-area/final-supplementary-reports.html

Economic Impact Analysis for Future Regional Plans

Environmental Impact Report

Equity Analysis Report: Including Title VI, Environmental Justice and Equity Analysis for Plan Bay Area

Financial Assumptions

Forecast of Jobs, Population and Housing

Glossary

Government-to-Government Consultation with Native American Tribes

Local Street and Road Needs and Revenue Assessment

Online Project Database and Transportation Project List

Performance Assessment Report

Priority Development Area Development Feasibility and Readiness Assessment

Public Outreach and Participation Program (Volumes 1–4)

Regional Housing Need Plan for the San Francisco Bay Area: 2014–2022

State Highway Needs and Revenue Assessment

Summary of Predicted Land Use Responses

Summary of Predicted Traveler Responses

Transit Operating and Capital Needs and Revenue Assessment

Transportation Air Quality Conformity Analysis for Plan Bay Area and the 2013 Transportation Improvement Program

Appendix 2

Maps

Appendix 2 includes a set of 18 detailed maps of the region showing key resource lands, job and housing growth (2010–2040), and total future housing and job intensities for 2040. For each topic, three close-up maps of different parts of the Bay Area region are included. See page 153 for legend information.

Map **Page**

Open Space and Williamson Act Lands: 2013

Resource Lands: 2013

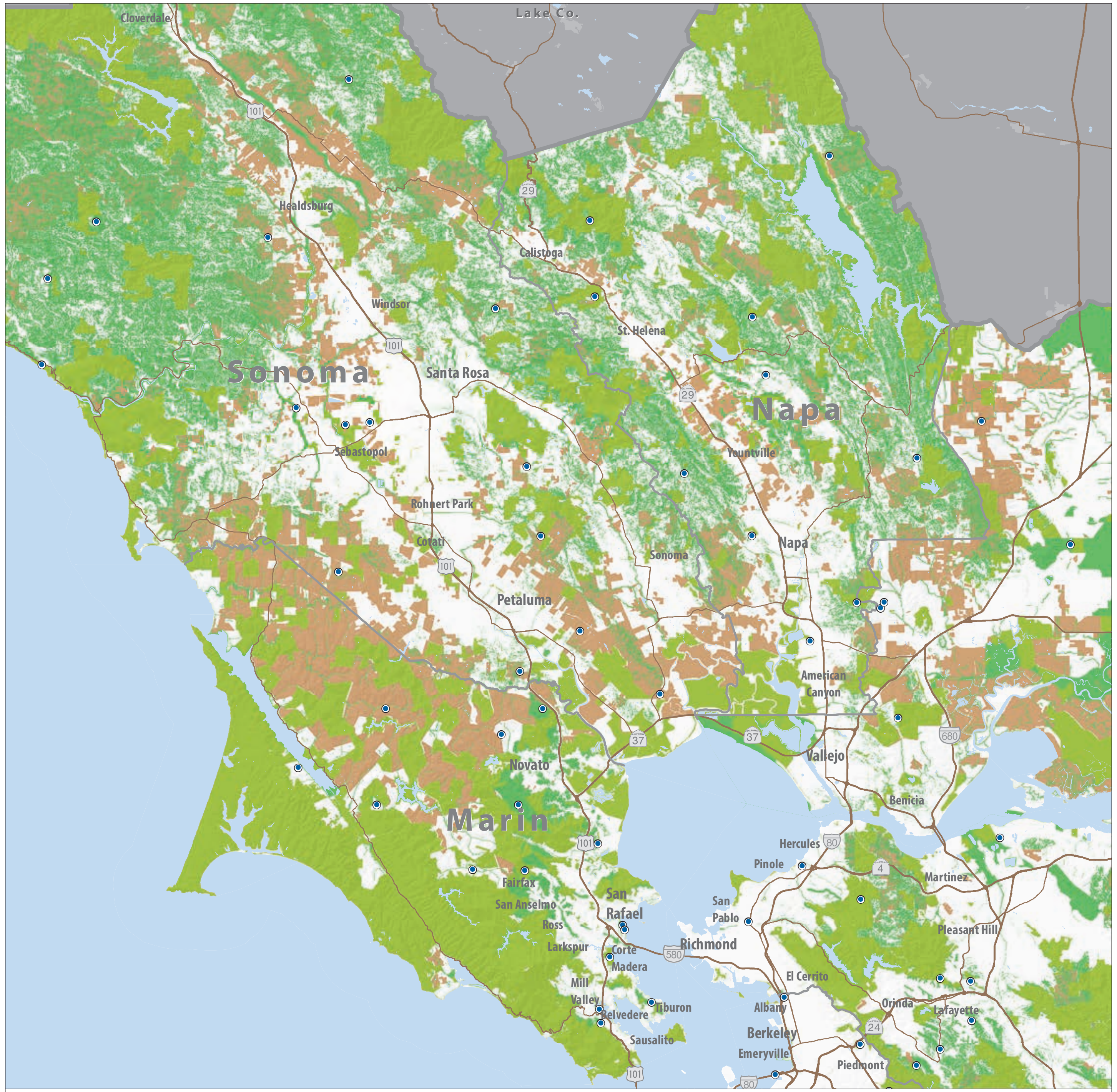
Job Growth: 2010–2040

Household Growth: 2010–2040

Jobs per Acre in 2040

Households per Acre in 2040

MAP 14 **North Bay/West: Open Space and Williamson Act Lands**



Open Space and Williamson Act Lands

🟩 **Publicly Owned Parks and Open Space**

● **Priority Conservation Areas**

🟫 **Williamson Act Lands**
Some Williamson Act contracts are set to expire and be decommissioned during the plan period.

🟩 **Riparian Corridors, Hillside Areas, Greenbelt Reserves and Floodplains**

☐ **Not Categorized**
Includes land that may be designated as Urban and Built-up as defined by the Farmland Mapping and Monitoring Program in 2010. These lands include areas occupied by structures with a building density of at least 1 unit to 1.5 acres, or approximately 6 structures to a 10-acre parcel. This land is used for residential, industrial, commercial, construction, institutional, public administration, railroad and other transportation yards, cemeteries, airports, golf courses, sanitary landfills, sewage treatment, water control structures and other developed purposes. Also may include areas within Urban Growth Boundaries/ Urban Limit Lines, Urban Service Areas and Spheres of Influence. This category may also include undeveloped lands classified as Farmland, Critical Habitat and Grazing Lands. See "Resource Lands" map for the location of these areas.

0 5 10 15 Miles

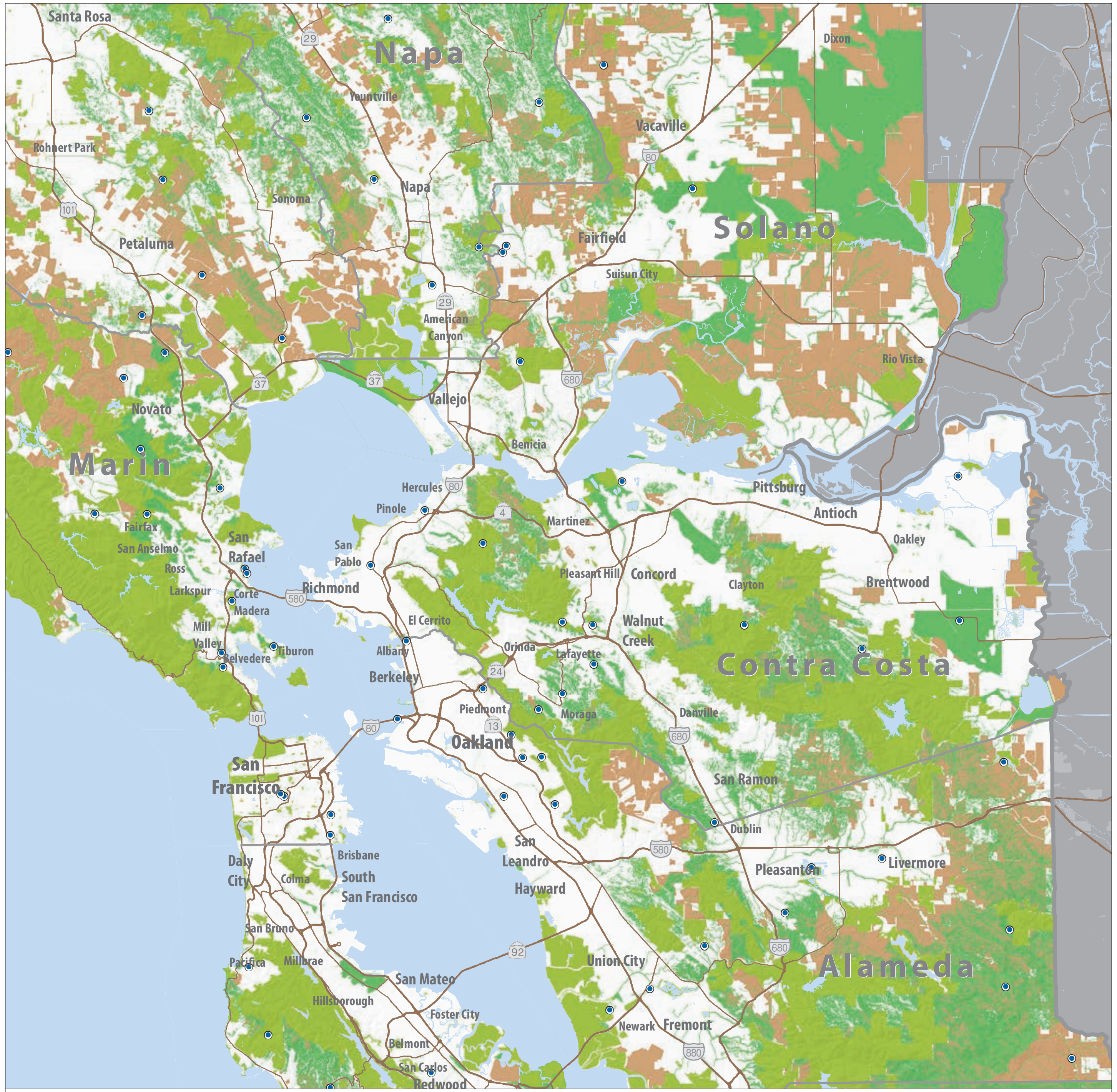
0 5 10 15 Kilometers

POPULATION

Oakland > 350,000
Novato 50,000 - 350,000
Pacifica < 50,000

Map is for general information. For more information on local zoning or designations for a particular site or parcel, please contact your city or county.
See page 153 for legend information.

MAP 15 Northeast and Central Bay: Open Space and Williamson Act Lands



Open Space and Williamson Act Lands

🟩 **Publicly Owned Parks and Open Space**

● **Priority Conservation Areas**

🟫 **Williamson Act Lands**
Some Williamson Act contracts are set to expire and be decommissioned during the plan period.

🟩 **Riparian Corridors, Hillside Areas, Greenbelt Reserves and Floodplains**

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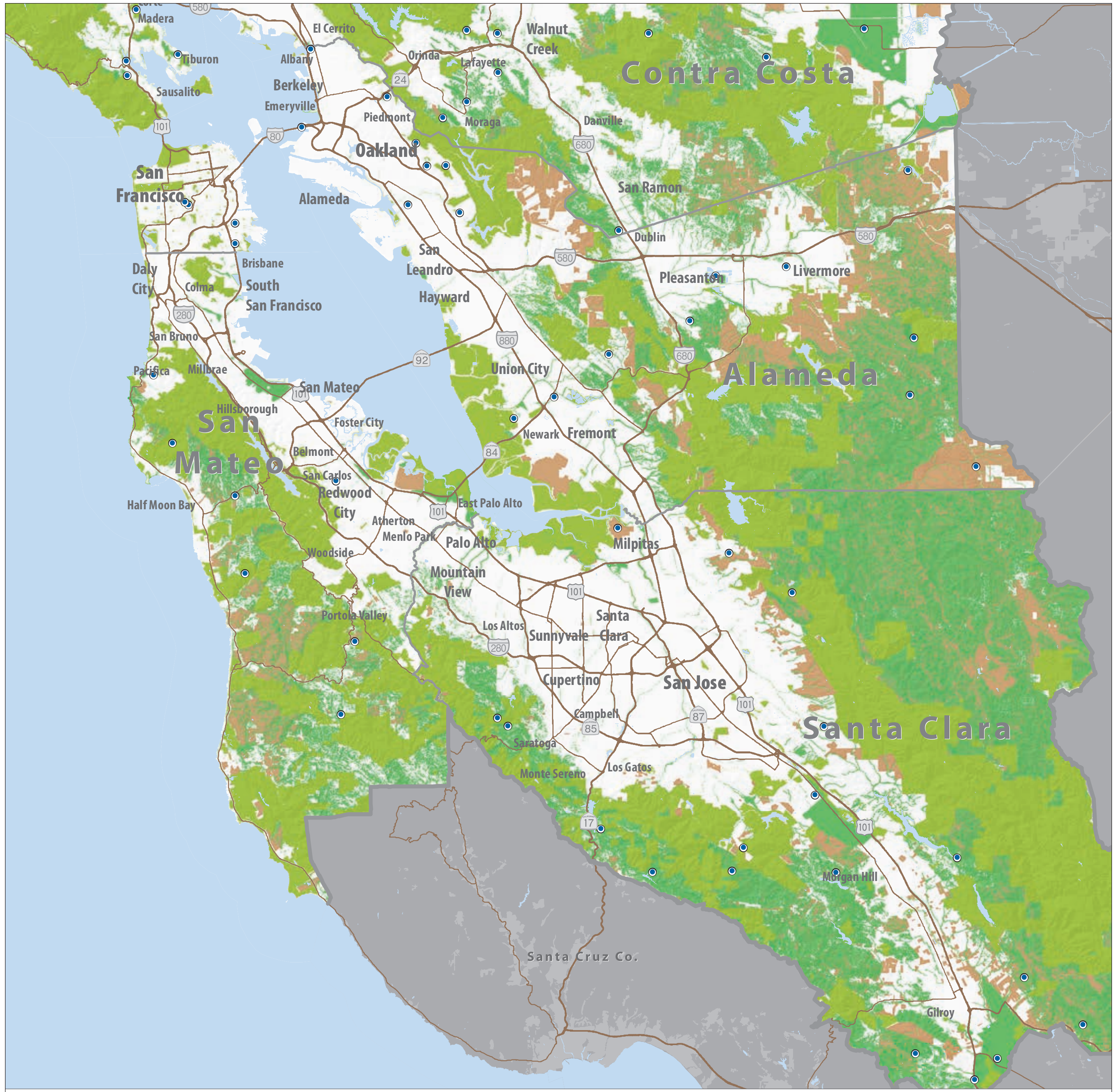
0 5 10 15 Miles

0 5 10 15 Kilometers

POPULATION	
Oakland	> 350,000
Novato	50,000 - 350,000
Pacifica	< 50,000

Map is for general information. For more information on local zoning or designations for a particular site or parcel, please contact your city or county.
See page 153 for legend information.

MAP 16 South and West Bay: Open Space and Williamson Act Lands



Open Space and Williamson Act Lands

🟩 **Publicly Owned Parks and Open Space**

● **Priority Conservation Areas**

🟫 **Williamson Act Lands**
Some Williamson Act contracts are set to expire and be decommissioned during the plan period.

🟩 **Riparian Corridors, Hillside Areas, Greenbelt Reserves and Floodplains**

☐ **Not Categorized**
Includes land that may be designated as Urban and Built-up as defined by the Farmland Mapping and Monitoring Program in 2010. These lands include areas occupied by structures with a building density of at least 1 unit to 1.5 acres, or approximately 6 structures to a 10-acre parcel. This land is used for residential, industrial, commercial, construction, institutional, public administration, railroad and other transportation yards, cemeteries, airports, golf courses, sanitary landfills, sewage treatment, water control structures and other developed purposes. Also may include areas within Urban Growth Boundaries/ Urban Limit Lines, Urban Service Areas and Spheres of Influence. This category may also include undeveloped lands classified as Farmland, Critical Habitat and Grazing Lands. See "Resource Lands" map for the location of these areas.

0 5 10 15 Miles

0 5 10 15 Kilometers

POPULATION
Oakland > 350,000
Novato 50,000 - 350,000
Pacifica < 50,000

Map is for general information. For more information on local zoning or designations for a particular site or parcel, please contact your city or county.
See page 153 for legend information.

MAP 17 North Bay/West: Resource Lands

Resource Lands

🟩 Farmland

▨ Critical Habitat

Grazing Lands

☐ Not Categorized

Includes land that may be designated as Urban and Built-up as defined by the Farmland Mapping and Monitoring Program in 2010. These lands include areas occupied by structures with a building density of at least 1 unit to 1.5 acres, or approximately 6 structures to a 10-acre parcel. This land is used for residential, industrial, commercial, construction, institutional, public administration, railroad and other transportation yards, cemeteries, airports, golf courses, sanitary landfills, sewage treatment, water control structures, and other developed purposes. Also may include areas within Urban Growth Boundaries/ Urban Limit Lines, Urban Service Areas, and Spheres of Influence. These areas may also include Open Space/Parks, Riparian Corridors, Hillside Areas, Greenbelt Reserves, Floodplains and Williamson Act Lands. See "Open Space and Williamson Act Lands" map for the location of these areas.

POPULATION

Oakland > 350,000

Novato 50,000 - 350,000

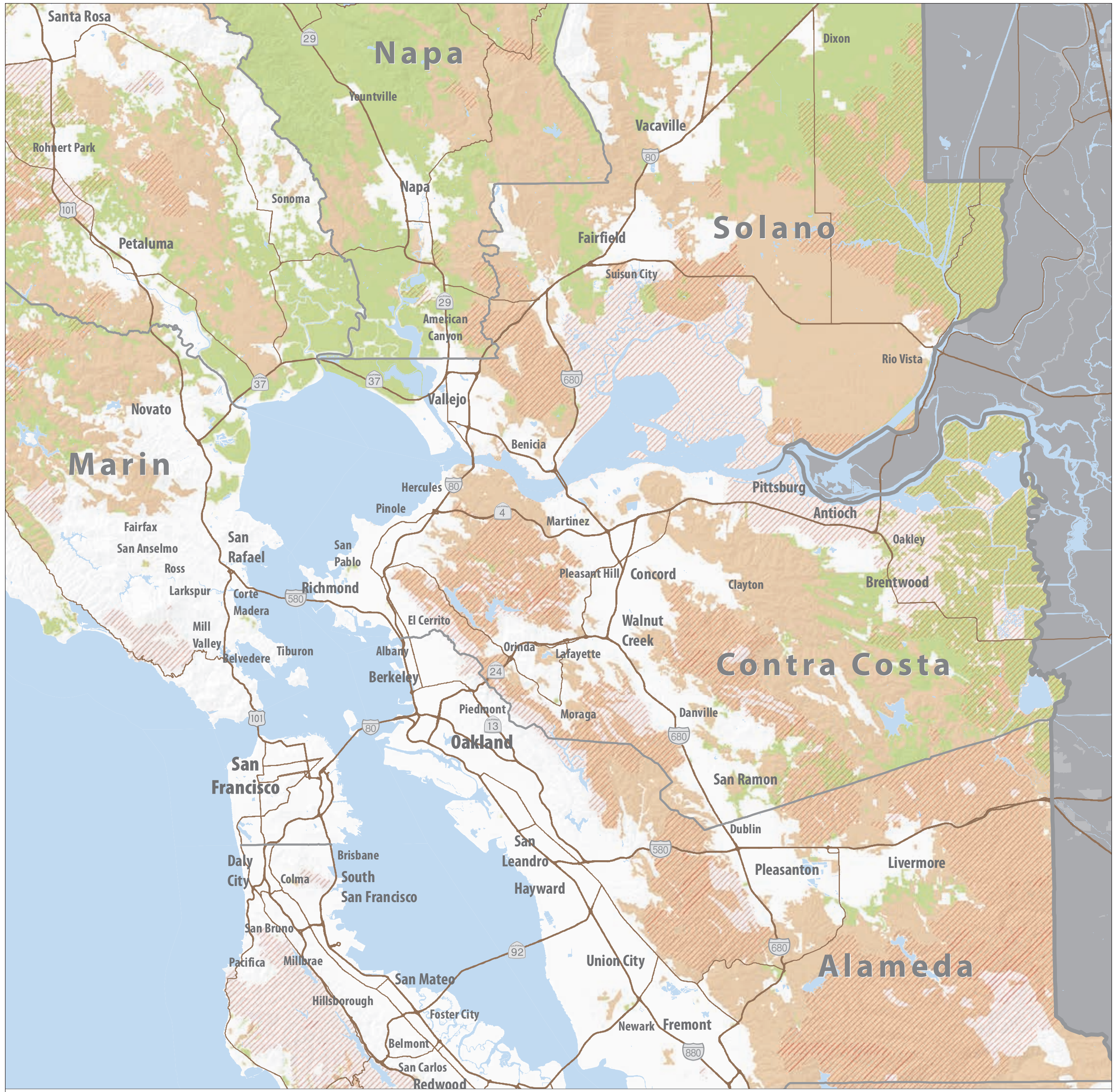
Pacifica < 50,000

0 5 10 15 Miles

Kilometers 0 5 10 15

Map is for general information. For more information on local zoning or designations for a particular site or parcel, please contact your city or county. See page 153 for legend information.

MAP 18 Northeast and Central Bay: Resource Lands



Resource Lands

🟩 Farmland

▨ Critical Habitat

Grazing Lands

☐ Not Categorized

Includes land that may be designated as Urban and Built-up as defined by the Farmland Mapping and Monitoring Program in 2010. These lands include areas occupied by structures with a building density of at least 1 unit to 1.5 acres, or approximately 6 structures to a 10-acre parcel. This land is used for residential, industrial, commercial, construction, institutional, public administration, railroad and other transportation yards, cemeteries, airports, golf courses, sanitary landfills, sewage treatment, water control structures, and other developed purposes. Also may include areas within Urban Growth Boundaries/ Urban Limit Lines, Urban Service Areas, and Spheres of Influence. These areas may also include Open Space/Parks, Riparian Corridors, Hillside Areas, Greenbelt Reserves, Floodplains and Williamson Act Lands. See "Open Space and Williamson Act Lands" map for the location of these areas.

POPULATION

Oakland > 350,000

Novato 50,000 - 350,000

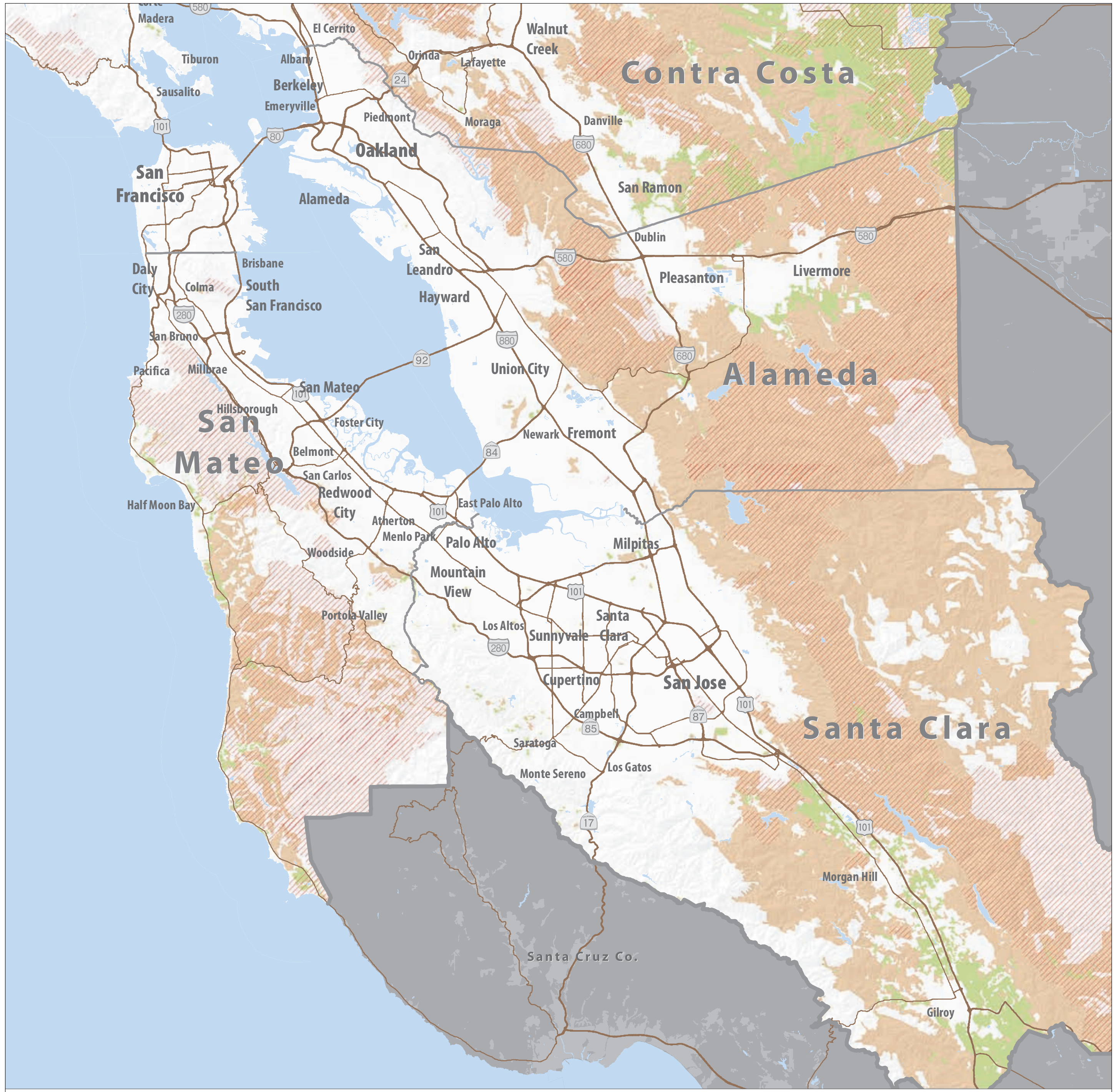
Pacifica < 50,000

0 5 10 15 Miles

Kilometers 0 5 10 15

Map is for general information. For more information on local zoning or designations for a particular site or parcel, please contact your city or county. See page 153 for legend information.

MAP 19 South and West Bay: Resource Lands



Resource Lands

🟩 Farmland

▨ Critical Habitat

🟧 Grazing Lands

☐ Not Categorized

Includes land that may be designated as Urban and Built-up as defined by the Farmland Mapping and Monitoring Program in 2010. These lands include areas occupied by structures with a building density of at least 1 unit to 1.5 acres, or approximately 6 structures to a 10-acre parcel. This land is used for residential, industrial, commercial, construction, institutional, public administration, railroad and other transportation yards, cemeteries, airports, golf courses, sanitary landfills, sewage treatment, water control structures, and other developed purposes. Also may include areas within Urban Growth Boundaries/ Urban Limit Lines, Urban Service Areas, and Spheres of Influence. These areas may also include Open Space/Parks, Riparian Corridors, Hillside Areas, Greenbelt Reserves, Floodplains and Williamson Act Lands. See "Open Space and Williamson Act Lands" map for the location of these areas.

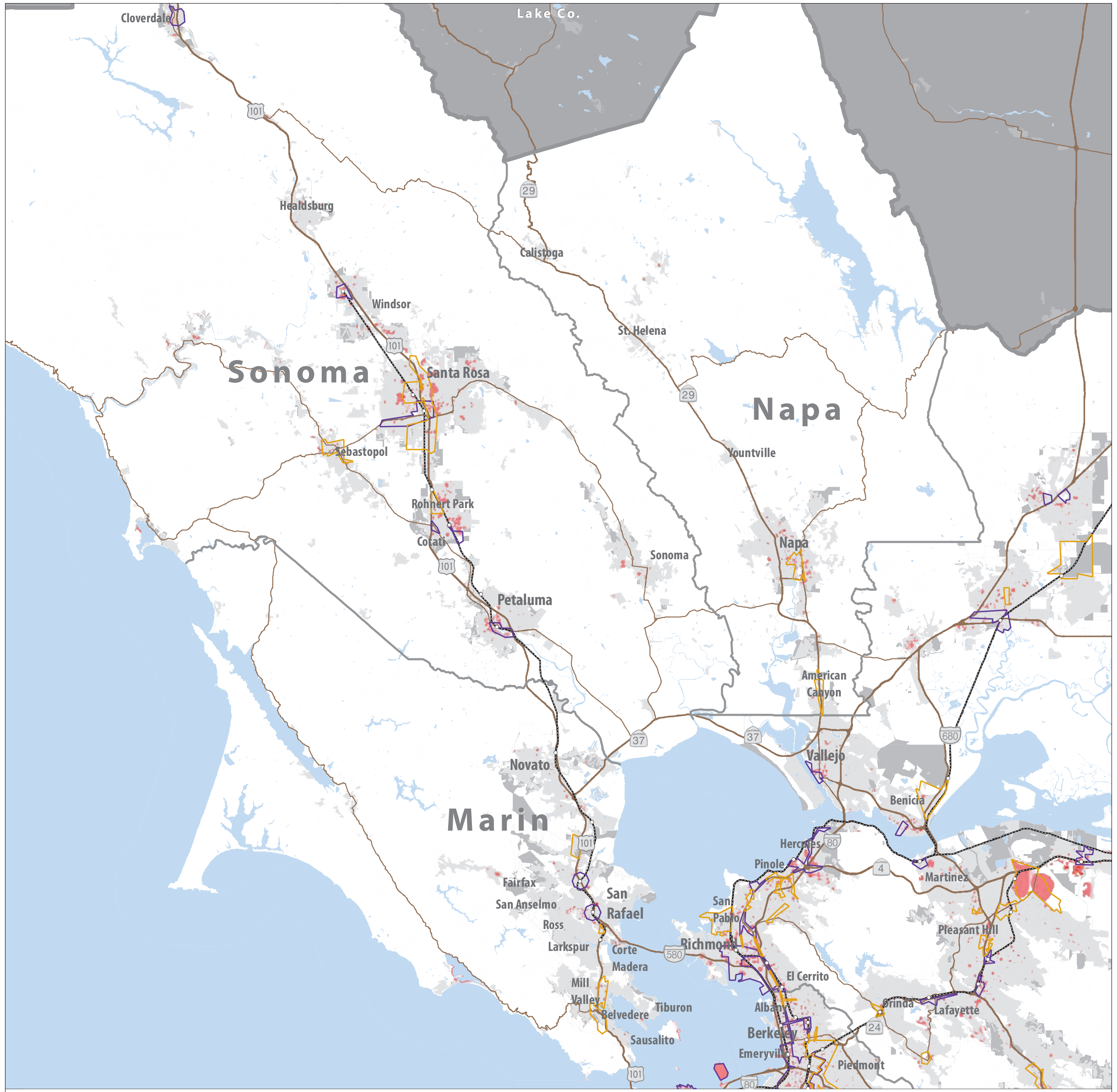
POPULATION	
Oakland	> 350,000
Novato	50,000 - 350,000
Pacifica	< 50,000

0 5 10 15 Miles

Kilometers 0 5 10 15

Map is for general information. For more information on local zoning or designations for a particular site or parcel, please contact your city or county. See page 153 for legend information.

MAP 20 North Bay/West: Change in Jobs per Acre — 2010–2040



Change in Jobs per Acre, 2010 - 2040

Very Low	1 - 50	Med. High	5,000 - 10,000
Low	50 - 1,000	High	10,000 - 20,000
Medium	1,000 - 5,000	Very High	Greater than 20,000

Priority Development Areas

☐ Planned

A Planned PDA has a formally adopted plan, as determined by a local jurisdiction.

☐ Potential

A Potential PDA requires more local planning, review and action before it can become a Planned PDA.

-○- Rail Lines

Urbanized Areas

Urban Boundary Zones

Urbanized Areas: Includes land designated as Urban and Built-up as defined by the Farmland Mapping and Monitoring Program in 2010. These lands include areas occupied by structures with a building density of at least 1 unit to 1.5 acres or approximately 6 structures to a 10-acre parcel. This land is used for residential, industrial, commercial, construction, institutional, public administration, railroad and other transportation yards, cemeteries, airports, golf courses, sanitary landfills, sewage treatment, water control structures and other developed purposes.

Urban Boundary Zones: Includes areas within Urban Growth Boundaries/ Urban Limit Lines, Urban Service Areas and Spheres of Influence.

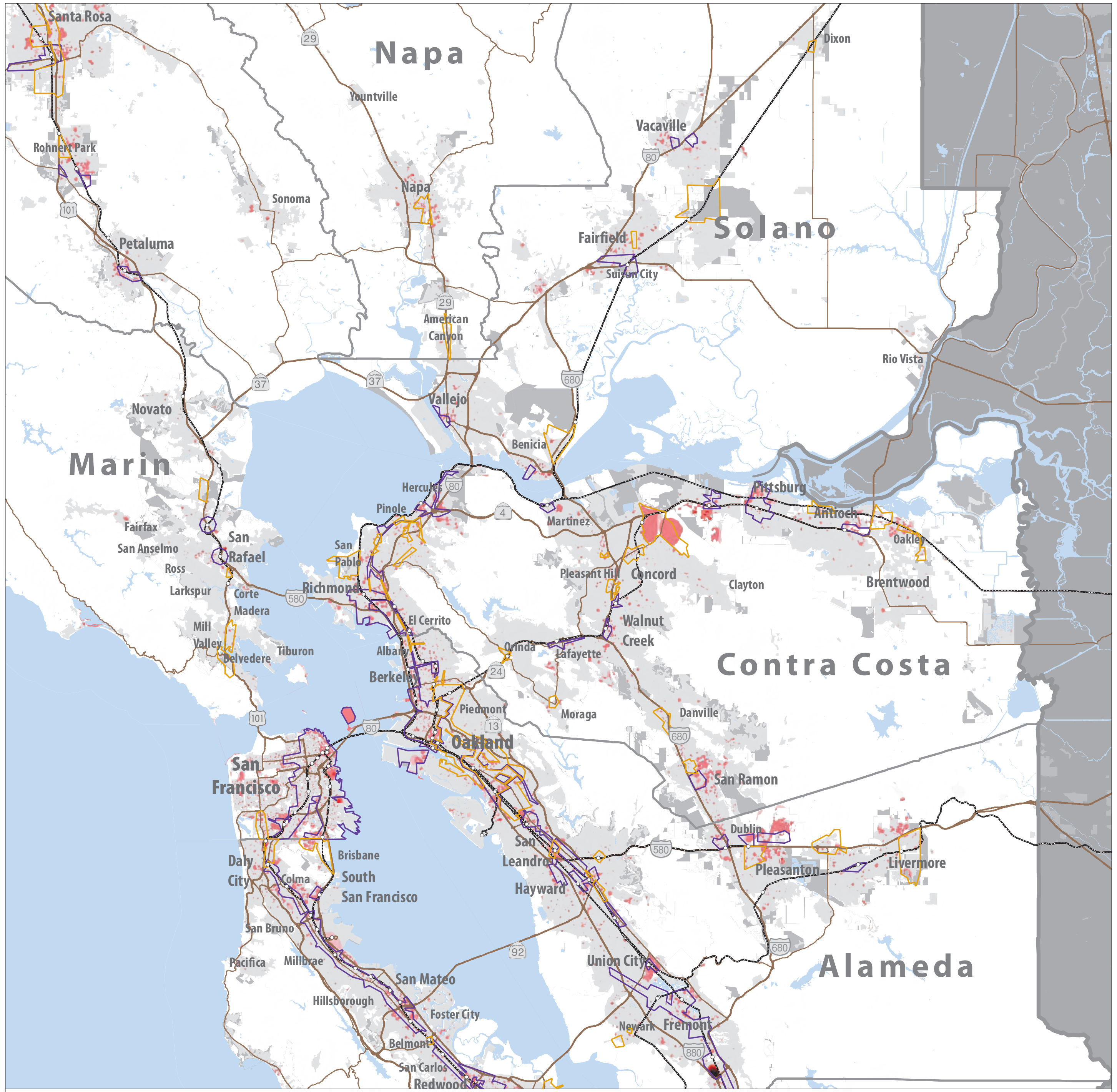
Map is for general information. For more information on local zoning or designations for a particular site or parcel, please contact your city or county.

POPULATION	
Oakland	> 350,000
Novato	50,000 - 350,000
Pacifica	< 50,000

0 5 10 15 Miles

Kilometers 0 5 10 15

MAP 21 Northeast and Central Bay: Change in Jobs per Acre — 2010–2040



Change in Jobs per Acre, 2010 - 2040

Very Low	1 - 50	Med. High	5,000 - 10,000
Low	50 - 1,000	High	10,000 - 20,000
Medium	1,000 - 5,000	Very High	Greater than 20,000

Priority Development Areas

☐ Planned

A Planned PDA has a formally adopted plan, as determined by a local jurisdiction.

☐ Potential

A Potential PDA requires more local planning, review and action before it can become a Planned PDA.

-·- Rail Lines

▨ Urbanized Areas

▨ Urban Boundary Zones

Urbanized Areas: Includes land designated as Urban and Built-up as defined by the Farmland Mapping and Monitoring Program in 2010. These lands include areas occupied by structures with a building density of at least 1 unit to 1.5 acres or approximately 6 structures to a 10-acre parcel. This land is used for residential, industrial, commercial, construction, institutional, public administration, railroad and other transportation yards, cemeteries, airports, golf courses, sanitary landfills, sewage treatment, water control structures and other developed purposes.

Urban Boundary Zones: Includes areas within Urban Growth Boundaries/ Urban Limit Lines, Urban Service Areas and Spheres of Influence.

POPULATION

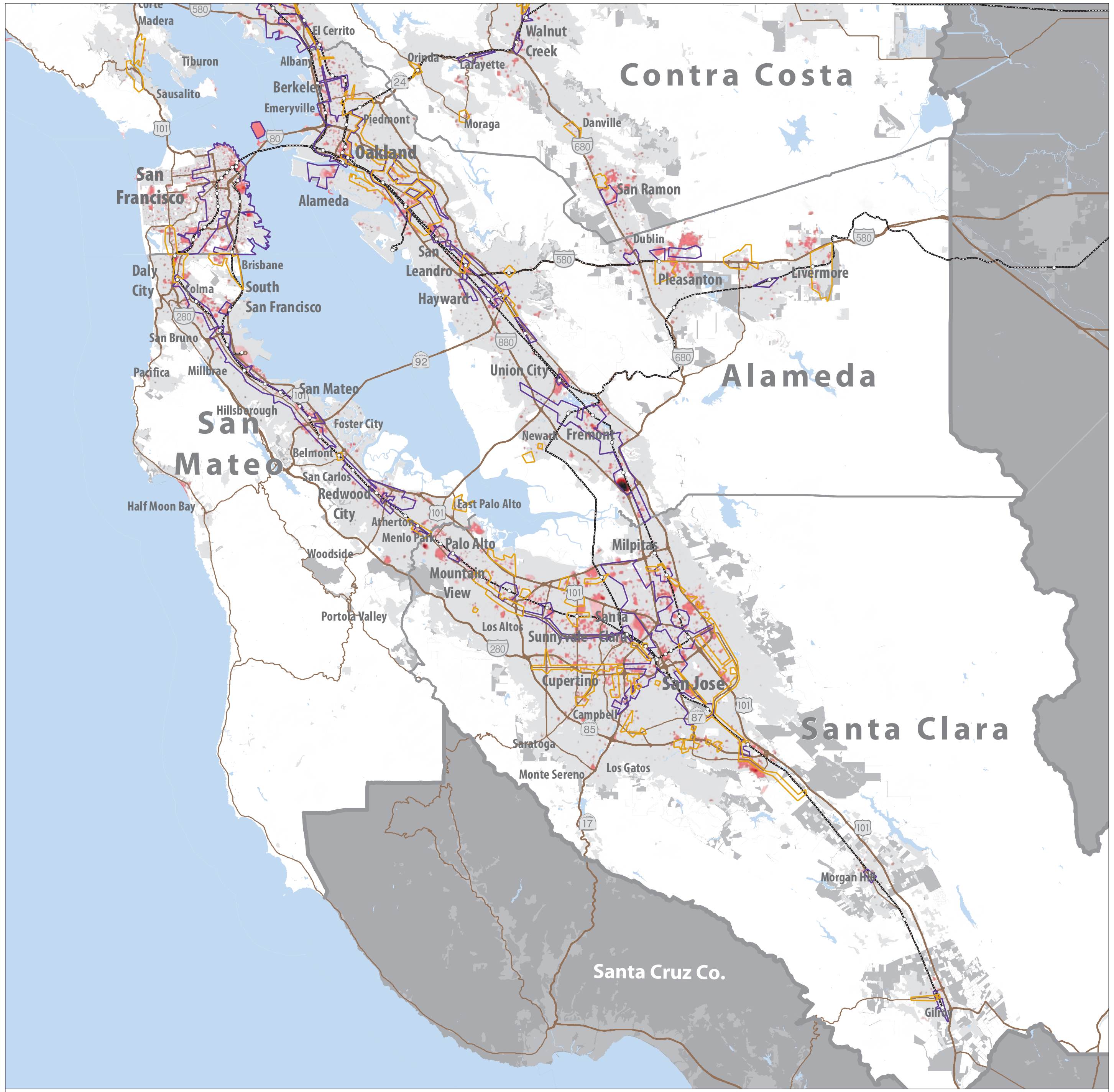
Oakland	> 350,000
Novato	50,000 - 350,000
Pacifica	< 50,000

0 5 10 15 Miles

0 5 10 15 Kilometers

Map is for general information. For more information on local zoning or designations for a particular site or parcel, please contact your city or county.

MAP 22 South and West Bay: Change in Jobs per Acre — 2010–2040



Change in Jobs per Acre, 2010 - 2040

Very Low	1 - 50	Med. High	5,000 - 10,000
Low	50 - 1,000	High	10,000 - 20,000
Medium	1,000 - 5,000	Very High	Greater than 20,000

Priority Development Areas

☐ Planned

A Planned PDA has a formally adopted plan, as determined by a local jurisdiction.

☐ Potential

A Potential PDA requires more local planning, review and action before it can become a Planned PDA.

-·- Rail Lines

▨ Urbanized Areas

▨ Urban Boundary Zones

Urbanized Areas: Includes land designated as Urban and Built-up as defined by the Farmland Mapping and Monitoring Program in 2010. These lands include areas occupied by structures with a building density of at least 1 unit to 1.5 acres or approximately 6 structures to a 10-acre parcel. This land is used for residential, industrial, commercial, construction, institutional, public administration, railroad and other transportation yards, cemeteries, airports, golf courses, sanitary landfills, sewage treatment, water control structures and other developed purposes.

Urban Boundary Zones: Includes areas within Urban Growth Boundaries/ Urban Limit Lines, Urban Service Areas and Spheres of Influence.

POPULATION

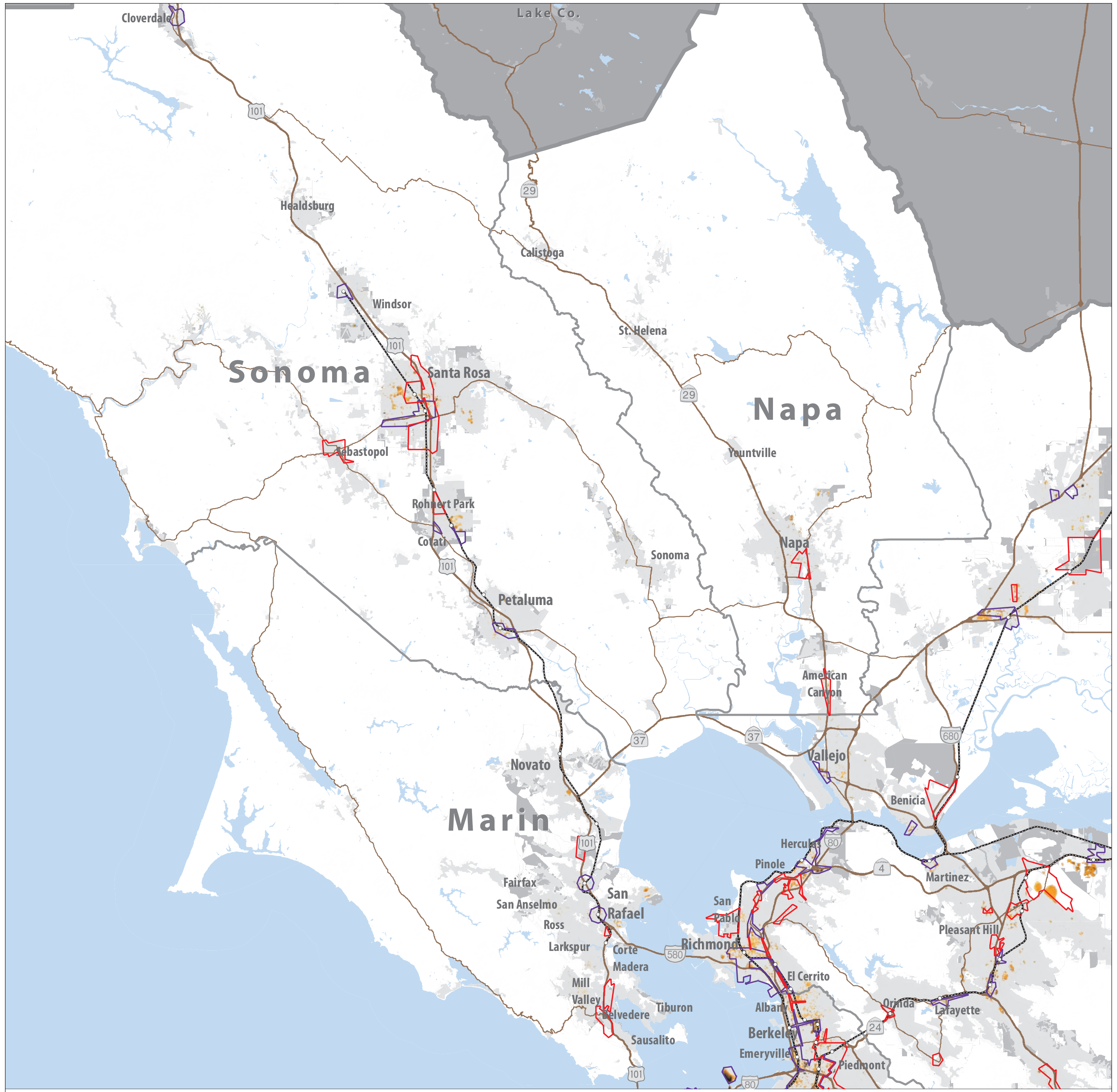
Oakland	> 350,000
Novato	50,000 - 350,000
Pacifica	< 50,000

0 5 10 15 Miles

0 5 10 15 Kilometers

Map is for general information. For more information on local zoning or designations for a particular site or parcel, please contact your city or county.

MAP 23 North Bay/West: Change in Households per Acre — 2010–2040



Change in Households per Acre, 2010 - 2040

Very Low	1 - 8	Med. High	30 - 60
Low	8 - 10	High	60 - 85
Medium	10 - 30	Very High	Greater than 85

Priority Development Areas

☐ Planned

A Planned PDA has a formally adopted plan, as determined by a local jurisdiction.

☐ Potential

A Potential PDA requires more local planning, review and action before it can become a Planned PDA.

-○- Rail Lines

Urbanized Areas

Urban Boundary Zones

Urbanized Areas: Includes land designated as Urban and Built-up as defined by the Farmland Mapping and Monitoring Program in 2010. These lands include areas occupied by structures with a building density of at least 1 unit to 1.5 acres or approximately 6 structures to a 10-acre parcel. This land is used for residential, industrial, commercial, construction, institutional, public administration, railroad and other transportation yards, cemeteries, airports, golf courses, sanitary landfills, sewage treatment, water control structures and other developed purposes.

Urban Boundary Zones: Includes areas within Urban Growth Boundaries/ Urban Limit Lines, Urban Service Areas and Spheres of Influence.

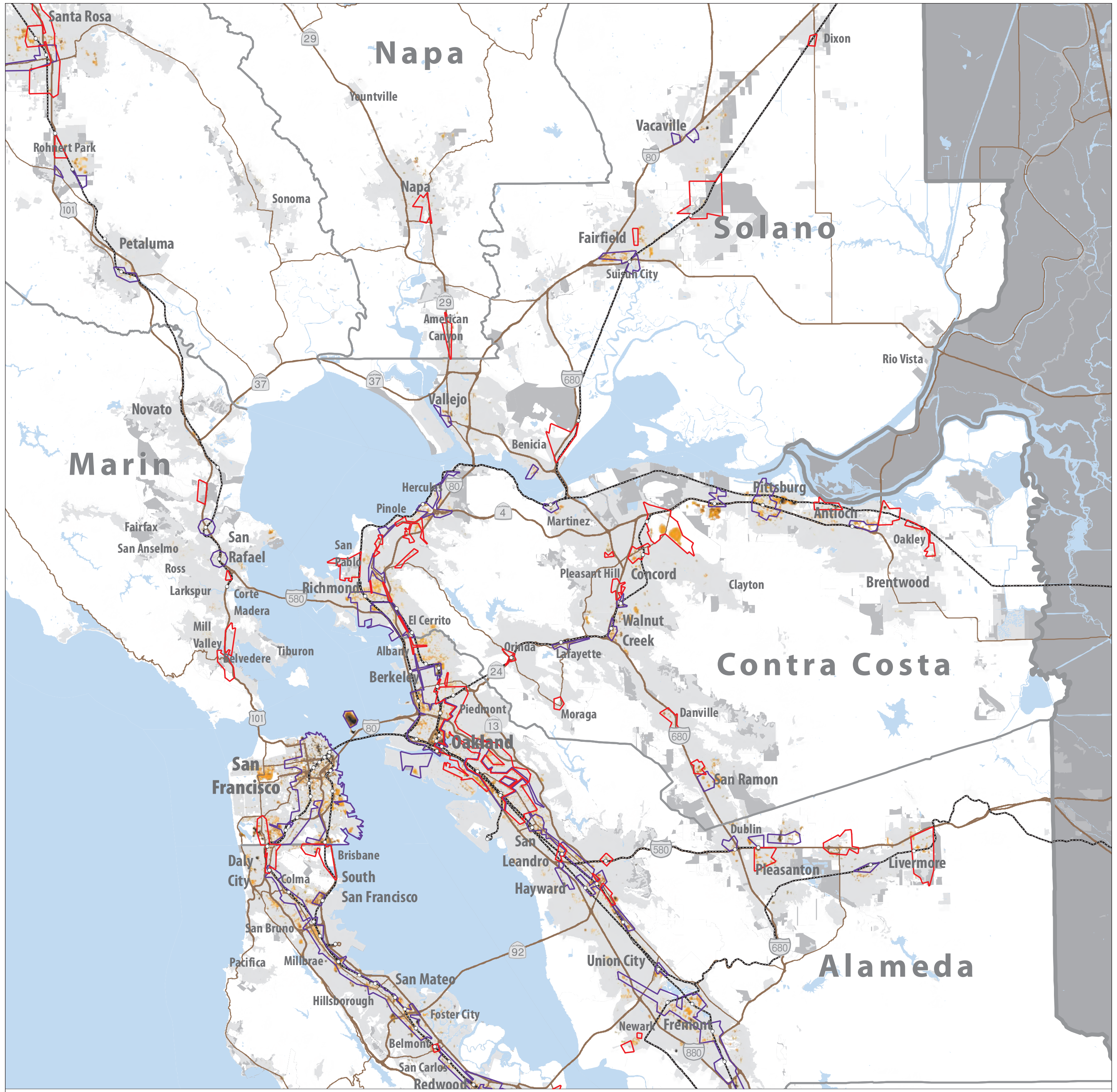
	POPULATION
Oakland	> 350,000
Novato	50,000 - 350,000
Pacifica	< 50,000

0 5 10 15 Miles

Kilometers 0 5 10 15

Map is for general information. For more information on local zoning or designations for a particular site or parcel, please contact your city or county.

MAP 24 Northeast and Central Bay: Change in Households per Acre — 2010–2040



Change in Households per Acre, 2010 - 2040

Very Low	1 - 8	Med. High	30 - 60
Low	8 - 10	High	60 - 85
Medium	10 - 30	Very High	Greater than 85

Priority Development Areas

☐ Planned

A Planned PDA has a formally adopted plan, as determined by a local jurisdiction.

☐ Potential

A Potential PDA requires more local planning, review and action before it can become a Planned PDA.

-○- Rail Lines

Urbanized Areas

Urban Boundary Zones

Urbanized Areas: Includes land designated as Urban and Built-up as defined by the Farmland Mapping and Monitoring Program in 2010. These lands include areas occupied by structures with a building density of at least 1 unit to 1.5 acres or approximately 6 structures to a 10-acre parcel. This land is used for residential, industrial, commercial, construction, institutional, public administration, railroad and other transportation yards, cemeteries, airports, golf courses, sanitary landfills, sewage treatment, water control structures and other developed purposes.

Urban Boundary Zones: Includes areas within Urban Growth Boundaries/ Urban Limit Lines, Urban Service Areas and Spheres of Influence.

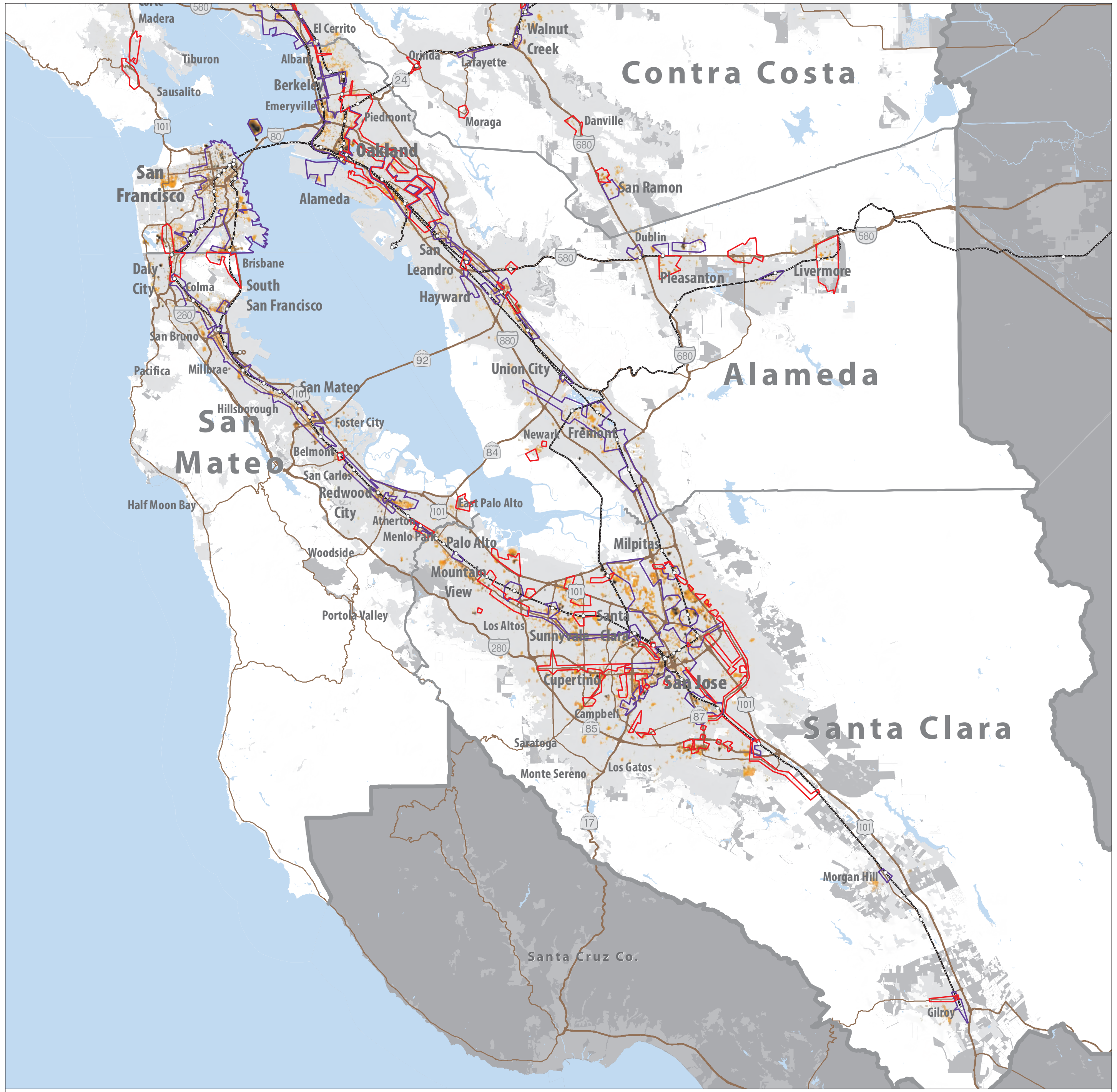
	POPULATION
Oakland	> 350,000
Novato	50,000 - 350,000
Pacifica	< 50,000

0 5 10 15 Miles

Kilometers 0 5 10 15

Map is for general information. For more information on local zoning or designations for a particular site or parcel, please contact your city or county.

MAP 25 South and West Bay: Change in Households per Acre — 2010–2040



Change in Households per Acre, 2010 - 2040

Very Low	1 - 8
Low	8 - 10
Medium	10 - 30
Med. High	30 - 60
High	60 - 85
Very High	Greater than 85

Priority Development Areas

☐ Planned

A Planned PDA has a formally adopted plan, as determined by a local jurisdiction.

☐ Potential

A Potential PDA requires more local planning, review and action before it can become a Planned PDA.

-·- Rail Lines

Urbanized Areas

Urban Boundary Zones

Urbanized Areas: Includes land designated as Urban and Built-up as defined by the Farmland Mapping and Monitoring Program in 2010. These lands include areas occupied by structures with a building density of at least 1 unit to 1.5 acres or approximately 6 structures to a 10-acre parcel. This land is used for residential, industrial, commercial, construction, institutional, public administration, railroad and other transportation yards, cemeteries, airports, golf courses, sanitary landfills, sewage treatment, water control structures and other developed purposes.

Urban Boundary Zones: Includes areas within Urban Growth Boundaries/ Urban Limit Lines, Urban Service Areas and Spheres of Influence.

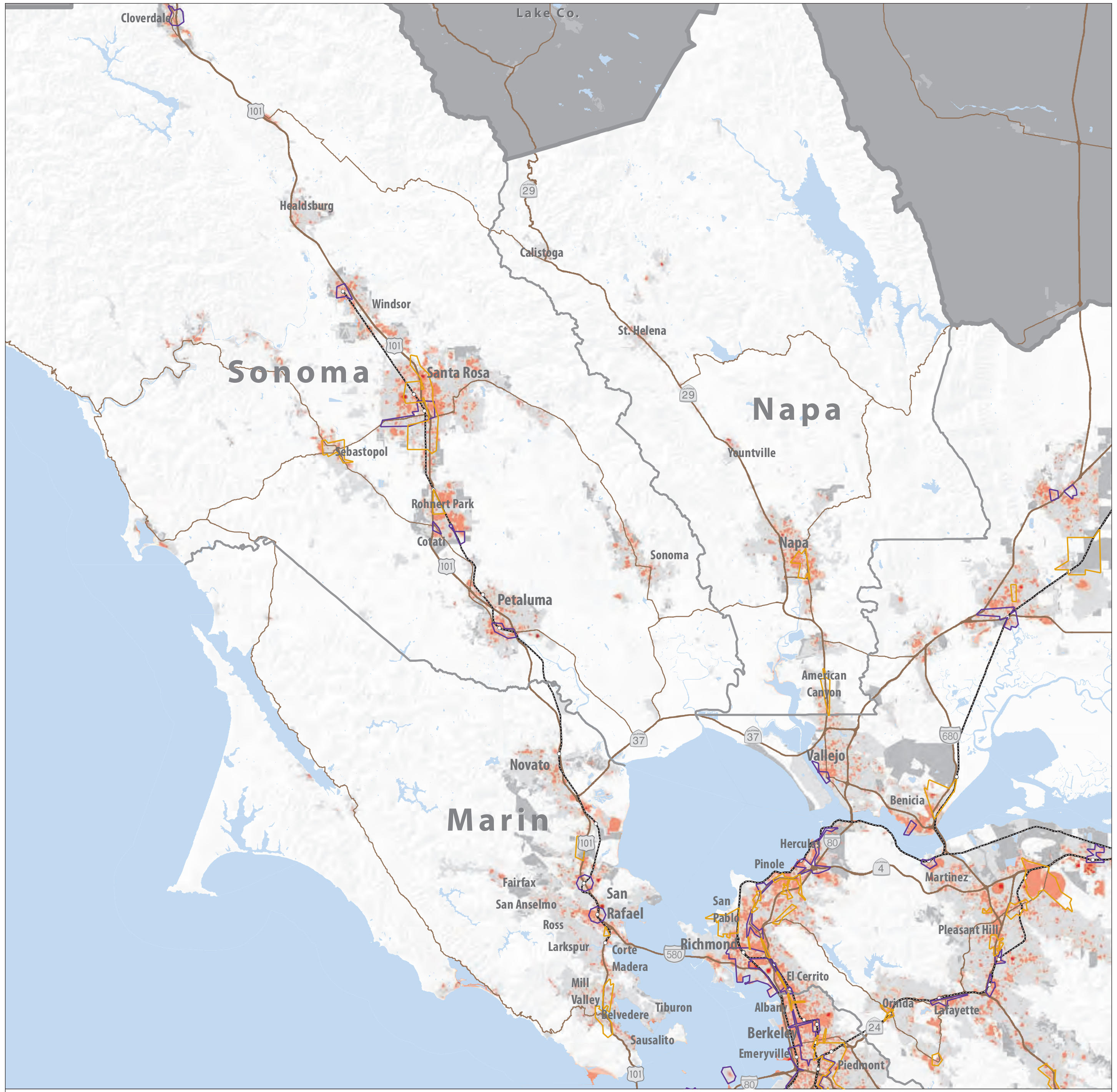
POPULATION

Oakland > 350,000
Novato 50,000 - 350,000
Pacifica < 50,000

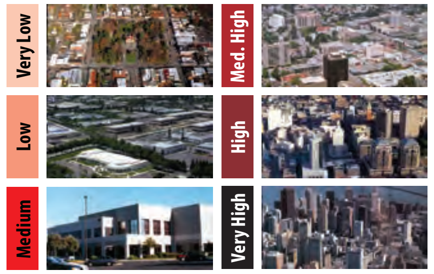
0 5 10 15 Miles
0 5 10 15 Kilometers

Map is for general information. For more information on local zoning or designations for a particular site or parcel, please contact your city or county.

MAP 26 North Bay/West: Jobs per Acre in 2040



Jobs per Acre in 2040



Priority Development Areas

☐ Planned

A Planned PDA has a formally adopted plan, as determined by a local jurisdiction.

☐ Potential

A Potential PDA requires more local planning, review and action before it can become a Planned PDA.

-·- Rail Lines

Urbanized Areas

Urban Boundary Zones

Urbanized Areas: Includes land designated as Urban and Built-up as defined by the Farmland Mapping and Monitoring Program in 2010. These lands include areas occupied by structures with a building density of at least 1 unit to 1.5 acres or approximately 6 structures to a 10-acre parcel. This land is used for residential, industrial, commercial, construction, institutional, public administration, railroad and other transportation yards, cemeteries, airports, golf courses, sanitary landfills, sewage treatment, water control structures and other developed purposes.

Urban Boundary Zones: Includes areas within Urban Growth Boundaries/ Urban Limit Lines, Urban Service Areas and Spheres of Influence.

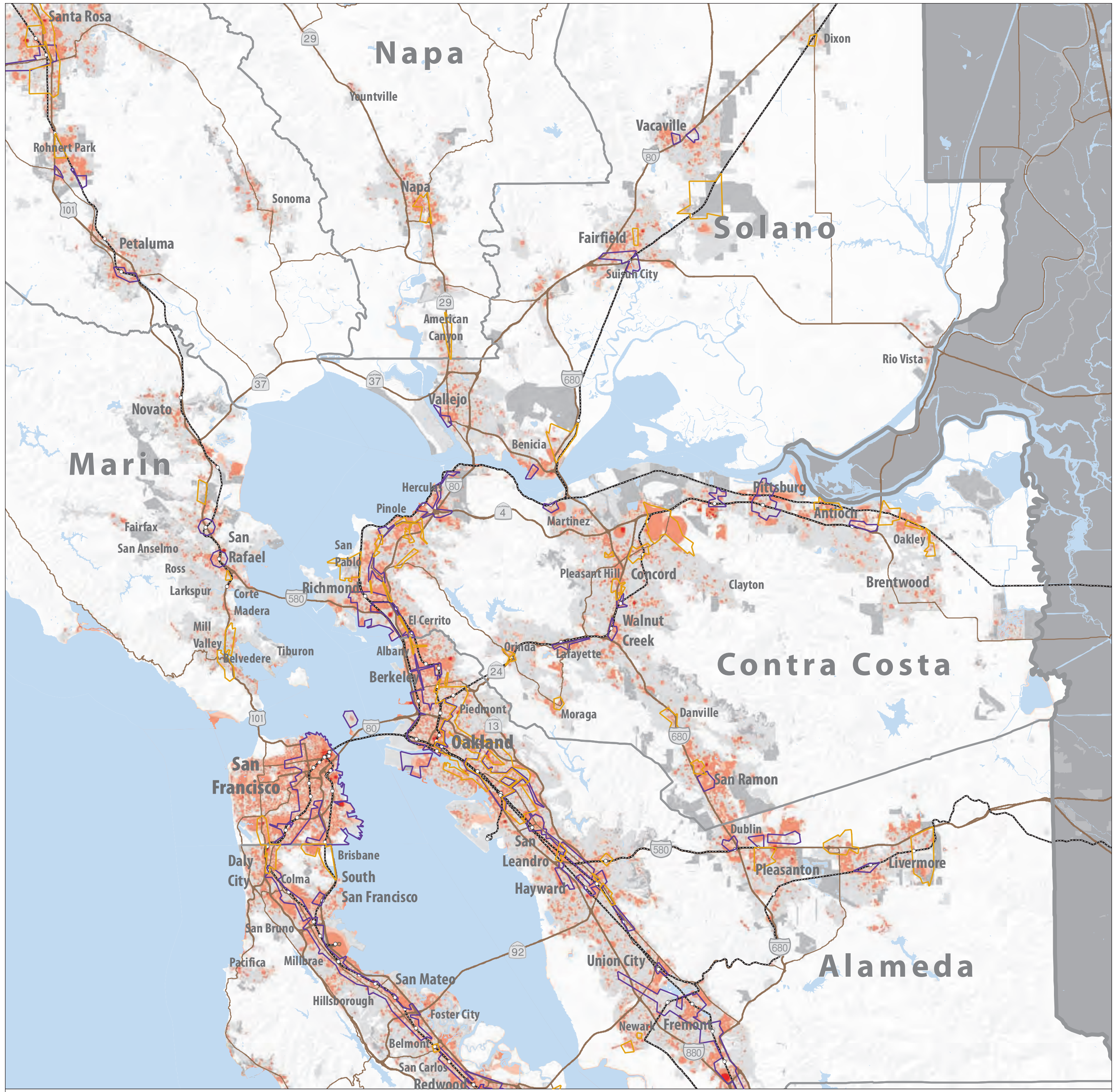
POPULATION

Oakland > 350,000
Novato 50,000 - 350,000
Pacifica < 50,000

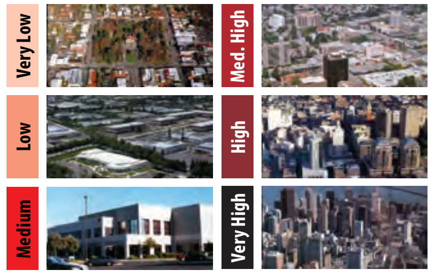
0 5 10 15 Miles
0 5 10 15 Kilometers

Map is for general information. For more information on local zoning or designations for a particular site or parcel, please contact your city or county.

MAP 27 Northeast and Central Bay: Jobs per Acre in 2040



Jobs per Acre in 2040



Priority Development Areas

☐ Planned

A Planned PDA has a formally adopted plan, as determined by a local jurisdiction.

☐ Potential

A Potential PDA requires more local planning, review and action before it can become a Planned PDA.

- -- Rail Lines

Urbanized Areas

Urban Boundary Zones

Urbanized Areas: Includes land designated as Urban and Built-up as defined by the Farmland Mapping and Monitoring Program in 2010. These lands include areas occupied by structures with a building density of at least 1 unit to 1.5 acres or approximately 6 structures to a 10-acre parcel. This land is used for residential, industrial, commercial, construction, institutional, public administration, railroad and other transportation yards, cemeteries, airports, golf courses, sanitary landfills, sewage treatment, water control structures and other developed purposes.

Urban Boundary Zones: Includes areas within Urban Growth Boundaries/ Urban Limit Lines, Urban Service Areas and Spheres of Influence.

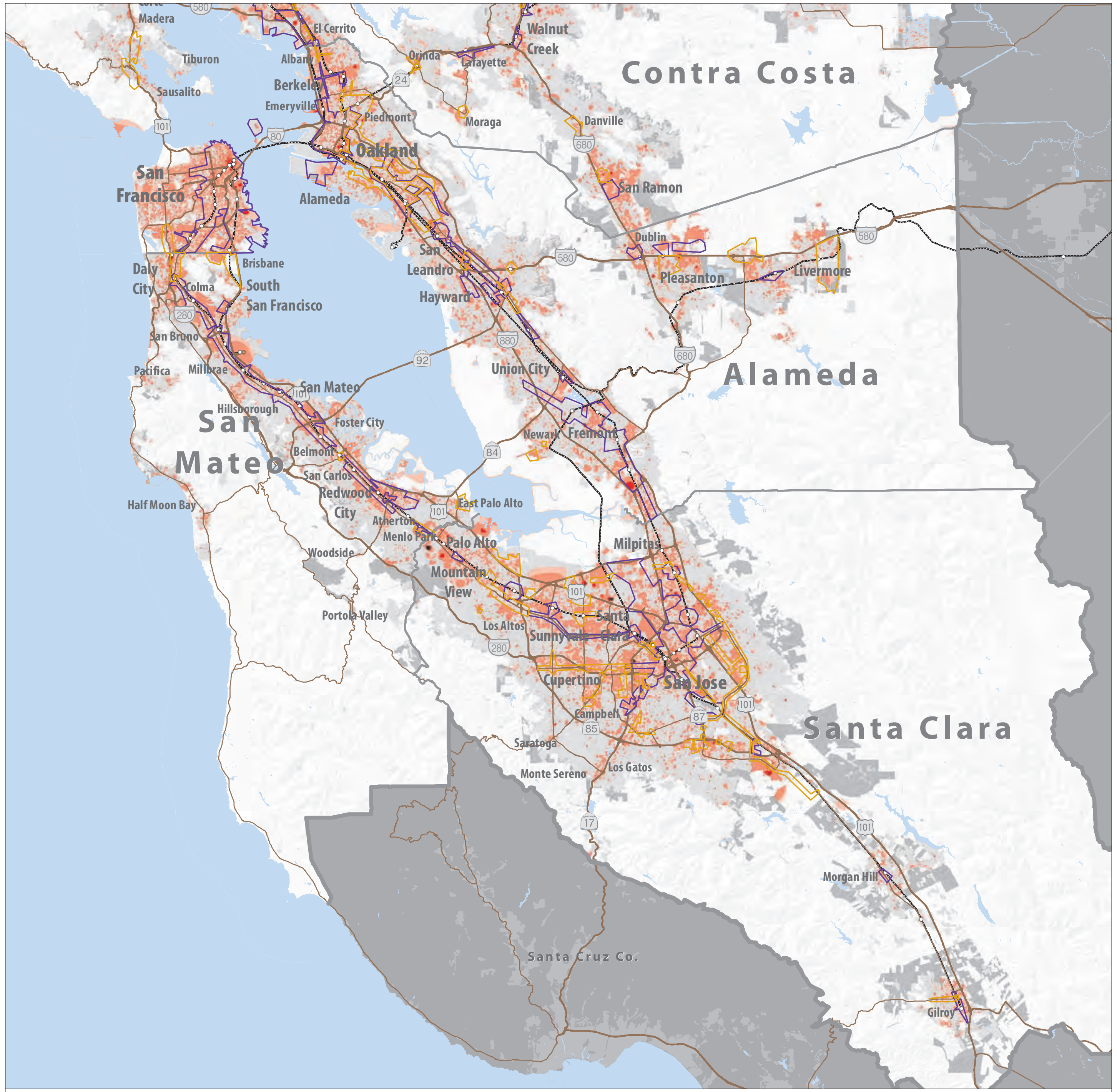
	POPULATION
Oakland	> 350,000
Novato	50,000 - 350,000
Pacifica	< 50,000

0 5 10 15 Miles

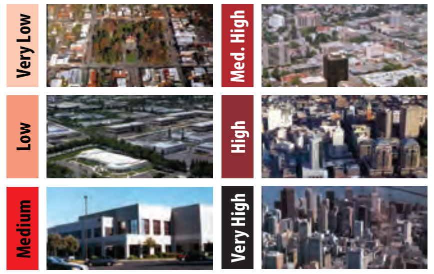
0 5 10 15 Kilometers

Map is for general information. For more information on local zoning or designations for a particular site or parcel, please contact your city or county.

MAP 28 South and West Bay: Jobs per Acre in 2040



Jobs per Acre in 2040



Priority Development Areas

☐ Planned

A Planned PDA has a formally adopted plan, as determined by a local jurisdiction.

☐ Potential

A Potential PDA requires more local planning, review and action before it can become a Planned PDA.

- -- Rail Lines

Urbanized Areas

Urban Boundary Zones

Urbanized Areas: Includes land designated as Urban and Built-up as defined by the Farmland Mapping and Monitoring Program in 2010. These lands include areas occupied by structures with a building density of at least 1 unit to 1.5 acres or approximately 6 structures to a 10-acre parcel. This land is used for residential, industrial, commercial, construction, institutional, public administration, railroad and other transportation yards, cemeteries, airports, golf courses, sanitary landfills, sewage treatment, water control structures and other developed purposes.

Urban Boundary Zones: Includes areas within Urban Growth Boundaries/ Urban Limit Lines, Urban Service Areas and Spheres of Influence.

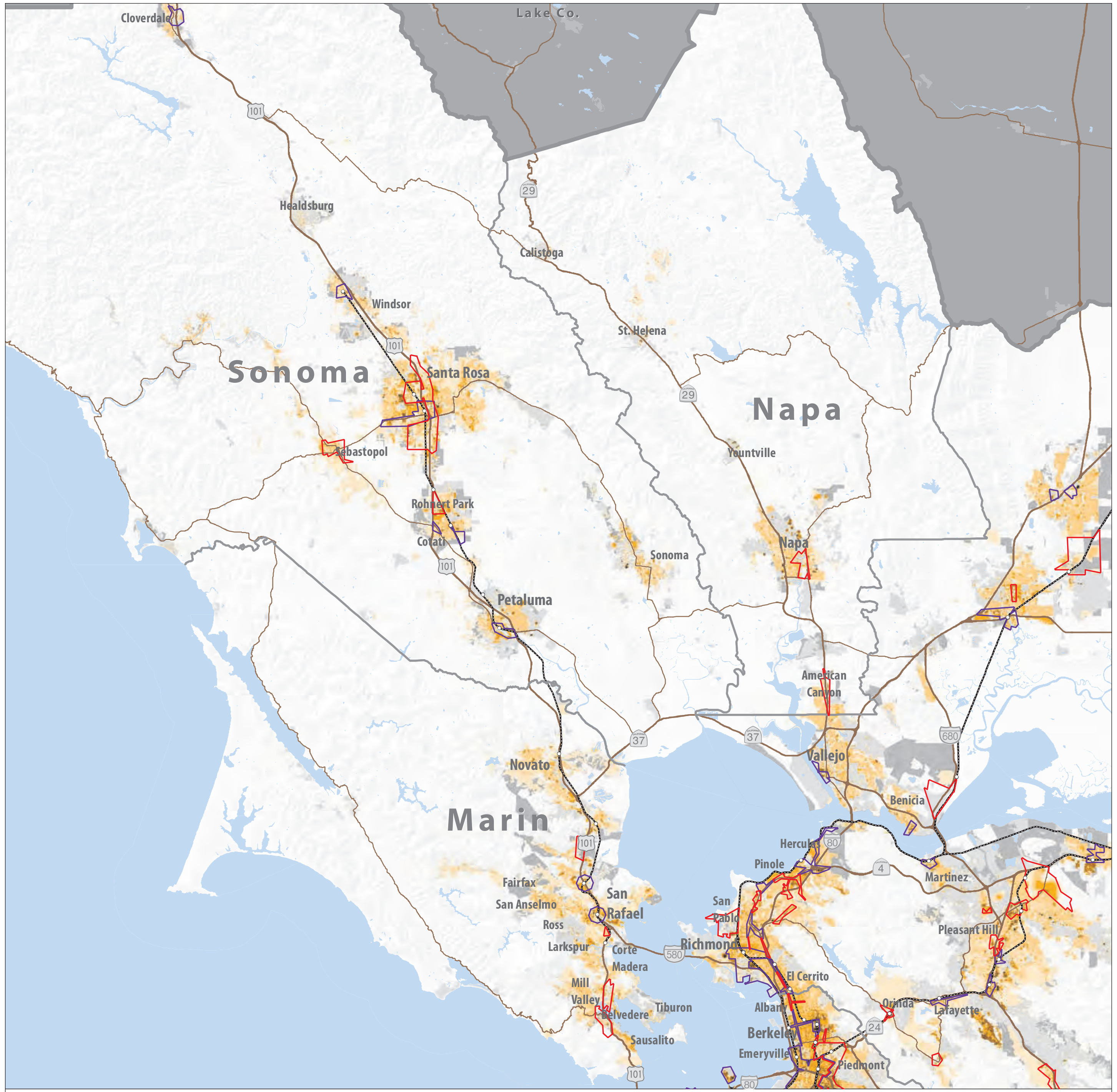
	POPULATION
Oakland	> 350,000
Novato	50,000 - 350,000
Pacifica	< 50,000

0 5 10 15 Miles

0 5 10 15 Kilometers

Map is for general information. For more information on local zoning or designations for a particular site or parcel, please contact your city or county.

MAP 29 North Bay/West: Households per Acre in 2040



Households per Acre in 2040

Priority Development Areas

☐ Planned

A Planned PDA has a formally adopted plan, as determined by a local jurisdiction.

☐ Potential

A Potential PDA requires more local planning, review and action before it can become a Planned PDA.

Rail Lines

Urbanized Areas

Urban Boundary Zones

Urbanized Areas: Includes land designated as Urban and Built-up as defined by the Farmland Mapping and Monitoring Program in 2010. These lands include areas occupied by structures with a building density of at least 1 unit to 1.5 acres or approximately 6 structures to a 10-acre parcel. This land is used for residential, industrial, commercial, construction, institutional, public administration, railroad and other transportation yards, cemeteries, airports, golf courses, sanitary landfills, sewage treatment, water control structures and other developed purposes.

Urban Boundary Zones: Includes areas within Urban Growth Boundaries/ Urban Limit Lines, Urban Service Areas and Spheres of Influence.

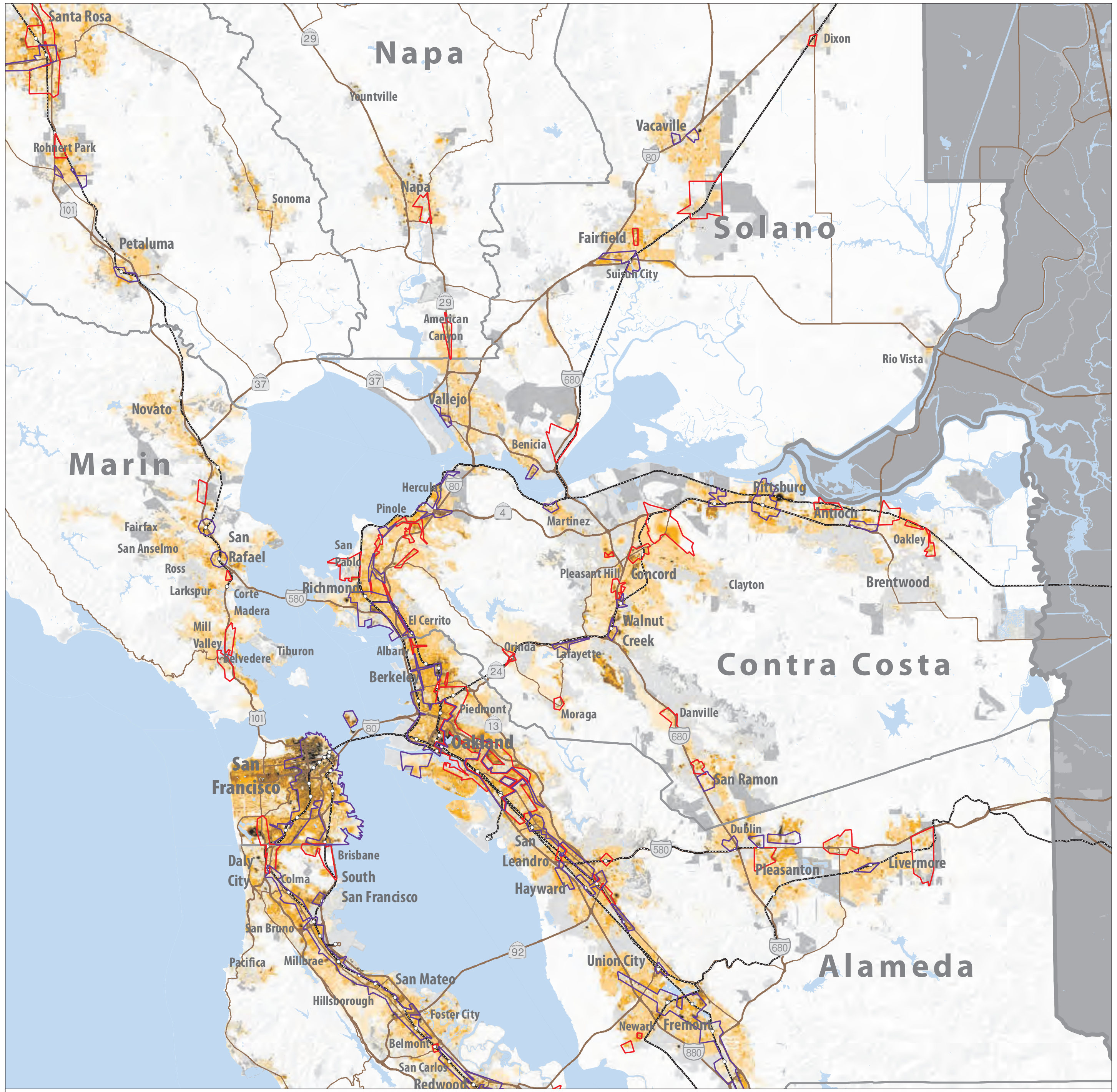
Map is for general information. For more information on local zoning or designations for a particular site or parcel, please contact your city or county.

POPULATION	
Oakland	> 350,000
Novato	50,000 - 350,000
Pacifica	< 50,000

0 5 10 15 Miles

0 5 10 15 Kilometers

MAP 30 Northeast and Central Bay: Households per Acre in 2040



Households per Acre in 2040

Priority Development Areas

☐ Planned

A Planned PDA has a formally adopted plan, as determined by a local jurisdiction.

☐ Potential

A Potential PDA requires more local planning, review and action before it can become a Planned PDA.

Rail Lines

Urbanized Areas

Urban Boundary Zones

Urbanized Areas: Includes land designated as Urban and Built-up as defined by the Farmland Mapping and Monitoring Program in 2010. These lands include areas occupied by structures with a building density of at least 1 unit to 1.5 acres or approximately 6 structures to a 10-acre parcel. This land is used for residential, industrial, commercial, construction, institutional, public administration, railroad and other transportation yards, cemeteries, airports, golf courses, sanitary landfills, sewage treatment, water control structures and other developed purposes.

Urban Boundary Zones: Includes areas within Urban Growth Boundaries/ Urban Limit Lines, Urban Service Areas and Spheres of Influence.

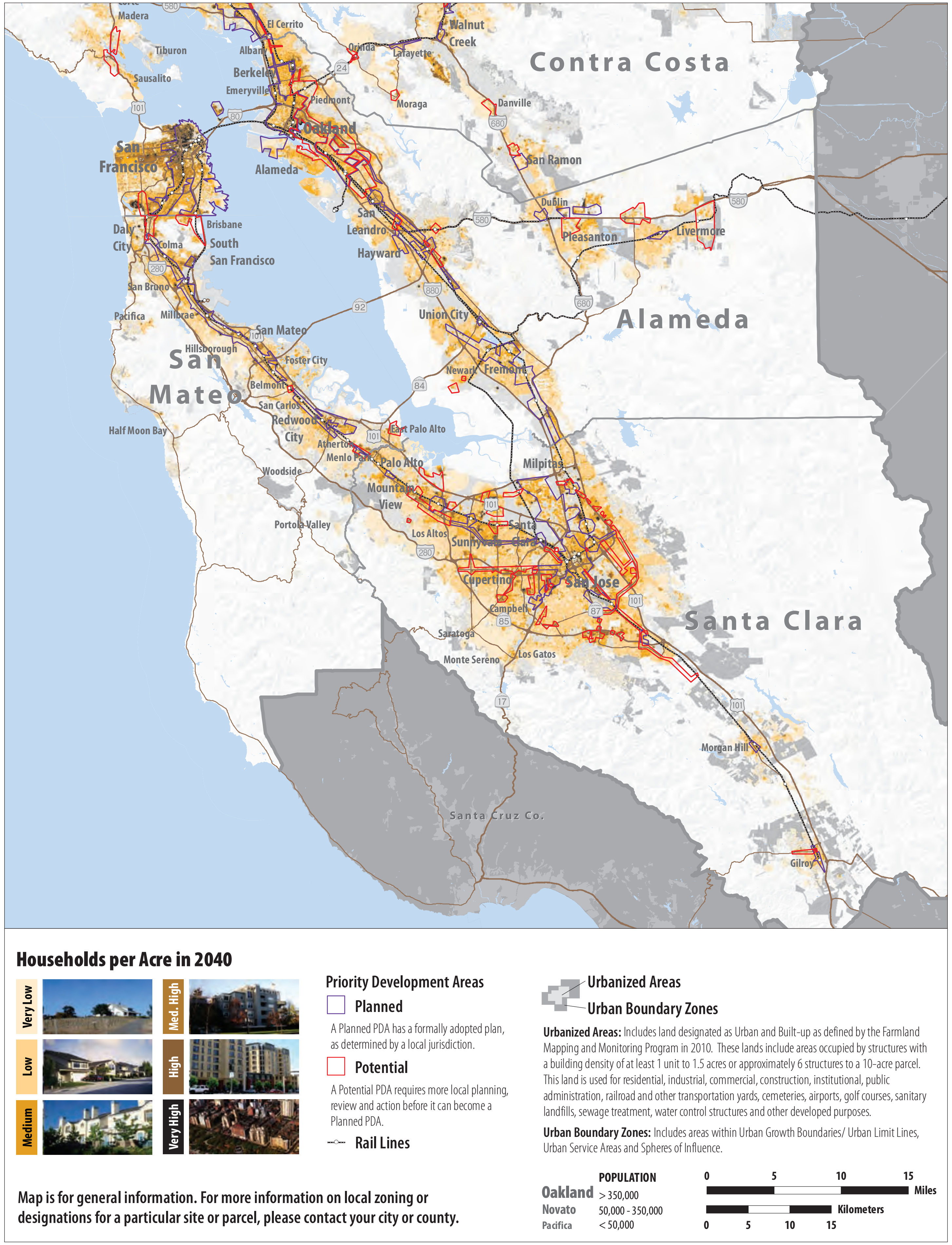
Map is for general information. For more information on local zoning or designations for a particular site or parcel, please contact your city or county.

POPULATION	
Oakland	> 350,000
Novato	50,000 - 350,000
Pacifica	< 50,000

0 5 10 15 Miles

0 5 10 15 Kilometers

MAP 31 **South and West Bay: Households per Acre in 2040**



Households per Acre in 2040

Priority Development Areas

☐ **Planned**

A Planned PDA has a formally adopted plan, as determined by a local jurisdiction.

🟥 **Potential**

A Potential PDA requires more local planning, review and action before it can become a Planned PDA.

Rail Lines

Urbanized Areas

Urban Boundary Zones

Urbanized Areas: Includes land designated as Urban and Built-up as defined by the Farmland Mapping and Monitoring Program in 2010. These lands include areas occupied by structures with a building density of at least 1 unit to 1.5 acres or approximately 6 structures to a 10-acre parcel. This land is used for residential, industrial, commercial, construction, institutional, public administration, railroad and other transportation yards, cemeteries, airports, golf courses, sanitary landfills, sewage treatment, water control structures and other developed purposes.

Urban Boundary Zones: Includes areas within Urban Growth Boundaries/ Urban Limit Lines, Urban Service Areas and Spheres of Influence.

	POPULATION
Oakland	> 350,000
Novato	50,000 - 350,000
Pacifica	< 50,000

Map is for general information. For more information on local zoning or designations for a particular site or parcel, please contact your city or county.

Legend Information for Plan Bay Area Maps

Data	Description
Critical Habitat **Source:** National Marine Fisheries Service; U.S. Fish and Wildlife Service; California Department of Fish and Wildlife; California Natural Diversity Database.	Includes lands designated as habitat for protected, sensitive or special-status species as defined by local, state or federal agencies, or protected by the federal Endangered Species Act, the California Endangered Species Act or the Native Plant Protection Act.
Farmland **Source:** Farmland Mapping and Monitoring Program, 2010.	Includes voter-approved, agriculturally zoned land that is identified as important for protection from urban development, and land outside all existing city spheres of influence or city limits as of January 2010 that is one of the following Department of Conservation's Farmland Mapping and Monitoring Program (FMMP) classifications: • Prime Farmland • Unique Farmland • Farmland of Statewide Importance
Floodplains **Source:** U.S. Federal Emergency Management Agency; data compiled by Greenbelt Alliance staff in February 2012.	Floodplain areas identified as important for protection within a city's general plan. Based upon general plans and 100-year storm flood level from the U.S. Federal Emergency Management Agency.
Grazing Lands **Source:** Farmland Mapping and Monitoring Program, 2010.	Defined by the FMMP in 2010, this category includes land on which the existing vegetation is suited to the grazing of livestock. This category was developed in cooperation with the California Cattlemen's Association, University of California Cooperative Extension and other groups interested in the extent of grazing activities.
Greenbelt Reserves **Source:** Based upon Local Jurisdiction General Plan maps. Data compiled by Greenbelt Alliance staff in March 2012.	Large open space reserves that are set aside permanently or temporarily by a single jurisdiction or several jurisdictions.
Hillside Areas **Source:** Based upon local jurisdiction General Plan maps. Data compiled by Greenbelt Alliance staff in March 2012.	Hillside areas identified as important for protection or conservation based on city and county general plans. Policies mapped include areas identified based up the slope of a hill, the area above a certain elevation, and the area within a certain vertical or horizontal distance from a ridge line.

Continues on following page

Legend Information for Plan Bay Area Maps *(Continued)*

Data	Description
Priority Conservation Areas **Source:** Association of Bay Area Governments, 2013.	These areas include lands of regional significance that have broad community support and an urgent need for protection. These areas provide important agricultural, natural resource, historical, scenic, cultural, recreational, and/or ecological values and ecosystem functions.
Publicly Owned Parks and Open Space **Source:** Data is derived from the Bay Area Protected Areas Database, Bay Area Open Space Council, 2012; California State Park Boundaries, 2012; The Conservation Lands Network, 2012.	These areas include publicly owned lands that are accessible to the public.
Riparian Corridors **Source:** Based upon local jurisdiction General Plan maps. Data compiled by Greenbelt Alliance staff in November 2011.	A policy that limits or prohibits new construction within a certain distance from rivers and streams to avoid the adverse impacts of urban development, such as pollution runoff, erosion and habitat degradation.
Urban Boundary Zones **Source:** Based upon local jurisdiction General Plan maps. Data compiled by ABAG Planning staff, March 2012.	Includes areas within Urban Growth Boundaries/Urban Limit Lines, Urban Service Areas and Spheres of Influence. For more information, see the supplementary report, *Summary of Predicted Land Use Responses*.
Urbanized Areas **Source:** Farmland Mapping and Monitoring Program, 2010.	Includes land designated as Urban and Built-up as defined by the Farmland Mapping and Monitoring Program in 2010. These lands include areas occupied by structures with a building density of at least 1 unit to 1.5 acres, or approximately 6 structures to a 10-acre parcel. This land is used for residential, industrial, commercial, construction, institutional, public administration, railroad and other transportation yards, cemeteries, airports, golf courses, sanitary landfills, sewage treatment, water control structures, and other developed purposes.
Williamson Act Lands **Source:** Williamson Act Program, California Department of Conservation, 2006.	The California Land Conservation Act of 1965 — commonly referred to as the Williamson Act — enables local governments to enter into contracts with private landowners for the purpose of restricting specific parcels of land to agricultural or related open space use. Some Williamson Act contracts are set to expire and be decommissioned during the plan period.

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EXHIBIT 18

Plan
BayArea
2040

Agenda Item 5a

TO: Joint MTC Planning Committee with the
ABAG Administrative Committee

DATE: September 2, 2016

FR: MTC Deputy Executive Director, Policy /
ABAG Executive Director

RE: Plan Bay Area 2040 Draft Preferred Land Use Scenario

Overview

The *Draft Preferred Scenario* represents a regional pattern of household and employment growth by the year 2040. Together with the corresponding transportation investment strategy, it forms the core of Plan Bay Area 2040 (PBA 2040). Staff has evaluated the *Draft Preferred Scenario* and transportation investment strategy against a set of regionally adopted performance targets to measure how well the *Draft Preferred Scenario* addresses regional goals including climate protection, transportation system effectiveness, economic vitality, and equitable access.

The PBA 2040 *Draft Preferred Scenario* largely reflects the foundation established in *Plan Bay Area* by:

- Focusing development toward Priority Development Areas (PDAs) — neighborhoods served by public transit identified by local jurisdictions as being appropriate for smart, compact development.
- Preserving Priority Conservation Areas (PCAs) by confining growth to established communities, and protecting the Bay Area's legacy of vast and varied open spaces.

The *Draft Preferred Scenario* largely follows the regional growth pattern of *Plan Bay Area*. The *Draft Preferred Scenario* focuses 75 percent of new households and 52 percent of new jobs into PDAs, and distributes all remaining growth within the region's planned urban growth boundaries/limit lines. Similar to *Plan Bay Area*, the *Draft Preferred Scenario* concentrates household growth in the cities of San Jose, San Francisco and Oakland, and along the east and west bayside corridors. In terms of employment, the *Draft Preferred Scenario* anticipates a modest shift from the growth pattern adopted in Plan Bay Area and incorporates substantial employment growth that has occurred since 2010. Since 2010, a significant amount of job growth has occurred in bayside communities (46 percent) and in the cities of San Jose, San Francisco and Oakland (37 percent) — areas comprising the preponderance of the region's commercial space. The *Draft Preferred Scenario* job growth pattern echoes the current trend to continue over the plan horizon and encompasses a more rigorous analysis of potential employment growth by location. Table 1 summarizes the *Draft Preferred Scenario's* regional growth pattern, compared to *Plan Bay Area*.

Table 1: Percent of Regional Household and Job Growth, 2010-2040

Subarea	Plan Bay Area Households	Draft PBA 2040 Preferred Scenario Households	Plan Bay Area Jobs	Draft PBA 2040 Preferred Scenario Jobs
Big 3 Cities[1]	42%	43%	38%	40%
Bayside[2]	34%	33%	37%	46%
Inland, Coastal, Delta[3]	24%	24%	25%	14%

[1] Big 3 Cities (the region's three largest cities – San Jose, San Francisco, and Oakland)

[2] Bayside (generally communities directly adjacent to San Francisco Bay – e.g., Hayward, San Mateo, and Richmond)

[3] Inland, Coastal, and Delta (generally communities just outside of Bayside – e.g., Walnut Creek, Dublin, Santa Rosa, Antioch, Brentwood, Dixon)

Background

The Bay Area economy has exploded over the past four years, attracting thousands of new people and jobs. As a result, ABAG adopted a revised regional growth forecast in February 2016. This forecast estimates an additional 1.3 million jobs and 2.4 million people, and therefore the need for approximately 820,000 housing units between 2010 and 2040. This represents an increase of 15 percent in employment and a 25 percent increase in households, relative to Plan Bay Area.

In May 2016, MTC and ABAG released three alternative land use and transportation scenarios illustrating the effects that different housing, land use and transportation strategies would have on the regionally adopted performance targets. The three scenarios represent a progression of plausible regional futures, from more intense housing and employment growth in the urban core ("Big Cities Scenario"); to more evenly apportioned development among PDAs in medium-sized cities with access to rail services ("Connected Neighborhoods Scenario"); to a more dispersed development pattern, with relatively more growth occurring outside of PDAs ("Main Streets Scenario").

Staff presented key takeaways from the scenario evaluation in May 2016. First, a more focused land use pattern better positions the region to achieve its greenhouse gas emission target. Second, despite the inclusion of a range of aggressive strategies to subsidize affordable housing, regional affordability and equity challenges are expected to worsen by 2040. Lastly, financial constraints lead to challenges in attaining the transportation targets, particularly travel mode shift and maintenance of the region's transportation system.

The release of the scenarios initiated a public process in May and June 2016 to garner input from the public, stakeholders, community groups and local officials, via public open houses in each county, an online comment forum, and an online interactive questionnaire (the "Build a Better Bay Area" website). By July 2016, MTC and ABAG had received comments from more than 1,100 Bay Area residents, as well as direct feedback from local jurisdictions. Many of these letters were shared at the July meeting of the Joint MTC Planning Committee with the ABAG Administrative Committee. Letters received subsequent to the July meeting are included in **Attachment B.**

Approach to Draft Preferred Land Use Scenario

To address the challenges of planning for an increasingly complex region, MTC and ABAG have continued to evolve technical methods for creating regional scenarios. UrbanSim incorporates current zoning for 2 million individual land parcels across the Bay Area, as well as available information about current regional and local economic and real estate market trends.

UrbanSim builds upon the methodology used by the Agencies in the prior Plan. The prior methodology combined a land use allocation process based on observed historic growth patterns with jurisdictional expectations described in local plans. This time, UrbanSim also incorporates zoning tools, the most recent PDA assessment, and household, business, and developer choice models. The agencies ran the model hundreds of times, testing the effects that different regional strategies could have on affecting the distribution of housing and employment growth. The output was measured against a set of growth targets put together by ABAG regional planners working with planners from local jurisdictions. Overall, the growth allocation results of the UrbanSim model align fairly closely with these growth targets at a summary level as well as for most localities, though, there are substantial differences for some individual localities. The extent of the differences between local plans and the UrbanSim output is a discussion for the agencies, regional stakeholders, and individual jurisdictions. UrbanSim is an ambitious project which compiles a large amount of data at a very detailed geographic resolution. The detailed level of UrbanSim output is used for the analysis of performance measures and for the environmental analysis.

The *Draft Preferred Scenario* accommodates 100 percent of the needed housing units, and offers a rationale that these units can be built given future market conditions and existing or expected policies to support focused growth at the local, regional or state level.

The *Draft Preferred Scenario* does not mandate any changes to local zoning rules, general plans, or processes for reviewing projects, nor is it an enforceable direct or indirect cap on development locations or targets in the region. As is the case across California, the Bay Area's cities, towns, and counties maintain control of all decisions to adopt plans and permit or deny development projects. PBA 2040 does not establish new state-mandated Regional Housing Needs Allocation (RHNA) numbers for each jurisdiction. RHNA operates on an eight-year cycle, with the next iteration not due until the 2021 Regional Transportation Plan / Sustainable Community Strategy (the next update of Plan Bay Area). Because RHNA numbers are not at stake this cycle, MTC and ABAG are characterizing this update to the region's long-range plan as limited and focused.

Distribution of Households and Employment

The complete distribution of 2040 household and employment forecasts is included in Attachment A, organized by local jurisdiction, and split into PDA and jurisdiction totals. These numbers stem from ABAG's economic forecasts and reflect empirical input from the regional land use model combined with expert reviews, extensive public input, and most importantly, dialogue with local officials.

Tables 2 and 3 below summarize the distribution of 2040 employment and household forecasts within three regional geographies:

- Big 3 Cities (the region's three largest cities – San Jose, San Francisco, and Oakland)
- Bayside (generally cities directly adjacent to San Francisco Bay – e.g., Hayward, San Mateo, San Rafael and Richmond)
- Inland, Coastal, and Delta (generally cities just outside of Bayside – e.g., Walnut Creek, Dublin, Santa Rosa, Antioch, Brentwood, Dixon)

Table 2: 2040 Household Forecast (000s)

Column	*A*	*B*	*C*	*D*	*E*	*F*
Subarea	**2010 House-holds**	**Share of 2010 Households**	**2040 House-holds**	**Share of 2040 Households**	**Growth in Households from 2010**	**Share of Regional Growth**
Total	2,607		3,427		820	
Big 3 Cities	802	31%	1,151	34%	349	43%
Bayside	1,030	39%	1,304	38%	275	33%
Inland, Coastal, Delta	775	30%	971	28%	196	24%
in PDA	559	21%	1,172	34%	613	75%
outside PDA	2,048	79%	2,255	66%	207	25%

Table 3: 2040 Employment Forecast (000s)

Column	*A*	*B*	*C*	*D*	*E*	*F*
Subarea	**2010 Jobs**	**Share of 2010 Jobs**	**2040 Jobs**	**Share of 2040 Jobs**	**Growth in Jobs from 2010**	**Share of Regional Growth**
Total	3,422		4,699		1,276	
Big 3 Cities	1,144	33%	1,648	35%	504	40%
Bayside	1,405	41%	1,997	43%	591	46%
Inland, Coastal, Delta	873	26%	1,054	22%	181	14%
in PDA	1,433	42%	2,094	45%	661	52%
outside PDA	1,989	58%	2,605	55%	616	48%

Overall, the regional pattern of households and employment in 2040 largely reflects the existing pattern observed in 2010. We see a slightly higher concentration of growth into the cities of San Jose, San Francisco and Oakland, and bayside communities by 2040. For example, those same areas will represent 72 percent of the region's households and 78 percent of the region's jobs in 2040, a two percent and four percent shift, respectively, from 2010. On the other hand, household and employment *growth* between 2010 and 2040 shows some modest differences. For example, the cities of San Jose, San Francisco and Oakland are forecasted to see much of the region's household growth (43 percent), while bayside communities are forecasted to see much of the region's job growth (46 percent). Finally, the concentrations of housing and jobs in PDAs are forecast to increase, with 75 percent of household and 52 percent of job growth in PDAs.

The 2015 PDA Assessment emphasized that in their current form, many PDAs may not be able to accommodate forecasted growth and require additional policy interventions to increase their development potential. As a result, staff assumed a range of regional policy and investment strategies in the draft preferred land use scenario to increase development potential in PDA's, and influence the overall regional pattern. These strategies are described below.

- Current urban growth boundaries/limit lines are kept in place.
- Inclusionary zoning is applied to all cities with PDAs, meaning that these jurisdictions are assumed to allow below-market-rate or subsidized multi-family housing developments.
- All for-profit housing developments are assumed to make at least 10 percent of the units available to low-income residents, in perpetuity (via deed restrictions).
- In some cases, PDAs were assigned higher densities than what those cities currently allow.
- The cost of building in PDAs and/or Transit Priority Areas (TPAs) is assumed to be reduced by the easing of residential parking minimums and streamlining environmental clearance
- Subsidies are assumed to stimulate housing and commercial development within PDAs.

These measures are not prescriptive, and there are many potential public policy options that could help the region attain its adopted targets. Staff suggests considering these strategies as illustrations of what it would take to keep the Bay Area and economically vibrant and sustainable region through the year 2040.

Environmental Assessment

A programmatic Environmental Impact Report (EIR) will be prepared for PBA 2040, with the adoption of the preferred scenario as the basis for the California Environmental Quality Act (CEQA) "project." This environmental assessment fulfills the requirements of the CEQA and is designed to inform decision-makers, responsible and trustee agencies, and Bay Area residents of the range of potential environmental impacts that could result from implementation of the proposed Plan. This EIR will also analyze a range of reasonable alternatives to the proposed project that could feasibly attain most of PBA 2040's basic project objectives and would avoid or substantially lessen any of the significant environmental impacts.

Next Steps

In September, staff will hold county workshops with Planning Directors to discuss the Draft Preferred Scenario results. Staff requests comments on the Draft Preferred Scenario by October 14. Later this year, staff will recommend approval of a Final Preferred Scenario. The *Draft Preferred Scenario* will be subject to environmental review and other analyses throughout the remainder of 2016 and into 2017. PBA 2040 is slated for final adoption in summer 2017.

Alix A. Bockel

Alix A. Bockelman

Ezra Rapport

Attachments

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Attachment A: Distribution of 2040 Household and Employment Forecasts

Plan Bay Area 2040 ***Draft Preferred Scenario***

County	Jurisdiction	Summary Level	Households 2010	Household Forecast 2040	Employment 2010	Employment Forecast 2040
Alameda	Alameda	**Total**	**30,100**	**41,700**	**29,200**	**39,600**
		PDA	1,850	6,000	6,900	15,200
	Albany	**Total**	**7,350**	**7,850**	**4,400**	**5,600**
		PDA	300	550	2,100	2,450
	Berkeley	**Total**	**46,500**	**55,700**	**90,300**	**139,400**
		PDA	6,700	13,300	28,500	42,000
	Dublin	**Total**	**14,900**	**23,300**	**18,100**	**31,400**
		PDA	3,100	8,500	5,000	14,000
	Emeryville	**Total**	**5,600**	**14,300**	**15,850**	**20,550**
		PDA	2,400	10,500	13,500	16,850
	Fremont	**Total**	**70,000**	**89,900**	**86,200**	**114,500**
		PDA	23,000	41,200	38,200	46,000
	Hayward	**Total**	**45,100**	**53,200**	**60,900**	**92,400**
		PDA	4,350	8,600	7,600	10,300
	Livermore	**Total**	**28,600**	**30,900**	**42,600**	**48,800**
		PDA	850	2,100	23,800	27,750
	Newark	**Total**	**12,900**	**15,450**	**17,300**	**25,600**
		PDA	200	2,150	200	450
	Oakland	**Total**	**157,200**	**235,000**	**179,100**	**257,500**
		PDA	115,500	190,500	158,200	229,400
	Piedmont	**Total**	**3,800**	**3,850**	**1,800**	**1,750**
	Pleasanton	**Total**	**24,700**	**34,600**	**60,100**	**69,900**
		PDA	1,300	8,000	12,500	19,600
	San Leandro	**Total**	**30,800**	**38,500**	**49,700**	**66,800**
		PDA	4,700	11,700	9,750	11,000
	Union City	**Total**	**20,300**	**24,200**	**21,000**	**30,700**
		PDA	500	3,450	250	250
	Alameda County Unincorporated	**Total**	**50,000**	**56,300**	**28,850**	**33,700**
		PDA	10,450	12,850	6,850	8,850
	County Total	**Total**	**548,000**	**724,700**	**705,500**	**978,300**
		PDA	175,100	319,300	313,400	444,000

County	Jurisdiction	Summary Level	Households 2010	Household Forecast 2040	Employment 2010	Employment Forecast 2040
Contra Costa	Antioch	**Total**	**32,400**	**41,900**	**20,200**	**25,400**
		PDA	1,400	5,200	2,050	2,300
	Brentwood	**Total**	**16,800**	**29,700**	**11,600**	**12,150**
	Clayton	Total	3,950	4,050	2,000	2,100
	Concord	**Total**	**45,000**	**66,000**	**54,200**	**95,200**
		PDA	4,000	22,200	10,200	41,400
	Danville	**Total**	**15,300**	**16,550**	**11,800**	**12,450**
		PDA	1,350	2,000	6,300	6,600
	El Cerrito	**Total**	**10,300**	**11,950**	**5,300**	**5,750**
		PDA	750	2,000	3,800	4,550
	Hercules	**Total**	**8,300**	**10,600**	**4,850**	**6,050**
		PDA	900	2,650	1,150	1,500
	Lafayette	**Total**	**9,200**	**10,750**	**9,050**	**9,650**
		PDA	1,700	2,700	6,650	7,250
	Martinez	**Total**	**14,250**	**15,450**	**20,800**	**26,200**
		PDA	700	850	6,800	9,650
	Moraga	**Total**	**5,600**	**5,750**	**4,500**	**5,800**
		PDA	30	40	1,400	1,650
	Oakley	**Total**	**10,600**	**16,700**	**3,350**	**6,050**
		PDA	800	6,400	1,550	4,050
	Orinda	**Total**	**6,500**	**7,050**	**4,850**	**5,150**
		PDA	250	550	2,650	2,800
	Pinole	**Total**	**6,550**	**7,300**	**6,850**	**9,000**
		PDA	350	950	5,250	6,950
	Pittsburg	**Total**	**19,400**	**27,400**	**11,800**	**16,400**
		PDA	5,150	8,900	4,600	6,100
	Pleasant Hill	**Total**	**13,500**	**14,000**	**16,300**	**19,600**
		PDA	850	950	5,750	7,100
	Richmond	**Total**	**36,700**	**56,500**	**30,800**	**63,500**
		PDA	8,600	22,300	13,400	37,000
	San Pablo	**Total**	**8,950**	**9,600**	**7,400**	**10,000**
		PDA	2,000	2,350	4,850	6,700
	San Ramon	**Total**	**24,400**	**31,100**	**47,900**	**46,100**
		PDA	200	5,800	25,650	22,400
	Walnut Creek	**Total**	**30,400**	**38,200**	**51,050**	**54,550**
		PDA	4,950	9,550	27,400	29,500
	Contra Costa County Unincorporated	**Total**	**57,800**	**70,700**	**0**	**0**
		PDA	4,400	16,100	0	0
	County Total	**Total**	**375,900**	**491,200**	**360,200**	**472,700**
		PDA	38,300	111,500	138,200	209,400

County	Jurisdiction	Summary Level	Households 2010	Household Forecast 2040	Employment 2010	Employment Forecast 2040
Marin	Belvedere	**Total**	**900**	**1,000**	**300**	**300**
	Corte Madera	**Total**	**3,900**	**4,350**	**6,650**	**7,450**
	Fairfax	**Total**	**3,400**	**3,550**	**1,550**	**1,700**
	Larkspur	**Total**	**5,850**	**6,300**	**7,450**	**8,800**
	Mill Valley	**Total**	**5,900**	**8,150**	**6,000**	**6,600**
	Novato	**Total**	**20,150**	**21,350**	**26,400**	**29,500**
	Ross	**Total**	**800**	**900**	**350**	**400**
	San Anselmo	**Total**	**5,200**	**5,450**	**3,300**	**3,650**
	San Rafael	**Total**	**22,550**	**25,950**	**43,300**	**49,100**
		PDA	1,650	2,750	9,000	10,100
	Sausalito	**Total**	**4,150**	**4,500**	**5,200**	**5,800**
	Tiburon	**Total**	**3,600**	**3,850**	**2,850**	**2,900**
	Marin County Unincorporated	**Total**	**27,450**	**30,600**	**17,500**	**21,350**
		PDA	1,500	2,050	650	750
	County Total	**Total**	**103,900**	**115,900**	**120,800**	**137,600**
		PDA	3,150	4,800	9,650	10,850
Napa	American Canyon	**Total**	**5,400**	**7,000**	**5,450**	**8,150**
		PDA	400	1,500	1,350	1,700
	Calistoga	**Total**	**2,050**	**2,400**	**2,200**	**2,650**
	Napa	**Total**	**28,100**	**30,250**	**34,000**	**36,500**
		PDA	350	1,200	5,300	6,300
	St. Helena	**Total**	**2,400**	**3,000**	**5,700**	**5,650**
	Yountville	**Total**	**1,100**	**1,200**	**2,750**	**2,750**
	Napa County Unincorporated	**Total**	**10,200**	**11,850**	**20,550**	**23,250**
	County Total	**Total**	**49,200**	**55,700**	**70,700**	**79,000**
		PDA	800	2,700	6,600	8,050
San Francisco	San Francisco	**Total**	**347,100**	**475,500**	**576,900**	**887,800**
		PDA	184,000	302,300	473,800	765,000

County	Jurisdiction	Summary Level	Households 2010	Household Forecast 2040	Employment 2010	Employment Forecast 2040
San Mateo	Atherton	**Total**	**2,350**	**2,500**	**2,150**	**2,300**
	Belmont	**Total**	**8,800**	**9,600**	**7,900**	**10,000**
		PDA	2,500	2,850	3,500	4,450
	Brisbane	**Total**	**1,800**	**6,300**	**5,200**	**17,600**
		PDA	0	4,400	0	10,900
	Burlingame	**Total**	**12,250**	**13,800**	**28,000**	**38,300**
		PDA	6,950	8,300	11,500	15,700
	Colma	**Total**	**850**	**1,250**	**3,950**	**4,900**
		PDA	700	1,050	1,450	1,950
	Daly City	**Total**	**30,700**	**37,000**	**18,400**	**23,150**
		PDA	8,500	13,500	4,650	5,800
	East Palo Alto	**Total**	**6,950**	**9,950**	**5,100**	**7,000**
		PDA	800	2,200	950	1,750
	Foster City	**Total**	**11,900**	**14,250**	**15,800**	**21,800**
	Half Moon Bay	**Total**	**4,200**	**4,700**	**4,900**	**5,200**
	Hillsborough	**Total**	**3,750**	**3,950**	**2,100**	**2,300**
	Menlo Park	**Total**	**12,300**	**17,800**	**34,600**	**45,000**
		PDA	200	1,050	6,200	7,950
	Millbrae	**Total**	**7,950**	**11,000**	**5,900**	**12,900**
		PDA	600	3,350	2,800	9,100
	Pacifica	**Total**	**13,900**	**14,300**	**5,950**	**7,300**
	Portola Valley	**Total**	**1,700**	**1,750**	**2,700**	**3,000**
	Redwood City	**Total**	**27,800**	**36,000**	**59,200**	**85,000**
		PDA	600	6,700	20,700	27,600
	San Bruno	**Total**	**14,600**	**18,300**	**12,900**	**15,350**
		PDA	3,700	6,750	9,300	11,300
	San Carlos	**Total**	**13,200**	**13,700**	**16,300**	**21,700**
		PDA	50	100	1,200	1,650
	San Mateo	**Total**	**37,900**	**49,200**	**51,000**	**67,600**
		PDA	11,200	19,200	25,300	34,000
	South San Francisco	**Total**	**20,450**	**23,450**	**38,800**	**55,400**
		PDA	5,300	7,650	8,250	11,350
	Woodside	**Total**	**2,050**	**2,500**	**1,950**	**2,150**
	San Mateo County Unincorporated	**Total**	**21,400**	**24,500**	**20,600**	**27,500**
		PDA	2,400	2,950	3,200	4,100
	County Total	**Total**	**256,900**	**315,800**	**343,300**	**475,300**
		PDA	43,500	80,100	99,000	147,600

County	Jurisdiction	Summary Level	Households 2010	Household Forecast 2040	Employment 2010	Employment Forecast 2040
Santa Clara	Campbell	**Total**	**16,550**	**18,950**	**25,200**	**31,800**
		PDA	600	1,650	5,250	6,950
	Cupertino	**Total**	**20,900**	**24,450**	**26,800**	**53,100**
		PDA	2,250	4,900	9,800	13,950
	Gilroy	**Total**	**14,000**	**19,600**	**17,850**	**20,800**
		PDA	1,400	3,350	4,500	5,300
	Los Altos	**Total**	**10,500**	**12,000**	**14,050**	**16,750**
		PDA	0	200	2,200	2,650
	Los Altos Hills	**Total**	**2,850**	**3,050**	**1,550**	**1,750**
	Los Gatos	**Total**	**11,900**	**12,400**	**19,000**	**21,250**
	Milpitas	**Total**	**19,000**	**30,800**	**42,000**	**56,400**
		PDA	800	8,800	5,700	9,900
	Monte Sereno	**Total**	**1,250**	**1,350**	**550**	**550**
	Morgan Hill	**Total**	**12,550**	**15,500**	**19,250**	**20,700**
		PDA	250	900	1,550	1,400
	Mountain View	**Total**	**31,800**	**58,500**	**48,500**	**69,600**
		PDA	5,800	29,300	25,200	39,000
	Palo Alto	**Total**	**26,550**	**29,150**	**102,000**	**123,200**
		PDA	500	950	3,850	4,800
	San Jose	**Total**	**297,700**	**440,600**	**387,700**	**502,600**
		PDA	67,200	201,700	229,200	299,400
	Santa Clara	**Total**	**42,100**	**54,900**	**102,900**	**189,100**
		PDA	300	6,200	10,200	13,100
	Saratoga	**Total**	**10,650**	**11,000**	**8,750**	**9,500**
	Sunnyvale	**Total**	**52,600**	**80,700**	**65,800**	**116,000**
		PDA	6,200	32,000	21,900	29,000
	Santa Clara County Unincorporated	**Total**	**26,100**	**33,600**	**29,500**	**36,500**
	County Total	**Total**	**597,100**	**846,600**	**911,500**	**1,269,700**
		PDA	85,300	289,800	319,200	425,500

County	Jurisdiction	Summary Level	Households 2010	Household Forecast 2040	Employment 2010	Employment Forecast 2040
Solano	Benicia	**Total**	**10,700**	**11,800**	**12,900**	**18,600**
		PDA	600	900	2,050	2,050
	Dixon	**Total**	**5,850**	**6,950**	**4,850**	**6,100**
		PDA	450	550	300	350
	Fairfield	**Total**	**34,200**	**38,700**	**43,100**	**51,600**
		PDA	2,300	5,000	6,450	7,100
	Rio Vista	**Total**	**3,700**	**10,400**	**2,350**	**2,450**
	Suisun City	**Total**	**9,000**	**9,650**	**2,500**	**3,000**
		PDA	1,100	1,550	1,100	1,300
	Vacaville	**Total**	**31,000**	**33,050**	**29,300**	**35,000**
		PDA	850	2,250	4,900	4,950
	Vallejo	**Total**	**40,950**	**45,050**	**30,900**	**35,300**
		PDA	400	1,150	2,600	3,050
	Solano County Unincorporated	**Total**	**6,900**	**14,700**	**4,250**	**4,400**
	County Total	**Total**	**142,300**	**170,300**	**130,200**	**156,500**
		PDA	5,700	11,400	17,350	18,800
Sonoma	Cloverdale	**Total**	**3,250**	**5,250**	**1,750**	**1,600**
		PDA	800	2,850	550	500
	Cotati	**Total**	**3,050**	**3,550**	**2,700**	**3,000**
		PDA	350	700	700	700
	Healdsburg	**Total**	**4,400**	**4,700**	**8,400**	**9,900**
	Petaluma	**Total**	**21,800**	**27,100**	**30,000**	**35,700**
		PDA	500	4,450	3,500	4,050
	Rohnert Park	**Total**	**15,000**	**21,100**	**12,050**	**13,350**
		PDA	1,300	5,300	4,250	4,900
	Santa Rosa	**Total**	**63,800**	**78,800**	**76,400**	**91,700**
		PDA	16,800	30,300	41,100	48,600
	Sebastopol	**Total**	**3,300**	**5,000**	**5,000**	**5,050**
		PDA	2,050	3,750	4,650	4,650
	Sonoma	**Total**	**4,900**	**6,250**	**7,150**	**8,050**
	Windsor	**Total**	**9,050**	**10,550**	**7,600**	**9,200**
		PDA	1,100	2,300	900	1,200
	Sonoma County Unincorporated	**Total**	**58,300**	**68,600**	**51,700**	**63,900**
	County Total	**Total**	**186,800**	**231,000**	**202,700**	**241,400**
		PDA	23,000	49,700	55,800	64,600
Regional Total		**Total**	**2,607,000**	**3,427,000**	**3,422,000**	**4,698,000**
		PDA	559,000	1,172,000	1,433,000	2,094,000

Attachment B

Ford Greene
Mayor

Kay Coleman
Vice Mayor

THE TOWN OF
SAN ANSELMO

Matt Brown
Councilmember

Tom McInerney
Councilmember

John Wright
Councilmember

525 San Anselmo Avenue, San Anselmo, CA 94960-2682
www.townofsananselmo.org
(415) 258-4600 | Fax (415) 459-2477

July 20, 2016

Miriam Chion
Director of Planning and Research
Association of Bay Area Governments
Bay Area Metro Center
375 Beale Street, Suite 800
San Francisco, CA 94105-2066

Ken Kirkey
Director of Planning
Metropolitan Transportation Commission
Bay Area Metro Center
375 Beale Street, Suite 800
San Francisco, CA 94105-2066

RE: Plan Bay Area 2040 Alternative Scenario Housing and Job Projections

Dear Ms. Chion and Mr. Kirkey:

The Town of San Anselmo has reviewed, and we wish to provide comments on, the household and jobs projections for the three alternative scenarios for Plan Bay Area 2040. We understand that your staff is now working on Draft Preferred Scenario projections. We again request that the assumptions and predictions in future projections be simply and fully explained to Bay Area residents, who do not have access to UrbanSim and the data ABAG/MTC is using for projections.

The Town has made the following requests for more detailed information to which, so far, we have received no direct response:

- December 29, 2015, staff emailed Miriam Chion to request specifics on Town projections and invited a representative of ABAG to explain them at a Town Council meeting (which ABAG did for San Rafael and Novato). No one responded to the email.

- January 5, 2016, in a response to a request for comments on the projections, staff emailed Christy Leffall, Regional Planner for ABAG, and again indicated that the Town has inadequate information to comment. Ms. Leffall referred staff to Hing Wong, the ABAG county planner.

- February 4, 2016, staff emailed Hing Wong to request the information, including "citations to data sources and information on how the numbers are generated." Mr. Wong promptly forwarded the request to Aksel K Olsen, Regional Analyst for ABAG. Staff asked Mr. Olsen for the information on the projections. Mr. Olsen indicated he would respond "within the next day or so" but never responded.

- February 8, 2016, Mr. Wong provided the town with information on regional projections and methodology, but not information to explain how the projections were assigned to the Town.

- July 2016, Marin County Planning Directors requested ABAG and MTC to provide assistance in understanding the modeling. Only Novato has received an explanation.

In order to intelligently respond to your request for comment, we need adequate, accurate information. Otherwise, the request for comment is more akin to a public relations posture rather than one that respects the requests of local government for what we need. We reiterate our request and ask that you please substantively respond at your earliest convenience.

The numbers that MTC/ABAG envisions for San Anselmo exceed what we expect for household and job growth under any regional development scenario, based on available land, site constraints (flooding and hillside topography), historic development, historic employment patterns, and existing land use policies and regulations. The Town is "built out." There are fewer than 100 vacant single-family lots available for development and few vacant commercial parcels. The Town does not expect significant future commercial development, which would primarily involve redevelopment of existing sites. Our housing element encourages development of housing in commercial areas and the Town has zoned commercial areas in order to meet its current share of the Regional Housing Needs Allocations for various income levels. In order to generate the 700 jobs projected for San Anselmo, the Town would need to construct approximately 200,000 to 240,000 square feet of office/retail/service space. This level of development is without factual basis and is not realistic.

The Town's population has remained stable for the last 45 years. The school district, Town government and grocery stores are likely the largest employers in Town. These employers will not be expanding significantly over the next 25 years, as we do not expect our population to change significantly, even with full build out under our General Plan.

The Town currently suffers from increasingly profound traffic congestion on our major arterial roads. We are certain that household and job growth predicted within and west of our community will result in the exacerbation of the already intolerable congestion if it is not accompanied by transportation investments to relieve congestion. Therefore, we support a modified preferred scenario that accounts for funding transportation improvements where existing traffic is an issue, or where any housing growth is planned.

We look forward to commenting on the Draft Preferred Scenario and request that ABAG/MTC make an effort to explain the modeling assumptions and predictions for the Town of San Anselmo.

Sincerely,

Ford Greene
Mayor

Rec'd 8/10

John McCauley
Mayor
Jessica Sloan
Vice Mayor
Stephanie Moulton-Peters
Councilmember

MILL VALLEY

Jim Wickham
Councilmember
Sashi McEntee
Councilmember
James C. McCann
City Manager

August 1, 2016

Miriam Chion
Director of Planning & Research
Association of Bay Area Governments
Bay Area Metro Center
375 Beale Street, Suite 800
San Francisco, CA 94105-2066

Ken Kirkey
Director of Planning
Metropolitan Transportation Commission
375 Beale Street, Suite 800
San Francisco, CA 94105-2066

RE: Plan Bay Area –2040 Projections and Scenarios

Dear Ms. Chion and Mr. Kirkey,

This letter is in regard to the draft 2040 Projections and Scenarios developed as part of the Plan Bay Area Update.

The City of Mill Valley has reviewed the projections data and attended the June 4, 2016 Open House in Corte Madera, and would like to submit the following comments for your review and consideration:

Projections:

- **Plan Bay Area 2013 projections for 2040.** At the Open House, MTC staff discussed the prior forecasts, and acknowledged that projections contained in Plan Bay Area 2013 have been the most accurate. With that in mind, and the fact that forecasting tends to run on the conservative side, staff suggests starting with the 2040 Assumptions generated in Plan Bay Area 2013 as a benchmark for projections used in this Update.

- **Plan Bay Area 2040 Methodology.** Please provide detailed information explaining how the projections were assigned to each jurisdiction within Marin County. In general, the household and job numbers that are presented in the draft projections and scenarios exceed the growth that expected in Mill Valley due to available undeveloped land; site constraints (flooding and hillside topography); historic employment patters; and land use

City of Mill Valley, 26 Corte Madera Avenue, Mill Valley, California 94941 • 415-388-4033

policies and regulations. The City has not, and continues to expect to see relatively slow development, which mainly consist of renovation and remodeling of existing homes. The City has not seen, and does not anticipate a significant change in the type of commercial development, nor do the City's land use regulations support intensification or expansion of commercial areas.

- **Mill Valley Household Growth Forecast: Base Year vs. No Project.** There seems to be some sort of disconnect as Mill Valley's household growth is disproportionate to any other jurisdiction in terms of the no project scenario. Please explain why.

- **Mill Valley Jobs Forecast.** The City of Mill Valley has four commercial areas, all of which are built-out. The largest commercial uses generated in Mill Valley are for food establishments, professional services and general office space. Renovations to the commercial areas in Mill Valley has resulted in changes of use but have not resulted in a change the total square footage of the City's commercial area, which equals approximately 4.5 million square feet. Mixed use buildings are also conditionally permitted in commercial areas, which should also be incorporated into assumptions as new commercial square footage cannot be assumed for all building square footages. While some additional employment may be gained through the change of use of commercial space and the large number of persons that work from home in Mill Valley, it is unreasonable to assume the City can accommodate 1,000+ jobs within the next 24 years. Staff is therefore requesting that the jobs projection be reviewed based on the above information.

- **Mill Valley Households Forecast.** The City of Mill Valleys' residential area is mainly built out, with small infill opportunities suitable for small-scale development. This is reflected through recent past census data:
    - 591 additional households from 1980 – 2000
    - Between 2000 and 2010 Mill Valley had a REDUCTION of 63 households

  While there are more households living per unit, it is unrealistic to think that Mill Valley will add as many households as it did in the 1980-1990 time period, and as recent historic trends illustrate, there is slow to no new household growth in Mill Valley.

Scenarios:

- **Assumptions.** In Open House materials distributed, the evaluation of scenarios included policy assumptions that should be further discussed. Assumptions and statements discussed in in the materials included the following policy items:
    - inclusionary housing;
    - commercial linkage fees;
    - business subsidies/transit subsidies;
    - second units;
    - tenant protections/displacement;
    - green infrastructure; and
    - open space/preservation funding.

First, MTC/ABAG should confirm with local jurisdictions that they support and are interested in implementing such policies at the local level. This would help to validate/support various scenarios. Second, MTC/AGAG, as part of the implementation of the Plan, should provide technical support to local jurisdictions that would streamline the implementation of such policies by providing best practices; model ordinances; technical studies and/or nexus studies. Local jurisdictions could then craft their own policy based on the tools provided—allowing jurisdictions to maintain local control while being provided additional tools to move important land use policy considerations forward on a regional level. This is especially important, given the limited amount of funding and staff time that small local jurisdictions have to implement these large scale policies, as well as the large cost in conducting the required research and, in some cases, legal nexus, for developing such policies. Once these steps have been made, then MTC/ABAG would be in a better suited to credit each scenario with such assumptions.

- **Projections vs Department of Finance.** The Projections data assumes that some land use restrictions would be eliminated to allow for new units. The Department of Finance does not include such an assumption. Please provide additional information as to why this assumption has been added, and how it impacts the projections.

Sincerely,

John McCauley, Mayor
City of Mill Valley

Cc: Jim McCann, City Manager
Mill Valley City Council

From: Save Marinwood
To: info@planbayarea.org
Subject: Comments on Plan Bay Area 2040. Even the Soviet Union had only a five year plan.
Date: Thursday, July 07, 2016 3:38:40 PM

Dear Commissioners of ABAG, MTC and other administrators of Plan Bay Area 2040:

Ever since hearing about the massive social planning experiment, One Bay Area and the inclusion of Marinwood-Lucas Valley as a Priority Development Area in 2012, our community has been following the developments of your social project. Save Marinwood represents a 6000 people in unincorporated Marin (North San Rafael).

The latest Plan Bay Area 2040 is very similarly flawed as the first Plan Bay Area as it relies on unsubstantiated data, environmental fallacies and complete fabrication of population and economic growth statistics. Even the old Soviet Union was never so bold to predict beyond a five year horizon.

I suppose with your new multi-million dollar headquarters, exclusive clique of political insiders and billions of dollars to spend on transportation, housing and "social equity", life must look pretty sweet. The voters, still largely ignorant of your coup over local government, seem to be agreeing to your plans and just approved some tax increases. They will wake up one day.

But life is much more than daily meetings filled with political rhetoric and empty promises. The REAL people who pay the bills with money earned in careers and businesses outside the government will discover your mischief. We work hard for our families to create the quality life we value and a suburban/rural lifestyle you despise. We will be deciding your future and not the other way around.

The June 23rd vote for Brexit is a harbinger of things to come for Plan Bay Area. As people wake up and learn the power and taxes you have illegitimately stolen from the voters, your house of cards will tumble. I have no doubt we "little people" will gather the political strength to push you out of power.

We endorse the attached letter of Sustainable Tam Almonte in its entirety. We urge you to take the points seriously.

Very sincerely yours,

Stephen Nestel
Save Marinwood
San Rafael, CA 94903
www.savemarinwood.org

Letter from Sustainable TamAlmonte to ABAG & MT...

From: LJ pfeifer
To:
Cc:
Subject: Public Comment: PBA 2017 Update Friday,
Date: July 08, 2016 12:15:32 AM

Friday July 8, 2016

To: ABAG & MTC - info@planbayarea.org

Re: Comments on Plan Bay Area Update 2017

From: Linda Pfeifer, Sausalito City Councilmember,
420 Litho Street Sausalito, CA 94965

Dear ABAG and MTC,

I am concerned to see the new job and household growth projections for Sausalito in the Plan Bay Area Update 2017. I had thought the lessons-learned from the first Plan Bay Area (PBA I) might be applied to these new 2017 projections to yield more realistic numbers based on historical data, economic realities, and trends.

For example, Sausalito's population has rarely wavered far from 7,300, give or take a couple hundred, and in a recent census our population decreased. Yet the PBA 2017 update adds an additional 300 households for the 2017-2040 projection, *regardless of scenario.* The baseline year is 4,200 and grows to 4,500.

I find it hard to reconcile these projections, especially in light of PBA 2013's projections of 23% job growth in Sausalito, now widely acknowledged as flawed. But now Plan Bay Area 2017 sets job growth projections in Sausalito at 900 in the Big City scenario and 1,000 in the Main Street and Connected Neighborhoods scenarios. Even during the economic boom times prior to 2008, Sausalito did not experience such high job growth.

While the Big City scenario seems to yield the least impact overall in Marin, to me the entire analysis is flawed. No scenario in PBA 2017 yields job or household growth projections for our small town that could be justified under the most robust economic conditions. In addition, Sausalito has hard borders with Richardson Bay and The Golden Gate National Recreation Area headlands, so it's hard to understand how our small town might expand without environmental consequence, even if half the percentage of these projected figures were plausible.

I urge MTC and ABAG to start this analysis over again and apply the lessons learned from the first Plan Bay Area. The public's confidence was shaken during the first PBA. This time around, it's important to get the process right. Thank you for your consideration.

Kind Regards,

Linda Pfeifer

Sausalito City Councilmember

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Linda Pfeifer ~
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From: John Kearns
To:
Cc:
Subject: RE: PBA 2040 Alternative Scenarios
Date: Thursday, July 14, 2016 5:41:15 PM

To Whom this May Concern;

We have taken the time to review the alternative scenarios and consistent with the Cities of Fairfield and Vacaville, we would not support the "Big Cities" scenario. We would also like consideration of important regional projects such Jepson Parkway and 680/80/12 as it appears they are missing from some of the scenarios. We look forward to reviewing and commenting on the documents through the next stage of the process.

John Kearns
Associate Planner
City of Suisun City
(707) 421-7335
jkearns@suisun.com

From: Lynn Keller
To: info@planbayarea.org
Subject: Comments on Plan Bay Area 2017
Date: Friday, July 15, 2016 4:01:13 PM

To: ABAG and MTC - info@playbayarea.org

From: Lynn Keller, 33 Monte Mar, Sausalito, CA 94965

Dear MTC and ABAG:

I am alarmed to see the inflated projections for job growth and housing growth for Plan Bay Area 2017 for Sausalito
We are a small town. We have Richardson Bay on the East, and GGNRA on the West. Our southern border is also up against GGNRA.
Our northern boundary is also geographically constrained.

Even during boom times Sausalito hasn't had exponential job growth like the job growth you're projecting. In the Big City scenario you expect Sausalito to have 900 more jobs? We are a small neighborhood town of artists and crafts people. Why are you trying to make Sausalito which a jewel of the Bay Area into a Silicon Valley type town?

And why are you planning to over build Sausalito with 300 new residences?

The original assumptions of PBA are overly inflated, and therefore the new projections are also inflated and alarming. It's my opinion you need to start over and get the base assumptions right before these aggressive housing and job assumptions are laid onto a small geographically constrained town.

Sausalito can't fit that many jobs or that many people. We have about 7,000 residents. I've lived in Sausalito for 25 years and our population hasn't grown in that time by more than a few people.

Sausalito is a jewel that people travel the world over to come and spend a day or week to relax and enjoy the views, the birds, the little shops and restaurants. Please, please don't ruin it with these overly aggressive and frankly, unrealistic and unfounded projections for job and housing growth. Please - if you are planning for the future I urge you to start over, get this right, and help us residents have confidence in the plan.

Thank you,
Lynn Keller
33 Monte Mar
Sausalito, CA 94965

From: susan k
To: info@planbayarea.org
Subject: Sausalito
Date: Tuesday, July 19, 2016 5:51:05 PM

To whom it may concern,

I'm upset that we are again having to write letters because of false data projections by Plan Bay Area. Your projections for Sausalito in the past have been grossly exaggerated and these exaggerations are reiterated in the latest projections. The historical trends do not support your numbers and Sausalito is a geographically constrained area which physically cannot expand. I am against Plan Bay Area philosophically as I believe communities are unique entities and I am against the corporatization of America. Plan Bay Area smells of conspiracy with big business and development. I hope at some point these data projections and the project as a whole will be taken to the higher courts as unconstitutional and those involved in the falsification of data will be held accountable.

Susan Samols
Sausalito, CA

EXHIBIT 19

As shown in the table below, the San Joaquin Valley Air Basin has among the worst air quality in the state, far worse than the Bay Area. Displacing growth from Plan Bay Area's priority development areas to the San Joaquin Valley would further impair air quality in this region as a result of increased total vehicle miles travelled, and would expose a greater number of people to the adverse health effects associated with poor air quality.

	2015			
	Ozone		**PM2.5**	**PM10**
Air Basins	**Days exceeding state 1-hour standard**	**Days exceeding state 8-hour standard**	**Annual average concentration (µg/m³)**	**Annual average concentration (µg/m³)**
San Joaquin Valley	24	74	17.8	44.1
South Coast	52	86	16.0	43.4
Salton Sea	3	51	6.5	46.5
South Central Coast	1	14	11.1	36.2
Sacramento Valley	4	19	12.3	24.9
San Diego	2	31	10.2	34.4
South Central Coast	1	14	11.1	36.2
San Francisco Bay Area	4	7	10.7	21.9
Great Basin Valleys	0	5	*	20.3
Lake County	1	0	3.7	9.0
Lake Tahoe	0	0	8.9	*
Mohave Desert	26	82	6.4	18.7
Mountain Counties	4	30	8.7	16.5
North Central Coast	0	0	6.2	*
North Coast	0	0	8.0	17.3
Northeast Plateau	0	0	*	12.9
PM10 statistics may include data that are related to an exceptional value.				

* There was insufficient (or no) data available to determine a value.

Source: California Air Resources Board Select 8 Summary, accessed March 9, 2017.

EXHIBIT 20

AGREEMENT RELATING TO TRANSFER OF WATER

This agreement is made this 20th day of December, 1990, by and between the Modesto Irrigation District (the "District"), a California irrigation district, and the City and County of San Francisco (the "City"), a municipal corporation, acting through its Public Utilities Commission.

RECITALS

A. The City desires to augment its water supply from the effective date of this agreement through March 15, 1991, in order to meet the needs of its customers in the event that the current drought continues.

B. The District owns and operates certain wells located on the western side of its irrigation service territory. Those wells historically have been operated only during the irrigation season (approximately March through October) for drainage purposes, in order to maintain water levels below the root zone of permanent tree and vine crops, and in part for other incidental purposes.

C. The District is willing to pump water from certain of those wells during the non-irrigation season for the purpose of making such water available to the City to augment the City's water supply, on the terms and conditions set forth herein.

Now, therefore, it is mutually agreed as follows:

1. This agreement shall commence on the date it is made as set forth above and shall terminate on March 15, 1991.

2. During the term of this agreement the District shall utilize its best efforts to make available to the City up to 20,000 acre feet of pumped drainage water, as measured at the locations set forth in Paragraph 3. Such water will be pumped from certain of those wells described in Exhibit "A", attached hereto and incorporated herein by this reference. Subject to paragraph 6(b) of this agreement, water to be supplied under this agreement shall be pumped and delivered in accordance with written schedules to be provided by the City.

3. Water shall be deemed delivered by the District to the City at the District's recording stations designated in Exhibit "B", attached hereto and incorporated herein by this reference. It shall be the sole responsibility of the City to provide for transportation of such water from the point of delivery to the City's facilities. The City agrees that the District shall have no responsibility with regard to such water once the water has passed such recording stations; provided, however, the City shall have no such responsibility as concerns water that is not pumped and delivered in accordance with said schedules.

4. The City shall pay to the District the sum of $45.00 per acre foot of water delivered at the points set forth in Paragraph 3 of this agreement. Within ten days after the end of each month, the District shall submit to the City a

statement setting forth the quantities of water delivered at each recording station, the rates therefor, and the total amount due for that month. The City shall pay the District the amount set forth in the statement within thirty days of the date of the statement.

5. The District shall maintain records of flows at the points described in Paragraph 3, and such records shall be available to the City for inspection and copying at the City's request. On reasonable notice to the District, the City shall be entitled to check the accuracy of the District's recording stations. If any errors are found, an adjustment shall be made in the next monthly statement.

6. (a) The District reserves the right to reduce or discontinue any or all deliveries of water to the City pursuant to this agreement if, in the sole opinion of the District:

(1) the facilities to be utilized for the pumping and transportation of water under this agreement are required by the District to meet other requirements of the District;

(2) continued pumping of groundwater from the wells designated in Exhibit "A," or any of them, will, or is likely to, adversely affect the aquifer from which the water is being pumped or groundwater supply of adjacent or nearby groundwater users;

(3) the quality of the water obtained from the wells designated in Exhibit "A" is such that continued pumping is no longer feasible, or that continued extraction of groundwater jeopardizes the long-term quality of the groundwater resource.

(4) action detrimental to the District arising from this agreement is taken or threatened by any governmental authority with jurisdiction.

(b) The District shall promptly discontinue deliveries of water to the City under this agreement at any time and from time to time as requested in writing by the City.

7. Except for compliance with the California Environmental Quality Act ("CEQA") and any permitting requirements of any governmental authority for discharges of water into the San Joaquin River and/or any of its tributaries as contemplated by this agreement, the City shall be responsible for obtaining and complying with all governmental authorizations, approvals, and permits necessary to accomplish the water transfer envisioned by this agreement, and compliance with any applicable mitigation measures, and the City shall bear all costs associated therewith. The District shall give its reasonable cooperation to the City regarding any arrangement the City has to make with the California Department of Water Resources and the United States Bureau of Reclamation to enable the City to receive the benefits it has bargained to receive under this agreement.

8. The District makes no representation or warranty with regard to the quality or quantity of water that may be available from the wells described in Exhibit "A", or the District's ability to deliver all or any portion of the 20,000 acre feet of water stated as the goal of the parties to this agreement.

9. (a) The City agrees to protect, defend, indemnify and hold harmless the District, its officers, agents, servants, employees and consultants from and against any and all losses, claims, liens, demands and causes of action of every kind and character arising out of, directly or indirectly, or in any way connected with the pumping and delivery of water contemplated by this agreement.

(b) In the event that the District knew or should have known of the condition described in paragraph 6(a)(2) of this agreement and despite that continues pumping under this agreement, the provisions of paragraph 9(a) of this agreement shall not apply.

10. The parties agree that the pumping and delivery of water pursuant to or in connection with this agreement shall not constitute evidence in any adversary action or proceeding of any matter or claim which would be adverse to either of the parties.

11. This agreement supersedes any or all other agreements either oral or in writing, between the parties with respect to the transfer of water during the term of this

agreement and contains all the covenants and agreements of the parties with respect thereto. Both parties acknowledge that no representations, inducements, promises, or agreements, orally or otherwise, have been made by either party, or anyone acting on behalf of either party, which are not embodied herein, and that no other agreement, statement, or promise not contained in this agreement shall be valid or binding. Any modification of this agreement will be effective only if it is in writing and signed by the party to be charged.

12. This agreement does not, nor is it intended to, affect, alter or impair in any manner the rights of the respective parties hereto in or to the waters or the use of waters of the Tuolumne River or its watershed acquired or existing under the laws of the State of California. The City and the District agree to recognize and abide by the provisions of the Raker Act and the so-called Fourth Agreement among the City, the District and Turlock Irrigation District.

13. Each term and each provision of this agreement performable by the City shall be construed to be both a covenant and a condition.

14. This agreement shall be governed by and construed in accordance with the laws of the State of California.

15. If in the District's judgment the compliance with CEQA required in connection with this agreement cannot be accomplished before February 1, 1991, the District shall promptly so notify the City in writing, and either the District

or the City shall thereupon have the right to terminate this agreement by giving written notice of termination to the other.

16. Except for the obligation of a party to make payments as required by this agreement, neither party shall be considered to be in default in the performance of any of its obligations under this agreement when a failure of performance is due to an uncontrollable force. The term "uncontrollable force" shall mean any cause beyond the control of the party affected, including, but not restricted to, failure of or threat of failure of facilities, flood, earthquake, tornado, storm, fire, lightning, epidemic, war, riot, civil disturbance or disobedience, labor dispute, labor or material shortage, sabotage, restraint by court order or public authority, and action or nonaction by, or inability to obtain the necessary authorizations, approvals, and permits from any governmental agency or authority, which by exercise of due diligence such party could not reasonably have been expected to avoid and which by exercise of due diligence it has been unable to overcome. Nothing contained herein shall be construed to require a party (a) to settle any strike or labor dispute in which it may be involved or (b) to agree to any terms or conditions of obtaining authorizations, approvals, or permits which that party deems unreasonable or unreasonably burdensome. In the event a party is rendered unable to fulfill any of its obligations under this agreement by reason of an uncontrollable force, such party shall give prompt written notice of such fact to the other party.

17. All references in this agreement to "parties" are to the District and the City, and all references in this agreement to "party" are to either the District or the City as the context may require.

18. Time is of the essence for this agreement.

MODESTO IRRIGATION DISTRICT

By Joseph B Marcotte
Joseph B. Marcotte, Jr.
Chief Executive Officer

PUBLIC UTILITIES COMMISSION OF THE
CITY AND COUNTY OF SAN FRANCISCO

By
Thomas J. Elzey, General Manager
Public Utilities Commission

Authorized by Public Utilities
Commission

Resolution No. 90-0436

Adopted: December 11, 1990

Attest:

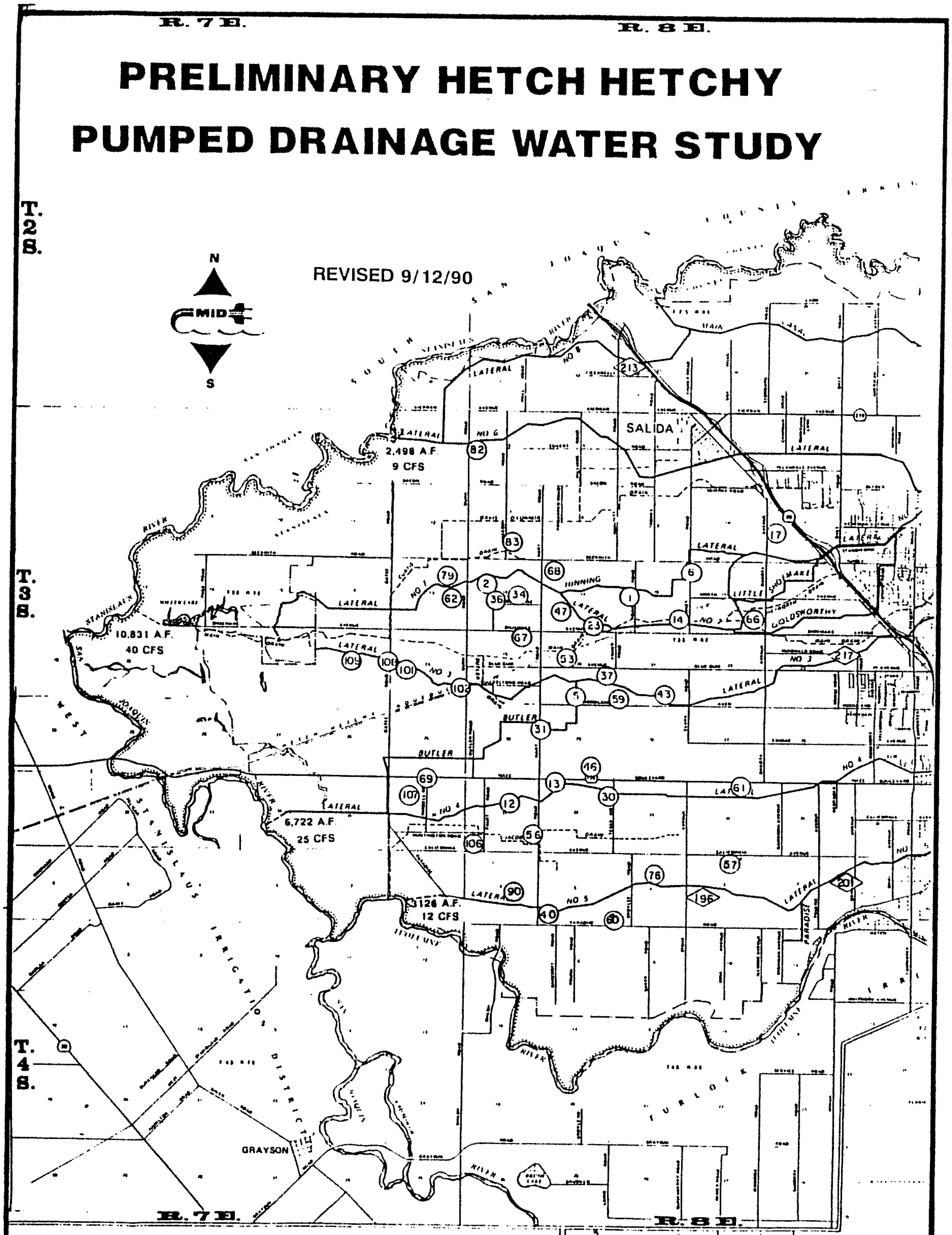
Romaine A. Boldridge
Romaine A. Boldridge, Secretary

APPROVED AS TO FORM:
LOUISE H. RENNE
City Attorney

By
George E. Krueger
Utilities General Counsel

PRELIMINARY HETCH HETCHY PUMPED DRAINAGE WATER STUDY

REVISED 9/12/90



MAP OF THE

MODESTO IRRIGATION DISTRICT

STANISLAUS COUNTY, CALIFORNIA

IRRIGATION DISTRICT BOUNDARY

ELECTRIC SERVICE BOUNDARY

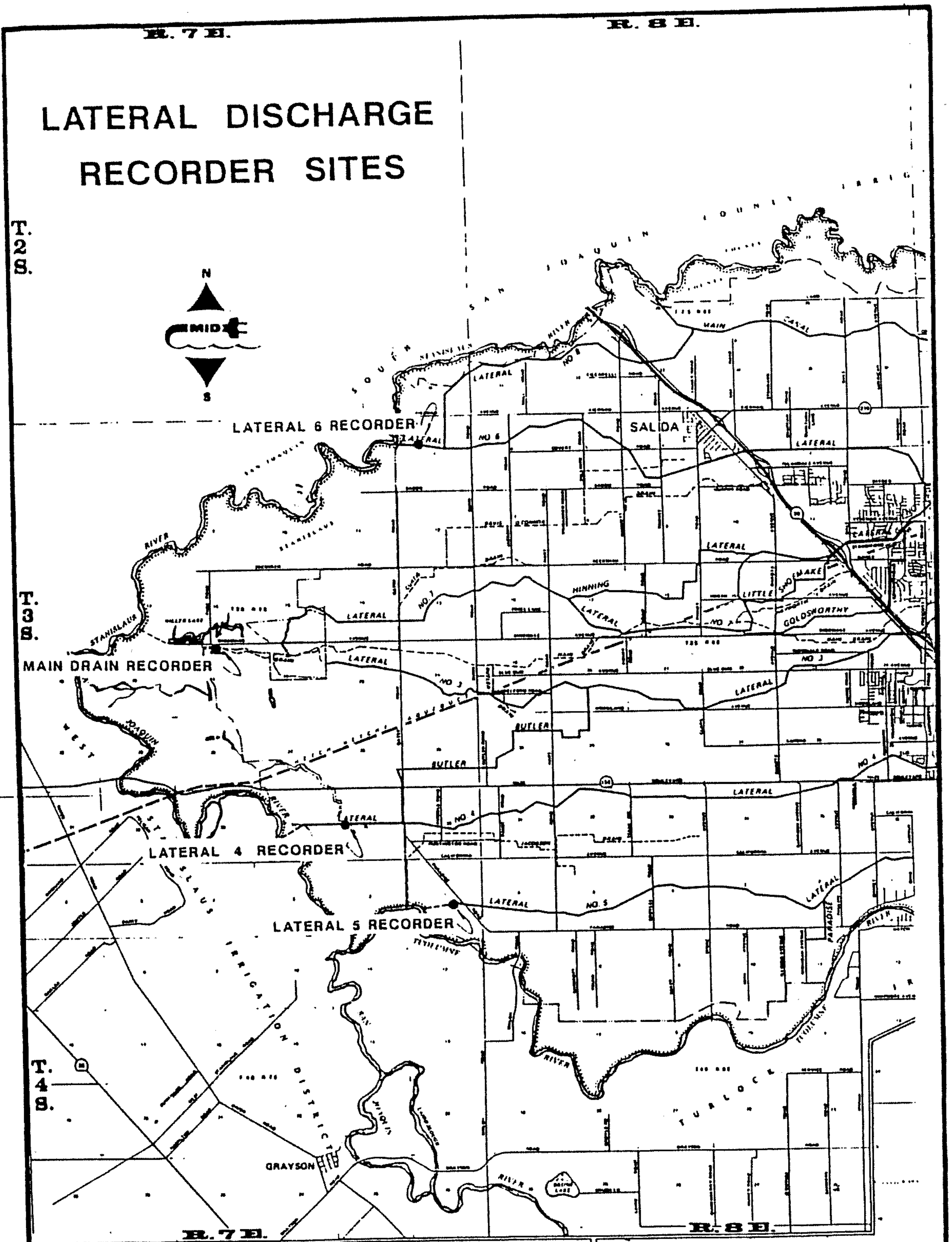
CANALS AND LATERALS

DRAINS

SCALE IN MILES

EXHIBIT "A"

LATERAL DISCHARGE RECORDER SITES



MAP OF THE

MODESTO IRRIGATION DISTRICT

STANISLAUS COUNTY, CALIFORNIA

IRRIGATION DISTRICT BOUNDARY

ELECTRIC SERVICE BOUNDARY

CANALS AND LATERALS

DRAINS

SCALE IN MILES

EXHIBIT "B"

EXHIBIT 21

As California Drought Deepens, Those With Water Can Sell at a High Price

By **Dan Brekke (https://ww2.kqed.org/news/author/danbrekke/)** (http://twitter.com/danbrekke)
JULY 2, 2014

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By Garance Burke (http://www.twitter.com/garanceburke)
Associated Press

(http://ww2.kqed.org/news/wp-content/uploads/sites/10/2014/01/FolsomLake1.jpg)

Folsom Lake, east of Sacramento, pictured in January as it reached its winter low. (Dan Brekke/KQED)

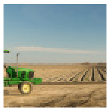
Throughout California's desperately dry Central Valley, those with water to spare are cashing in.

As a third drought year forces farmers to fallow fields and lay off workers, two water districts and a pair of landowners in the heart of the state's farmland stand to make millions of dollars by pumping their groundwater and selling it.

Nearly 40 others also are seeking to sell surplus water this year, according to state and federal records.

Economists say it's been decades since the water market has been this hot. In the last five years alone, the price has grown tenfold to as much as $2,200 an acre-foot. That's about 326,000 gallons of water, typically described as enough to supply two average California households for a year.

Unlike the previous drought in 2009, the state has been hands-off, letting the market set the price even though severe shortages prompted a statewide drought emergency declaration this year.



KQED Science: As Water Prices Soar, Some Profit From California's Drought (http://blogs.kqed.org/science/audio/some-california-farmers-fallow-fields-others-sell-water-for-big-profits/)

(http://blogs.kqed.org/science/audio/some-california-farmers-fallow-fields-others-sell-water-for-big-profits/)

(http://www.californiareport.org/archive/R201406061
KQED's The California Report: Drought
Drives Groundwater Drilling Frenzy
(http://www.californiareport.org/archive/R2014

Some water economists have called for more state regulation to keep aquifers from being depleted and ensure the market is not subject to manipulation such as that seen in the energy crisis of summer 2001, when the state was besieged by rolling blackouts.

“If you have a really scarce natural resource that the state’s economy depends on, it would be nice to have it run efficiently and transparently,” said Richard Howitt, professor emeritus at UC Davis.

In California, the sellers include some who hold claims on water that date back a century, private firms that are extracting groundwater and landowners who stored water when it was plentiful in underground storage facilities called water banks.

“This year the market is unbelievable,” said Thomas Greci, general manager of the Madera Irrigation District, which recently made nearly $7 million from selling about 3,200 acre-feet. “And this is a way to pay our bills.”

All of the Madera’s district’s water went to farms. The city of Santa Barbara, which has its own water shortages, was outbid.

> ***‘This year the market is unbelievable. And this is a way to pay our bills.’***
>
> — **Thomas Greci,**
> **Madera Irrigation District**

The prices are so high in some rural pockets that water auctions have become a spectacle.

One agricultural water district amid the almond orchards and oil fields northwest of Bakersfield announced earlier this year it would sell off extra water it acquired through a more than century-old right to use flows from the Kern River.

Local TV crews and journalists flocked to the district’s office in February to watch as manager Maurice Etchechury opened dozens of bids enclosed in sealed envelopes.

“Now everyone’s mad at me, saying I increased the price of water. I didn’t do it, the weather did it,” said Etchechury, who manages the Buena Vista Water Storage District, which netted about $13.5 million from the auction of 12,000 acre-feet of water.

The severity of this year’s drought means that the amount of water shipped from Northern California to the San Joaquin Valley and Southern California has been severely limited.

During the last drought, the state Department of Water Resources (DWR) ran a drought water bank, which helped broker deals between those who were short of water and those who had plenty. But several environmental groups sued, alleging the state failed to comply with the California Environmental Quality Act in approving the sales, and won.

This year, the state is standing aside, saying buyers and sellers have not asked for the state’s help. “We think that buyers and sellers can negotiate their own deals better than the state,” said Nancy Quan, a supervising engineer with the department.

The DWR, the U.S. Bureau of Reclamation and the State Water Resources Control Board have tracked at least 38 separate sales this year, but the agencies are not aware of all sales, nor do they keep track of the price of water sold, officials said.

The maximum volume that could change hands through the 38 transactions is 730,323 acre-feet, which is about 25 percent of what the State Water Project has delivered to farms and cities in an average year in the last decade.

That figure still doesn't include the many private water sales that do not require any use of government-run pipes or canals, including several chronicled by the AP. It's not clear, however, how much of this water will be sold via auctions.

Some of those in the best position to sell water this year have been able to store their excess supplies in underground banks, a tool widely embraced in the West for making water supplies reliable and marketable. The area surrounding Bakersfield is home to some of the country's largest water banks.

The drought is so severe that aggressive pumping of the banked supplies may cause some wells to run dry by year's end, said Eric Averett, general manager of the Rosedale-Rio Bravo Water Storage District (http://www.wakc.com/index.php/whos-who?pid=2&sid=90:Rosedale-Rio-Bravo-Water-Storage-District), located next to several of the state's biggest water banks.

Farther north in the long, flat Central Valley, others are drilling new wells to sell off groundwater.

Earlier this month, Stanislaus County's Del Puerto Water District approved a project (http://www.mercedsunstar.com/2014/06/05/3684236/water-district-approves-merced.html) to buy up to 26,000 acre-feet of groundwater pumped by two landowners in neighboring Merced County.

Since the district is getting no water from the federal government this year, the extra water will let farmers keep their trees alive, said Anthea Hansen, general manager of the arid Del Puerto Water District.

Hansen estimated growers would ultimately pay $775 to $980 an acre-foot — a total of roughly $20 million to $25.5 million.

"We have to try to keep them alive," Hansen said. "It's too much loss in the investment and the local economy to not try."

EXPLORE: ENVIRONMENT (HTTPS://WW2.KQED.ORG/NEWS/CATEGORY/ENVIRONMENT/), NEWS (HTTPS://WW2.KQED.ORG/NEWS/CATEGORY/NEWS/), DROUGHT (HTTPS://WW2.KQED.ORG/NEWS/TAG/DROUGHT/), GROUNDWATER (HTTPS://WW2.KQED.ORG/NEWS/TAG/GROUNDWATER/), WATER (HTTPS://WW2.KQED.ORG/NEWS/TAG/WATER-2/)

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Central Valley's Sinking Land Threatens Vital Canals
(https://ww2.kqed.org/news/[illegible]-valleys-sinking-land-threatens-vital-canals)

New Drought Aid Package From Governor, Legislative Leaders
(http://ww2.kqed.org/ne[illegible] legislative-leaders-offer-bill/)

AUTHOR

DAN BREKKE

Dan Brekke is a blogger, reporter and editor for KQED News, responsible for online breaking news coverage of topics ranging from California water issues to the Bay Area's transportation challenges. In a newsroom career that began in Chicago in 1972, Dan has worked as a city and foreign/national editor for *The San Francisco Examiner*, editor at Wired News, deputy editor at *Wired* magazine, managing editor at TechTV as well as for several Web startups.

Since joining KQED in 2007, Dan has reported, edited and produced both radio and online features and breaking news pieces. He has shared in two Society of Professional Journalists Norcal Excellence in Journalism awards — for his 2012 reporting on a KQED Science series on water and power in California, and in 2014, for KQED's comprehensive reporting on the south Napa earthquake.

In addition to his 44 years of on-the-job education, Dan is a lifelong student of history and is still pursuing an undergraduate degree.

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EXHIBIT 22

MINUTES

BOARD OF DIRECTORS

PLACER COUNTY WATER AGENCY

Thursday, July 21, 2016

2:00 p.m. Regular Meeting

Board Members Present: Chairman MIKE LEE, GRAY ALLEN, JOSHUA ALPINE, Vice-Chair ROBERT DUGAN, and PRIMO SANTINI

Board Members Absent: None

Agency Personnel Present Who Spoke: EINAR MAISCH, General Manager; SCOTT MORRIS, General Counsel; CHERI SPRUNCK, Agency Secretary/Clerk to the Board; RYAN CLINE, Power Scheduling Manager; ANDY FECKO, Director of Resource Development; DAN KELLY, Staff Counsel; JAY L'ESTRANGE, Director of Power Generation Services; JOSEPH PARKER, Director of Financial Services; TOM REEVES, Director of Field Services; JEREMY SHEPARD, Engineering Services Manager

A. CALL TO ORDER

1. Roll Call

Chairman Lee called the regular meeting of the Placer County Water Agency Board of Directors to order at 2:01 p.m. in the American River Room, Placer County Water Agency Business Center, 144 Ferguson Road, Auburn, California.

2. Pledge of Allegiance

Director of Field Services led the Pledge of Allegiance.

3. Announcements, introductions, and recognitions

a. Adopt Resolution 16-25 Honoring Thomas L. Reeves, Director of Field Services.

The General Manager reported on Mr. Reeve's 34 year employment history with the Agency, noting he did a fantastic job. He always put the customers first.

Chair Lee read a resolution honoring Mr. Reeves and presented it to him.

Mr. Reeves said he was the lucky one because he couldn't have done anything without everyone else to help him along the way. He noted the last 2½ years have been some of the toughest on all of us, but they have been some of the most fun in his career.

Motion by Director Dugan adopting **Resolution 16-25 Honoring Thomas L. Reeves, Director of Field Services**; motion seconded by Director Alpine and adopted by unanimous roll call vote of Director's present.

The General Manager introduced Dan Kelly, new staff counsel.

B. PUBLIC COMMENT:

No member of the public commented.

C. REPORTS BY DEPARTMENT HEADS

No reports received.

D. AGENDA CHANGES AND REVIEW

There were no changes.

E. CONSENT CALENDAR:

Action:

1. Adopt salary range 38.0 of the Water Systems Bargaining Unit salary schedule for the Customer Services Supervisor job classification.
2. Approve budget amendment in the amount of $30,000 from the Bowman Electrical Upgrade Project to a new project for the Colfax Water Treatment Plant Generator Pad Project, to construct a generator pad with associated appurtenances.
3. Authorize out-of-state travel and related expenses for the Hydro Electrical Engineer and Hydro Plant Electrician to attend the Basler DECS-2100 Generator Excitation System Training, in Highland, Illinois, August 2 - 4, 2016.
4. Adopt **Resolution 16-26 in Support of the Appointment of the General Manager to the Cosumnes, American, Bear, Yuba Joint Powers Authority Board of Directors.**

Information, Receive and File:

5. Treasurer's Investment Report for month ended June 30, 2016.
6. Check Register 16-14 expenses disbursed.
7. Budget Transfer between Debt Service Interest Expense and active Individual Water System Projects to record Capitalized Interest.
8. Board of Directors' expenses for the month of June 2016.

Motion by Director Santini approving Consent Calendar items 1, 2, 3, and 4; motion seconded by Director Alpine and adopted by unanimous roll call vote of Directors present.

F. AGREEMENTS AND CONTRACTS:

Action:

1. Approve water service applications as follows:
   a. Facilities Agreement (FA) 2622 Amendment No. 1, Sunset at Stanford Ranch Subdivision, Rocklin, 0.5 equivalent dwelling units (EDUs);
   b. FA 2632, Bella Tuscany, Auburn, 10 EDUs.

2. Approve Amendment No. Two to Engineering Services Contract with Peterson Brustad, Inc. for the Alta Water Treatment Plant Phase II Project, in an amount not to exceed $9,898, increasing the total contract amount from $271,377 to $281,275.

3. Approve the following for the Ralston and Hell Hole Rockfall Barrier Protection Project, Contract No. 2015-05, with Access Limited Construction, Inc.:
   a. Contract Change Order No. Seven in the reduced amount of $6,050, revising the contract total from $1,015,700 to $1,009,650;
   b. Authorize the Clerk to the Board to file a Notice of Completion.

4. Approve the following for the Middle Fork Surge Access Road Reconstruction Project, Contract No. 2015-07, with Lorang Brothers Construction, Inc.:
   a. Contract Change Order No. Three in the reduced amount of $2,434.09, revising the contract total from $447,814.35 to $445,380.26;
   b. Authorize the Clerk to the Board to file a Notice of Completion.

5. Consider the following for the Mount Vernon Road Intertie Project, to construct a pipeline and emergency intertie between PCWA and Nevada Irrigation District:
   a. Approve a budget amendment in the amount of $500,000 from the Water Division Renewal and Replacement Projects Reserve Account to the Mt. Vernon Intertie Project, increasing the project budget from $753,290 to $1,253,290;
   b. Award Construction Contract No. 2016-04 to Civil Engineering Construction, Inc. in the amount of $887,340.

6. For the reoperation of surplus Middle Fork American River Project (MFP) consider the following:

   a. Adopt **Resolution No. 16-27 Authorizing the Reoperation of Surplus MFP Water to U.S. Bureau of Reclamation in 2016** declaring a surplus of water available for sale;

   b. Approve 2016 Reservoir Reoperation Agreement authorizing the reoperation of up to 20,000 acre feet of surplus MFP water for delivery to U.S. Department of the Interior - Bureau of Reclamation at Folsom Reservoir in 2016;

   c. Declare project exempt from CEQA and authorize Clerk to the Board to file the Notice of Exemption.

7. Award Procurement Contract #P-16-02 to Keyinfo for the purchase of an IBM Power 8 platform to replace the i5 series platform which will no longer be supported by IBM using California Multiple Awards Schedule contract# 3-16-70-0032H and General Services Administration contract# GS-35F-110DA pricing in an amount not to exceed $116,000.

8. Authorize General Manager to enter into 2016 Consent to Groundwater Substitution Transfer Agreement between Sacramento Suburban Water District and Placer County Water Agency.

<u>Information, Receive and File</u>:

9. Progress Pay Estimate and Non-Discretionary Contract Change Order Summary for the period, May 28, 2016, through June 13, 2016.

Items 6 and 8 were pulled for discussion.

Motion by Director Dugan approving Agreement and Contract items 1, 2, 3, 4, 5, and 7; motion seconded by Director Santini and adopted by unanimous vote of Directors present.

Director of Resource Development gave a chronology of the water transfer market this year. Due to several dry years there was quite a bit of deficient in storage south of the Delta. In December, parties south of the Delta approached the Agency for water to refill their reservoirs. As hydrology improved, the ability to move water in the transfer season from north to south became limited because of limited pump capacity in the south Delta and the interested buyers left the market. This year we have plenty of surplus water available. We were approached to provide additional Delta outflow this summer to benefit species. The proposed contract is one of three steps to move water. There will be a refill agreement with the U.S. Bureau of Reclamation; they have to clear us of our refill obligations we incurred in the prior three years of transfers.

Staff Counsel explained there are two sets of pumps in the Delta – the federal is Jones, and state's is the Bank's facility. The state has a greater ability to pump water out of the Delta. The state and federal projects have a joint point of diversion where they share pumping capacity. This year we had decent precipitation and the state increased its contractor's allocation up to 45 percent which maxed out Banks pumping capacity. That left Jones pumping plant, which is pumping from a single unit. The federal contractors that received 5% share were under the impression that San Luis Reservoir would be full. But it is expected to hit zero this weekend, so there is no federal water in San Luis Reservoir after this weekend. Contract deliveries to some of the Central Valley Project (CVP) contractors south of Delta will cease this weekend. A lot of San Joaquin Valley CVP contractors purchased about $20 million in water last year, but it is being held in Shasta because of Sacramento River temperature issues. The CVP is saying there is too much risk in transferring water, so if we are going to sell it, they are going to pay a very small amount.

Legal Counsel said there are restrictions on the pumping because of smelt. Westlands Water District has filed suit over this issue last weekend.

Staff Counsel reported on the case regarding the state's entry onto properties to do environmental studies. The state, as part of its investigation for the water fix, sought entry orders into hundreds of properties in the Delta to conduct environmental studies as part of its pre-condemnations activities to see where it wanted to build the project and what mitigation it would have to do. Many of the landowners fought the state and claimed the entries were so intrusive they constituted an actual taking for which the Department of Water Resources (DWR) would have to institute an imminent domain proceedings and pay just compensation. The trial court issued the entry order for DWR to go ahead and do studies with some limitations. The landowners appealed and won. The appellate court said it was a take and would have to institute an imminent domain proceeding to compensate landowners. Today the Supreme Court overturned the appellate court's decision. The court rewrote the pre-condemnation statutes to provide more protection for landowners.

Board inquiry and staff response followed.

Motion by Director Allen approving Agreement and Contract item 6; motion seconded by Director Santini and adopted by unanimous roll call vote of Directors present.

Regarding item F.8. Director of Resource Development reported on the PCWA/Sacramento Suburban Water District (SSWD) water supply contract arrangement. When Folsom inflow is above a certain level, PCWA is allowed to sell to SSWD. If SSWD wants to remarket or resell PCWA water, they have to pay the Agency 95% of the sale price that they receive—unless they get consent from PCWA to modify the agreement. The purpose of the water sale is assist the groundwater basin. SSWD is going to switch to groundwater this year and use some of the 300,000 acre feet they have banked previously to get them through. Because SSWD is in our place of use, we don't transfer the water to them, so there is no refill arrangement associated with that water. That is water that PCWA was going to put into Folsom. He explained the provisions of the Consent to Groundwater Substitution Transfer Agreement.

Motion by Director Dugan approving Agreement and Contract items 8; motion seconded by Director Alpine and adopted by unanimous vote of Directors present.

G. POWER:

1. For the Hell Hole Dam Core Raise Project to meet California Department of Safety of Dams and Federal Energy Regulatory Commission requirements for Probable Maximum Flood loading:
   a. Open the noticed public hearing on the proposed Mitigated Negative Declaration (MND);
   b. If no comments are received that warrant continuation of the hearing, close the hearing and consider adopting Resolution 16-__ approving the MND and Mitigation Monitoring Plan and authorizing staff to file a Notice of Determination**.**

The Engineering Services Manager introduced Janelle Nolan, Environmental Consultant Manager with Cardno Entrix.

Ms. Nolan provided an overview of the proposed project and the CEQA process. The California Department of Water Resources, Division of Dam Safety, requested PCWA evaluate the Hell Hole Dam to see if it met probable maximum flood requirements. PCWA determined a maximum flood would overtop the dam core. PCWA prepared the environmental evaluation. She showed a map of the area. An initial study, mitigated negative declaration was prepared and distributed. Three comment letters were received from 1) Central Valley Water Quality Control Board, which is the standard letter that we must obtain appropriate permits; 2) Shingle Springs Rancheria asked for any records search on cultural or tribal resources completed as part of the project and field study results; 3) United Auburn Indian Community of the Auburn Rancheria requested participation in cultural resource surveys and results of data searches and field surveys completed and notified if anything is found during project implementation. PCWA is gathering the documents to provide to the tribes. The project is planned to be implemented in summer and fall 2017.

Director of Power Generation Services further reported on details of the project.

At 2:51 p.m. the Chair opened the hearing for public comment. There being no public comment, Director Santini made a motion to close the hearing at 2:51 p.m.; motion seconded by Director Alpine and adopted by unanimous vote of Directors present.

Motion by Director Allen adopting **Resolution 16-28 approving the Mitigated Negative Declaration and Mitigation Monitoring Plan, and authorizing staff to file a Notice of Determination**; motion seconded by Director Alpine and adopted by unanimous roll call vote of Directors present.

2. Approve the 2016 financial modifications to the 2013 Collection Agreements with the U.S. Forest Service.

Director of Resource Development explained the purpose of each collection agreement. The Agency has recreation facilities in the Tahoe and Eldorado National Forests watersheds. The Forest Service runs the facilities on the Agency's behalf. The first agreement is the funding mechanism to pay them to staff those recreation facilities for the Agency and to provide all the janitorial services. Our payments are offset by unspent funds from prior years and the charges they assess on visitors. The second agreement is part of our FERC license arrangement because we are responsible for upkeep/maintenance of facilities. The third agreement is payment to the Forest Service for environmental work, clearances, and oversight of projects for Agency use of Forest Service roads and facilities.

Motion by Director Santini approving the 2016 financial modifications to the 2013 Collection Agreements with the U.S. Forest Service; motion seconded by Director Dugan and adopted by unanimous vote of Directors present.

3. Review of 2016 energy market conditions and hydrology.

The Power Scheduling Manager gave a PowerPoint presentation reporting on the Middle Fork Project's energy sales. Accumulative precipitation in June was 73 inches/107 percent of average. Staff anticipates generating 975,000 MW hours. Last year staff projected $41.4 million in revenues. Above normal precipitation coupled with significantly lower energy prices should lead to roughly $42.6 million in total MFP revenue, or 3% above the 2016 forecast. The Agency gets paid based on the number of hours it runs and natural gas prices. Natural gas prices hit an all-time low of $1.73 in May.

H. <u>REPORTS BY DIRECTORS</u>:

Director Dugan reported the Regional Water Authority Executive Director review went out to the Board. He asked for collective wisdom from the PCWA Board members to be included in the report.

Director Santini reported he and Director Lee attended the July 12 Lincoln/PCWA Committee meeting. They received a review of groundwater legislation. There was discussion about the Groundwater Sustainable Authority and groundwater sustainable plan. The City's concern was about the organizational structure that protects their use of groundwater water (10% of their total use) and making sure whatever plan we come up with encapsulates authority over agriculture use in the County. The main thing to keep in mind is that it is an iterative process. There are deadlines at end of 2017 for the agency formation and the 2022 for plan. They talked about expansion of the Ophir plant—giving Lincoln information they need to make a decision to buy capacity or whether they choose to address their water supply needs with their own separate plant with Nevada Irrigation District.

He attended a Middle Fork Project Finance Authority meeting this morning and heard a hydrology report and six year budget comparison. Revenue will be up by 3 percent and expenses down by $3 to $4 million.

I. REPORTS BY LEGAL COUNSEL:

No reports received.

J. REPORTS BY GENERAL MANAGER:

The General Manager thanked Director Santini for recognizing that life is an intricate process and we do the best we can day by day.

K. CLOSED SESSION

With all members present, as heretofore designated, the meeting adjourned to closed session at 3:08 p.m. to consider the following:

1. **Conference with Legal Counsel - Existing Litigation** - Pursuant to subdivision (a), Section 54956.9 of the Government Code.
   Name of case: Bat Electric, Inc. v. Orenco Hydropower, Inc., et al.
   Shasta County Superior Court Case No. Superior Court 185128

N. REPORT FROM CLOSED SESSION

The Board returned from closed session at 3:49 p.m. It was noted there was nothing to report.

O. ADJOURNMENT:

At 3:49 p.m. Director Dugan made a motion to adjourn; motion seconded by Director Santini and adopted by unanimous vote of Directors present.

ATTEST:

/s/ Cheri Sprunck

____
Cheri Sprunck, Clerk to the Board
Placer County Water Agency

EXHIBIT 23

MINUTES

BOARD OF DIRECTORS
PLACER COUNTY WATER AGENCY

Thursday, June 18, 2009
2:00 p.m., Regular Meeting

Board Members Present: CHAIRMAN GRAY ALLEN, ALEX FERREIRA, LOWELL JARVIS, MICHAEL LEE, and BEN MAVY
Board Members Absent: None
Agency Personnel Present Who Spoke: DAVID BRENINGER, General Manager; ED TIEDEMANN, General Counsel, CHERI SPRUNCK, Agency Secretary/Clerk to the Board; JOHN KINGSBURY, Director of Customer Services; JOSEPH PARKER, Director of Financial Services; BRENT SMITH, Deputy Director of Technical Services

A. CALL TO ORDER
1. Roll Call

Chairman Allen called the regular meeting of the Placer County Water Agency Board of Directors to order at 2:00 p.m. in the American River Room, Placer County Water Agency Business Center, 144 Ferguson Road, Auburn, California.

2. Pledge of Allegiance: Led by Brent Smith

Director Jarvis arrived at 2:01 p.m.

3. Introductions & Presentations

General Manager introduced Auburn Journal Publisher Tony Hazarian.

Mr. Harzarian thanked the Board for their support of the Fire and Water Brochure. (Handout provided)

B. PUBLIC COMMENT: No member of the public commented.

C. REPORTS BY DEPARTMENT HEADS

No reports received.

D. AGENDA CHANGES AND REVIEW

A PowerPoint presentation was given under G.3.c. regarding the status of Renewal and Replacement projects.

E. CONSENT CALENDAR:

1. Approve and file:
   a. May 21, 2009, minutes
   b. Check Register 09-11 expenses disbursed
   c. Budget transfers, as recommended by the Director of Financial Services. ***See attached and other non-routine budget transfers that may be included as part of specific items that follow.***
   d. Board of Directors' expenses for previous months
   e. General Manager's expense reimbursement claim summary
2. Approve the following late employee claim pursuant to Chapter 3, Article 1, Section 3003, of the Agency's Personnel and Administration Manual:
   - David Jarman's expenses dating back to March 2009 in the amount of $219.20.
3. Approve Water Education Foundation 2009/2010 sponsorship in the amount of $2,500.
4. Approve Regional Water Authority's annual dues in the amount of $34,365.
5. Approve out-of-state travel request for the Resource Planning Administrator, Hydro Engineer, and Associate Engineer to attend the Waterpower XVI Conference July 27 - 30, 2009, in Spokane, Washington.
6. Approve **Resolution 09-22 authorizing the Grant of an Easement to Pacific Gas & Electric Company** for the Foresthill Substation.

Motion by Director Ferreira approving Consent Calendar items 1, 2, 3, 4, 5, and 6; motion seconded by Director Lee and adopted by unanimous roll call vote of directors present.

F. AGREEMENTS AND CONTRACTS:

Award:

1. Approve Sacramento Water Forum agreement relevant to the Water Conservation Element Update.
2. Approve Agency's portion of the 2009/2010 Water Forum Cost Share Agreement in an amount not to exceed $20,560.
3. Approve agreement with Liebert, Cassidy, Whitmore for the Gold Country Employment Relations Consortium for 2009-2010 in the amount of $3,165.
4. Approve a Consulting Services Contract with Charpier Engineering for Red Ravine Siphon Project and Colfax Distribution Box and Header Pipe Project, in an amount not to exceed $116,000.
5. Approve a Consulting Services Contract with Steve Yaeger, Consulting Engineer for Antelope Canal Encasement and Clover Valley Desilting projects, in an amount not to exceed $69,000.

Existing:

6. Approve Amendment No. One to the Materials Testing Contract with Youngdahl Consulting Group, Inc. for the Auburn WTP Raw Water Pipeline Project, Contract #2008-09, in an amount not to exceed $10,335.25.

7. Approve the following with Herback General Engineering for the Middle Fiddler Green Siphon Replacement Phase II project, Contract #2009-02:
   a. Progress Pay Estimate No. One in the amount of $71,558.18.
   b. Receive for filing Non-Discretionary Contract Change Order No. One in the increased amount of $11,596 approved by the Director of Technical Services pursuant to authority previously granted by the Board of Directors.
8. Approve the following with Doug Veerkamp General Engineering, Inc. for the Auburn Water Treatment Plant Raw Water Pipeline project, Contract #2008-09:
   a. Receive for filing Non-Discretionary Contract Change Order No. Three in the decreased amount of $17,903, approved by the Director of Technical Services pursuant to authority previously granted by the Board of Directors.
   b. Progress Pay Estimate No. Five in the amount of $438,843.15
9. Approve Progress Pay Estimate No. One with Delta Excavating, Inc. for the Secret Town Pipeline Phase II Improvements, Contract #2009-01 in the amount of $71,550.

Items F1 and F2 were pulled for discussion. Director Mavy expressed concern with the Water Forum Agreement putting fish before people. He also expressed concern over the Best Management Practices. He suggested a cost benefit analysis be done. Director of Customer Services responded to Board inquiries. Discussion followed.

Motion by Director Jarvis approving Agreement and Contract items 3, 4, 5, 6, 7, 8, and 9; motion seconded by Director Ferreira and adopted by unanimous vote of directors present.

Motion by Director Jarvis approving Agreement and Contract items 1 and 2; motion seconded by Director Lee and adopted by unanimous vote of Directors present.

G. <u>WATER AVAILABILITY AND WATER SUPPLY</u>

1. Zone 1 treated water service; take action as appropriate:
   - Single Connections (In fill): Two applications for a total of 1.3 acre-feet or 2.0 equivalent dwelling units

Deputy Director of Technical Services reported on the applications for single connections.

Motion by Director Lee approving the applications for single connections in the total amount of 1.3 acre-feet; motion seconded by Director Ferreira and adopted by unanimous vote of Directors present.

2. Requests for response from Agency on water availability; take action as appropriate.
   a. SB 221 (tentative map)
   b. SB 610 (environmental process)
   c. All other requests or information

No reports received.

3. Reports and response on water resource policy, planning and management issues and interests; take action as appropriate:
   a. Water rights and contracts
   b. Land use and water policy
   c. Water supply, service, and infrastructure system
   d. Water use efficiency and conservation
      - Approve U.S. Bureau of Reclamation Water Efficiency Matching Grant in the amount of $24,875.
   e. American River Pump Station Project
   f. Sacramento River Diversion Project
      - Status report on Sacramento River Water Reliability Study.
   g. Regional water matters
   h. Delta and State water matters

Under item G.3.c. Deputy Director of Technical Services gave a PowerPoint presentation updating the Board on four key renewal and replacement projects. The reported included information about the $2.1 million Auburn Raw Water Pipeline Project on upper Lincoln Way in north Auburn, a $400,000 replacement of the Middle Fiddler Green Siphon near Ophir, a $340,000 improvement to the Auburn Water Quality building, and the $1.9 million second phase of the Secret Town Pipeline Project above Colfax.

Under item G.3.d. Director of Customer Services reported about the U.S. Bureau of Reclamation's matching grant for high-efficient toilets and washing machine rebates.

Motion by Director Ferreira to enter into a $24,875 U.S. Bureau of Reclamation Water Efficiency Matching Grant; motion seconded by Director Jarvis and adopted by unanimous vote of Directors present.

Under item G.3.f. Director of Strategic Affairs reported in 2001 Congress authorized and directed the Bureau of Reclamation to prepare a feasibility study on a potential diversion of existing water supply entitlements from the Sacramento River to service the Agency and other regional water supply needs. One objective was to modify the allowable place of use for the Agency's Central Valley Project (CVP) contract water supply because the Agency does not have access to infrastructure that would enable it to divert water from Folsom Reservoir to deliver to its Zone 1 service area. The Bureau has agreed to expand the CVP place of use to include Agency Middle Fork Project water rights place of use. The Agency will be able to use its CVP supply to meet its water supply commitments to San Juan and the City of Roseville. A NEPA document is required before the change can be implemented.

The regional planning study is affected by uncertainties over future operation of the Central Valley Project and State Water Project. Also, a slower rate of growth in Placer County has reduced the urgency for additional water supplies.

The Board directed staff to suspend work on the Sacramento River Water Reliability Study (SRWRS) project pending resolution of Operational Criteria and Plan/Delta issues between the CVP, State Water Project, Fish & Wildlife Service and National Marine Fisheries Service, and until there are signs of recovery in the local economy, and that available SRWRS budgeted funds be used to pursue approval of a change in the Agency's CVP place of use.

H. MIDDLE FORK AMERICAN RIVER PROJECT, (FERC PROJECT 2079), RELICENSING PROGRAM

1. Report on relicensing process, schedule, and activities; take action as appropriate.

2. Report on financial matters and services; take action as appropriate.

No reports received.

I. GENERAL ITEMS

1. Report of fiscal status.

Regarding the Water System, the Director of Financial Services reported plant flows have been down and continue to be down because of the wet May. The flows are down 14% but billings are only down 2.3% from last year. The accounts receivables balance is staying steady and the Agency is getting revenues because Collections is tracking year-to-day levelly with where billings are. He reported the Agency's current balances. On a weekly basis water bills and cash receipts are being monitored and he noted on the amounts. Other revenues include Renewal and Replacement projects, which are on budget. Expenses of departments are on or under budget.

Regarding Agency-Wide he reported on types of revenues and noted in-county water sales are 68% of budget and the Agency is ahead of budget. The property tax revenue will be levied July 1. Department expenses are on budget.

2. Report on request for assistance from Lake Tahoe area water purveyors.

Deputy Director of Technical Services showed maps of publicly and privately owned water districts in the North and West shore of Lake Tahoe. The districts are trying to determine, with fire departments, how to best improve facilities to protect structures and the area from fire. There are many undersized facilities for many districts in the area.

Tahoe City Public Utility District and North Tahoe Public Utility District asked the Agency to assist as a neutral party and to manage the project, help facilitate on a regional level, manage the consolidated master plan for public and private water systems and assist with applying for FEMA's Hazard Mitigation program.

Motion by Director Ferreira authorizing staff to provide project management assistance in developing a regional master plan for water systems for the north and west short of Lake Tahoe and assist in submitting a FEMA Hazard Mitigation Grant; motion seconded by Director Lee and adopted by unanimous vote of Directors present.

3. Report on State and Federal legislation.

No report received.

J. REPORTS BY DIRECTORS:

Director Jarvis attended the Mountain Counties Water Resources Association & Association of California Water Agencies Region 3 meeting. About 80 people attended representing various water districts. John Woodling, Regional Water Authority Executive Director, gave a report about water use misconceptions and water conservation. Victoria Whitney, Chief, Division of Water Rights, State Water Resources Control Board, spoke about water rights priorities: drought and conservation, Term 91, water quality certifications, and Delta pumping restrictions—how they affect water rights. About 60 of the attendees went on a tour of the Agency's American River Pump Station.

He also attended KMT&G's 50-year anniversary celebration. At the event he spoke to Stan Kronick about a curtailment letter received from Victoria Whitney and the State Water Resources Control Board.

Director Mavy attended a Dutch Flat Mutual Water Company board meeting. They have issues similar to all small water districts, such as keeping up with state mandates. They are looking for help and will be calling Agency staff for advice.

Director Lee reported he, Director Ferreira and two of the Agency's staff went on the Placer County Ag Tour. They visited Fowler's Nursery and learned about wholesale tree growing. The tour also stopped at the Forester cattle ranch/hay farm. Both are important agriculture projects that bring revenue to Placer County.

Director Ferreira reported the Placer County Ag Tour visited the DeWitt Farmer's Market where the Cattlewomen's Association hosted lunch.

Chair Allen attended the Sacramento Metropolitan Chamber's Legislative Day and talked to legislators about issues related to the Bay-Delta and the Governor's proposed 20 percent conservation by the year 2020. He expressed concern about one legislative committee consultant who said that anyone who diverts water anywhere upstream from the Delta is a beneficiary of the Delta and, therefore, must pay and sacrifice, just like those who receive water from the Delta.

K. REPORTS BY LEGAL COUNSEL

Legal Counsel reported staff is working diligently on the San Diego County Water Authority water transfer. He reported on responses filed to the protests of such transfer.

L. REPORTS BY GENERAL MANAGER

General Manager spoke about Dutch Flat Mutual Water District sending one of their Board members in the past to the Agency's Board meeting.

He noted relations with PG&E are good regarding the water transfer and the agreement with PG&E regarding same is signed. The challenge is how the water can be exported.

He reported he will send a letter to PG&E regarding the Agency's Water Supply Contract which is up for renewal in 2013.

Meeting date options for East Slope Board meeting were discussed.

M. CLOSED SESSION AND REPORT

With all members present, as heretofore designated, the meeting adjourned to closed session at 3:30 p.m. to consider the following:

Conference with legal counsel – anticipated litigation
Significant exposure to litigation pursuant to Subdivision (b) of Section 54956.9 of the Government Code
Number of Potential Cases: One

The Board returned at 3:40 p.m. No reportable action taken.

N. ADJOURNMENT

The Chair adjourned the meeting at 3:41 p.m.

ATTEST:

____
Cheri Sprunck, Clerk to the Board
Placer County Water Agency

EXHIBIT 24

WATER & POWER
Serving Central California since 1887

Modesto
Irrigation
District
The Power to Grow

August 6, 2014

State Water Resources Control Board
Division of Water Rights
Attn: Mark Gowdy
P.O. Box 2000
Sacramento, CA 95812

Dear Mr. Gowdy,

In a letter dated May 6, 2014 to the San Francisco Public Utilities Commission ("SFPUC"), the Division of Water Rights outlined certain "key assumptions" that State Water Resources Control Board ("State Water Board") staff will use in its impact analysis for the revised Draft Substitute Environmental Document in Support of Potential Changes to the Water Quality Control Plan for the Bay-Delta: San Joaquin River Flows and Southern Delta Water Quality ("SED"), to evaluate impacts to the City and County of San Francisco ("CCSF") that may result from the proposed Tuolumne River flow alternatives. The Modesto Irrigation District and the Turlock Irrigation District ("Districts") support the comment letter from the San Francisco Public Utilities Commission ("SFPUC") dated July 29, 2014, and wish to add the following additional comments.

In the May 6, 2014 letter, the State Water Board staff ("staff") makes a number of erroneous assumptions regarding how CCSF will fulfill its obligations to its customers in the Hetch Hetchy Regional Water System ("RWS") and to the Districts under the Raker Act and the Fourth Agreement as a result of new instream flow requirements on the Tuolumne River.

Staff proposes that socioeconomic impacts to CCSF from increased instream flow requirements will be limited because CCSF will be able to purchase sufficient water from the Districts to avoid water shortages and consequent reductions in water deliveries throughout the RWS service territory. Additionally, the letter explains that staff will use two divergent interpretations of CCSF's responsibility under Article 8(b) of the Fourth Agreement to estimate the volume of water that CCSF would need to purchase from the Districts to avoid reductions in water deliveries.

Regarding the purchase of water from the Districts, while it is theoretically possible to do so, such a scenario is neither reasonable nor feasible. Any sale of District water is and will be subject to a broad variety of unpredictable forces and independent decision makers unique to each District and the Districts as Tuolumne River partners. Neither the SWB nor the Districts can reasonably depend on whether or to what extent a water sale of unknown and unprecedented scope to CCSF would survive such an unpredictable gauntlet. The Phase 1 SED will be legally insufficient if the State Water Board fails to review the impacts born of the most likely scenario to its imposition of the

Lower San Joaquin River instream flow proposal, namely that CCSF and its customers will experience critical water shortages in the RWS.

First and foremost, there is a broad variety of customers to which the Districts' water is already pledged, and any potential sale would necessarily have to be subject to those needs. The Districts' duty to serve its existing customers' varying demands is the paramount use of District water, if not the very purpose of the Districts' locally-financed water distribution and storage system.

Next, and as this most recent drought has highlighted, it is hydrological reality that in certain dry years water will not be available to sell to CCSF, willingly or as otherwise contemplated by the State Water Board. Therefore, the State Water Board should and must incorporate into its Phase 1 SED analysis the relevant socioeconomic impacts from water shortages and consequent reductions in water deliveries to RWS outlined in CCSF's Comment Letter to the Phase 1 SED dated March 29, 2013.

Additionally, each District is governed by a locally elected Board of Directors. Each Director has a duty to govern and direct District activities in his or her best judgment, and all District goals and activities are subject to the Board of Directors' ability to reach agreement. Adding yet another layer of complexity, each Director and the District itself are subject to the will of the electorate. CCSF's comment letter dated July 29, 2014 aptly cites to two (of several) newspaper articles reflecting the District-electorate's currently negative tone towards the sale of District water to CCSF. While public displeasure with District action does and should not always control District decision-making, the Districts denied the then-proposed water transfers to CCSF due to concerns with evolving circumstances like customer demand and the infrastructure-related logistics of transfer. The State Water Board must recognize the (at least) two recent instances where a proposed transfer of water to CCSF was not feasible due to independent decisions and actions by the public officials and the relevant electorates within each District. In so doing, the State Water Board must then incorporate the reasonably foreseeable impacts of water shortage to RWS, as more fully described in CCSF's above referenced Comment Letter dated March 29, 2013, due to the reasonable likelihood that CCSF will not be able to purchase water from the Districts as proposed in the State Water Board letter to the SFPUC dated May 6, 2014.

Once again, the State Water Board has failed to consult with responsible agencies. The San Joaquin Tributary Authority ("SJTA") pointed out in its March 29, 2013, comments on the SED that neither the Board nor the staff consulted with the SJTA members (which include the Districts and CCSF) concerning the extent or content of environmental review. Prior to the release of the SED, neither the Districts nor CCSF were consulted about the Fourth Agreement and how operations on the Tuolumne River comply with the Raker Act despite numerous opportunities to do so. Rather, staff used a report from NRDC as the source of their information.

Quite unfortunately, more than one year later, staff has once again embarked on a course without consulting with the Districts or with CCSF, the entities with the most knowledge and expertise.

As you know, the SED must consider a reasonable range of alternatives which could feasibly attain the basic objectives of the project. (Pub. Resources Code § 15126(d); Friends of the Eel River v. Sonoma County Water Agency (2003) 108 Cal.App.4th 859, 873.) It is well established that environmental review is not required to analyze every conceivable alternative; however, the SED is required to analyze a reasonable range of potentially feasible alternatives that will foster informed decision making and public participation. (Preservation Action Council v. City of San Jose (2006) 141 Cal.App. 4th 1336.)

It is not reasonable to assume that the Districts have water available to sell to CCSF to meet the SED's desired flow objectives. As was pointed out in the SJTA's March 29, 2013 comments on the SED, any additional flow requirements will have significant water supply, economic, and groundwater impacts to the Districts and the customers they serve. It is pure speculation to assume that CCSF will be able to purchase water from the Districts in order to meet a share of the SED's desired flow objective. There have been no discussions, much less agreements, between the Districts and CCSF regarding the purchase of water to meet some "share" of Tuolumne River instream flow as envisioned in the SED and no such discussions have been planned.

Furthermore, assuming that such an arrangement between the Districts and CCSF were feasible, the agreement would require full environmental analysis and review under CEQA. The revised SED must analyze the environmental effects of any alternative it proposes and identify the mitigation measures.

Finally, such an analysis is unnecessary as the water users most affected by the SED's proposed flow alternatives have already provided the State Water Board with an estimate of the potential economic impacts. (See the comments submitted to the State Water Board by CCSF at the March 21, 3013 hearing on the adequacy of the draft SED and the March 29, 2013 comment letter from the Bay Area Water Supply and Conservation Agency.)

It bears repeating that the Districts, with their several decades of information and expertise surrounding the Tuolumne River and its operations, welcome the opportunity to be consulted concerning the extent or content of the environmental review of Phase 1.

Sincerely,

Roger VanHoy

Casey Hashimoto

Roger VanHoy, General Manager
Modesto Irrigation District
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roger.vanhoy@mid.org

Casey Hashimoto, General Manager
Turlock Irrigation District
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cc: Barbara Evoy, State Water Resources Control Board

EXHIBIT 25

Breaking News Alerts

September 18, 2012 2:13 PM

Modesto Irrigation District kills proposed water sale

The board of the Modesto Irrigation District voted 5-0 this afternoon to stop its proposed water sale to San Francisco after the parties deadlocked on contract revisions sought by the MID.

By John Holland - jholland@modbee.com

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A closed-session vote Tuesday brought a sudden end to the Modesto Irrigation District's controversial plan to sell water to San Francisco.

The district board voted 5-0 to cease negotiations with the city, after the parties deadlocked on contract revisions sought by the MID.

With that, a debate that has roiled the Modesto area for nearly a year — pitting people worried about water shortages against others who saw a windfall for the MID — appears to be over.

"I'm very pleased with it," said board member Larry Byrd, an opponent from the start. "This is what needed to be done to save our community, and we did it."

The contract involved 2,240 acre-feet of Tuolumne River water per year, about 1 percent of the MID's average annual deliveries to farmers and the treatment plant serving Modesto-area domestic users. San Francisco would have taken it into its Hetch Hetchy Water and Power System, upstream on the river.

The plan included a study of a potential sale of an additional 25,000 acre-feet — water that would have been freed up by conservation projects on MID canals.

The city agreed to a starting price of $700 per acre-foot in the first sale, about 70 times what MID farmers pay. The cost would have been spread among about 2.6 million Hetch Hetchy customers in four Bay Area counties.

Two proposed revisions to the sale contract were unacceptable, said Steven Ritchie, assistant general manager for the water enterprise at the San Francisco Public Utilities Commission.

One would have allowed the MID to reduce the sale volume during dry years in proportion to the cuts for farmers and domestic users in the district, he said.

"Since we would be paying a premium price, we felt that we really do need this water all the time," he said.

The other revision would have granted the MID the right to end the sale for any reason, Ritchie said. "For us, that really put this water at risk."

Modesto officials have said the sale would have violated the 2005 agreement under which the district will supply water to an expanded treatment plant. The MID board postponed four votes on the sale since May so those issues could be discussed.

"It looks like in my mind that they were trying to get San Francisco to address some of our concerns," Modesto Mayor Garrad Marsh said, "and they were not willing to do that."

The vote was welcome news to the Tuolumne River Trust, which argued that the sale would reduce flows below Hetch Hetchy Reservoir.

"We feel the water is best used locally in the river to improve the health of the salmon population," said Patrick Koepele, the group's deputy executive director. "San Francisco can meet its water needs through water conservation and water use efficiency."

In a letter to the MID dated Tuesday, SFPUC General Manager Ed Harrington said the sales would "maintain MID's existing supplies and result in no harm to resources in the lower Tuolumne River."

He added that San Francisco officials "remain open to further discussions."

MID board Chairman Tom Van Groningen said "anything is possible" in the future, but for now, the sales are off the table.

The income from the sales could have paid for an estimated $115 million in upgrades to the MID system. They include the small reservoirs that would free up the water for sale, along with connections between canals and replacement of the nearly century-old flume that carries the main canal over Dry Creek.

The income also could have covered the MID's estimated $25 million cost for a new federal hydropower license for Don Pedro Reservoir on the Tuolumne.

Tuesday's vote was a turnaround from the 4-1 vote in January to have the district complete negotiations on the first sale. Van Groningen and directors Nick Blom, Glen Wild and Paul Warda favored the move.

"I said all along I didn't care if we sold water or not," Wild said Tuesday. "I was concerned about paying the bills."

Van Groningen said he would like to form an advisory committee representing various interests to explore other ways to pay for canal system improvements. "We will have to direct our energy toward whatever it is we can do for a 21st century water delivery system for the farming community," he said.

The committee could include the Stanislaus County Farm Bureau. It opposed the San Francisco sales but has indicated that farmers could accept somewhat higher water rates to pay for a slimmed-down version of the system upgrade.

Members of the group's Young Farmers and Ranchers program went ahead Tuesday evening with a scheduled discussion of the San Francisco proposal.

Jake Wenger, a walnut and almond grower west of Modesto, said he did not like the idea that San Francisco would have had the "right of first refusal" on other MID sales. He also noted the 50-year term for the first sale and the lack of escape clauses for the district.

"The only way MID could get out of the contract is if the city and county of San Francisco let them out," he said.

Tuesday's open session of the MID board drew several critics of the sale, as has been the case in recent months even when the matter was not on the agenda.

John Duarte, who grows wine grapes east of Modesto, suggested that the MID sell water to nearby farmers who rely on uncertain groundwater supplies.

"It doesn't seem that there is any inherent logic to making water available to San Francisco during a prolonged drought when it's water we will need in a prolonged drought," he said.

Bee staff writer John Holland can be reached at jholland@modbee.com or (209) 578-2385.

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Legal threat, foes force MID to hold off on SF water sale vote

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EXHIBIT 26

GROUNDWATER CRISIS JANUARY 23, 2014 4:14 PM

Modesto Irrigation District blocks Oakdale water sale to SF, for now

HIGHLIGHTS

The Modesto Irrigation District, which dropped a hotly contested proposal to sell water to San Francisco two years ago, temporarily has stopped the Oakdale Irrigation District from doing the same thing. However, MID’s blockage could be removed someday when the district finishes creating a policy addressing highly controversial water transfers.

The Modesto Irrigation District building in downtown Modesto is seen here in 2011. Modesto Bee

By Garth Stapley - gstapley@modbee.com

The Modesto Irrigation District, which dropped a hotly contested proposal to sell water to San Francisco two years ago, temporarily has stopped the Oakdale Irrigation District from doing the same thing.

However, MID's blockage could be removed someday when the district finishes creating a policy addressing highly controversial water transfers.

With such a framework, MID could facilitate OID's deal with San Francisco, "and potentially much more," MID Board Chairman Nick Blom said last week in a "not yet" letter to OID leaders.

In light of news that OID is negotiating separate, much larger sales to wealthy water buyers to the south, Blom on Thursday said MID has not talked recently about shopping its water. But MID leaders do envision short-term sales sometime in the future, if the district can store up enough extra without hurting local farmers, Blom said.

OID has been talking about paying some of its customers to fallow their land and selling water that would have been used there to thirsty districts in the Fresno area and beyond. Because of the drought, OID might not have enough to spare from its mountain snowmelt via the Stanislaus River, but the district intends to pump more than 5 billion gallons of groundwater this year, or five times more than normal.

That could threaten the wells of nearby farms and residents. “If their plan is just to continue pumping, that’s not a good thing for anyone,” Blom said Thursday.

OID, an active player in the water transfer market, has improved its canals and other facilities with $51 million reaped in recent water sales, the district said in a “briefing paper” on its proposed deal with San Francisco.

In October, the OID board agreed to accept San Francisco’s $112,000 option, plus an undetermined fee for 730 million gallons of OID water in a one-time deal this year.

But the agreement depends on MID’s blessing because it shares a connection with San Francisco on the Tuolumne River, and OID does not. MID would give some of its allotment to the city and receive a like amount from OID through a canal connection near Albers Road and Dusty Lane, between Modesto and Waterford, and MID would get 10 percent of the option and sales revenue for its trouble, according to the OID pitch.

Similar agreements between the Oakdale and Modesto utilities date to 1917 and were used regularly to fulfill state government demands for better fish habitat in the Tuolumne from 1998 through 2010.

But this time, MID said “no,” at least for now.

MID leaders don’t want to trade their pure river water for OID’s canal water, which is tainted to some degree with tailwater, or leftovers after draining from Oakdale customers' farms. The MID board has not been satisfied, Blom said, with OID's assurances regarding water quality.

Further, MID is more interested in "a comprehensive agreement covering the long term" than in a one-time deal, Blom said in the letter. He also chastised OID for "inferring MID's participation in any water transfer" at OID meetings "or with the media."

Tom Orvis of the Stanislaus County Farm Bureau said it makes sense for MID and OID to "at least explore opportunities" for cooperation in a formal framework.

On Thursday, Blom said the MID board has not talked about paying customers to fallow their land. "To me, district water is there for your district and not for you just to sell. I'd rather keep growing here and not make as much money," he said.

OID General Manager Steve Knell could not be reached Thursday for this report. His district has sold water over the years to Stockton-area taps and to a federal agency boosting fishery flows. Last year, OID sold more than 13 billion gallons to irrigation districts on the southwest side of the San Joaquin Valley, including Fresno-based Westlands Water District. Those transfers were handled on the Stanislaus River and did not require MID permission.

Last year, OID offered to sell water to the Modesto and Turlock irrigation districts, and in another deal, MID agreed to sell water to TID. But all of those ideas were dropped for various reasons, including an uptick in TID groundwater pumping to augment its surface water.

MID's proposed sale to San Francisco fell apart in 2012 amid concerns over having enough for local farmers in dry years.

RELATED CONTENT

- Oakdale Irrigation District sets closed session to discuss water sale
- OID reveals proposal to sell water to Westlands Water District

MORE GROUNDWATER CRISIS

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EXHIBIT 27

NEWS OCTOBER 13, 2015 7:05 PM

OID reveals big-money water sale to outside buyers

HIGHLIGHTS

$11.5 million deal will help fish, farmers elsewhere and Oakdale Irrigation District finances, leaders say

Stanislaus officials stunned to learn of water transfer negotiated in secret

Candidates challenging incumbents say deal is perfect example of nontransparency

BY GARTH STAPLEY
gstapley@modbee.com

OAKDALE — Irrigation agencies in Oakdale and Manteca will reap $11.5 million selling Stanislaus River water to outsiders in coming weeks.

Sensitive to pressure from local farmers, government officials and media, the Oakdale Irrigation District kept the deal under wraps until Tuesday's announcement. It surprised some Stanislaus County leaders who had been urging OID to negotiate with local buyers during the ongoing drought, and angered candidates for the OID board who have railed on secrecy and called for transparency.

“This really is a rogue agency,” said county Supervisor Jim DeMartini, among many encouraging local deals. “With the (OID) board operating in secret and not being truthful in presentations, I’ll have a hard time believing anything they say anymore.”

> “
> **THIS REALLY IS A ROGUE AGENCY.**
> Jim DeMartini, supervisor, Stanislaus County

OID leaders defended the deal as helpful to all parties: state and federal wildlife agencies overseeing river conditions for fish, thirsty farmers in the Southern San Joaquin Valley and OID customers benefiting from a cash infusion.

“The end product is what we all wanted,” said OID General Manager Steve Knell. “It worked out good. And it’s no different from what we’ve done in the past.”

He referred to water transfers that have brought $50 million to OID in the past dozen years, helping to upgrade canals and equipment.

Knell noted that terms of those water sales were negotiated behind closed doors and announced publicly when deals were consummated. OID and its partner on the Stanislaus, the South San Joaquin Irrigation District, will present a summary of the current deal Thursday when both boards meet jointly in Manteca as the Tri-Dam Power Authority.

“We’ll explain the whole thing in the open,” OID board chairman Steve Webb said.

Although the negotiation-announcement pattern is similar, the agencies went a step further this time, approving in August a draft contract with obscure wording on a Tri-Dam agenda – not as separate boards, as was done with previous contracts. Also, OID officials said nothing of the deal during lengthy discussions about water transfers in meetings of the Stanislaus Local Agency Formation Commission, in a public debate in Oakdale, in a debate before Modesto Bee editors and in last week’s OID board meeting.

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> **IT WOULD NOT BE GOOD POLITICS FOR US (TO DISCUSS PUBLICLY) BECAUSE PEOPLE ARE GOING TO ASK QUESTIONS. WE AGREED WE WOULD DO IT ALL AT TRI-DAM.**
>
> Steve Knell, general manager, Oakdale Irrigation District

"This is very disturbing news," said Gail Altieri, a board candidate whose platform focuses on transparency. "We were told there was going to be no water sale, then they pull a stunt like this."

Linda Santos, a candidate for another OID seat, questioned whether the deal was handled on the Tri-Dam level "to circumvent those of us watching OID. It just irks me to no end. They don't have a right to sell our water unless we give them that right."

Both said opposition to outside water transfers helped prompt them to run for office.

Santos attended the Aug. 20 Tri-Dam meeting but saw no indication from agenda language that the joint boards were fixing to approve the water sale. The item read, "Discussion and possible action regarding a fall water release in cooperation with state and federal agencies."

Knell said that fulfilled the agencies' obligation under California open meetings law, but acknowledged that the vote was taken with no public discussion of terms of the pending deal, including price or volume of water to be sold. Tri-Dam later published meeting minutes indicating that the joint boards had approved a "contract to transfer water" under that agenda item.

The districts will sell 23,000 acre-feet of water at $500 per acre-foot, for a combined $11.5 million to split between them. The Stanislaus will swell with the extra water beginning next Tuesday.

Six days after the Tri-Dam meeting, Knell gave a lengthy presentation to LAFCO on OID's operations, including its history of selling water to outsiders, and outlined benefits to OID and its customers. Knell said OID had shopped extra water to eight local agencies but got no takers, for various reasons, as well as to five outside agencies. The last two, state and federal contractors, “will take as much as they can” and were “willing to work on an annual contract in the interim, till some of these water issues get worked out,” Knell said, without noting OID’s deal with those very buyers.

Three county supervisors – DeMartini, Terry Withrow and Bill O’Brien – urged Knell to negotiate with locals. All three came away from the meeting, they said this week, with no understanding that OID already had approved a multimillion-dollar deal with outsiders.

“Local farmers not in OID want some OID water, that I do know is true,” said O’Brien, whose county district overlaps with much of OID’s.

Withrow said, “There’s just no need for that water to leave this county.”

Oakdale-area grower Louis Brichetto has been at odds for years with OID despite having served previously as a board member. He said Tuesday that he has tried for eight years to buy OID water and said several others in recent years have, too.

His lawsuit threat earlier this year derailed an OID plan to sell water to Fresno-area buyers, based on environmental studies that OID failed to conduct. The district is pushing ahead with such studies in hopes of striking a new bargain next year, but needs no such document for the current deal, approved in the past couple of weeks by state and federal water and wildlife agencies.

"We don't want to beat up on the district," Brichetto said. "We just want to buy water, and we'll pay a premium for it."

Knell in August told LAFCO that growers in the Paulsell Valley southeast of Oakdale, such as Brichetto, would see land values instantly rise $15 million if annexed into OID. On Monday, Withrow said that reasoning made little sense to him: "What's that got to do with the water? Are you jealous of him?" Withrow said.

"I think a lot of bad blood out there is interfering with things that could benefit our county and we've got to get past that," Withrow continued. "We can't have old disputes preventing sound deals from being made."

Another of OID's prickly relationships, with the Modesto Irrigation District, stands in the way of dealing with other local agencies.

With the drought worsening two years ago, OID formally sought offers from MID and its partners on the Tuolumne River, the Turlock Irrigation District and San Francisco. At the LAFCO meeting, Knell said MID and TID "didn't want any part of it;" at last week's OID meeting, he said, "after meeting with MID, we decided there was no point in pursuing this."

Others, such as the Del Puerto Irrigation District near Patterson, would happily buy OID water but have no connection to receive it. MID could "wheel" the water, acting as a broker, by giving Del Puerto some of its supply from the Tuolumne and receiving in exchange a like amount from an MID canal adjacent to one of OID's. But that OID water would have traveled through OID farms, picking up impurities, MID said in a January letter to OID.

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> **THE ABILITY TO KEEP WATER LOCAL FOR LOCAL USES TO A LARGE EXTENT ... DEPENDS FOREMOST AND PRINCIPALLY ON THE COOPERATION OF MID.**
>
> OID staff report, Oct. 6 meeting

MID also wanted a commitment to develop a long-term water-swapping policy, but OID apparently wasn’t interested. “Our questions and concerns have yet to be addressed,” MID spokeswoman Melissa Williams said.

Last week, the OID board considered taking another run at shopping surplus water to local agencies, but decided to hold off because weather forecasts predict a wet winter. Webb on Monday said that issue was discussed as a response to comments made at a political debate two weeks ago.

Political machinations aside, the deal will bring $5.75 million each to OID and SSJID. The cash, Knell said, will help offset an expected $10 million budget gap over the past two years; with little water captured in dams, the districts are generating less electricity for wholesale to a private buyer, and have few other ways of raising income.

Because the districts have no claim on water stored in federally operated New Melones Dam each year after October, it’s possible that state and federal wildlife agencies might have released that water to cool the Stanislaus and attract salmon returning from the ocean to spawning beds, with no regard for OID or SSJID. That would have angered the districts, which in April formally agreed to conserve water for so-called pulse flows benefiting fish in the fall, at the request of the state and federal agencies, and a dispute could have resulted in an ugly lawsuit.

The deal gives credit to the districts while allowing them to sell the water to the San Luis & Delta-Mendota Water Authority, which has 28 member agencies on the Valley's west and south sides.

"We turned a loss into a benefit, not only for us but for the fisheries," Knell said. "We extended cooperation and are building on working relationships while other fisheries around the state are suffering."

O'Brien said, "You can probably justify the transfer, if they were just going to take it from us anyway; this way, they get paid for it. But we do have farmers still trying to buy this water."

Many farmers made planting decisions based on OID's action earlier this year to cut back on the amount customers typically get, imposing a ceiling for the first time in the district's 105-year history.

"They cut us (customers) back," Santos said, "because they wanted to make a water sale at the end of the season. I am so angry that this board thinks this is the way to do business."

Her opponent on the Nov. 3 ballot is board member Al Bairos, who was not reached for comment. Altieri is challenging board member Frank Clark, who said he had nothing to add to an OID news release touting cooperation among the various agencies.

Knell said the water sale will be explained in a portion of the Tri-Dam meeting labeled on the agenda as the general manager's report. The meeting begins at 9 a.m. Thursday in the SSJID chambers at 11011 Highway 120, Manteca.

Garth Stapley: 209-578-2390

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Water is vital for the valley farmers. OID is going to ruin the farmers while everyone just looks on and watches. Vote and make a difference.

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Which farmers Diane ?
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EXHIBIT 28

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SUPERVISORS VOTE ON ORDINANCE OCT. 1

Subhead:

Corrections:

Body Text:By next month, Stanislaus County is expected to have a long-awaited ordinance to restrict groundwater exports and prohibit the sale of groundwater outside the county.

The Board of Supervisors is expected to vote Oct. 1 on an ordinance billed as a starting point for preventing the adverse effects of groundwater overdrafting.

The ordinance has exemptions for local irrigation districts, but proponents said it will protect a vital resource by outlawing out-of-county groundwater sales and transfers that threaten to deplete aquifers.

County leaders asked their Agricultural Advisory Board to start working on an ordinance four years ago, after farmers in western Stanislaus County were exporting groundwater so they could irrigate their orchards near Firebaugh.

That type of transfer, which was not a water sale, would be possible under the ordinance if applicants for a permit showed the transfer would not hurt neighbors' wells or drain the aquifer, officials said.

Two supervisors praised the proposed ordinance because it would prevent an irrigation district from pumping groundwater to replace surface water sold to a buyer outside the county. That scenario was raised by the Modesto Irrigation District's proposal to sell water to San Francisco, which was dropped last year after months of fierce debate.

"Water is a precious resource in Stanislaus County," said county board Chairman Vito Chiesa. "We need to save every drop."

The county's initial attempt to formulate an ordinance was rebuffed by water districts and farming interests. The county made progress, however, when it brought in a facilitator to run meetings with "stakeholder" groups such as the Modesto, Turlock and Oakdale irrigation districts and the cities of Modesto and Turlock.

PRAISE AND CRITICISM

The resulting ordinance is praised for bringing the different agencies together but criticized for being watered down.

"We ended up with a lot of exemptions," acknowledged Supervisor Terry Withrow, who worked on the effort with Supervisor Jim DeMartini.

Withrow said the exceptions were needed to allow water agencies to continue certain practices that are consistent with sound use of groundwater. It would allow farmers near the county border to irrigate crops on contiguous land across the county line and allow pumping for conservation projects and recharge of groundwater.

Other language in the agreement grants an exemption for areas with a shallow water table, small wells that produce 100 gallons per minute or less, and the sale of bottled water.

People who violate the ordinance could be prosecuted on misdemeanor charges and ordered to pay a fine of as much as $1,000 or spend six months in jail.

The county Department of Environmental Resources will be responsible for enforcing the ordinance and will review any applications for permits to export groundwater.

Sarge Green, a staff scientist for the California Water Institute at Fresno State University, served as facilitator for the meetings with local groups. He said the ordinance is less restrictive than the rules in other counties, which require a permit for any proposal to convey groundwater.

By contrast, the Stanislaus County ordinance gives credence to the groundwater management plans of local water districts, Green said. Permits will be required only for activity that is not exempt.

Green said some transfers have value by helping to save crops during dry years or draining shallow groundwater that damages the roots of crops.

Jam Aggers, county environmental services director, said the permit process likely will include an environmental review, engineering data and a groundwater study. Staff is developing the review process for board approval Oct. 1 and could recommend that each groundwater export permit require approval from supervisors.

The ordinance does not address agricultural pumping in the eastern part of the county, which has affected residential wells and threatened to cause soil subsidence. Chiesa said the board will consider hiring a water expert -- either a staff member or consultant -- to work on a comprehensive plan to address those issues.

With millions of dollars invested in nut trees and vines, it's a hard problem to tackle. "You can't just stop people from pumping water," Chiesa said. But inaction by local government could lead to the state imposing rules on the county, he said.

RESTRICTIONS SUGGESTED

DeMartini said the county should consider limits on pumping in the eastern foothills or possible restrictions on tree planting outside irrigation districts. "Once the groundwater (in the eastern foothills) is gone, it's not a rechargeable system," he said. "That is going to be real controversial."

Stanislaus would follow 28 other counties in California in adopting a groundwater ordinance.

Officials hope to avoid the kind of groundwater crisis that's gripped another county. Last month, San Luis Obispo County approved an emergency ordinance that prohibits new irrigated crops within the groundwater basin near Paso Robles unless there's a water offset. The growth of wineries and vineyards there has reportedly dropped aquifer levels by 70 feet since the late 1990s.

Withrow said he wants to get other water districts and cities involved in the next round of policy-making.

"It's not going to happen overnight; I have no idea how long it will take," Withrow said. "We can build on this first ordinance and then address the issue with the relationships we built in the stakeholders group."

Bee staff writer Ken Carlson can be reached at kcarlson@modbee.com or (209) 578-2321.

Caption:

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2 Attachments

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If you wanted to get an actual copy of the front page, I would need to go into our physical archive to pull and print. I can proceed with this task if you like, and I would be able to send later this week. Let me know how you would like to proceed, the article is attached.

On Mon, Feb 6, 2017 at 1:32 PM, Carlson, Ken <kcarlson@modbee.com> wrote:

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> Mr. Carlson:
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>
> Your attention to this matter is appreciated. Thank you.
>
> --
> **Ken Carlson**
> Staff Writer

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EXHIBIT 29

FAQs

What is the status of the project?

The project was completed at the end of 2015 and is currently in operation. Find out more on the project website.

What's Carlsbad's role in the project?

The project is located in Carlsbad, but it is not a city project. The project's developer is a private company called Poseidon Water. The San Diego County Water Authority purchases the water and distributes it to water agencies throughout the region, including in Carlsbad.

The City of Carlsbad was very involved in helping this project get off the ground. Originally, the City of Carlsbad planned to buy water directly from Poseidon. When Poseidon could not secure financing for the project, the San Diego County Water Authority worked on a deal with Poseidon to purchase water from the desalination project and distribute it to water agencies in the region. This deal, called a water purchase agreement, was approved Nov. 29, 2012, by the San Diego County Water Authority board of directors.

Will Carlsbad get all its water from the desalination project?

No. The desalination project will provide about 7 to 10 percent of the region's water supply in 2020. Carlsbad Municipal Water District currently purchases all of its drinking water from the San Diego County Water Authority. The San Diego County Water Authority adds desalinated water to its water supply mix prior to distributing water throughout its water distribution system. Water purchased by CMWD is a blend of desalinated water and other imported water supplies.

What does the water taste like?

Desalinated water is very high quality and tastes much like bottled water.

Is desalinated water expensive?

Desalinated water costs more that our current imported water supply, but those supplies are limited, and the price is increasing. It is estimated that in about 10 years, the cost of desalinated water would be comparable to the cost of imported supplies, and it will eventually be less expensive.

Do Carlsbad residents still have to conserve?

Yes. Locally controlled water sources,like desalinated seawater help, but water conservation will continue to be a way of life in Carlsbad. Mandatory water use restrictions are currently in effect statewide.

What does the plant look like?

The project is two-stories high, located north of the existing power plant. The exterior of the plant was built to look like an office building rather than an industrial building, so it will be compatible with future redevelopment of the power plant site once the old power plant is torn down.

What happens when the old power plant is torn down?

Poseidon has always anticipated that the desalination plant would eventually outlive the power plant. Poseidon has acquired the first right to use the power station water intake and outfall facilities when the power plant shuts down.

What about the proposed new power plant?

A new, smaller power plant has been approved just east of the desalination project site. This project is currently under construction and does not affect the desalination plant.

Will the project cause growth?

No. Growth in Carlsbad and San Diego County will occur in accordance with land use policies. In Carlsbad, voters approved a Growth Management Plan in 1986, which limits the amount of building that can occur and sets aside nearly 40 percent of the city as open space. Regionally, SANDAG has projected that the county's population will grow by one million by 2030, with most of that occurring from births rather than in-migration. This project will help meet these projected needs and compensate for the expected cutbacks of supply from Northern California and the Colorado River.

What are the project’s effects on marine life?

The city took the initiative during the environmental review process to extensively study the desalination plant's impact to the environment. The city’s certified EIR concluded that the desalination plant can operate without significant impacts to marine life. In fact, since the desalination plant will withdraw from and discharge into the same seawater outfall pipeline that the power plant uses now, effects are essentially the same as current conditions. When and if the power plant stops using the seawater intake and outfall pipes, the desalination plant will continue to use them, subject first to approval of additional environmental review.

Does desalination require a lot of energy?

Carlsbad’s current water supply must be pumped from hundreds of miles away, over mountains, requiring significant energy. Although seawater desalination also requires energy, the desalination plant will be “carbon neutral” because Poseidon is mitigating the plant’s energy use.

EXHIBIT 30

City of Carlsbad
California

Agua Hedionda Lagoon

Located between Tamarack Avenue and Cannon Road, Agua Hedionda Lagoon allows active use, such as boating, water skiing and wake boarding, personal watercraft use, sailing, windsurfing and fishing. It includes three inter-connected lagoons, which are divided by the I-5 freeway and the railroad bridge. The lagoon is owned by Cabrillo Power 1 LLC.

The 66 acre outer lagoon, adjacent to the Pacific Ocean, provides cooling water for the power plant, shore fishing and is leased to an aquaculture company cultivating shellfish for a wide-ranging market. The 27 acre middle lagoon is home to the North Coast YMCA Aquatic Park. The 295 acre inner lagoon extends approximately 1,800 yards in a southeasterly direction from the Interstate 5 highway bridge.

The inner lagoon may be used for boating. Permitted crafts include jet skis, power boats and passive vessels, like sail boats and kayaks. In order to operate any vessel on the lagoon, visitors and residents must meet certain requirements and purchase either an annual or daily permit.

The inner lagoon has one point for public power vessel launching, the privately owned and operated California Water Sports, located at the northwest end. It features a dock, launch ramp, a water sports equipment rental shop and snack bar. Fees for daily lagoon use permits, boat launching and parking can be paid here. Public access for launching passive vessels is located at the south end of Bayshore Drive. The Bayshore Drive public access is for use of the beach along the shoreline and fishing from shore only.

The Agua Hedionda Lagoon Discovery Center offers public programs and outreach activities, such as exhibits, lectures and festivals celebrating the lagoon.

Before visiting the lagoon, be sure to review all rules and regulations.

For more information, visit the Agua Hedionda Lagoon Foundation.

EXHIBIT 31

Desalination’s Future in California Is Clouded by Cost and Controversy

ww2.kqed.org/science/2016/10/31/desalination-why-tapping-sea-water-has-slowed-to-a-trickle-in-california/

By David Gorn

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Once thought to be the wave of the future, desalination is proving to be a tough sell in California.

The idea of turning ocean water into drinking water has long held promise, but the dream of sticking a straw in the sea and getting unlimited clean water simply by opening the spigot of technology — that’s looking less and less likely here.

Scarcely a decade ago, when “desal” was relatively new to the state and optimism was high, there were 22 different proposals for plants up and down the California coast. Since then, Marin, Santa Cruz and other coastal cities have scrapped their plans. A tiny desal plant has been constructed in Sand City, north of Monterey, but only one significant project has been completed.

It’s in Carlsbad, 30 miles north of San Diego, and it’s the largest desal plant in the nation, built and operated by Boston-based Poseidon Water. Peter MacLaggan looks up at the giant building like it’s a monument to common sense.

“If you don’t plan for the future and ensure you have an adequate supply,” says MacLaggan, a senior vice president with Poseidon, “you’re going to find yourself in a crisis that costs a lot more than if you plan ahead and do it right.”

He says one of the reasons the San Diego area managed to get a desal plant built is because of its location at the tail end of the state’s water pipe.

“When you look at San Diego and where it’s located in the water supply system in California, it’s at the end of a very long plumbing system, 500 miles from its nearest source,” MacLaggan says.

That intensified the need for another water supply, he says. This plant supplies about 10% of the San Diego area’s water needs.

The sprawling Carlsbad desalination plant is the nation’s largest. It’s been online for less than a year but has been cited several times for environmental violations. *(Adam Keigwin/Poseidon Water)*

Environmental Costs

MacLaggan and other proponents hold up Carlsbad as proof-positive that desal works. But just 60 miles up the coast from Carlsbad, you get a different view; another one of these gigantic plants is proposed for a white expanse of sand at Huntington Beach.

Ray Hiemstra says this spot is the poster child for why desal *doesn’t* work.

“It’s going to kill marine life, pollute your water, increase your rates and most importantly we don’t need it,” he says.

Hiemstra works for Orange County Coastkeeper, a South Coast environmental watchdog. He starts to run out of fingers as he enumerates all the other reasons to reject the plant proposed for Huntington Beach. There’s an active earthquake fault here. It’s in a tsunami zone. And its elevation is so low that rising seas might inundate the proposed site.

One of the big problems with taking the salt out of seawater, says Hiemstra, is what to do with it after it’s removed; that highly concentrated brine typically goes back into the ocean. At Huntington Beach, you can see the outflow pipe just a thousand feet offshore.

“It’s right there,” he says, squinting and pointing at the surf line. “There’s a couple of surfers out there, right by it.”

The proposed Huntington Beach desal plant would use the outflow pipe from the AES power plant (background) to deposit salt residue (known as brine) back into the ocean.

When you increase the level of salt in the water, he says, even diluted to low levels, it disrupts marine life all around that spot.

“Anything that comes through here and realizes that brine plume and higher salinity, even a little bit higher salinity, it’s just going to move away.”

That area of less sea life and the water at the outfall can drift south, he says, affecting the food supply of the California least tern, a threatened bird living nearby.

And there’s another problem with putting water from a desal plant back in the ocean: it may have residue from the chemicals used to treat the water, such as chlorine.

‘There are some people who still hold onto it as the Holy Grail.’*Heather Cooley, Pacific Institute*

The Carlsbad plant isn’t even a year old but state officials have cited it a dozen times for environmental violations. That includes what they call “chronic toxicity,” from an unknown chemical used in water treatment that has been piped into the ocean. The company is still trying to identify, isolate and clean it up.

Expensive Water

Despite their severity, environmental concerns aren’t the main barrier.

“In general, one of the big challenges has really been the cost,” says Heather Cooley, an analyst with the Pacific Institute in Oakland. The nonpartisan research group recently issued a lengthy report on the state of desalination in California.

Beyond the environmental cost is the actual price tag: the plant in Carlsbad cost $1 billion to build, with a rough estimate of $50 million a year for the power to run it. The estimated cost of the water to San Diego is about $2,300 dollars an acre-foot — more than double the cost most Southern California cities pay for water. (An acre-foot is enough water to supply one-to-two California households per year.) And ratepayers need to pony up for that water even during rainy seasons when the price of water from more traditional sources plummets.

Cooley says the expense is the main reason communities have turned away from desalination.

“As many of these projects sort of went through the process and started looking more seriously at the cost,” she says, “there started to be concern that that was too high, that there very likely were other options.”

Those options include treating wastewater and putting it back into the water table, catching stormwater runoff, or simple conservation efforts. That’s the future most agencies are pursuing in California.

Cooley says desal used to be high on the list of possible water sources, but now it’s closer to the last choice on the list.

“There are some people who still hold onto it as the Holy Grail,” she says, “that thing you’re seeking that’s going to solve our problem.”

Now, six years into the drought and counting, the demand for water sources is only liable to intensify. That could set the stage next year for yet another fight over approval for the Huntington Beach desal plant.

Explore: Engineering, Environment, News, Oceans, Radio, Water, desalination
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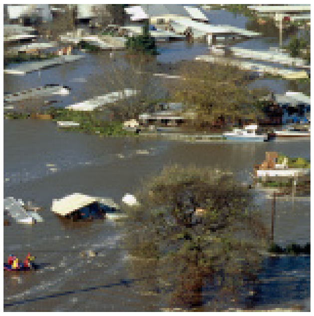

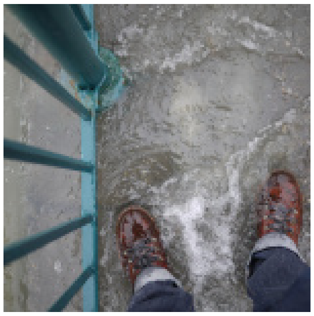

EXHIBIT 32

State's biggest desal plant to open: What it means

By **Bradley J. Fikes**

DECEMBER 13, 2015, 6:28 AM

Poseidon Water’s desalination plant in Carlsbad is poised to begin regular operations within days — decades after water officials first considered harvesting drinking water from the sea and 14 years after they formally took the first steps toward its construction.

The opening, to be celebrated with an anticipatory ceremony Monday, will be a milestone for the company, for arid San Diego County and for all of California.

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The San Diego region, which imports most of its water, will enter a new era in its quest for a reliable supply of this precious and increasingly pricey commodity. For the first time, a significant portion of its water supply will come from the sea.

Poseidon will sell the fresh water it produces to the San Diego County Water Authority, the region’s main provider. The authority will resell that water to retail districts that serve residents, schools and businesses. The Poseidon plant can create up to 50 million gallons of fresh water a day; that’s about 8 percent to 10 percent of the county’s overall supply.

For California, the Poseidon plant represents the mainstreaming of seawater desalination in California. Ocean desalination has long been used in nations such as Saudi Arabia, Australia and Israel, where the company that designed the Carlsbad plant, Israel Desalination Enterprises, is based. Israel's extensive use of desalination to conquer a seemingly perpetual drought has become an internationally recognized success story.

California may be poised to join the trend. About 15 other desalination projects have been proposed for the state's coastline, from the San Francisco Bay Area to Southern California. The figure doesn't include those in Mexico that would serve San Diego County to varying degrees.

And for Poseidon, successfully operating the largest desalination plant in the Western Hemisphere would demonstrate that large-scale ocean desalination is feasible in California. It could strengthen the company's case for building a similar facility in Huntington Beach.

View the photo gallery: Getting drinking water from sea

While desalination of brackish water has been common, seawater desalination has been mostly confined to niche applications where no other source of water is available, such as on Catalina Island.

Along with other steps that San Diego County officials have taken or hope to take, from buying water from Imperial Valley farmers to potentially recycling wastewater into tap water, ocean desalination could give the region greater control over its water destiny.

That prospect comes at a steep price: Altogether, the undertakings will cost billions of dollars. Business, agricultural and residential water utility customers will bear these expenses.

Water from the Poseidon plant costs about twice as much as water purchased from the Metropolitan Water District of Southern California, the region's largest water wholesaler.

Ocean desalination is also more expensive than the drinking water recycled from sewage, from which the city of San Diego plans to get one-third of its drinkable water by 2035. Previous city leaders rejected the option, fearing a public backlash over what some dubbed "toilet to tap."

San Diego Mayor Kevin Faulconer — urged on by regulators, environmentalists, the life-sciences industry and others — has decided that the need for water recycling is too great to continue passing it up. He and the City Council last month supported a multi-year increase in water bills partly to pay for expansion of the recycling infrastructure, which is expected to grow from a single-site pilot project to a network of filtration plants, pumps and pipelines.

NUMBERS

$1 BILLION: Final cost for the building project, which includes a 10-mile pipeline connecting the plant to the county's water-distribution system.

50 MILLION: Maximum amount of potable water (in gallons) the facility can produce each day; that's 8 percent to 10 percent of the county's entire water supply.

$2,000: Approximate cost of an acre-foot of water from the new desalination plant, which is about double what the Metropolitan Water District of Southern California charges for the same amount of water from its supply.

48,000: Minimum number of acre-feet of desalinated water the San Diego County Water Authority has agreed to buy each year, for 30 years, from Poseidon.

15: Proposed desalination sites along California's coastline.

Critics of the Poseidon plant in Carlsbad said its technology uses enormous amounts of electricity, harms marine life and locks San Diegans into a costly option that they could have avoided entirely. They said for years the region's elected officials and water managers should have put more stress on everyday conservation while being more aggressive in starting water recycling.

End of the pipeline

San Diego County has always been vulnerable to drought because it has little water of its own and is located at the end of the pipeline for imported water.

This vulnerability didn't hit home until the late 1980s. Until then, the Metropolitan Water District had proved to be an extremely reliable source of water. In most years, there was an abundance, and in lean years there was still enough to scrape by.

That changed with the severe drought of 1987 to 1992.

By 1991, Metropolitan board members were seriously discussing a proposal to cut water deliveries to its member agencies by 50 percent. Since the agency supplied about 95 percent of the water used in the county, that would have represented a ruinous cutback.

By contrast, the city of Los Angeles was less vulnerable. The city had secured its own municipal supply decades ago from the Owens Valley, and used Metropolitan water as a secondary source.

That 50 percent cut never materialized, thanks to the last-minute storms that produced what went down in history as "Miracle March" in 1991.

The county water authority resolved to get the county out of that vulnerable position by diversifying its supply. This included conserving water and securing supplies from outside Metropolitan. Ocean desalination became part of that mix of options.

The Poseidon plant arose out of two events at the turn of the century. One, Poseidon began a feasibility study in 2000 about building a desalination plant in Carlsbad by the Encina power plant, the location that was ultimately chosen. Two, the San Diego County Water Authority voted in 2001 to spend $50,000 to search for good locations for a desalination plant.

The Carlsbad site had the significant advantage of being able to piggyback on an existing seawater intake and return system, used to cool the power plant. That meant the desalination plant should have less of an environmental impact than at other coastal locations. Moreover, the city of Carlsbad was interested in securing the water.

Then as now, desalination cost more than other sources of water. But the difference had narrowed considerably by 2001.

In 1991, Southern California Edison shut down an experimental seawater desalination plant it built on Catalina Island. The desalted water produced by that facility cost about $3,000 per acre-foot.

In 2001, Poseidon reported having reduced that expense to about $560 per acre-foot, about 7 percent more than the $521 per acre-foot that members of the county water authority paid for water at the time.

An acre-foot is about 326,000 gallons of water — what two average single-family households use in a year.

Busting the budget

MILESTONES

2000: Boston-based Poseidon conducts feasibility study on building a seawater desalination plant on the grounds of the Encina Power Station.

2001: San Diego County Water Authority approves $50,000 in spending to identify promising locations for a desalination facility.

2006: Carlsbad gives OK to desalination plant. A coalition of environmentalists sues the city over that approval.

2008: California Coastal Commission approves the Poseidon project. So does the State Lands Commission. Surfrider Foundation and the Planning and Conservation League file suit against the Coastal Commission, seeking a reversal of the agency's decision.

2009: Another key agency, the San Diego Regional Water Quality Control Board, grants a permit for the desalination facility.

2012: San Diego County Water Authority approves a 30-year water purchase agreement with Poseidon. Financing for the project closes in December. Also, the final pieces of litigation against the project are resolved.

2013: Construction begins on the facility and surrounding infrastructure.

2015: Plant conducts test runs in November and December, leading up to Monday's scheduled start of normal operations.

In the early 2000s, the Poseidon plant was estimated to cost about $270 million, a figure that rose to $300 million, to $530 million and finally to about $1 billion. One environmentalist critic, Peter Gleick, named it one of the "zombie" water projects that would never get built, but never die.

However, the price for other sources of water also went up, and continued shortages of imported water drove home the desirability of a local source.

Now, 14 years later, the actual cost of Poseidon's desalination water turned out to be about $2,000 an acre-foot, while water from Metropolitan costs about half that. Plans for the desalination plant were changed, environmental mitigation added in, and energy costs to run the plant also rose.

Years of planning reviews and public hearings lay ahead, along with protests and lawsuits over potential environmental harm, along with a temporary halt to talks between the county water authority and Poseidon in 2006. This was prompted by a decision of the power plant's owner to replace it with a new facility that didn't need seawater for cooling. The switch made an environmental impact report based on the earlier assumption no longer valid.

"Please know that this board is fully committed to seawater desalination as an important water supply for the county, but we will no longer pursue such a facility in Carlsbad.," wrote then-water authority Chairman James Bond in an opinion article in the North County Times. "Rather, we will focus our seawater desalination efforts in other parts of the county and work closely with our member agencies on other local water supply projects."

At that time, it looked like Poseidon and the city of Carlsbad might conclude their own deal. But Carlsbad by itself lacked the financial heft the county water authority carried, essential for financing the project.

Poseidon pushed ahead, and in 2008 won a critical approval from the California Coastal Commission, which had previously been skeptical of the project. Other good news for Poseidon swiftly followed.

In 2009, the San Diego Regional Water Quality Control Board unanimously approved a permit for the plant, lawsuits against the plant were rejected and various local water agencies signed on to buy water from Poseidon.

However, those agencies struggled to conclude a workable deal, so they asked the county water authority to help. That agency stepped in, and after months of negotiations approved a term sheet setting the general conditions, followed by more negotiations. Final approval came on Nov. 29, 2012.

New environment

The three years since that approval have both confirmed and challenged assumptions that went into the desalination project.

Extended drought has confirmed that San Diego County needs more local sources of water to provide a reliable supply. But now that the water is available, local water agencies may not benefit as they anticipated — at least in the short term.

Under Gov. Jerry Brown’s executive order for the drought, water agencies must cut back an average of 25 percent from residential water use of two years ago. That mandate is strictly based on past usage, and doesn’t take into account any new sources of water that a region may have been able to secure.

The county water authority and other civic leaders said this arrangement is unfair, pointing to the billions of dollars they have spent on water reliability programs during the past 25 years. Those efforts have allowed the region to lower its demand for water from Northern California and the Metropolitan Water District.

Such investments should be recognized with lower conservation targets, the local leaders said.

Brown has given general assurances that he will make adjustments once the existing conservation mandate expires in February.

He hasn’t specified whether San Diego County’s water-reliability programs, including the new supply from the Poseidon facility in Carlsbad, will influence his calculations. And if the much-heralded El Niño storms don’t relieve the drought by January, Brown said he will extend the conservation mandate.

EXHIBIT 33

BAY-DELTA PHASE I STAFF

TECHNICAL WORKSHOP OF DECEMBER 5, 2016

TRANSCRIPT OF VIDEO RECORDING

Reported by: Amanda Johnson, CSR No. 13922

LES GROBER: Good morning. For those watching
on the web, we don't have a very big crowd here. So I

hope the crowds are on the web and are going to take advantage of being able to see all of this from the comfort of your office.

My name is Les Grober. I am the deputy director for water rights at the State Water Resources Control Board, and the topics for today's discussion are technical workshops. This is the first of two workshops. The next one is on Monday, December 12th to discuss the phase one update of the Bay-Delta Plan.

I am joined on my left by Will Anderson and Tim Nelson. They are water resource control engineers that are going to be doing the heavy lifting this morning, presenting a lot of material on the methods and results today for the water supply effect model and some other things.

I am going to have a 15- or 20-minute

presentation introduction that I am going to go into in just a couple of minutes. But before I get started, I would like to remind folks that in the event that we have an alarm, you should look around now and identify the exits nearest you, and if there is an alarm, you should take your valuables with you and use the stairways, not the elevators, and exit to our relocation site, which is kitty-corner across the street in Cesar Chavez Park. And if you can't use the stairs, the staff or someone will assist you to find a protected area.

So with that, welcome all. As I said, this is the first of two technical workshops. Some of you may have already participated in the first day of five days of hearing last week, on November 29th. The purpose today, however, is for staff to provide a deeper description and understanding of the models that were used to develop the Substitute Environmental Document, or SED, for the amendment of the water quality control plan, and that is for that phase one update having to do with San Joaquin flows and Southern Delta salinity.

We can answer questions to help interested persons prepare their comments both for the upcoming hearings but also for their written comments. So we have at least a couple of hours of direct presentation and PowerPoints to show our work and then opportunities after each session -- three or four half-hour sessions to answer comments.

Since we have a small crowd here today, I suggest you come on down to the front. We can make this less formal. So as we go through the presentation, if you have clarifying questions, we want to do what works for folks that are here to understand what we have done.

So the order of the day, we have this welcome introduction and overview followed by Gita Kapahi, the director of the Office of Public Participation, is going to describe some of her work, how she is going to be helping us today with a roving mic, and other things.

Then we are going to have the topics shown on the slide. First, the water supply effects model, the methods, and then the results followed by the temperature model and the HEC5Q model and results. Then in the afternoon, the ecological benefits and a closing session/next steps. Actually, I think the split is for some of the results -- some of the HEC5Q in the afternoon.

And I apologize now for those of you that were at the November 29th or other meetings, but just to make sure that everybody is on the same page that haven't been to those meetings, I have about a 15-minute introduction to just understand what the project is. So this is the update of the plan -- of two elements of the plan, San Joaquin River Flow Objectives for the Reasonable Protection of Fish and Wildlife and Southern Delta Salinity Objectives for the Reasonable Production of Agriculture and the programs of implementation for those objectives.

To show us where we have been, where we are, and where we are going, this time line shows a few elements that I will refer to in these introductory comments. You can see about in the middle, in 2009, that is when we issued the notice of preparation for this project. That is also when the Delta Reform Act was adopted by the legislature. That was followed by our preparation per the Delta Reform Act of the Delta flow criteria report, which provides much of the scientific basis for this as well as the 2011 -- well, and then we did a scientific peer review on the scientific basis for the proposal.

We released a draft SED in 2012. Comments were received. Based on the number of comments and the complexity of the comments and concerns, we took several years to recirculate a draft SED. We also had the intervening drought years. So that is where we are today, and we hope to get this back before the board for their consideration by summer of 2017.

So the impetus for this project is that for the current plan, as we have shown in the previous time line, the last major update was in 1995 with a minor update in 2006. We reidentified the need for an update because a lot of things have changed. Conditions have changed. We have had a decline of species.

With that decline of species, the Endangered Species Act has caused water restrictions because of

managing RPAs. That is on the Delta but also on the Stanislaus. Consistent with the administration's water action plan, that is one of the elements of that plan, to implement or obtain the coequal goals of reliable water supply and ecosystem protection.

So that is what this plan is really all about. It is doing that thing -- that balancing, if you will, with regard to San Joaquin River flows and Southern Delta salinity. The project area is shown on this map in a very schematic form for the flow objectives. It is the lower San Joaquin River; the three salmon-bearing tributaries -- the Merced, the Tuolumne, and the San Joaquin River -- leading to the confluence; then to Vernalis, where it enters the Delta; and showing a bit of the Southern Delta, just north of Vernalis and west is the Southern Delta. That is where the Southern Delta Salinity Objective applies.

A little bit more detail -- and I see we have several folks here from districts in the affected area, but the principal affected area is the San Joaquin River basin downstream of the confluence of the Merced River, including the watersheds of the Merced, the Tuolumne, and Stanislaus. And principally where the flow objectives would apply is in the valley floor parts of it, downstream of the Rim dams. And this chart shows a

number of the districts that would be affected by the principal effects of the projects, which would be the water supply effects.

So the purpose and goal, as I have already expressed, is the two objectives. And one is for the flow objectives, and the key word there -- it is about the reasonable production of fish and wildlife objectives in the San Joaquin River, and it is for the three eastside salmon-bearing tributaries. So that basically summarizes what the project is about. It is about those three salmon-bearing tributaries, and it is for the reasonable production.

Similarly, for agriculture, it is for the reasonable production of agriculture. I emphasize that "reasonable" because it is not about absolute protection. That is what the SED is all about. It is how you look at the costs and the effects of implementing these objectives.

This immediately begs the question of "Why do we focus on flow?" We are focusing on flow because scientific studies -- and a lot of that new information shows that that is the major factor that is relevant to the survival of fish, such as salmon. There are many benefits to flow. There is direct effects immediately, such as water temperature and increase in floodplain.

That leads to ancillary effects that can reduce the risk of predation, disease. It can increase the success and resilience of the species because of improvement in various life stages.

That being said, the board is very mindful of the program implementation and has many words about and speaks to the importance of non-flow measures. But this board has limited authority to require non-flow measures. But to recognize that, that is part of the successful implementation.

Just a couple of slides to show that flow is important. We have had these declines -- and why focus on the San Joaquin River? The chart here shows the difference in salmon abundance between two time periods:

the 1992 through 2011 time period, the more recent period, compared to 1967 through 1991. So it is showing the difference. A negative means there has been a decline.

Of all of these Sacramento River watersheds, the San Joaquin is the one that has had the biggest declines through those three. So it is really striking compared to successes elsewhere in the basin. This other one makes the point as well of showing how important flow is with regard to salmon production.

This chart is showing the returns of adult

♀ 9

salmon and the flow experienced by juveniles. It shows that by shifting what is on the right axis, the total tributary discharge. It is showing that for the two years prior to the returns, mindful of the life cycle of salmon.

And you can see a very strong correlation then between what is shown on the left, escapement, the returns of adults. They coincide with those flows. So flow is really that major factor. And as noted here, as you will see in a number of other charts and tables today, we make reference as appropriate to where the figure comes from in the SED, or Substitute Environmental Document.

So the board is also very mindful of how hard this is. This is getting to the crux of what the board does. It is the balancing. I had mentioned that 2010 flow criteria report required by the Delta Reform Act. That was a purely technical report that said if you weren't going to look at any of the other beneficial uses -- if you weren't going to look at the effects, the costs on other uses of water, what quantity of water would you need to protect fish, like salmon? And it found that 60 percent of the flow should be left in the San Joaquin River.

Unimpaired flow -- and "unimpaired flow," meaning that is the total quantity of water if you weren't diverting it or storing it in a reservoir. The current uses, as this analysis shows, are upwards of 80 percent of the unimpaired flow -- agriculture, drinking water, other things, consumptive uses of water. Sometimes when I say, "and more," some of that February through June period where we are proposing flow requirements, there can be unimpaired flow in the single digits. More than 90 percent of the flow is being taken out of the river.

So unlike this 2010 report, the current proposal -- the current staff report is intended to balance those competing uses of water. That is why the recommendation is for between 30 and 50 percent of unimpaired flow with a starting point of 40 percent. So this is a big increase, but still it is not the quantity of water that the science shows would be best if you didn't have to consider those competing uses of water.

So this is a hard thing to do. That is an understatement. But it is why we have five days of hearing including the affected area. That is why we are having these couple of days of workshops and additional outreach. It is very important for the board to make sure that we are communicating effectively both what the proposal is and the basis for the proposal.

We are showing our work. But it is because it is hard. It is just what the state water board has to do. It is one of the best things they do, the most important things they do. And because it is hard, the board also has crafted this in a way to encourage settlements so that we have a rather durable solution to the problem and not end up necessarily in court or arguing. But is there a better way to implement this that can make the best use of water?

When I say the proposal is wrapped around this, at the core of the proposal is this thing called "adaptive implementation," which means that we have that adaptive rain, that 30 to 50 percent rain, so that water can be used wisely, effectively, most effectively, and rely upon other measures that can achieve the narrative goals of fish and wildlife protection.

So it is not about just hitting the numbers but rather also about reasonably protecting fish and wildlife. This is why we have had outreach in the affected area because part of that settlement will come from the ground up, from those that are most familiar with how the systems are managed and how to best implement other solutions, non-flow solutions to fish and wildlife protection.

The Natural Resources Agency is the key driver that is leading settlement discussions, and they are looking for that comprehensive agreement. Not just in the San Joaquin River, some of this can be linked up with -- and they are also looking to how this can be achieved in the Sacramento River as well as it relates to our phase two update for other elements of the Bay-Delta Plan.

So to describe just briefly now what the proposal is, the current spring flow objective is just at one location -- the San Joaquin River. If you recall that graphic, it is at the San Joaquin River at Vernalis, and it is in the form of minimum monthly flows that vary by water year type. It includes a pulse flow mindful of the migration period in April and May of each year. But since it is only on the one location and it was implemented through water right priority, the Bureau of

Reclamation is the only responsible water right holder, which means most of the flows now come from the Stanislaus River, which is not optimal.

So in contrast, the proposal is now for the three salmon-bearing tributaries -- so at the confluence of each the Merced, the Tuolumne, and the Stanislaus River -- and the proposal takes two forms. It has a narrative objective that I referred to. So the ultimate goal is to achieve that narrative objective to maintain

inflow conditions from the San Joaquin River watershed to the Delta at Vernalis sufficient to support and maintain the natural production of viable native San Joaquin River fish population last migrating through the Delta. And that numeric portion, as I said, is that 30 to 50 percent range with a 40 percent starting point. And the definition, again, is that of unimpaired flow.

That critical element, adaptive implementation, which allows adjustment within that range in two different ways -- shaping that using it as a block of water through that February through June period so that perhaps it is the -- in a particular year, it is best to just have something to get the lower end of that range -- 20 percent, 30 percent -- and then bulk it up so that you have the equivalent of 50 percent at some later month to achieve something with more flow, something that is optimal for fish and wildlife.

It also allows for a portion of the flow to be shifted to periods outside of that February through June period. So it can be used to avoid temperature impacts, say in the fall. It has crafted to it the adapted implementation that would be guided by what we refer to as the Stanislaus, Tuolumne, and Merced, or STM, working group. It would be the implementing entity. That could also be the entity that would fall out from the

development of voluntary agreements or some settlement.

One of the first tasks will be the development of biological goals because that is all about what you can do to improve fish and wildlife protection, salmon specifically, in the tributaries without the concern for the effects of the Delta or ocean conditions. So it is about developing biological goals that are controllable.

It can be achieved just by manipulating flows and non-flow measures in the salmon-bearing tributaries. It also has elements of planning, monitoring, and reporting that would be covered within the STM working group. And as I said, voluntary agreements can be one in the same with the STM working group.

The current Southern Delta Salinity Objectives are now variable objectives where there is an April through August 0.7 microsiemens per centimeter and a winter non-irrigation season of 1.0 based on different salt sensitivities of different times. And there are four compliance locations, one at the San Joaquin River at Vernalis on the river system and three on the interior Southern Delta.

The proposal is to change it to -- and this gets back to that reasonable production of fish and wildlife. The science has shown that 1.0 year-round provides for the reasonable production and growing of all crops in the

Southern Delta, and it is also generally reflective of the current condition.

The other part of the proposal is to change the three compliance locations in the Southern Delta to water channel segments, including initially to do some analysis of how to best monitor salinity because the three current stations aren't necessarily most representative of salinity conditions in the overall Southern Delta.

The proposal would call for a continued conditioning of the bureau and the Department of Water Rights and specifically of the bureau to maintain that summer 0.7 millimhos per centimeter so as to provide a simulative capacity in the interior Southern Delta stations. It would also continue to require the department and the bureau to continue what they have been doing with regard to the operation of barriers and other measures to address the other impacts of the Central Valley contract and state water projects.

Other requirements include a comprehensive operations plan. That has to do with better understanding of how to best monitor and operate in that Southern Delta, including the maintenance of water levels and flow conditions that could affect salinity monitoring and reporting, and that initial study I referred to to understand initially the dynamics of water level flow and

salinity conditions.

It is worth noting that this is a package, these combined proposals, that the flow proposal would have the effect of increased flows in the spring months, the most important time for germination of many crops. So there is that incidental benefit of increased flows from the San Joaquin River that would provide improvement also in the Southern Delta.

So you are going to see a lot more about this later this morning and the rest of the day, but just to give a bit of -- lay a foundation for the modelling that was done, here we have a map of the affected area. And now imposing on it a schematic of the three major eastside tributaries, the Rim dams, the three tributaries from south to north -- Merced, Tuolumne, and Stanislaus -- and the San Joaquin River to the west.

The existing requirements are a mix of FERC requirements on the Merced and the Tuolumne and RPAs having to do a biop on the Stanislaus as well as these current Bay-Delta Plan requirements at the San Joaquin River at Vernalis.

So this proposal is for unimpaired flows -- a percent of unimpaired flow at the confluence of each of those salmon-bearing tributaries. So it begs the question of what to do. How do you model what -- this

seems to be a fairly simple system, but as you will see when Will will show some of his impressive slides, it can actually be quite complicated. How do you bring it back to be simple and actually crunch the numbers to do all of this?

So the tool that does most of this is what we call the water supply effect model. That is the core model. It does two principal things. It gives you output in terms of it shows the water supply effect, the reduced water available for consumptive purposes, principally agriculture. It also tells you what the new instream flows will be. So it gives you both what would be the negative effects, the impacts that could occur, and also the positive benefits with regard to fish and wildlife.

So on the right side, the CEQA impact analysis, it shows that you can develop the surface water deficit and make determinations about groundwater, run it through a model to see what kind of cropping would occur, and then in the end what would be the economic impacts. And then on the benefits side, you can see both floodplain inundation and temperature improvements.

I want to remind everyone here that this is a programmatic analysis. We use the quantitative information from these models to inform us what would be

the physical changes that could result from the planned amendments and have the potential for the impacts. And the principal resources that we looked at are river flows, reservoir operation, surface water diversions, groundwater pumping, and all of these are described in the SED in the chapters for the various resources and fish benefits because it is important. That is one of the comments that we got in the last round. It is like, "Well, this is all about the impact. Show us something about the benefits."

So this is part one of the technical workshop.

I am going to pause here now and introduce again Gita Kapahi to talk a little bit about how we are going to be running the meeting and have the roving mics.

GITA KAPAHI: Thank you, Les.

Good morning, everyone. I am Gita Kapahi. I am the director of the Office of Public Participation. I will be facilitating the dialogue today and at the second technical workshop next Monday. Again, as a reminder, we will not be discussing policy. This is a technical workshop.

Because there is so few of you, I think I am going to change things around a little bit and allow clarifying questions during the presentations. If it gets to be unruly, I may cut that and monitor the time and ask you to wait until the end of the presentation to make your comments. There are blue cards at the back of the room. For the clarifying questions, we don't need them filled out. However, for the others, I would like you to fill out the card and indicate the subject you wish to speak on. That way we can manage the comments at the end of each session. My job, again, is to keep you on track and on time.

A little historical note on the time line, in another life, ten years ago, I was chief of Bay-Delta and brought the 2006 update before the board. So that was a long time ago.

There are a few challenges. There is a holiday event going on. So the mezzanine area has tables. There will be about 600 people filtering through this area in the next little while, but they will start at noon. Our break is at 12:30. Hopefully, we will not be in conflict with that. There will be a couple of breaks during the day. And let me see. What else do I want to say?

Ground rules, please silence any noise-making devices. I have to do that myself. Please honor time. If you have a comment to make, if you could make it concisely. Use common conversational courtesy. All ideas have points and value. Our job here today is to make sure you understand the work that the staff has done

and why they have chosen to do what they have done, and that is it for that part of it.

Again, please, the cards, there are a number of them at the back of the room. This will help me manage the comments at the end of each session. There are four technical presentations today. When you are making comments, if you could please state your name and use the microphone. There are folks on the web, and we want to make sure everyone can hear you. I will have staff running through the room, bringing you a microphone. So raise your hand. I will take you in the order that I see you, and we will make sure that everyone gets heard.

That is it for right now. So we will turn it over to Will.

LES GROBER: Actually, just one more word. I just want to make a point very clear. This is a technical workshop so that we can answer clarifying questions to help you navigate the documents. But in terms of comments, we have five days of hearing -- and we have had one, four more coming up -- on the 16th, the

19th, and the 20th of this month and the 3rd of January. So this is to help you provide comments to make sure that they get before the board, you know, either in oral or written form with a comment period ending January 17th.

With that, I will turn it over to Will.

WILL ANDERSON: Good morning. Thank you for joining us. My name is Will Anderson. I am a water resource control engineer in the division of water rights. I have been with the State Water Resources Control Board for a little over three years now. And since I will be talking to you for quite a while, I will tell you a little bit more about my background.

Before working with the water board, I started my career in working with Tetra Tech in 2001 after receiving my bachelor's in science and engineering and civil and environmental engineering. And with Tetra Tech, I derived quantitative watershed assessments as a contractor for the EPA and state water agencies for the purpose of developing total maximum daily loads, or TMDLs as they are known as, the Clean Water Act analysis.

There is a similar kind of grand comparative analysis where you compare a baseline to other scenarios of gluten loadings to receiving waters. And to do this often requires watershed models, receiving water, hydraulic 1D, 2D, 3D models, as well as water quality models as well.

I moved to California ten years ago to South Lake Tahoe to continue to work with Tetra Tech in supporting the Hunt and Regional Water Quality Control Board in their Lake Tahoe TMDL and their integrative watershed management program. I spent a couple years with my boots on the ground with the resource conservation district implementing some of the erosion control VMPs that they have up in Tahoe before moving here and joining the division of water rights.

Can you hear me okay? Do I need to get closer? Is that working? Okay. There we go.

So the main thing I am going to talk about today is the water supply effects model; why this was derived; how it was derived; some of the changes, if you have seen an earlier version of this, from the 2012 SED; our definition of what is a baseline for the CEQA analysis and how we implement our alternatives; how instream flow requirements are established; and how they are evaluated and analyzed in the context of the lower San Joaquin River alternatives.

The characterization of surface water demands and how much water is needed for consumptive uses is an important driver for how much is available instream and how much needs to be balanced between the beneficial uses. And, finally, the allocation of water within the model is a little tricky to wrap your mind around as it was, you know, for anybody in there. And how this plays over from an individual year to an 82-year sequence and how allocation changes in the alternatives is one that we

are really trying to communicate today. So any kind of questions are very valuable to continue that conversation.

As Les showed, here is kind of a wider plan area, the three rivers, the three major Rim reservoirs -- New Exchequer to the south and Merced to Don Pedro on the Tuolumne River and New Malones Reservoir on the Stanislaus River.

We all know -- you know, I just want to add a couple more pictures to just give an idea of what we are getting into in a spreadsheet model. This is a picture of New Malones Reservoir at a very low state in 2015 at the Parrotts Ferry Bridge. This is a little shot of a diversion canal. This is the Oakdale south canal at Goodwin. And here is a photo of the Honolulu Bar restoration site on the Stanislaus. This is a good example of a non-flow measure increasing fisheries habitats.

So Les mentioned a little bit about the historical context or what the instream flows have been, and I have got a couple of slides that show that from 1984 to 2015. What we see here on the top bar chart, we have got in blue the unimpaired flow as estimated by the Department of Water Resources at the Rim Reservoir. And in red is the instream flow at the confluence reach, in

this case at Ripon on the Stanislaus. And these are total flow volumes from February through June, which will be the time that the alternatives will be implemented.

And on the lower chart is the actual fraction for that year's total, February through June, resulting instream flow at the confluence as a fraction of the total February through June unimpaired flow at the Rim

Dam. And we see that, for the Stanislaus, about half the years are well below the 40 percent level, and some exceed that.

So the fraction of unimpaired flow alternative would rise in the years that are below 40 percent to that level as a minimum. We have seen some commenters try to average multiple years and say, "Well, there is X percent over a 10-year or a 20-year or 30-year time frame," and we are really looking at the instream flow requirement for each month, February through June, in every year.

So this actually lumps the months together, if you parse the difference there between the monthly meeting a minimum of 40 percent and a total February through June 40 percent. But that is a minor detail. But keep that in mind. Here, we have the Tuolumne, as Les mentioned, in the single digits in the late '80s, early '90s drought down to as low as 6 to 8 percent of the Rim Dam unimpaired flow. There are a couple of low

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years, especially in the 2014, 2015 time frame.

We see those are about 75 percent of the years or at some point below the 40 percent level, and we also see about that characteristic on the Merced. And I am going to go through pretty quickly. I have a lot to go through. Feel free to raise your hand and say, "Stop" or "Go back," if you are still looking at something and I blow past it too fast. So same picture on the Merced, well below 40 percent in a lot of the years. I hope that that is clear.

So the water supply effects model that I am here to talk about today is essentially an Excel spreadsheet that evaluates the mass balance -- the water balance in the system. It is a monthly spreadsheet model that utilizes the calcium mass balance framework that many of you may be aware of. We use it to evaluate the effects of unimpaired flow for each lower San Joaquin River alternative. We have got our baseline -- which I will describe in detail to you -- of 20, 40, and 60 percent of unimpaired flow at the confluence reaches.

So unimpaired flow is not the same as inflow. We get this comment also that, "How can we compare the unimpaired flow at the Rim Dam to what is at a confluence?" There may be -- there definitely are additional inflows, accretions, and depletions below the

Rim Dam and above the confluence reach. Essentially, what this proposal does is uses that unimpaired flow estimate as an index for what could be in the stream at the confluence reach for the protection of beneficial uses, and that is an important distinction that I have got to clear up there.

And it is not trivial that there is accretions and depletions between the Rim Dam and the confluence reach. These do have an effect and can effectively -- when there is times when there is a lot of ample precipitation, you might have the tributaries' accretions contribute quite a bit towards that target, which means there may be less release required. And at other times, when there are minimal accretions, then that would require more release from the reservoir.

So the basic core of the WSE is the allocation scheme based on the demands for each of the major districts as well as some minor and riparian diversions at each node. We allocate based on the need from March through September, which essentially is the same as the way the New Malones index operates, if you are familiar with that.

You start with the reservoir storage at the beginning of March and you add what you are expecting for inflow for that, and that kind of gives you an idea of

your total water supply for the growing season. And we allocate some fraction of that after our instream flow requirement has been met.

Reservoir constraints are a key part of that, and a lot of my talk will go into how these work. We have guidelines for carryover storage, which is a modelling parameter that will essentially drive that fraction of allocation. It includes a fraction called the percent draw from storage, and these parameters work together to show what amount of supply is available.

In some cases, we have a minimum percent allocation to balance out the equation, which will give districts some minimum amount. So if for some reason there is a dry year but quite a bit of storage, you don't want to see that diversion delivery go too low all at once. It kind of balances it out.

And the last one is drought refill constraint. We found that if you go into a drought and your reservoir levels are extremely low, there is some benefit to kind of restricting or restraining diversions in order to let the reservoir build back up again. That will not only increase the cold pool but also give a little bit more reliability for the following year.

This is a diagram that we showed last Tuesday. It is a basic visual idea of allocating inflows to major

reservoirs, including the constraints, and basically between stream flow requirements and surface diversions. That is the main nut to crack here. If we are putting more toward stream flow requirements, that will undoubtedly make less available for diversions, and the storage dynamic is what the model is designed to assess.

Les already showed the chart and how the WSE model is the core of our effects analysis. We use it to evaluate the diversions that can be made and the alternatives which then leads to the deficit of surface water, applied water needs, groundwater use, which we will be talking about next month. So I won't be getting into too much detail about exactly how those are calculated. I am going to stick with the core model.

We are going to talk a little bit about the temperature model this afternoon. And generally when we run an alternative in a water supply scenario, we will have temperature model effects, and we would then maybe see some things that we would want to balance out, times where we see a reservoir going too low, and that causes the temperatures to spike. It will iterate and work with different parameters to get that final set you have seen published in the SED.

How did we come up with the spreadsheet model? Well, this predates me a little bit, and CalSim predates me by quite a lot. But, essentially, starting with the CalSim 2 model for the San Joaquin River basin, it essentially establishes a common assumption set of hydrology parameters of inflows, accretion, and depletions, and demands that was developed by the California Department of Water Resources and Reclamation. Many of you may have been involved with that in the past, but it is basically a mass balance -- what goes in must come out sooner or later.

This version of CalSim 2 was peer reviewed back in 2005. It includes 82 years of monthly records from 1922 to 2003. Those are water years. And it hasn't been updated since then. We are expecting CalSim 3 to come out imminently, we are told. But this 82 years of monthly records is the very best available set of hydrology that includes the entire three-river plan area in the lower San Joaquin. If you have comments about that dataset, that could be very helpful in writing to inform the work in the future.

The important thing about CalSim 2, the main mass routing that we have to work with is the inflow bound rating at each rim reservoir. So that is not the same as unimpaired flow. In the case of Tuolumne, it would also account for diversions by the city and county of San Francisco Chechenski (phonetic.) And in the case

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of the Stanislaus River, it would include different types of inflows to the reservoir based on upstream hydropower facilities.

It includes diversion demands. CalSim has an allocation scheme that we mimic in the baseline condition, and return flows are also a factor where they come back into the system. As I mentioned before, the local hydrology, the inflows, the accretion, and the depletions are key factors for those downstream reaches.

One last point about the CalSim overview is that scenarios are based on user specification. The hydrology set for CalSim 2 is essentially -- for our purposes, it is fixed. There are alternative versions of CalSim, though. But the scenario is made by user specification. So you may choose to run an evaluation of the upper San Joaquin restoration program. You may have a baseline that is before the biological opinion or with the biological opinion or with the biological opinion with an off-ramp where it doesn't apply in certain years.

The implementation of decision 1641 and different implementations of CVP contractor demands are all factors that the user specifies. So we have gone in, and we have a water board version of CalSim 2 that we use for our foundation of our WSE model.

So we showed this last Tuesday, also. This is

the grand schematic of the lower San Joaquin part of CalSim. Not to wow you with complexity, but each of these arrows represents a mass flow from one node to another. We have got the three inflows, the Rim reservoirs, a couple of stream nodes, and so on. I am going to break that down in a minute, but it essentially represents the physical system as we know it.

The three big reservoirs, the major regulating reservoirs, are an important part of the distribution system. We can see the five major senior districts and the two CVP contractors in San Joaquin County. Also, the Merced riparian and adjudicated water rights, known as the Cal agreement diversions, are an important part of the flow stream there.

If we simplify that spaghetti diagram a little bit, this is the CalSim 2 schematic with the three rivers with just the ins and outs. We will get into how we figure out what the demands are in a minute, but this is the basic hydrology, if you will, incorporating -- all of the blue arrows are -- the major ones at the top are the major inflows of the three tributaries. The minor blue arrows are accretions or depletions. The red arrows are diversions for consumptive use. The green arrows are return flows, and you can see how all of these will combine to result in flows.

These are average monthly flows for each stream reach between the nodes, and we will be evaluating the stream flows in the confluence reaches, which are the nodes between Ripon, Modesto, and the lower node on the Merced, Steavenson, and the San Joaquin River, respectively.

So the scenario that we have used at the water board in CalSim 2 incorporates the baseline conditions that, in our discretion, represent the existing environment at the time of our notice of preparation in 2009, and we include the pulse flow implementation and the Vernalis Adaptive Management Program, or VAMP. For the remainder of the spring season, we have the decision 1641 requirement at Vernalis for stream flow and salinity.

We have the 2009 salmonid biological opinion, reasonable and prudent alternatives, and also, if I recollect, requirements at the diversion dams. And these are the Goodwin on the Stanislaus, La Grange on the Tuolumne, and Crocker-Huffman Dam on the Merced River. Our CalSim 2 scenario also includes the surface water demands for irrigation districts as well as minor and riparian diversions at each node.

Just to step back up here, there are 17 nodes in this diagram. So it is very finite. Each one of those can be described in detail and has a monthly time series. The minor and riparian are fairly static from year to year. We generally deliver the full amount to those, and it is the senior districts with the largest demands that do experience allocation issues at times of shortage.

Let's go back here. So refinements that we have made since the 2012 SED, the original SED had used the department of water resources delivery and reliability report CalSim from 2009. We received some extensive comments from the U.S. Bureau of Reclamation that pointed out that they had made some revisions to this in their implementation of VAMP and the way that they implemented the biological opinion and also the specific amounts that should be allocated to the CVP contractors based on their contracts with Stockton East Water District and Central San Joaquin Water District.

So going along with using a new CalSim, we have done quite a bit of refinement to the water effect supply models since 2012. For one, it is continuous and year-round. Before we had done each year separately, and this time, instead of using a fixed demand for every year, we used the monthly variance demands from CalSim. And these were really the key linchpin in representing the variation between years.

You might have a higher district demand in a dry

year versus a wet year where precipitation contributes to meet that total demand. And CalSim conservative use components incorporate the fact to be of that total demand, and we use that pattern variation to build our total demand time series.

In the new SED, the water supply effects model compares the WSE flow alternatives for unimpaired flow to a WSE baseline, whereas before it was the water supply effects model allocation compared to CalSim baseline, which was a little bit of a hybrid approach that had some issues with that. So, now, we are more apples to apples.

In WSE, we now include FERC flows and a more accurate representation of the Cal agreement and Davis-Grunsky flows on the Merced. We have included consideration of the Stanislaus 1988 agreement between Oakdale Irrigation and South San Joaquin Irrigation with the Bureau of Reclamation, and we have also used data from the agricultural water management plans to characterize efficiencies within the district. And those are used to translate the consumptive use crop demand to the total surface demand required at the diversions.

I am going to describe that in further detail. It is important to note that the components of the water balance after diversions are used to create the total surface demand, but WSE only really evaluates that total

demand and allocation scheme. The specific components of the total demand are not used or considered by the WSE. So comments that inform how those efficiencies are used will be relevant for the groundwater analyses and the applied water shortage analysis that we will talk about next Monday. But the specific components are not used within the WSE once that total surface demand is calculated.

UNIDENTIFIED SPEAKER: What exactly do you mean by "the specific components"?

WILL ANDERSON: So I will get into that. So hopefully I will answer your question in a few upcoming slides. I will describe them for you now.

So the total surface demand at a point of diversion, or the other water diverted, has various fates, if you will. There is a component that may return to the river as an operational spill or a return. There is a portion that will be percolated from a regulating reservoir or evaporated from a regulating reservoir. It could be lost in a conveyance system to either, in some cases, riparian use, which is generally small, or percolated in an unlined ditch or evaporated. And there is a component that would be the major component. It is the beneficial use at the farm gate. But I hope that -- we will get into a little bit more detail about that.

And essentially we have evaluated the ag water management plan data to get an idea for how operations work and represented those in a generalized sense to translate what is needed at the field to what is actually diverted from the river. And so I hope that it will become clear as we move forward.

Just a snapshot of what the model looks like, it is a spreadsheet. It includes a time series of flow data from each arrow that we saw on the CalSim diagram, and then we will go and, you know, basically essentially do the math of what is available for stream flows and allocations.

The way we use it is a comparative analysis. That means that we have got a baseline scenario, which has certain conditions for the 82-year time period. So these conditions, such as decision 1641 and the flow requirements at Vernalis, did not exist in 1922 nor did the full build-out of the districts nor did the major Rim reservoirs. But for the comparative analysis, we are looking at what would happen based on this historical hydrology if the system were in place at the level of demand that we see in the 2009 time frame.

So this baseline again represents the existing environment in 2009, decision 1641 requirements, and VAMP. And, also, the biological opinion stream flow

requirements and the FERC stream flow requirements and comparing the alternatives of 20, 40, and 60 percent of unimpaired flow from February through June, we can see the effects compared to baseline of what the allocations will do.

We have included some in the latest version, an adaptive implementation of this 20, 40, and 60 percent of unimpaired flow, and there is a few different ways that works that Les has described. And one of these is that we shift flow to outside of the February through June period to the summer and fall. And the main intent of that and the alternatives is to offset, reduce, and otherwise eliminate the indirect effects and temperature impacts of reoperating the system.

So what happens if we allocate water to instream flow as well as water district demands? The reservoir could be lower, and that could cause increased temperatures in the project. And then in order to reduce that effect, we would have some additional flow, a fraction, which we have restricted to a maximum of 25 percent of the February through June flow to be allocated to other months. It doesn't usually get up towards 25 percent, but there is cases where that is a constraint.

So here is a visual for you of model comparisons and scenarios that I have described in droning in so many

words. Starting out with the water specified scenario of CalSim 2 with our baseline conditions, as I have just described, based on the Bureau of Reclamation's new and improved 2013 CalSim version, it was used to create the WSE model foundation, which is those baseline results, which is an 82-year monthly time series of each flow component.

Now, we have got the WSE model spreadsheet with all of the same parameters of CalSim, which creates our WSE baseline, which there is going to be some slides where we call it the WSE/CalSim, which is the best comparison of mimicking the CalSim system. There is times where we have adjusted a few of the demand levels to what we think better represents the system, and those are called the WSE/CEQA baseline, which is then used to compare the alternative results for the impacts. And so that keeps everything apples to apples.

We started off looking to CalSim to make sure that our representation of the system is consistent. If we have to adjust anything, then we do that apples to apples on the impacts analysis. Now, the changes are minor to the demands. It is just a little tweaking here and there based on the new and improved information of ag water management plans and, in some cases, district operation models -- the FERC operation model on the

Tuolumne as well as the Stanislaus operation model and the Merced operation model -- and it gives us a representation of demands in a way that was not available prior.

I am going to start off -- I am just going to dive in here to some plots of how WSE compares to CalSim. It looks like I am going to go a little over time on the first section. I have got about ten minutes. I am going to break for any questions and then move forward with that timing.

Now, let's see how this shows up on the big screen. Okay. This is a representation of stream flow on the Stanislaus at Ripon. This is the confluence reach, as we call it, the downstream point on the Stanislaus River. There is two traces on here, and these are monthly results for stream flow based on CalSim and our WSE baseline.

The CalSim is going to be the tan or orange line, and the WSE baseline is going to be green. You can see that they are both operating to the same stream flow requirements, the same excess flows, the same big flood in January of '97, which causes a reservoir spill. We can see that they do diverge a little bit in 2001, 2002, and 2003 just to show you that there is actually -- they are different models.

But you can see in this plot, which is the monthly total diversions for the Stanislaus River, again comparing the CalSim baseline to WSE baseline. And these are monthly values. We see them, you know, in growing season, a peak of diversions to meet water supply demand. We observed that in the '88 to '92, '93 drought that diversions are much less in CalSim, as well as in WSE, and they track very closely together with each other.

This next trace, which makes up the triumvirate of the mass balance here, is the storage condition of the New Malones Reservoir. Starting off in '85, '86, it is almost full. After a number of critical years under the San Joaquin index, it ends up being almost completely empty in '91 and '92 with a little bit of a refill in water year '93. It goes back down in '94, and then it will come up and eventually spill in a little later successive year. So the WSE baseline is tracking CalSim pretty closely here. The little red line at the top is the top of the conservation pool or otherwise in this plot denoted as the flood stage, though WSE doesn't go over that.

This is an annual summary of the diversion plot that we saw a couple slides ago. The annual total diversions from the Stanislaus River -- that includes Oakdale Irrigation District, South San Joaquin Irrigation

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District, the CVP contractors, Stockton east, and Central San Joaquin Water District, and the riparian and minor diversions along the Stanislaus River, which are a minor component -- added up for each water year from 1922 to 2003.

So this represents the core of the allocation where WSE matches baseline. We will notice a few of the years that have low deliveries essentially show where there is not enough in the system, not enough in the reservoir and combined with inflow to meet the diversion demands. Now, there are a lot of years that the demands can be met. We have a fairly high reliability in the baseline condition, and you can see that there is about a 10 to 15 percent variation between the wet and dry years. And that is important with how we characterize that total demand when we look at using the monthly CalSim core demand or the COAW demand.

So a little bit about some more of the exceedance plots that we are going to see for the rest of the day here, many of you, I'm sure, are familiar with exceedance plots, but this is that -- a way of rank ordering the data in the plot from smallest to largest, where the largest value, the maximum, is never exceeded. In other words, it is exceeded zero percent of the time. The 50 percent would be a median value. The minimum ever

observed in this system for total annual diversion delivery would be -- looks to be about 260,000 acre-feet, and that is exceeded 100 percent of the time.

I would like to point out that if we look at any percent -- exceedance on this plot, for example, at 10 percent -- or excuse me -- 90 percent exceedance would be the value at which 90 percent of the years would receive a greater diversion than this value, and 10 percent of the years would be less than this value. There is a very notable inflection point at about 94 percent. The four years in the 82-year sequence that had supply shortages are kind of the key factor that we are talking about when we look at allocations and any kind of scenario results of how does moving water to instream flow affect the inflection point where demands can't be met anymore?

Also, the whole left side of this -- so the 90 percent of the time that demands are met, there is quite a bit of variation, and again that is the wet versus dry year dynamic that I was pointing out before. If we see at the 90 percent level, it is a little bit more than 500,000 acre-feet for the Stanislaus River example. This is just one last way that we can confirm that the WSE model is comparing adequately with the CalSim model.

We are going to see a few of these today, the four exceedance plots in this configuration. The top left is the February through June total instream flow at the confluence downstream reach there. The top right is the exceedance plot of the reservoir storage conditions at the end of September. The bottom left is the diversion delivery exceedance plots that we were just looking at in the prior slide, and the lower right is a percent of that total February through June flow quantity as a function of the unimpaired flow index.

In this case, we see that the lowest years in the Stanislaus are around -- it looks like the lowest year is 10 percent, and then there is a bunch of years around 20 and 30 percent. The median is about 35 percent, but in some cases, it is higher than that. So the instream flows will see that flatten out.

So the next thing I am going to talk about is the way that we evaluate instream flow requirements in the WSE model, and I guess I am going to stick to our schedule here. I have got plenty of time to talk about the other model methods, but I can break here for any questions and then move forward if there aren't questions at this time on what I have covered so far.

BARBARA: Hi. This is Barbara. I am with MIMS. When you -- and I guess maybe this is coming out of a CalSim demand. On the Stanislaus, for example, when the conditions are dry, you mentioned that is where the water

supply effect is strongest. Is the amount of that water supply impact, is that determined in the model by basically when the existing agreements or FERC requirements run up against those reservoir constraints, and then that determines what sort of impact occurs in the modelling versus some other sort of fixed rule, for example?

WILL ANDERSON: And the short answer is yes, that the shortage to the diversion demand is a function of water availability both from storage as defined by the storage parameters and the amount of available inflow. And in the case of the unimpaired flow alternatives, there is that portion of -- the portion of inflow is reserved for instream use, and the remainder would be available for diversion. So there is the two components -- the available from inflow for the growing season and the available from the storage at March 1st.

BARBARA: And then, I guess, one -- and this is maybe in the modelling. So you mentioned earlier that looking at one of those confluence gauges, for example, that is where the current compliance point is. So let's say you saw 100 CFS there. The unimpaired flow, however that is measured, was, you know, 80 CFS, and you have got 20 CFS of inflow. Does the modelling account for the fact that, say, 20 CFS of inflow is sort of a freebie

from runoff, and so it is sort of not pulled out of the reservoir? Is that dynamic included in sort of the storage outputs?

WILL ANDERSON: Yes. For the alternatives --

BARBARA: So that is all built into the system?

WILL ANDERSON: Additional water would not be released to exceed the flow requirement.

BARBARA: Okay. Perfect.

WILL ANDERSON: So if you look at how much is downstream, then additional release would not be required if that is met by those flows.

BARBARA: Okay.

UNIDENTIFIED SPEAKER: One sort of similar question but upstream, when you are calculating the inflow -- you talked about inflow to Rim dams and unimpaired flow in your unimpaired flow calculation. That accounts for water that is captured upstream in other reservoirs; is that correct?

WILL ANDERSON: Right. The inflow time series is equivalent to the CalSim time flow series, which is not the same as the unimpaired flow, which would be the estimate of watershed flows upstream.

Did I -- am I getting to the germ of your question?

LES GROBER: Yes. So I think --

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UNIDENTIFIED SPEAKER: I understand there is a difference. Which did you use?

WILL ANDERSON: We use the inflows to represent the amount of available water for the baseline and alternatives analysis, the actual inflows.

UNIDENTIFIED SPEAKER: So when you took 40 percent of the "unimpaired flow," you are taking 40 percent of the flow that hits New Malones or Exchequer or Don Pedro in that February through June time period?

WILL ANDERSON: The index of unimpaired flow may not actually hit the Rim Reservoir in the case of the

Tuolumne. Some of that would be diverted upstream, but we only have the inflows to allocate to our instream flow requirement. In other words, we don't modify upstream releases for this analysis.

LES GROBER: But the index is based on the unimpaired flow. It is looking at the total quantity of water. So it is not a percent of the inflow. It is a percent of the index, which is the total quantity of unimpaired water flow.

UNIDENTIFIED SPEAKER: Okay. That is what I wanted to know.

MIGUEL MATEO: Miguel Mateo with the Merced Irrigation District. Just a simple question on -- any reason why you chose 2009 as your demand year for your baseline?

WILL ANDERSON: Well, from my perspective, this is actually -- it goes to the CEQA requirement to evaluate the existing environment at the time that we made the notice of preparation. So if we are evaluating the total level of demand, we essentially have to evaluate multiple years within the modern context. So that could be the day that we have from the ag water management plans. It could be partially information by the reclamation evaluation by the level of demand that they put in the CalSim.

So 2009, that is the target, but we don't have enough data from one year to explain the total dynamics and demands in every year. For example, the hydrologic condition in 2009 would not form the entire 82-year simulation. That would include years of other conditions such as -- I don't know exactly what water year type that was. But I hope that answered your question.

MIGUEL MATEO: It is just because 2009 comes after two critically dry years. So it may skew the demand because usually after two dry years, the demand could be lower than the average.

WILL ANDERSON: Well, we didn't use -- so 2009 is the evaluation context, but we don't just look at the demands in 2009. We looked at, actually for the case of

Merced, the total sweep of all diversions that are represented in that model as well as the amounts of diversions that are shown for every year that the data is provided in the ag water management plans. And we have to kind of look at both of those and decide where to land on that.

And I will talk a little bit more about that in upcoming slides.

MIGUEL MATEO: Thank you.

UNIDENTIFIED SPEAKER: So, Will, you are saying that 2009 is basically the regulatory framework? You are using hydrology from '22 through 2003, but 2009 is just the regulatory framework within which the hydrology is moved through the system; is that right?

WILL ANDERSON: That would be the context for the baseline stream flow requirements, yes. I think that gentleman was asking more about "How do we get demands from that year?" And for demands, we have to look at multiple years to assess the 2009 level of demands, if you will.

UNIDENTIFIED SPEAKER: Right. The land use that was in existence at that time.

WILL ANDERSON: Right.

UNIDENTIFIED SPEAKER: Okay. Thanks.

BARBARA: While the microphone is passing me,

one question on, maybe, a follow-up on this unimpaired flow question. I am thinking about how the STM working group might implement this kind of framework. On a day-to-day basis are the -- like on the Stanislaus again, for example, is that NML gauge that is available on cediac, is that FNF, or full nature flow column, is that equivalent to an unimpaired flow, as you guys analyzed? And is it close enough -- if you could just comment on where, for example, an unimpaired flow value in realtime might come from, that would be helpful. Thanks.

LES GROBER: It would be gauges like that. With that being said, those familiar with the data know that they can be kind of problematic once you are trying to determine the full nature flow on a daily basis. So there is some work and determinations to be done to make sure that the information on the seven-day running average is good enough. Because since unimpaired flow is, you know, partly a calculated amount, "Is that the sweet spot?"

You know, I think when we went out the last time, we talked about a 14-day. And there is that tension there. You know? We want to be able to have a short enough time period to be reflective of the peakedness, which is important, you know, for biological function but not make it so short that it becomes unmanageable in the implementation.

So I think that is a fair comment to raise here, but the bottom line is we use the best available information for the modelling, which tends to be the monthly numbers. Distilling this down to the daily is going to have to be something that we work on in the implementation.

VALERIE KINCAID: This is Valerie Kincaid. You showed the difference between the WSE and the CalSim baselines on the Stanislaus. I guess I have two questions. One, can you explain how -- the difference between the CalSim baseline and the WSE baseline, not just in results but how you created or how those -- the inputs, I guess, to those two calculations would change?

And, secondly, do you have a comparison of the difference between the two baselines on the other rivers?

WILL ANDERSON: So for the first part, the differences between the two are because they are different allocation equations. I am not trained as a CalSim practitioner so I can't explain exactly how the code would evaluate the available flow and allocate that, but the WSE model closely matches what we see in the baseline based on the reservoir constraint parameters.

So if you look at the -- rather than a huge optimization equation that CalSim might use, we have a

very simple method that allocates available water based on the reservoir constraints that we will talk about. We will walk through the allocation, yes.

So part two is, am I showing other results? I am not showing more CalSim versus WSE in the presentation today. We have documented that in appendix F1 for the other rivers, essentially for the same slides that we have been looking at here. And if there is something that is not there, we would be happy to provide it to illustrate that.

VALERIE KINCAID: Well, are there different reservoir constraints in the WSE versus the CalSim 2 for any of the three tributaries?

WILL ANDERSON: In the WSE model development, the constraints or the carryover guidelines plus the maximum draw from storage are essentially an imperial interpretation of CalSim's allocations. So these are the parameters that we have developed from looking at what

CalSim does in those situations, and we have essentially matched it pretty well.

I don't know if that answers the question, but it is -- they are imperial grammar. So it is not -- I am not -- I will have to get back to you on what the exact carryover storage requirement would be in CalSim, but essentially we see that the behavior is the same. So if

it looks like a duck and walks like a duck, it is kind of like it is pretty close to a duck.

VALERIE KINCAID: Okay. Thank you.

GITA KAPAHI: I am just going to remind the speakers to identify yourselves, and then if there is a follow-up, if you could provide a card so that we can make sure that we get back to you. Thank you.

AMY KENDALL: Amy Kendall, ACR. My question is about carryover storage. Are you going to be going into how the alternatives were developed in the later slides?

WILL ANDERSON: I am going to show where we landed on that and some of the way that that works. So I will come up to that point.

Okay. Well, if there are no further questions, I don't know -- now would probably be a good time to take a short break, if that is okay. Maybe 10 or 15 minutes.

GITA KAPAHI: So I will just open it. Are there any other general questions on this -- on the presentation so far?

WILL ANDERSON: I can actually go -- if we want to hold to the schedule, I can do 15 minutes and then do --

GITA KAPAHI: Why don't we take a break.

WILL ANDERSON: Okay.

GITA KAPAHI: And then we will come back at a

quarter to, and then we will resume with the presentations. Thank you.

LES GROBER: By that clock there?

GITA KAPAHI: Yeah. By the clock at the back of the room.

WILL ANDERSON: Thank you.

(Whereupon a break was taken.)

LES GROBER: It is 10:45. We would like to get started since we have a lot of material, please.

GITA KAPAHI: If we could have everyone take their seats, please, we are going to resume. Thank you.

LES GROBER: We were handed a card during the break on a question regarding carryover storage, how it was determined for the alternatives. That is going to be covered in some of the presentation that is coming up. So we will go through that, and then if the question is not answered, we will return to it.

So Will --

WILL ANDERSON: Okay. Thanks for coming back. I hope to have you on the edge of your seats here for the next part in talking about the instream flow allegations and the actual allocation scheme there.

So the next topic is on instream flow requirements, and so basically for baseline, we have got our biological opinion at Goodwin. We have got FERC flow requirements at La Grange on the Tuolumne, Shaffer Bridge requirements, and both the FERC-Cowell agreement and DFW Davis-Grunsky flows on the Merced. And we have got our 1641 requirements in Vernalis for flow insalinity as well as the spring pulse flows, which are lower than the base decision 1641 in VAMP implementation.

So the proposed flow requirements of the confluence of each major tributary -- once again, I am going to show the effects or the components of the flow to meet each of these flow requirements at the three UF denoted reaches here. Basically below Ripon, below Modesto, and below Steavenson.

This is a shortened diagram of how the stream flow target allocation works. We have got the major Rim Reservoir upstream diversions at the major diversion dam and your return flows or local inflows that may occur downstream of that above the target reach.

Now, in this case not shown on here, there could be additional inflows at La Grange, or, you know, in the case of Tulloch, there is certainly some major inflows that happened there. But this is a simplified diagram. We basically look at the target, evaluate available water from all of the inflows, calculate the diversions that are available and -- oops. There is a typo there -- reservoir release to meet the target.

So just for a little comparison of the proposed 40 percent unimpaired flow requirements to what the 2009 requirements are, in this case, we have got -- on the Stanislaus, we have got a biological opinion known as the appendix 2E flows, and we are showing on here the results of instream flow requirements for critical years on the low end. This is an average of the critical years that we have evaluated and for wet years on the high-end items. And those are the solid lines.

The dotted lines are the 40 percent of unimpaired flow requirements for February through June. The lower end is the average of critical years, and the higher end is the average for the wet years according to the San Joaquin 60-20-20 index. You can see that the critical year increase for 40 percent unimpaired flow is a minor but substantial increase to the RPA flows and that they are both above the existing 2E flow requirements.

For the Tuolumne, we are operating from the FERC settlement agreement flow requirements, which also has a year-type designation. They have both a spring and a fall pulse flow requirement. And in general, the 40 percent of unimpaired flow is always going to be higher than the baseline. Likewise, for the Merced, there is a combination for FERC and the Davis-Grunsky requirement,

which actually comes into play at Shaffer Bridge, but this is the downstream. Actually, that is the literal requirements comparison, and we see that it is a much greater instream flow requirement.

So just a word about VAMP and the latest implementation of WSE including the San Joaquin RGA implementation. This is the double-step VAMP. Basically, if you have a couple dry years, it doesn't increase the requirement. But it basically takes over for the decision 1641 pulse flow from April 15th to May 15th, and that is in the model.

Just a picture of results, we showed this slide on Tuesday, and it is an example of the Tuolumne flows from the 1990 water year to '95. The red line is the baseline scenario based on the flow requirements that we have seen, and the dotted green line is the 40 percent scenario. The blue line is the unimpaired flow index at La Grange, as you can see from the dotted green line where more flows would be required.

Now, components of that flow -- and I want to see how this looks on the big screen here. It looks like the colors come into play pretty well. This is actually, "Out of the instream flow requirements that are met, what is the source of that flow?" In the light blue or the cyan on the base of these bars, these are monthly instream flows and CFS on the Tuolumne River at the Modesto reach. Cyan is the local inflows and accretions. And the red portion represents the additional flow that would be released to meet or maintain that instream flow requirement.

We see in '93 that there are actually flood control releases. In WSE, this would be where the reservoir volume would exceed the top of the conservation pool. The model will release that flow as a spill release.

Now -- go ahead.

ART GODWIN: Art Godwin. Are these all model flows or are these --

WILL ANDERSON: Yes. So this is now breaking down in the water supply effects model what is -- in the model universe, what would be occurring to meet the baseline flow requirements, and I am going to show 40 percent in a minute.

ART GODWIN: So if we had these requirements from 1990 to 1995?

WILL ANDERSON: That is correct, yes.

ART GODWIN: Okay. And then on the -- so on the Tuolumne then, are you using the flow requirement that was in existence from 1990 to 1995 or the one that was post '95?

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WILL ANDERSON: No. This would be the FERC settlement agreement of '95 that we are using to represent the baseline condition. So we are going to have 82 years of flows to meet the existing regulatory requirement for our baseline scenario, if that makes sense.

ART GODWIN: All right.

WILL ANDERSON: So I think these flows are actually greater than what actually occurred in '95.

So now I am going to switch to 40. So it is like the optometrist that gives you a different lens and says, "You know, how does that look?" The green here represents the flow releases that are to meet the 40 percent of unimpaired flow requirement, and that is in addition to or in lieu of the baseline flow requirements.

So if it is greater than the baseline flow requirement, it is shown as "all" to meet the 40 percent of unimpaired flow. In the other months that are not

February through June, you will see that the existing baseline is still in effect. And so these are -- I will go back and show you the baseline, and now we have the 40 percent flows. We can see what months these 40 percent instream flow requirements are and the reason for them.

We actually have a good amount of flow shifting, which is also light blue. But in the water year '93,

this is the case where some of that big flow also was moved to fall to reduce the indirect effect of lower temperatures when there isn't spill in the 40 percent alternative.

So next I am going to talk about the characterization of the irrigation district's diversion demand. And I am just going to show a couple of examples. The numbers that we have shown in appendix F1 -- and I would be happy to answer additional questions about this part. We are going to get into greater detail on this when we talk about the components from diversion to available applied water and how groundwater substitution works into that on next Monday's workshop. I will just give you a brief preview of the considerations that have gone into this.

Again, we have got the five major senior districts, CVP contractors. We have got a representation of a demand for each one of these. One of the main data sources other than CalSim, we have used the ag water management plans from 2012 as a basis for better understanding district operations, kind of the fate of the diverted water as we discussed earlier, the specific attributes of the conveyance systems, and what the efficiencies are there.

So the demand parameters, how we get from total

diversion, the components are maybe -- in some cases, municipal deliveries, seepage from regulating reservoirs, the minimum annual groundwater pumping offsets demand so we won't need to divert that surface water. There are areas where they may not be hooked up to the conveyance system, but they can be district lands. That would reduce that demand in accordance to that estimate there.

The model has been in development since the 2012 SED, and the 2015 plans are more recent. So we haven't incorporated all of the data in there.

LES GROBER: But we did do a query updating with more recent information in 2015; is that correct? Not necessarily for all of the system elements but for some of the data.

WILL ANDERSON: Right. For the WSE model, we were able to, you know, complete the WSE model level of demand analysis prior to the 2015 ag water management plans coming out. However, for the groundwater assessment, we did have to take a look at what happened in 2014 and some of the greater use in that time frame. So it is not for the WSE model, but for some of the other analyses, it was used. So just the depercolation fraction and distribution losses show actually how much was used as applied water there.

Here is just a picture of the generalized water balance with the simplified components that we have used. I know if you are operating a water district, it looks a lot more complicated than this, and it might have a lot more components. But we are interested in what is diverted from the river, how much might be lost through evaporation, how much is used for municipal use, how much is used for applied water and otherwise may be contributing to percolation of the groundwater basin.

For the WSE model, we used the CalSim monthly consideration of consumptive use of applied water. In other words, the crop ET requirement. And essentially we have to translate that to what is needed for surface water diversion. And we found that we tuned our diversion amounts to match what we think the level of demand is there.

This is an illustration of the raw CalSim consumptive use needs for each district for the 82-year time frame, and it is based on climate, so crop needs based on whether that is a wet or a dry year. You see a demand that goes up and down accordingly. And this you can compare back to our total diversion plot for 82 years where we saw a few shortages there, but it otherwise will follow the same pattern. And this is really key.

Here are illustrated some of the components of surface water diversions. And this is what I mean by ag

water management plan parameters. We have to generalize an average of whether it is going to be applied water for crops or depercolation, what are the reservoir losses, and so on. And then those are then translated into the total diversion demand, which changes from year to year and even month to month. According to this pattern, we then have what the fate of what that water is. And so when we have shortages, we know kind of what is the fate of the shortage, if you will.

So to summarize that, just because it is a brief snapshot, we go from the CU, consumptive use, of applied water crop requirements to generalized efficiencies in that diagram and form the data that we have evaluated. We have got the minimum pumping from the management plans as well as some information requests that we have sent out to get an idea of what is the low end of the pumping that offsets that demand in every year.

And then we adjusted this consumptive use demand from about 9 to 15 percent based on the efficiencies in here to get the total surface demand as our level of demand. We think this is the most reasonable match with the operations models and the historical range where we think it should match the historical range. In the case of the Tuolumne, we would not expect it to match the diversions of the 1970s. It is a little lower now.

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But we use CalSim and ag water management plans and the office models all to inform us of what is the total demand -- level of demand. And we can't represent this just with the ag water management plan data because there aren't enough years, and as was pointed out, we can't just use 2009 as a basis. We have got to look at a whole spectrum of water year types and conditions.

So next, the moment you have all been waiting for, talking about, "How do the reservoir constraints work?" And I will attempt to illustrate this. I have scratched my head and thought, "What is the best way to describe this?" Essentially we have got the end of September carryover storage guidelines, which is not a hard and firm requirement. It is a guideline that works with the additional parameter of what fraction can be taken from storage, and both of these work to mimic the CalSim time series. And, also, alternatives add additional constraints to what can be diverted. We also have the minimum allocation fraction, and this will essentially keep allowable diversions from going to zero in some years but then will draw down the reservoir below the target. Again, these were developed empirically.

And then for the alternatives, we have got the drought refill provision, which will also constrain diversions in order to give a boost to the reservoir level so that it can meet carryover guidelines in the future. And that comes into play when there is a very low reservoir level and there is a lot of inflow. It will then kind of be a constraint -- it will be a maximum allocation for that year. It only comes into play in a few years, but kind of coming out of the drought, you will see the benefits of that.

Just an example here of the extreme variability that we are aware of. This is the available water and the 40 percent alternative for the Tuolumne River. Total volume that is available for diversion after the streamflow requirement, available from both storage and from inflows, can be a very low number. If inflows are very low, 40 percent of that is already going to the alternative. It can be a very low number.

Also, with extreme variability, we can see up to 3.5 million acre-feet, and maybe that is in 1986 or '97, one of the big years. But the median available water meets the total surface demand, which we see the range of the total surface demand is based on the wet and dry year types. So in most years, we will have a reliable supply essentially.

The way this is calculated is similar to the New Malones index as a basis for a starting point. We calculate the amount of storage in the reservoir at the

end of February or March 1st and the anticipated inflow. We have got a perfect foresight. So we know what happens in CalSim, what is going to be inflow available from March through September. We then consider the reservoir constraints, the end of September guideline, and the percent draw from storage parameter -- and those both work together to get that allocation number. Then we subtract the streamflow requirements from March through September. So our flow requirement is February through June, but it will have certain requirements. In addition to that, the baseline requirements, et cetera, what is required to be instream is deducted from the inflow essentially. If there is sufficient water in the available calculation, then district demands are met 100 percent. If there is not enough, then diversions are curtailed.

So another way of restating that is we determine the streamflow requirement first, and then we determine the available water from the inflows after the requirement is deducted. We have got the available water in storage, and that is after the end of September carryover guideline and the percent draw are factored in. Then we have to compare that to the growing season demand, being the total surface demand from March through September.

And then that allocation is the fraction of the diversion available. It is a fraction of that total growing season demand. So that is basically a percent of demand met for that growing season, and it continues through the next February of the irrigation year. So this is an example that I have put in appendix F1. As for the Stanislaus River in 1990, which was a critical year after a couple of critical years, we have got a fairly low reservoir storage at 657,000 acre-feet but only 310,000 expected as inflow from March through September.

If we take the -- let's see if this shows up here. Oops. All right. That didn't go but same as looking at it here. Looks like some things fell off the slide. Oops. All right. Well, a lit bit of technical difficulties on this one.

Essentially, on the left, we have got the end of September guideline at 85,000 acre-feet. We see in '91, '92 extremely low levels in New Malones and some effects of that. But essentially more of that, as shown in the hatched part of the bar, would be available for diversion. Take 80 percent of all of the storage down to that carryover guideline and compare that to when you have a higher guideline on the right -- in this case, 700,000 acre-feet. It makes much less available for

diversion.

Also in that alternative of the available draw would be 50 percent of that amount in storage above the guideline as well as what is available for diversion from inflows after the streamflow requirements are accounted for, both the 40 percent and any biological opinion required flows from July, August, and September.

So I am going to now look at this, over multiple years what happens. The blue bar on this chart is the total demand for diversion. The green line -- the green bar is the baseline diversion, and the red bar is the available diversion under the 40 percent alternative. And here we see the drought of record in terms of duration that we see lower allocations available in the 40 percent alternative for sequential years. And these are fairly severe curtailments. They were -- you know, we saw some of the greatest shortage on record from 1922 -- well, up to the 2003 period. It occurred in '91 and '92.

So here we see the New Malones Reservoir storage condition during that time frame, and we can see that essentially the reservoir storage guideline is keeping it at a higher level, whereas in baseline -- it is not showing up on my screen, but yeah. The tan line shows up pretty well on that screen of what happened in the baseline condition. We will see some temperature effects of that in the temperature model a little later this afternoon. So stay tuned on that.

Some exceptions to the rule of that allocation scheme, there is a minimum allocation, which basically allows drawdown below the carryover guideline. There is the end of drought refill, which could constrain diversions during a wet year after low reservoir conditions. There is existing agreements, such as the 1988 agreement, which would limit -- it would cap the Stanislaus senior districts at 600,000 acre-feet. And then if there is requirements at Vernalis, that could also be a factor in the model that would tend to reduce that slightly.

I am going to show a couple tables on here that are the resulting carryover guidelines and max draw parameter and the scenarios that we use flow shifting for the 40 percent flow alternative. We see that on the Stanislaus, we have got a minimum allocation of 35 percent or 210,000 acre-feet, a higher carryover guideline. The max draw is that empirical parameter that combines with the carryover storage. And we see that in 40 percent, that we also engage that flow shifting to fall. We will talk more about that a little later.

We have got a cut to 70 percent for the end of

drought storage refill. That 70 percent allocation is the max that can be taken to allow the reservoir to recharge. And, again, we are -- so there is a Vernalis minimum flow requirement in the alternatives of 1,000 CFS, which kicks in very rarely.

For the Tuolumne, essentially, in baseline, it very rarely gets below 800,000 acre-feet. It does in the '89 to '92 drought pretty severely. That is because there is a minimum allocation that we see where they would get at least 50 percent. It was kind of the lowest on record there up to the 2003 period. And then that minimum diversion would be at 33 percent in the alternatives with a 50 percent max draw from storage and, again, 70 percent storage refill.

For the Merced, we have a small minimum allocation because there is many years that availability is very low in the Merced. We have a little bit of boost to the carryover guideline to 300,000 acre-feet from 115 as a baseline guideline. There was a similar max draw of 50 percent. There is no storage refill contingency in the 40 percent alternative because when it is wet in the Merced, it spills.

Now, I am going to show the sensitivity to this carryover storage. You think, "Well, gosh. If there is a requirement or a guideline of 700,000 feet in New

Malones, how does that constrain deliveries" or "What would it be if we had a different carryover storage level?" And so this plot is intended to illustrate the effect on annual supply or available diversions for the 40 percent flow alternative for different values for the carryover storage parameter.

And we do see a slight reduction of the average annual supply. That is an average figure. So you might say there may be a statistic that would be a little more illustrating, which would be, "What is the effect on the annual supply in critical years," which would be a greater amount.

My animation doesn't work here. But essentially on the baseline, we are at very low levels in the Merced and Tuolumne, and then we are boosting up to 700,000 for New Malones. The Tuolumne River -- the carryover guideline is always at 800, but just the allowable minimum allocation is less than the alternatives so that that limits when it can go below that.

So I guess I should stop for a second and take any questions on the allocation scheme because I know that that is pretty clear as mud at this point. Hopefully not.

DEREK HILL: Derek Hill with the Fish and Wildlife Service. It is great to see sensitivity analyses. I am wondering if you did any related to the perfect foresight of inflows. Did you try to put a statistic additive to it to not perfectly forecast what the inflows would be?

WILL ANDERSON: No. Not at this time. We don't have that.

DEREK HILL: The district is using 90 percent; is that right? Normally when they start off, it is 90 percent of the forecast?

WILL ANDERSON: In my experience.

DEREK HILL: All right. Thanks.

WILL ANDERSON: And that would be conservative on supply, and that is -- yeah. Good question.

AMY KENDALL: Amy Kendall, HDR. So my question has to do with why the modeled alternatives would be different from how they are presented in chapter 3. It didn't have any mention of these maximum draw from storage parameters, and it seems to me like without this parameter, the operations could negatively affect temperature. You have to increase the carryover storage to protect the cold water pool.

So as I understand it, you have iteratively developed it by running the alternative, looking at the temperature model effects, and then, you know, making some adjustments to balance it out. Can you respond to

that? Does that kind of adequately characterize it?

WILL ANDERSON: I don't disagree with any of those statements.

AMY KENDALL: Okay.

LES GROBER: And as you suggest, with the increased drawdowns that would occur to meet the flow requirements, that was found to have temperature effects. So this was done to not have those effects by increasing the carryover storage. So -- and I have to check. I'm not sure if we have a slide later because it is a question that had come up at the hearing as well. I mean, this shows the -- the chart that Will just showed that is on the screen shows the different water supply effects using a different carryover storage.

Similarly, the reason for selecting the carryover storage we did was to minimize those temperature effects that would occur by drying the reservoir down further. Do we have a slide for that yet?

Because I know we were going to do some temperature runs based on the --

WILL ANDERSON: We will show how that works in the temperature model and some of the temp effects of the difference in carryover storage.

So this would be a good time to point out that with these parameters, it is a way to operate the system,

and it is what we have shown for the development of the impacts analysis. It is by no means the only way to operate under the implementation plan. We have got adaptive implementation. We have got an operations group. These carryover storage guidelines are necessary for the analysis, and we can observe that they do have an effect on the system. But what those are, I'm sure, will be a topic of much discussion to come.

AMY KENDALL: So was there any sensitivity analysis done to obtain these parameters? They back off the Tuolumne, for example, in increments of 5 percent. And I was wondering, if I were to set up a model run how I would go about obtaining those.

For example, if you look at the exceedance curves for Don Pedro, the carryover storage is below 1 million acre-feet, which would be the years that you would be concerned about just as a rough guideline because it is the low storage years. Nearly all of the time the alternatives end with a higher carryover storage than the base case, and if that is not there as an alternative and it is there as a means of, you know, making the temperature impacts less severe, then I was wondering if there was any optimization or sensitivity analysis done for that.

LES GROBER: There was no -- I mean, I want to

make that point there was no attempt to optimize here, but there is a number of different errors that can be made with an analysis like this. The error that we did not want to make is to underestimate the water supply effects at the same time that we would not be mitigating for a temperature effect. So this was a number that was sufficient not to have a temperature effect later in the year, but it certainly might overestimate the water supply effect.

AMY KENDALL: Okay. One more question. So if we end with higher carryover storages increasing as the percent unimpaired flow increases for storages -- for example, in Don Pedro below 1 million acre-feet -- then could we not see temperature benefits from this increasing carryover storage?

LES GROBER: That is mostly to look at the effect for times after the February through June period. But I understand that your question is: "So if you have that carryover, how does that feed into the next year?" And I imagine the run will be -- the results of the run will be for the way that it was modeled. So I guess there would be some overall effect from that level of operation.

But I want to get back to the point that this is intended to compare and contrast the different percents of unimpaired flow and with the baseline. So it is for comparative purposes.

WILL ANDERSON: I would add just one more nuance to the carryover storage and in developing model alternatives. There is an aspect of reliability to having a carryover storage, where if you draw it all the way down and then have increased requirements in a successive year, then that would be -- have less available for consumptive use in the following year as well.

So if you look at the exceedance or the reliability curve, you can actually decrease the severity of a shortage in some years by shifting that to other less severe years. So if you think of drawing it all the way down, that leaves less for the next year's supply. Since instream flow is a fraction of what is coming in, which might be low if you don't have any supply in the next year, then that year could end up being worse. And so for a model scenario that has 82 years, we would tend to boost the reservoir level a little bit essentially to keep it from drying out the reservoirs as well as to decrease the negative temperature effects.

AMY KENDALL: Just to clarify, so it is a mitigation measure for water supply and for temperature?

WILL ANDERSON: I -- I'm --

LES GROBER: Let's just say it was an assumption used for carryover storage because we are outside of the bound of how reservoirs are currently operated to reduce or eliminate the temperature effects that would occur after the February through June period.

WILL ANDERSON: Thank you, Les.

Okay. Are there additional questions on allocation? Let's just --

LEE BERGFELD: Hi. Lee Bergfeld with MBK Engineers or on behalf of Merced ID. It is kind of a little bit of a follow-up to the questions that were asked on carryover, but I will expand that to talk about the maximum draw percentage and the drop refill percentage as well.

And as I went through parts of the SED -- I won't say that I read it cover to cover -- but for the carryover, there is some discussion about that in appendix K and the program limitation that the state board may look at to implement a carryover. I believe the maximum draw from storage, it states in appendix F1, where this is not envisioned as a regulatory requirement -- and I think, Will, you have done a nice job of explaining that that is a model parameter included in here.

And then the drought refill criteria, I couldn't

really find anything in there -- I am not saying it is not there -- whether it would be a regulatory requirement or whether it is not. But the three of these I believe were essentially developed to mitigate the temperature impacts of the increased spring flow requirements. And I wonder if I could get a little bit of your perspective on, "Have we analyzed the proposed project if some of these are not included in the program of implementation or envision but are more of just model inputs or model parameters to arrive at how it could work in the future?"

LES GROBER: Well, first, as you point out, we do have a program implementation that there would be some reservoir carryover requirements included to offset any temperature effects, and also the same language is in there for health and safety needs. The reason for not including it as an explicit amount -- explicit requirement is for the reasons that Will has said, because we haven't optimized it. So we don't want to presume and establish any fixed number that wouldn't be a better number to presume how the reservoirs need to be operated.

Anybody here that does reservoir management knows that that is a complex thing. It is a big deal, and there is many things that could be done better optimally. That being said, we have modeled, I think, in this way -- it is a conservative estimate that probably tends to have the bigger water supply effect recognizing that you could probably achieve the same results through some more strategic optimal reservoir operation to reduce any temperature effects in the summer or fall months and still achieve both the instream flow goals of the objective and the program implementation.

LEE BERGFELD: All right. That is it. Thank you for that.

Any thoughts on the maximum draw from storage parameter that is included in the modelling in the analysis but is explicitly stated that it is not meant to be a regulatory requirement? And I did not see where it was mentioned as a requirement or part of the program or implementation.

LES GROBER: Yeah. That is also not a regulatory requirement.

BILL PARIS: All right. Bill Paris, MID. I have a two-part question. Did you run the 40 percent without the reservoir constraints?

WILL ANDERSON: The work that was done there predates me a little bit, and we just went back in the following -- since last Tuesday, when I have seen the interest in that, we have rerun that, and we can show some of those results a little later this afternoon in

terms of the temperature effects. So yes, it was done, and that is more than a couple of years ago when that was originally set up to kind of derive these parameters. So I can't fully elucidate how those were derived only to say that they appear to work, and there is some sensitivity noted.

BILL PARIS: Okay. Just so I am clear, but putting aside the temperature effects, when you ran the continuous model from '22 to '03 without the reservoir constraints, were you able to do the 40 percent impaired flow? Or have you done impaired flow consistently, or did you need something in the reservoir constraint to make that 40 percent available?

WILL ANDERSON: In order to make it work with no constraints, we would have zero minimum allocations because when you have a low reservoir, that would dry it out. So in order for the lower constraint to work, it would have to have that effect as a very hard -- hard barrier.

BILL PARIS: Okay. And last question, I think, on this, you mentioned that there are temperature effects in the summer and fall. Can you describe the nature of those? Are those regulatory effects that are currently existing? Are those minimum instream flows that are built into the schedules? What is it exactly that you

folks are trying to manage to or for or that you saw in the modelling that suggested that these reservoir constraints of any size were necessary?

WILL ANDERSON: Well, I can address two aspects of that that we will look at in terms of the temperature model. One of those is that it really has to do with the effects of the project. Kind of one of the overarching modelling objectives was to do no harm or to not -- have fewer days of meeting the EPA-7 datum criteria of the project as without. So that is kind of an overarching idea.

And the two places where we really see the effects of the project in the absence of carryover storage is temperatures in the fall and a change in the elevated temperatures when there are no spills. So in the baseline condition, without the flow requirements, the reservoirs are at a higher level and do not spill as much. There may be years without a carryover storage requirement -- first of all, that there is no spills at all. And then so the temperatures would be generally much higher all through the summer so you might see high spill flows.

The second aspect of that is that the flow shifting that we have done will account for that as well as the carryover storage. So carryover storage and flow

shifting are kind of intrinsically linked to meet those -- making sure that there are not negative temperature effects.

BILL PARIS: Can I ask a follow-up on that? So just to be clear, so absent the -- absent a reservoir carryover storage requirement, there would be -- temperatures would be higher under these scenarios notwithstanding existing flow schedules? So there would be more days of not achieving -- you picked 2003; is that what you were going for?

WILL ANDERSON: That is what we observed.

BILL PARIS: And can you -- do you have that? Is that something you can share? You mentioned earlier that you did a lot of iterations, and you could look and see. Can we see those iterations so we can understand sort of the inflection points --

WILL ANDERSON: A lot of that was prior to my work. We have some of those records that we have provided as public record act requests, some of the old runs. And I can -- we definitely are going to show some of those dynamics this afternoon with the temperature model. And it is definitely a topic worthy of discussion and comment.

LES GROBER: Just because -- this is a question that came up at the hearing last Tuesday. So confirming, so we have a couple of slides that show a comparison of what happens to temperatures if we didn't adjust the carryover storage requirements.

WILL ANDERSON: And, also, if we don't shift flows to fall.

LES GROBER: Okay.

UNIDENTIFIED SPEAKER: Actually, two questions --

GITA KAPAHI: Yeah. I have got two -- yeah. Sorry.

UNIDENTIFIED SPEAKER: It is okay.

GITA KAPAHI: I have got two back there, and then we will come to you, sir.

ROB SHERRICK: My name is Rob Sherrick with HDR. I am a water resources engineer, and I am working with models of this type, specifically the FERC Don Pedro relicensing model. I was looking at the WSE model, and in the assumptions in there for accretion on the Stanislaus, Tuolumne, and Merced sheets, there is a toggle that allows the user to change the percent of unimpaired objective from the downstream locations of Ripon, Modesto, and Steavenson to the upstream locations of Goodwin, La Grange, and Crocker-Huffman.

On average I found with a rough analysis using that toggle, about 20 percent of the unimpaired flow

objective -- for the 40 percent of unimpaired flow, about 20 percent that was met by natural accretions in the rivers for the whole run. I think -- I am not entirely sure, but it looks like those assumptions for accretion come from CalSim.

WILL ANDERSON: That is correct.

ROB SHERRICK: I was unable to find detailed documentation on the calculations in the SED or in CalSim documentation, but they are relied upon heavily for the alternatives analyzed. The 40 percent unimpaired flow objective actually ends up looking more like a 32 percent unimpaired flow objective for release flow. And so just given that it is such an important assumption, I would just like to know if you think that those values are reliable going into the future.

In estimates I made for the Don Pedro relicensing, I came up with estimates from 1987 to 2012, which were considerably less than what is in the model. And looking back at it now, in the most recent couple years of drought, I have estimated some values that are near zero for accretion. So if you could, just comment on that assumption and sensitivity to that assumption in your model.

WILL ANDERSON: I am going to -- those are very astute observations, and I am going to leave that comment

to stand on its own and encourage you to include that in your written comments.

ANNA BRATHWHEAT: Hi. My name is Anna Brathwheat. I with the Modesto Irrigation District, and I am a little bit off topic. I don't want to ask a question about carryover storage, but I did have a question about your slides 71 and 73 and how the municipal component is built into the WSE model.

And so maybe just to lay out the question, so my understanding is in chapter 9 the service providers and the groundwater impacts are separated out from the irrigation districts' water supply. So if there is no joint analysis in the SED that looks at groundwater impacts with the service providers having a decreased amount of supply, I am wondering if on the WSE model -- so on either slides 71 or 73 -- the municipal component that you showed on that slide, is that a toggle that you can either increase or decrease to reflect what the municipal demand is?

WILL ANDERSON: It can certainly be done. Our analysis considers the municipal supplies that are delivered directly from the irrigation districts to the Stanislaus Regional Water Authority and to the City of Modesto water treatment plant to be fixed values for both the baseline and the alternatives.

ANNA BRATHWHEAT: Okay. And when you did --

WILL ANDERSON: That would be about --

ANNA BRATHWHEAT: Go ahead. Sorry.

WILL ANDERSON: Pardon me. That would be about a 2009 level of demand.

ANNA BRATHWHEAT: Okay. So when you did the groundwater impact analysis, then you didn't just change that toggle; you just left it at full supply?

WILL ANDERSON: That is correct. And the groundwater issues will be discussed in further detail next week.

ANNA BRATHWHEAT: Right. Because they are not together, I just wanted to ask now how you got to each impact. So is that true for the surface water providers -- service providers as well when you did that analysis? You just decreased or increased the amount of water going into the service provider?

WILL ANDERSON: We didn't -- in the effects analysis, we have not modified the available surface water to the water treatment plants. Those are fixed quantities, and that is a component of demand. And so, essentially, when there is decreased availability, that would -- that would fall on the irrigation districts rather than on the municipalities in terms of our effects analysis.

ANNE HUBER: I am Anne Huber. I work with ICF. We helped put together the SED, and for service providers, we analyze impacts qualitatively because we are -- you know, it is uncertain at this point to what degree their demands may be cut. So there is some consideration of potential reductions in supply to service providers, but it was not part of the groundwater analysis. For the groundwater analysis, the assumption was that all reduction and supply effected agriculture.

ANNA BRATHWHEAT: Okay. So there is no modelling to the service providers' impacts; the modelling is done for the groundwater impacts to the irrigation districts?

ANNE HUBER: Right. But we do consider that there is a potential that the service providers' supply will be reduced.

Thank you for the multiple questions.

UNIDENTIFIED SPEAKER: Thank you. For

clarification, the available water on slide 76, you have 150,000 there. How does that jive with slide 87? I see a reduction from 800 to 700,000. What am I missing there?

WILL ANDERSON: How do we --

UNIDENTIFIED SPEAKER: Is that available water just inflow or is that a combined -- that is the least

available water in the study period?

WILL ANDERSON: So the latter of the two, I am not clear on what you are referring to.

UNIDENTIFIED SPEAKER: Well, if the available water is 150,000 acre-feet -- and I assume that is the worst year -- then on slide 87, when you got to the sensitivity analysis, you show the range going from

800,000 down to 700,000. I would just think that something just doesn't make sense to me, or I am not following the train of thought.

WILL ANDERSON: Okay. So this is referring to average annual supply. So that is an average of annual supply over 82 years. So we see the effect on average of changing a carryover storage requirement.

The other slide was simply attempting to show the variability of what supply would be available after instream flow and with a carryover requirement. So this statistic is all rolled into that average, and that one shows the variability between the high and the low.

LES GROBER: And if we could step back, Dan Worth, the senior environmental scientist has joined us to provide a little bit more information about the question about the temperature effects after the February through June period and reservoir reoperation and flow shifting.

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DAN WORTH: Yes. So I heard one of the questions regarding temperature in other times of the year. I didn't hear all of Will's response, but I just wanted to say that reservoir storage targets were developed in this model and were designed to try to make temperature conditions no worse than baseline under the alternatives.

And one of the challenges is to -- under baseline conditions, we see years where there is reservoir spills late in the year. And one of the challenges is trying to, essentially, match the temperatures we saw under some of those spill conditions. And one of the ways that that was done was allowing some of the fisheries' water to be shifted to the other times of the year and then spilled in the river. And so the heavy lifting was done with the reservoir storage targets that Will talked about, and then some of these other things were matched with shifting some of the fish water to the fall.

So I don't know if that answered all of the questions that came up, but --

LES GROBER: And we can discuss this some more this afternoon in terms of the effects and the temperature modelling and the benefits.

DAN WORTH: And I will just add, without storage targets and storage rules, there would be significant changes to the temperature at other times of the year. If the -- if reservoir storage is allowed to drain, that would certainly make temperatures much warmer than what happened under baseline conditions. So there is a need to have storage rules and storage targets to keep the reservoirs spilling cold water in particularly the summer time period and the fall.

WILL ANDERSON: Thanks, Dan.

I believe there is another question.

CHRIS SHUTES: Hi. Chris Shutes with the California Sport and Fishing Protection Alliance. I am curious about the generation of the figures for the carryover storage numbers. First, you know, what each one is. Second, whether you did any sensitivity analysis in-between no requirement and the existing requirements that you generated. And, third, I want to confirm with Les. He said that that carryover may be a regulatory requirement, but it is not assigned in appendix K at this time. And I want to confirm if that is correct.

LES GROBER: I will confirm that we are not proposing any explicit carryover numbers for the reasons that I said earlier because we did optimize. We didn't do the detailed sensitivity, and the crafting of the entire program is intended to show what can be broadly

achieved but not necessarily coming up with the specificity. Because with that specificity would come constraints that may prevent us from doing the smarter operation, if you will.

With that being said, the program implementation is very clear that the board will establish such requirements that are needed to achieve the overarching fish and wildlife, including temperature goals, and to not cause any negative effects for times of the year where we are not expressly establishing a flow objective.

WILL ANDERSON: I would like to address the first part of the question, which is how the figure is derived. Essentially, for the exceedance plots, we are looking at the end of September resulting in carryover storage. This is a monthly calculated value. So it does, in effect, get lower after September in some years -- many years. But that is the target and the guideline and kind of like, you know, one way to look at it and evaluate the changes from year to year.

And the second part -- could you repeat part two?

CHRIS SHUTES: Actually, the first part was a little more specific, which was how you got to those numeric values and not just that you have an end of September number. I get that.

WILL ANDERSON: Okay.

CHRIS SHUTES: But how you arrived at the numbers that you did. And the second part was, did you do any sensitivity analyses for intermediate values less than the numbers you arrived at and used but greater than zero?

LES GROBER: I -- we have not done the sensitivity analyses. We understand that this has been a comment and question and as to, "How much is the effect," and we will explore to see -- because you start having additional temperature effects. So the thought I infer from this as well is, "Is there a sweet spot in there that could reduce the water supply effect but still otherwise achieve temperature goals?" We did not do that.

UNIDENTIFIED SPEAKER: I just want to confirm Les's response to Chris. So you are not confirming a specific carryover number, but you are proposing carryover in your proposal plan?

LES GROBER: Yes. If necessary to not have negative temperature effects. Because we referred to temperature effects but also with regard to health and safety. So it is just to make sure that with the -- the overarching rationale is that by perturbing the system by having these higher flows in the spring, if there is not some other constraint in terms of operation, it could have some of these, you know, redirected effects. So we would have requirements to prevent those from happening. But the specific requirements are not yet provided, what we have and what we have modeled.

UNIDENTIFIED SPEAKER: Okay. Thank you.

VALERIE KINCAID: Thanks. Valerie Kincaid from the San Joaquin Tributaries Authority. There are three or four -- I don't know if you would call them assumptions or inputs that you had in an earlier slide. One was the drought refill requirements, the minimum allocation fractions, and the minimum diversion allocations. I was hoping -- and those are the slides that you just ran through, 83 through 86.

They show the impacts of those, but I am more concerned with how they were developed and, kind of, a brief explanation of the assumptions and mechanisms development calculations used to arrive at those. That wasn't part of this presentation. So if you could go through each one of those and explain what the drought refill provision is, how it was developed, and if you can, run through any calculations of how you get there and how it applies in these later slides.

Those later slides are in the SED, and I think, you know, for folks who have been to the SED, I know

those slides. But my question -- and I was hoping this workshop would get to those -- is on the input assumptions and mechanisms that you used to develop those. So if you could kind of go through each one of those and explain how they were developed and how they work, not by result basis but by development, I think it would be really helpful. Thanks.

WILL ANDERSON: I am not able to step through -- I don't believe it is going to be satisfying. I can't step through the development of that. Simply to say that these are parameters that are inherent and important and critical for describing -- for our description of the system operation in terms of representing baseline. We think that it is -- these parameters describe, essentially, how the system operates in baseline in lieu of an optimization function in CalSim. It is essentially, "Here is what works in the baseline."

And when we go to the alternatives, those numbers have to be modified to make it work and to not dry out the reservoirs and to kind of distribute that risk in the shortage years in, yeah, the least impact possible, I should say.

ANNE HUBER: And I just want to add that I think before you even started work on this project, there was, sort of, a lengthy process of trial and error, and there

was a lengthy process of trial and error to determine what set of values would give -- maybe not optimal results because I'm sure not every possible combination was assessed, but multiple runs were made to pick good sets of values.

VALERIE KINCAID: I guess from a transparency perspective, from the regulated community's perspective, I understand the -- well, I don't understand the complexity, but I appreciate that there is a huge amount of complexity in iteratively arriving at those. But the problem is that that is what we want to see. I mean, that is what I would like to see. I don't know how that was developed or how it was arrived at, and I frankly thought that that was what this workshop was going to be about. I mean, I have been to the SED. I have seen the results. I want to know how we got there.

But having said that -- and it sounds like we are not going to do that today -- that is fine. I did have one follow-up question to Will's comments. Those parameters that I named and that were on that slide, you said something about them being in baseline. My understanding is those are actually model inputs, and those are things that are necessary for the model to work. Do you -- I guess I am confused about -- and maybe you mean modelling a baseline. But did I misunderstand?

You don't think that those are actually in place in some sort of existing scenario that is on the ground today or in 2009, do you?

WILL ANDERSON: In the WSE model, it has a unique allocation scheme that incorporates those parameters that we found to mimic the CalSim baseline, that they are very -- they give the same results by working and interacting the way that they do. And so it is simply a way of reoperating the system continuously for 82 years that constrains deliveries in a way that works.

VALERIE KINCAID: Right. And I guess --

LES GROBER: And I would like to --

VALERIE KINCAID: So that is a modelling? That was something that was a model?

LES GROBER: Just to say it in a different way -- hopefully a somewhat different way and just going back to really the -- well, what we have done showing our work and the intent is, as Will had said, to show a way that the model of the system can run. That is not to be interpreted as an optimal way to make it run. This is one possible -- and as we document, it is a response to the perturbation of requiring bypass of higher amounts of flow from the reservoir at the 40 percent level and at the other alternatives looking at the range from 20 to 60 percent.

Once you perturb the system in such a way, the first thing that you see is if you keep everything else the same, the reservoir runs dry. So we have had to make assumptions that we have described and disclosed about reservoir operation that prevent those things, like running reservoirs dry or temperature impacts in the summer and fall. It prevents from those occurring. It is not to be construed as the way or the only way that it can be done but a way that helps to show what would be the physical effects on the system by changing water supply and other things like that.

So I -- we will attempt to -- and you will see some this afternoon -- to show not so much the sensitivity, but it is a simple presentation to show, "Well, if you don't have the increased reservoir carryover storage, you are going to blow up the system and have very high temperatures, if you keep demands and diversions for other uses at the same levels as we see on the baseline." So it is not a terribly interesting result, but we can show some of that. But we did not do an exhaustive review of different methods and sensitivities for seeing one of the any number of ways that you could operate the reservoirs.

VALERIE KINCAID: I understand that, but it

would be -- and I fully understand that you can't look at every possibility. But it would be good to fully understand how you got to the one scenario that you analyzed.

LES GROBER: And the short answer to how we got to the one scenario, it was a scenario that we could demonstrate avoids those temperature effects and achieves the goals of the program.

WILL ANDERSON: Okay. It is now 12 o'clock. I am going to move on and just talk about one additional dynamic and a bunch of results, and then we will have an opportunity for some more questions prior to our 12:30 break.

So back to where we left off here, I was getting ready to talk about the concept of flow shifting, and this is an adaptive implementation method to move flow out of the February through June period to later in the year to counteract and offset some of these temperature effects that we observed in the figures in the document F1.2-7, just a generalized illustration of what it might look like and moving some of that spring flow pulse under the 40 percent alternative to the fall months.

And I am just going to show just how much and what years we do it. So this is the -- it takes place as an instream flow target, NCFS, at the downstream reach of

each river. And on all three rivers, it occurs in wet years, and that counteracts the temperature effects of having fewer spills in wet years. In the Stanislaus, it occurs in every year type in October. And on the Merced, it takes place also in -- above normal types for the same reasons. Those are the CFS targets also in the document F1.2-25.

And next I am going to show you the total amounts that are shifted. These are average quantities shifted under each alternative to meet those flow targets. I see an average of -- in the 20,000 acre-feet up to 36,000 acre-feet on the Merced to meet those flow targets for producing those indirect temperature effects. But that is all I have on the WSE model methods.

I know we will have some additional questions coming up, but I am going to jump into the results of the model in other ways that we haven't looked at yet. Maybe you have, if you looked at the document. But I am going to go pretty quickly just to allow time for more questions since they are the most productive aspect of this session.

So in the executive summary, we show the average instream flow from February through June on each tributary. The fact is that the average instream flow would increase by 288,000 acre-feet, or about 26 percent, on average. We see that the average annual effects on surface water diversion from 30 to 50 percent alternatives range for the plan area from 149,000 acre-feet at the 30 percent objective up to 293,000 acre-feet, or 14 percent reduction, at the 40 percent alternative and a little greater -- a much greater reduction, 23 percent of average annual surface water diversions in the 50 percent alternative.

Did you have anything to add, Les? Okay. I saw you looking for the mic.

Okay. So another way to look at this is, "Well, that is the average number. What happens in different year types?" I see no change in wet years, very minimal change in above normal years but greater reductions in surface water availability for consumptive uses in below normal, dry, and critically dry years.

In dry years, that is a 30 percent reduction from what is essentially a full allocation. In the critically dry years, that is a 38 percent reduction from what is already in a drought year not fully meeting the agricultural needs.

Sir --

UNIDENTIFIED SPEAKER: It looks like the water supply is higher in the below normal and dry than it is in the wet; is that correct?

♀

WILL ANDERSON: Yes. That is an effect in the change in demand in dry years. So in a wet year type, when you have precipitation that would account for some of your crop needs, you would not need to divert as much. So the dry year type is when we see the highest diversion demand, and that is the year that we would see the reductions due to the lack of supply.

UNIDENTIFIED SPEAKER: So the water supply that is available includes inflow?

WILL ANDERSON: Right. So this is a roll-up of the results of 82 years of the model, and the -- if we see in the baseline condition, which is what we are comparing here is the baseline and the alternative, the dry years generally get full allocation, which is a slightly greater demand diversion requirement. And then in the alternative, that supply, because of the 40 percent of increase of -- 40 percent of unimpaired flow -- instream flow requirement is an increase from the baseline, then less is available in that year based on the reservoir condition and the reoperation and the constraints, all that we have described.

LES GROBER: I think if your question is, "Why does it look higher in those middle years," it is because in the wet years and above normal years, some of the -- it is both the availability and the demand. Some of that

demand is met by precipitation so the demand/availability is greatest in those --

UNIDENTIFIED SPEAKER: So this is just a water supply demand that is met?

LES GROBER: That is correct.

UNIDENTIFIED SPEAKER: Okay. Thank you.

WILL ANDERSON: Thank you. Good question.

So at this point, we are going to talk about comparison of the WSE baseline and the alternatives in greater detail. Stop me, please, if there is something that strikes your fancy or interest that you would like to ask a question about or just to have a longer chance to look at these slides because there is a lot of charts and graphs here.

The first one here is the Stanislaus baseline flows from '90 to '95, which if we are going to look at a time series and pick some years to look at, I think the '89 to '92 drought and a couple following years is a really good example of what happens in drought years, which are the most interesting.

Here we see the inflows do comprise a fair portion of the monthly baseline flow requirements. We see additional release is needed to meet the RPA biological opinion index 2E flows, and we see the little bits in yellow are additional releases that reclamation would need to make for New Malones to meet the Vernalis EC requirement.

Okay. So Les is speeding me up here. So if we go to the 40 percent alternative, we see what the aspects of the downstream resulting flows are from each component. We see the green is the unimpaired flow requirement releases. We also see the light blue on top. That would be additional releases if some of that flow shifted to the fall months in October for this and also in the spill year there in '93.

So Tuolumne, again, I believe is the same that we saw earlier, baseline, and we see the big spill year is in '93. There is increases with the 40 percent flow alternative, with a little bit of flow shifting in the wet year.

In the Merced, same story. It is fairly low instream flows at Steavenson and baseline. I do see spills in '93 for the 40 percent. We see higher instream flow requirements and lower spills in the '93 year.

Yes --

UNIDENTIFIED SPEAKER: Slide 1001, the previous slide, you don't have any VAMP flows on there?

WILL ANDERSON: We don't see them -- I was just looking at that. And we don't see the VAMP two-step flows coming into effect being depicted here in the successive critical years. I think that is a good question. I am not observing them in the model results for these years.

UNIDENTIFIED SPEAKER: That is interesting because of the way VAMP was structured with Merced providing both of the VAMP flows. You showed it on the other two trends.

WILL ANDERSON: Right. Well, it is --

UNIDENTIFIED SPEAKER: I don't know if there is any there. I can't see it.

WILL ANDERSON: It is listed on the legend, but we are not seeing releases that are attributable to VAMP in these particular years. So these are not the best years to look at for VAMP because if you have got -- if you are -- it has got that off-ramp and the double step in successive critical years, and we are looking at a bunch of critical years in a row. So it is an interesting dynamic, and it is one of the -- if you want complexity, that is the most complex aspect of the model, is how to incorporate those VAMP flows, and definitely it is a good comment, an astute observation.

So moving on, we have seen these components before. That is a new thing that we recently developed. So if you have a request of certain years that you want to look at, I think we can provide whatever is requested

there. So more of the four-panel plot, this is kind of our grand summary showing the February through June instream flow exceedance as well as the end of September storage exceedance on the top right.

We have got baseline, 20 percent, 40, and 60 percent alternatives all on here. The baseline is going to be the dark blue diamonds, and the 20 percent alternative is going to be the cyan circled. 40 percent is the green triangles, and the tan or orange boxes represent the 60 percent alternative.

So we can see in the top right that in baseline, New Malones is less than 700,000 acre-feet about 25 percent of the time, going below as low as 100,000 in the '91 and '92 time frame. Probably the most interesting aspect of this is the diversion delivery dynamics that -- oops. Let's see. I am going to go on through to the diversion exceedance plot here, which shows the reliability and availability of diversions for each of the lower San Joaquin River alternatives.

The baseline again is the dark blue diamonds where we see essentially 94 or 95 percent of years full demands being met. In the 20 percent alternative on the Stanislaus, we see that these are met in closer to 15 percent of the years. And then the 40 percent alternative, only 60 percent of years give an entire

supply and meet demands, and you can see that the decreases in demand occur under the 40 percent alternative.

And at 60 is when it encompasses the wide range of alternatives that we have evaluated. It really does cause some extreme cuts. So that is, kind of, an upper limit of what the system would withstand. I don't think that is a desirable one but just for comparison purposes.

Back to the annual total diversions, this is the unordered -- same data as that exceedance plot. The dark blue line is the baseline diversions. We see some low years. We see some lower years and more of them in the alternative as we would expect. And that is the same story for each river. I will just step through, just to not favor any particular one of these things.

They have similar dynamics. Some of the differences are with New Don Pedro, it is drawn down less often in the baseline, and we observe that in the upper right -- the little blue triangles that, kind of, bottom out around there, around 600,000. And we see a greater reliability of supply in the Tuolumne except for there is some years that there is a 50 percent allocation. I am going to step forward into that one.

Here we see the total diversion from the Tuolumne River. This would be for Turlock and Modesto

Irrigation Districts. In baseline we see that for this 82-year period, the greatest cut that is in the scenario is about 50 percent allocation -- 50 percent of the max -- and then the 40 percent alternative, there is diversion cuts in more years. Again, what it looks like in a time series plot. I just rearranged the order.

So on the Merced, in the upper right, we can see that the reservoir end-of-September levels are drawn down to around just over 100,000 -- 120,000 in 10 percent of the years. And then our alternatives would boost that up to the 300,000 acre-foot mark. In terms of reliability, dry years on the Merced have a greater proportional impact than the other two watersheds where the baseline diversions are cut. You can see the drought years. In about 12 percent of years, I am seeing some pretty obscene -- fairly high shortages and then greater as we see the 20, 40, and 60 percent alternative for that year, just for a greater view.

So I won't belabor any of these, unless there is something that anybody would want to see about these.

LES GROBER: I would just like to call out, this is the for the Merced. The other tributaries, when you look at the exceedance plot for diversions, the 20 percent alternative pretty much tracks the baseline. Here in Merced, it shows that even at the 20 percent it

has that difference between baseline and the cyan. The dark blue and the cyan shows that you start losing water availability 25 percent of the time, even with that.

We will show a slide in a moment showing the project area as a whole. That is showing the project area as a whole, which is why we say, "Well, the 20 percent is generally reflective of the current condition," but even with that, the 20 percent has a water supply cost.

WILL ANDERSON: I will go ahead and jump to that slide just to continue that train of thought. This is the plan area total.

Okay. Go ahead, ma'am.

AMY KENDALL: Can we just go back a few slides to the exceedances?

WILL ANDERSON: For which reference?

AMY KENDALL: Any reservoir is fine, any of them.

WILL ANDERSON: For the reservoir --

AMY KENDALL: Yeah. Back a few. Yeah. So I am looking at around 55 percent exceedance from the top right corner -- -

WILL ANDERSON: Uh-huh.

AMY KENDALL: -- at the end of September storage.

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I am wondering why the alternatives need to be higher than the baseline for carryover storage. I understand that you are not trying to do harm, but I am just wondering why the carryover storage -- I just wanted to point that out. It is so much higher than the baseline. And how is that arrived at, and is there a reason?

WILL ANDERSON: It is arrived at because we have that set of parameters for the alternatives that is -- I wouldn't say -- it is somewhat from the simplicity of those parameters, the allowable draw and the carryover guidelines that those are constants. We don't change those in this analysis. And if you wanted to achieve -- they work together.

So it is not just a carryover guideline that you will have. And that is a hard target that you shoot for. It is more of the combination of the allowable draw to that target. So that will scale down as you get closer to the target and may, in fact, go below it if you have a minimum allocation.

What you are talking about is, "Well, maybe it doesn't need to be that high in all of those years that you might be able to utilize that." That would require additional complexity in the parameterization. So if you would say, "Well, we have X condition and whatever

inflow," you might choose to go for a lower target. But those two parameters that we have for the 40 percent alternative result in this.

AMY KENDALL: Could you increase the maximum allowable draw to get that a little closer? Would that be a parameter that you could adjust?

WILL ANDERSON: That wouldn't essentially --

LES GROBER: As a hypothetical -- I mean, this is a good discussion, but I think this comes back to the same answer. By doing that, you could opt -- it seems based on things like this, you could somehow optimize the system and perhaps achieve the goals of, you know, not having any temperature effects and still achieve the instream flow and reduce some of the water supply effects, but we didn't do the optimization.

AMY KENDALL: Right. It wasn't really a question about optimization. I guess to clarify, I am just talking about for impact analysis. So to get more comparable and more apples to apples results, could it be a parameter that you adjust to get it a little bit closer to baseline so you are not seeing artificial effects from carryover storage?

WILL ANDERSON: I appreciate the comment, and it is on point. From modeler to modeler, if I were to add complexity to this analysis, which I am not going to do because Les would shoot me at this point --

AMY KENDALL: Good point.

WILL ANDERSON: -- what you could do is say under -- "Well, for this particular year based on this set of conditions, you may have more of a draw." But for us, we have the draw; we have the carryover storage. They work together, and they yield this result. So we have released the model, and I encourage you to play with it and ask questions if you want to run something like that.

AMY KENDALL: My curiosity came just from there, looking at the model and trying to do runs on my own. I was wondering how I would arrive at different parameters. Thank you.

WILL ANDERSON: I just have a couple more slides I want to roll into before the break, and then we will take any additional questions. We were looking at the total plan area results, and these are -- it is a composite of the three rivers, the three reservoirs, of instream flows, the three tributaries, and the total volume diversions at the upper left.

As Les pointed out, the baseline in 20 percent are kind of the closest to each other, where 40 percent is a greater cut to diversion reliability, and there is some differences that you see on each river based on

their specific attributes there. And we see just the bottom left is the resulting February through June flows on the San Joaquin River at Vernalis, and then in the lower right, we see the total February through June flow as a percent of unimpaired flow for each alternative.

And I would like to point out, this is fairly interesting that the resulting flow at Vernalis is, in some years, less than the percent unimpaired. One of those reasons is that the Vernalis unimpaired flow is kind of its own subject, and essentially we see some years that are higher than that and some years that are slightly less than that because the flows that we are allocating in the proposal are the 40 percent unimpaired flow at each of the tributaries.

So the grand total -- we have already seen the 30, 40, and 50 percent reductions in surface water diversion. Another -- this is a more blown up way of looking at that that shows the 35 percent and 45 percent -- so the 30 to 50 range. At the bottom, you can see the 30 percent is minus 149,000 acre-feet. 40

percent is 293; 50 percent is 465, just for future reference, if you would like to examine that.

So with that -- well, this is just by year type, the same parameter. I know it is getting close to lunch. I am going to just end that part of the presentation and

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take any additional questions. We have a couple minutes before the break.

DEREK HILL: Thanks. Will, can you go back to slide 92? I think on there you show what the average requirement is by year type, and I am wondering, have you looked at the daily values that cediac produces to see -- for example, let's take the wet for the 50 percent unimpaired. It shows an average of 2,500 TAF. What is the range in the seven-day running average for that condition? Is that in the SED? I haven't gotten through much of the SED. So I apologize if it is. I am just wondering what the variability is compared to the averages.

WILL ANDERSON: Right. This is the monthly average flows --

DEREK HILL: Right. But the proposal is to have a seven-day running average; right?

LES GROBER: That is correct. But we only run it with monthly averages.

DEREK HILL: Thanks.

ART GODWIN: Art Godwin. On the basin-wide analysis, the flow at Vernalis, was that a combination of CalSim on a main stem and the water supply effect model effects on the three tribs?

WILL ANDERSON: Right. So CalSim does have an input for the upper San Joaquin, and that is the same for each of all of our alternatives. So that does add to the result of the instream flows at Vernalis, and any return flows from the west side would also be included in that less any diversions to those downstream water users. That is correct.

BILL PARIS: Just a follow-up on -- Bill Paris, MID -- on Derek's question. So did I understand you guys right? You haven't modeled the proposal; is that correct? The proposal is not based on the monthly, and you are presenting monthly data. Have you modeled it in a less than monthly time step, and if so, can we see that data information?

LES GROBER: No. We only modeled it at the monthly time step for the -- because this is intended to be a budget of water, if you will, really. This is getting back to the adaptive implementation. We -- it is not -- we didn't do a daily model for showing this.

BILL PARIS: Is there a daily model available?

LES GROBER: Not that we have run except what we have run for temperature modelling.

WILL ANDERSON: The temperature model takes the monthly, and it runs on a daily time step. So there is some smoothing there, but it is essentially the monthly averages.

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LES GROBER: So, again, this kind of speaks to not being intended to optimize it. It shows what it could be if you look at it very broadly programmatically. So say for the temperature, of course you would see some other variations potentially, depending on how this is operated. If you had rigid adherence with a seven-day running average, you would expect to see somewhat different results. But we have looked at the monthly -- the very coarse monthly and then the coarse disaggregation of monthly and daily for the temperature effects.

BILL PARIS: Sure. But I guess I would flip that around and say from the impact perspective, modelling what you are going to require the regular community to comply with would be a more accurate picture of what those impacts might be.

LES GROBER: Are you suggesting that it would result in a different quantity of water at a seven-day average than on a monthly?

BILL PARIS: Yeah.

LES GROBER: Okay. You can provide that comment.

CHRIS SHUTES: Chris Shutes in response to Mr. Paris. For the Don Pedro relicensing, Dan Steiner built a dandy daily model, and if Dan would like to

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modify it to allow us to run a percent of unimpaired, I would be thrilled to have the opportunity to use that to get more resolution. And I would note that Mr. Bergfeld from Merced did make that adjustment and, in fact, model proposals based on percent of unimpaired in the Merced relicensing, and it allows a lot greater granularity than the monthly model appears to. So I think that Mr. Paris' interest is in his own hands or at least that of his employer.

LES GROBER: And, again, I would -- we are happy to receive comments on this as part of the hearing in the written comments. So I appreciate all of the comments, but bringing it back to this is a programmatic analysis, and any such comments would have to demonstrate what different result one would be expecting to achieve and how it would be -- I can imagine in the details, it could be different, but why running this on a monthly time step is insufficient, one, to demonstrate what can be achieved broadly in terms of temperature improvements and broadly in terms of the water supply effects.

WILL ANDERSON: While they are preparing that mic, we are cutting into our lunch break a little bit. So I guess we'll take one more and break. We will have a chance to come back to any of this material, if we wish, after discussing the temperature model and so on.

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But go ahead, Lee.

LEE BERGFELD: Thank you. It is kind of a follow-up on the monthly versus daily as well as tiering off of Mr. Sherrick's comment earlier about the accretions in the local flow and their contributions to meeting the requirements.

Any analysis -- I understand you didn't do it daily but the water supply effects model currently assumes that 100 percent of that local flow could meet any minimum requirement or any canal demands if it comes in above the canals.

Any analysis just, kind of, looking at the daily variability of some of those local inflows that would lead to that assumption, that all of it would be available? It is not quite going to the level of detail of doing a full analysis on a daily basis, but I would question the assumption that 100 percent of it, when you are doing a monthly model, would be available. So I guess a question of whether it was looked at and a suggestion if it wasn't.

LES GROBER: And let me just understand the question. Say, for some of those accretions if it is, say, side flows are from a tributary, a smaller tributary, it might have a peakedness for argument's sake that could exceed, say, the 40 percent for, say, a short period of time but then not for the rest of the time; is that what you are referring to?

LEE BERGFELD: That is correct, Les. So, for example, on the Merced, there is a dry creek flow that comes in above Steavenson as well as other local flows, but that is one in particular. It is a drainage rainfall -- a runoff-driven drainage. So it is definitely more peaky than just a steady base flow that you can always count on being in the river.

LES GROBER: Sure. I mean, that is an interesting thought. And I will restate that we did the monthly time step modelling, and the modelling is used as comparative purposes for the baseline and the others. So, you know, a lot of things get lost in that averaging. It wouldn't necessarily be a detail that would be -- though interesting, I'm not sure how important, but please provide the comment.

LEE BERGFELD: Sure. Will do.

And one other, I guess, kind of follow-up comment because we have talked a lot about that the analysis was not done to optimize anything. But I think a lot of folks were kind of questioning things in terms of carryover storage and the maximum draw. And more of the question while we didn't optimize -- and I don't think that is a requirement under the CEQA document to

look at the environmental impacts.

The question more being, "Did we analyze the effects of the proposed project?" And there is some things in there that are a little unclear in the SED as to what is the proposed project and what is not.

Although it is very clear -- and you have been very transparent about what was analyzed. And so I think that is driving a lot of the questions. That is a comment that you will see. I just wanted to make it clear as to context, I think, to a lot of the questions and the discussion that we have had this morning, which has been commented on.

LES GROBER: Great. Thank you.

GITA KAPAHI: So with that, I would like to propose that we break for lunch. If we could come back at 1:30 on that back clock, which would give you 55 minutes. Is that okay with everybody? Perfect. Thank you so much.

(Whereupon a lunch break was taken.)

LES GROBER: Welcome back, everybody. Everyone

-- for those you on the web, everybody -- there is about 15 of you folks here. Hopefully you have had a chance to grab some food out in the lobby from the holiday party. So we will commence with part two.

Any questions before we get started?

Seeing none, we will jump into the temperature modelling.

WILL ANDERSON: Thanks, Les. So earlier today, I mentioned in some of the discussion about the benefits of flow and the flow shifting and what happens in spill years and so on, I suggested that we will be showing that this afternoon, and we are. So this is the part where we discuss the HEC5Q temperature model and just a couple snapshots of the results that we get. Okay?

Can we get it up on the screen? Okay. Thank you.

This is just an intro slide here. So talking about the temp model, this will be a little more impromptu. And I really appreciate all of the good appointed questions, and we can continue to do some clarifying as we go along here. It has been a good discussion in terms of time. It probably won't take very long to go through these, but I am going to stop at each slide and go ahead and welcome some input and discussion on each of these dynamics.

So the temperature model, let me tell you a little bit about the background and how we used data from the water supply effects model. The version of the temperature that we are using was originally configured to use the CalSim node structure and inflows and assign them to specific cross sections of the temperature model. So WSE essentially mimics that. We will see about that, how that works. We are going to show some results and just some specific dynamics.

Now, we have got 34 years of temperature data, which in a six-hour time step is a huge, you know, DSS file of information, and we have to process that and look at how we are -- the change from the alternatives, see the effects of spills, the effects of flow shifting, other notable effects.

But for the SED and for the temperature effects and the potential benefits, we have rolled this massive dataset into some summary statistics, and Dan is going to talk a little bit more about that this afternoon. I am going to try to show visualizations of time series of temperature so we can get an intuitive feel for the examples of how operations of different flows and different storage levels of the reservoir affect the instream conditions.

So HEC stands for U.S. Army Corps of Engineers Hydrologic Engineering Center. They have got a suite of different hydrologic assessment models. You may have heard of HEC graphs. These are different ones. This one was designed for reservoir operations and instream temperature effects. The particular lower San Joaquin

basin application was peer reviewed in 2009 as part of a CALFED project. There was more recent updates in 2013 by the California Department of Fish and Wildlife. These reports are referenced in appendix F1 and are part of our record, if you would like to see more about how our temperature model was developed.

The version we are using -- like I said, we use stream flows from the CalSim flow balance, which we are substituting in the WSE model flows, which use the same foundation and the same physical structure. So how do we do that? I will give Tim credit for this slide. In representing the system, the four major parameters that are passed over from the water supply effects model here are the boundary inflows, the storage conditions, and the evaporation. So it is water that has been no longer in the reservoir and also the result instream flows as a function of the operations.

We also have the upper San Joaquin boundary, as pointed out by Mr. Godwin, and we will evaluate the temperature in the three tributaries for this presentation. So the WSE model data is taken out of an Excel spreadsheet. There is a little plug-in that you can get for Microsoft Excel. It is called the DSS add-in. You can take any time series and put it into the -- the DSS is the HEC data storage. It is basically

a database visualization program for large data sets and large time series.

So we will get that monthly average WSE data, and it will then be transformed back into the CalSim notation for each node that it represents. Then there is a preprocessor written by Don Smith at RMA that then converts the monthly CalSim values to a daily time stem.

And there is a little bit of smoothing that has to happen with the reservoir condition because you can do a monthly average flow. That works no problem, but if you go from a reservoir storage condition at A, and then a month later it is at B, you have got to draw a line between them. So it does that.

After we are at a daily time step, then the temperature model will have additional specified parameters and boundary conditions, such as the reservoir temperature profile, which will evolve with the time and the climate data, such as the ambient air temperature, wind speed, and the local inflows.

The HWMS is our name for the interface. That is the RMA system. It is basically a graphical user interface that will help set up runs for the model to look at the system schematic, and we will see a picture of that in a second. The run files describe what years you are running and what time step and so on and the

means of the output files, et cetera. So this is all of the nitty-gritty details, but I am not going to talk about that for too long because we want to talk about some results.

So this is a picture of the same three-river structure as shown in the interface with example cross sections pointed out. These are actually the river miles. I don't know if there is a particular river mile scheme on that, but essentially it is the same physical system we have been talking about this morning.

This is a little more detail of where the specific nodes are in the model through the reservoirs; particular locations of interest, such as the major diversion dams -- Goodwin, La Grange, Crocker-Huffman -- some compliance points of interest, such as Orange Blossom Bridge, Knights Ferry, Oakdale, Ripon, and Stanislaus. We have got Basso Bridge, Highway 99, Tuolumne, Shaffer Bridge, Cressy, and Steavenson on the Merced.

So, again, I am just going to show a couple snapshots of the results here. Basically, we have got the same alternatives from the WSE that were set up in the temperature model baseline. We talked about the baseline conditions. We have got 20, 30, 40, 50, and 60 percent of unimpaired flow from February through June and all that entails in terms of flow scenarios.

The outputs are a six-hour time step, and we have got it from 1970 to 2003. This essentially ends -- well, at the end of the CalSim time frame, we have extended this --

Go ahead.

Right. We have provided -- we did some work to take WSE to the end of the CalSim time period and extend it through the most recent drought. And we didn't have all of the accretions and the depletions for this time period because CalSim hasn't been updated.

The main driver for this system for all of the dynamics is the Rim inflows. But -- and this is a big but -- and there is -- it is the reason why we didn't use any of the extended output as a basis for the findings of the effects analysis. Because everybody wants to see what it looks like if you run up to 2015 and go through the most recent drought.

If we make the assumption that the accretions and depletions, A, are fairly minor and, B, can be represented by similar year types from the historical records that we do have, then we can see how the system works up to 2015. I won't put a lot of weight on that. We have updated the HEC5Q model to 2010.

So I would advise caution in using that for

those reasons that I have specified. If someone went and updated CalSim and had a complete set of accretions and depletions for all of those months, that would certainly be an improved result. We have not evaluated the adequacy of those surrogate years and how well that might represent the actual accretions and depletions, but it is useful to look at to see the potential system operation with those caveats.

Go ahead.

UNIDENTIFIED SPEAKER: All right. Just to clarify, those results were used for the SALSIM fishery's population models?

WILL ANDERSON: Yes.

UNIDENTIFIED SPEAKER: Thanks.

WILL ANDERSON: We will have a little more discussion of SALSIM a little later on.

So once we have run each alternative, we pull the results back into Excel using our DSS add-in, and we process the six-hour temp data and derive the -- out of the daily average, we then will have the seven-day average of daily maximums, which is useful for comparing to that EPA temperature criteria. Although the plots we see today will be the seven-day average of the daily maximum plots --

Go ahead, Mr. Godwin.

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ART GODWIN: Art Godwin. So for this modelling exercise, you took monthly data and converted it to daily and then the temperature model and converted that to six-hour time steps and then you took six-hour time steps and made that seven-day average daily max temperatures?

WILL ANDERSON: Right.

ART GODWIN: Okay.

WILL ANDERSON: So I am going to show a couple slides that just illustrate the benefits of instream flow or the change in the alternatives of what happens. On the top of this plot, we see the Tuolumne River at Modesto. This is the downstream reach flow from the water years 1990 to '94.

So the top slide shows -- in the solid line, we see the baseline flows in this dry year period that we have seen in some of the other slides in the previous presentation. We do see the wetter year in '93, and then for the dotted line, you see the alternative results for the 40 percent alternative flow scenario.

And on the lower plot, the baseline is again the solid line. It is a seven-day average of daily maximum temperatures at Modesto. And so we can clearly see the seasonal trend of hot in the summer and cold in the winter. The key change in the model is in the months February through June -- and we are going to zoom into a specific example of that in the year 1991.

And here we see a really big difference in the seven-day average daily maximum. I am not going to get into specific statistics, but these are all rolled up into how often they meet certain criteria and how often they are within a certain percentile distribution, et cetera, within the report.

Now, we can compare that situation in 1991 where we see a really good temperature benefit of the increased flow. This is a longitudinal profile, starting on the right side of the screen, with the release at La Grange moving downstream from right to left. We will see that the baseline condition is -- the solid line, it is warmer, and it warms quicker all the way down the confluence. The monthly average -- the seven-day average of daily maximum temperatures is around 70 degrees at the confluence for May of 1991.

And the dotted line represents the 40 percent flow alternative and also warming -- the warming more slowly as it moves downstream and the effects of the increased flow, the cold water there yielding a confluence temperature of -- a seven-day average of daily maximums a little bit greater than 60 degrees that reaches the San Joaquin.

Now, we can compare that to a series of wetter

years here. In the case where the reservoir is full, it is spilling, and we are not releasing anything in addition to that as part of a 40 percent unimpaired flow alternative. So there is no change in flow. There is no change in temperatures when it is at the -- when it is spilling. And so, therefore, we see very little change in the temperatures, as we might expect. So it is -- the benefit is in dry years but not so much in wet years.

Next, we are going to talk about the dynamics of the reservoir storage levels that we have had a lot of discussion about. This example is Lake McClure and New Exchequer Reservoir on the Merced. The dry year time series starts out in water year 1990 through '94. So the top plot is of the reservoir storage condition at baseline at the solid line, and the dotted line represents the 40 percent alternative. We can see the difference between the baseline going between the 100,000 and 200,000 acre-feet condition, whereas the alternative is about 250,000-plus until 1992, when we have a fill and spill year at that point.

On the bottom plot, we see the temperature effects for the release out on Lake McClure. The baseline is the solid line again. And we see a much greater warming trend in the summer at a lower amount of cold pool, and the alternative is the dotted line, which

shows less warming in the summer but quicker cooling -- or excuse me. The 40 percent alternative will be more full. So it cools less quickly in the wintertime as well.

On the -- by the time we get to 1993, there is no change because the reservoir condition is the same. So we can observe the '92 conditions -- change in conditions. For September of '92, again, the longitudinal profile release from Lake McClure and New Exchequer on the right-hand side, we see that the 40 percent alternative is at a higher, around a 300,000 acre-foot level, releasing at about a 55-degree average. Well, it is going to be a pretty consistent temperature there. Whereas the lower reservoir storage in September, it will be releasing at closer to 65 degrees. Now, there is not a lot of flow in September of '92, so they both warm very quickly and reach equilibrium not too far down the stream.

Next we can look at another month more towards the fill and spill area. In May of '93, the reservoir condition is slightly greater, in the 40 percent alternative. So it is -- but it is not as cold. But it warms less quickly as it moves downstream from right to left. The difference is between 45 to 47 degrees Fahrenheit in May. And with less flow, it warms very

quickly; with more flow, that cold water is propelled downstream.

Are there any questions up to that point? I am just going to look at some more temperature plots.

Lee, go ahead.

LEE BERGFELD: Will, just a point. There is a minimum pool requirement in Lake McClure, which I know is not reflected in the baseline, but when you see these operations through the critical drought sequence, I don't believe the reservoir would be pulled down as low as it is coming down in the baseline.

The water supply effect model considers the 115 as a target, but in Merced's FERC license, it prohibits the release of water when storage is below 115 for anything other than the minimum flow requirements in the FERC license.

So, you know, just as a comment, as you look at these and you think, "Okay. We need to have this higher storage to prevent the temperature condition that you are predicting in the bottom in the baseline," I don't believe that temperature condition -- particularly as a release temperature out of Lake McClure -- is representative of the baseline because of the way the water supply effects model is simulating Lake McClure storage.

Does that make sense?

WILL ANDERSON: I will have to chew on that for a little while. I value the input and the insight. I think in the most recent drought, we have seen some very low levels, and I'm not sure whether that is consistent with the comment.

LEE BERGFELD: That is a good point and, true, if there was a request for relaxation that went to both FERC and the state board in order to draw down the reservoir. But it is a requirement in the FERC license for Merced to maintain 115.

I would be happy to follow up with you. I can provide you the reference to the FERC license articles.

WILL ANDERSON: I would like to see how it comports with what you are saying.

LEE BERGFELD: Absolutely.

AMY KENDALL: Amy Kendall, HDR. This question doesn't have to do with carryover storage. It has to do with the inputs. I didn't see anywhere in the SED where meteorology was described. Can you verify which meteorology you used?

WILL ANDERSON: Well, let me get back to you on that.

AMY KENDALL: Okay.

WILL ANDERSON: I am happy to.

LES GROBER: Anybody else? Do we have that information?

DAN WORTH: Wouldn't it have come from the HEC5Q temperature model?

WILL ANDERSON: I would hate to speculate on the record, but the source -- the original source of the temperature model was the DFW version. And so I would have to verify that it is that set of meteorological criteria -- inputs.

AMY KENDALL: You are referring to the CDFW, 2013?

WILL ANDERSON: That is what I am referring to. I would have to verify that.

AMY KENDALL: Okay. Earlier you cited a CALFED 2009 peer-reviewed version. Is the meteorology different? The reason I am going into this question is because much of the variability in temperature we are seeing -- because we are only modelling monthly flow, we are getting all of the sub-monthly and the sub-daily variability that is being analyzed from the meteorology.

So it is very important to verify that it has been calibrated, and it is very important to make sure that -- well, that the model was set up to account for a monthly average flow.

From what I understood and what I read in the

CALFED and the CDFW 2013 report, they used daily flows in their calibration. And I just wanted to confirm their meteorology as well. So twofold, was the calibration verified for this set of results?

LES GROBER: Question/comment noted. We will try to get back to you offline, and please provide the comment.

WILL ANDERSON: I would add that at this stage of comparative scenarios, that it is -- there is not a calibration specifically used to get to that point. You have to go compare it to the actual observed data in the calibration, and that would be part of the peer-review exercise. And then once we go to comparative analysis, our baseline is similar to the historical baseline.

But for the reasons we have mentioned earlier, it is for this long period of record, assuming certain conditions were as they were in 2009, et cetera. So it wouldn't necessarily be expected to have the same events. But meteorology is actually a little more straightforward than that because we do have the historical meteorology, even if the flows are different.

And in terms of flow variability, flows do change sub-daily, but I would say that there is a little less variability in the flow from day one to day two than the inter -- between in the intraday.

I can't address that right now, but the accretion notes have been well noted.

Any more questions leading off of that?

Okay. So we have seen Merced profiles. Now we are going to look at the effects of flow shifting. Another look at Merced in the 1993 time frame, it was a very wet year. In the baseline alternative, there is essentially a spill, and the temperatures are maintained much lower later in the summer.

And then when we have the 40 percent alternative, in the absence of shifting any flow to the summertime, we do see a spike at that time because in the absence of flow requirements in the summer on the Merced, there is really not much flow. And so the temperatures are much warmer. So the effect of the project in this case, if we didn't shift flows, would be warmer than today's case.

Are we all in agreement? No?

UNIDENTIFIED SPEAKER: We would like to see that, and I think I have asked for that previously.

WILL ANDERSON: Okay.

UNIDENTIFIED SPEAKER: I'm sorry. I'm not trying to be argumentative, but I think we deserve to see the effects of the project and then the iterative steps you went through to mitigate for those problems.

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WILL ANDERSON: Okay. Thank you.

CHRIS SHUTES: I am Chris Shutes with the CSPA.

I have a question about what flow levels you used in the summer that you were -- that you got those big spikes.

WILL ANDERSON: Okay. Well, in Merced at summertime in the Steavenson, it is very close to zero flow. That is, I think, a reality that we see out there.

LES GROBER: But we operated to meet existing minimum instream flow requirements.

CHRIS SHUTES: So those are the FERC flows?

WILL ANDERSON: The FERC flows and the requirement at Shaffer Bridge.

CHRIS SHUTES: Right. Okay. And so -- all right. I had a related question.

At what point in the river are you evaluating the temperature impacts and then making a decision that you need to make an adjustment, and how did you determine that? Is it Shaffer or somewhere else?

WILL ANDERSON: Well, we are looking at various points along the river, and Dan is going to get to this next. So there is no -- I guess I should let him answer that.

DAN WORTH: So in chapter 7 of the SED, we did evaluate changes to the temperature throughout the summer time period. And -- but going back to the iterative

process, I think we considered changes everywhere in the river during the summer time period, and some of that goes back a few years now. And it sounds like there is a need to try to show this iterative process a little bit better, but in chapter 7, the specific river locations and temperature criteria that were used are documented.

SAM RAUCH: Hi. Sam Rauch, NOAA Fisheries. If you get to this later, you can defer this question. But I would be interested in hearing about how this flow -- the flow that results from this assumed flow shifting relates to the modelling assumptions regarding meeting the October Vernalis flow requirement, which is still sort of a carryover from the current water quality control plan.

Basically, does the flow shift in water assume to contribute to that October Vernalis flow requirement?

WILL ANDERSON: Let's -- I want to get back to you on that, just to give you the correct -- to make sure we are all on the same page on that. So the flow shifting meets a minimum flow target, which in the case of the base case -- well, the flow shifting and -- let's get back to you on that.

So what we see when we then move some of the spring flow to the fall -- so, again, we see the improvements with the 40 percent flow alternative from

February through June. Then we will shift some of that flow and eventually counteract that effect of the wet year. That is pretty much the essence of the flow shifting there. There is a lot of nuances to how it is implemented with up to 25 percent of the spring pulse but not usually that much to meet those targets.

But I welcome your written comments or questions.

Okay. So next I am going to show one more notable dynamic that really shows an example that at first makes you scratch your head and wonder what is going on in the model, but then it has a happy ending. And I am going to throw out a question to the audience to make sure that you are paying attention.

But Barb, you are not allowed to answer or anybody that works real closely on this working group.

Here we see the baseline temperatures at the release from New Malones in January through December of 1992. With the 40 percent alternative, the reservoir is at a fairly high level. Temperatures don't change that much in terms of the release, but we see something weird happening with the baseline release temperatures from New Malones.

Does anybody know --

UNIDENTIFIED SPEAKER: There is a water pool behind Old Malones that you are not able to access until the reservoir drops. And then you release that cold water, and it plunges the release temperatures out of New Malones. And then it quickly exhausts that resource, and the temperatures go back.

WILL ANDERSON: That is good. That is part of it. That is really key to the dynamics. There is a second step in here, which when I saw how the model was working, it is kind of encouraging.

And what happens as that drawdown happens and we are going from dropping below the level of New Malones? What is happening with the -- where does the water come from? Does anybody know? We will take it a step further.

Barb knows.

Can we get the microphone to Barb? I think she can explain.

No? Don't put you on the spot? Okay.

Okay. Well, I think what happens there is there is a lower outlet in the New Malones Reservoir. It is very rarely used. In fact, this is the only time frame that it was actually used, and I think that reportedly they are afraid to open the gates down there anymore for fear of not being able to shut them again.

But what happens when you go from a higher

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reservoir storage level down to a lower one where you are starting to interact at that level, which is around -- well, it is greater than 75. But if we are somewhere between 100,000 and 250,000 acre-feet, they can no longer use the hydropower intake for New Malones. So they would have to withdraw that from the lower outlet.

And so they open the lower outlet and we get -- first, we get a spike of temperature as it is just using the warm water from the surface. And then we see a big drop as it pulls from the lower outlet. And then as that small amount is depleted, then the temperature goes up again.

So I thought that was an interesting observation of the temperature model actually knowing which outlet is in use and what the temperature is at that outlet. And there are slides from reclamation that they presented more recently to illustrate kind of -- and anticipate what might happen in 2015, if we hit extremely low levels again. But these were actually -- these were similar to what was observed in '92. So I thought you might like to see that.

This is -- in the green line, we see the elevation of the water surface in New Malones, and the red line is the time below, which releases from the lower outlet. So that is a complete explanation of that. I'm

done. Thank you for abiding with that slide. I know your time is valuable.

So the next thing I am going to talk about fairly briefly is evaluation criteria and how they are compared to temperature model results. We basically use the -- for reference the US EPA Region 10 Salmon Guidance from 2003 for optimal temperatures based on a seven-day average of daily maximum statistics for various life stages. And Dan Worth here is going to talk more about that in a little while. But these are the basic criteria that we evaluate how much time are we either meeting or not meeting these criteria.

So the example of the Tuolumne from '90 to '95 is the same one. I just like to throw this up to remind us of the differences between the baseline and the 40 percent unimpaired flow. For the water year 1990, this is just a magnified view -- and I showed it last Tuesday -- of the difference between baseline and the 40 percent alternative.

Now, baseline is in the solid pale green line, and the 40 percent alternative is in the dotted line. And you can see the Delta or the difference between the alternatives. You don't see much in February, but you start to see it in March through May. And it gets to -- they both start to increase fairly rapidly in June, but there is a big delta between them, and you can also compare the lower to the higher of the criteria that Dan is going to talk about.

I want to give a visual of this for one year because then it helps to think about how they roll up to -- once you look at 34 years of this data just to keep in mind what kind of -- what the year looks like. If you look at a year where the flows aren't very different, like a very wet year or a spill year, there is not much change in the temperature, but there can be a big change in the temperature and the amount of time of meeting these criteria within these certain months.

Now, taking that a little more downstream to river mile 13 in the Tuolumne, the 40 percent alternative is still either within or very close to the -- between the lower and the upper -- I mean, near the upper criteria for the five stages, whereas the baseline condition is warming very rapidly at that point. So we see the effects of both the cold water and the greater release.

Are there any questions about that or comments?

Okay. Just one more shot of a longitudinal profile for April of 1990, which is the same period that we were just looking at for the prior two slides. Basically the first one would have been at the 3/4 river

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upstream location. It is denoted here. This is a monthly average now of the seven-day average of daily maximums.

The second one, the more downstream, mile 13, would be more of a 1/4 river on the left-hand side of this longitudinal profile. And we see the baseline is the warmest line followed by the 20 percent in the red dotted line. The green is the 40 percent, and the purple dotted line, the lowest one, is 60 percent. So you don't get that much more of a temperature benefit from increasing from 40 to 60.

I am not going to dwell on the following slide, which is kind of the statistic rollup. The green squares indicate the benefit or increased number of days meeting this temperature criteria for each life stage. This is in the report. We had discussed the Merced in June on Tuesday, but I have got some extra slides if we have got time to discuss that.

So for further information on the WSE model and the HEC5Q temperature model analysis, I would refer you to chapter F1, and if there are still questions, please refer them to us and to me specifically. I would be happy to try to answer any additional questions.

AMY KENDALL: Amy Kendall. Are you aware of the model results at river mile 56.2? This is towards the

downstream of the San Joaquin near the boundary condition. In the years 2005, 2006, 2009, and 2010, the temperatures in February through June oscillate from 35.6 to 104 degrees Fahrenheit. And did you see those model results, and could it be a sign of problems with model structure?

DAN WORTH: Can you specify where that is again?

AMY KENDALL: River mile 56.2 on the San Joaquin river. That is the node Mossdale. Any ideas about what could cause that sort of thing?

DAN WORTH: What year was that?

AMY KENDALL: 2005, 2006, 2009, and 2010.

DAN WORTH: And what months?

AMY KENDALL: February through June, nearly every day.

WILL ANDERSON: I can't answer that offhand, but I would be happy to look into it.

AMY KENDALL: Thank you. Follow-up question, with the knowledge of that, does that have any effects in the CalSim model that you are aware of?

WILL ANDERSON: I believe we are going to have a little more talk about CalSim in a little while.

DAN WORTH: Yes. Yeah, we will. It certainly would if that is being input into the CalSim model. It would affect potentially baseline conditions if it is

occurring in baseline and also --

AMY KENDALL: Yeah. It occurs in all of the alternatives.

LES GROBER: Okay. And just to make sure, that is on the San Joaquin River?

AMY KENDALL: San Joaquin River, mile 56.2, and it was in all of the alternatives and the baseline. So I was a little alarmed when I saw a little model instability and concerned about model structure.

LES GROBER: Thank you.

ART GODWIN: Art Godwin. While we are on the subject of the San Joaquin River, I notice that you didn't show any results of the temperature model on the San Joaquin River. And from what I read in the SED is the temperature targets are almost never met.

DAN WORTH: That is correct. In the San Joaquin River, the temperature targets that we used, specifically this multiplication criteria, are not improved. There is no improvement in meeting the 57 degrees, and there are improvements in average temperature. So there is reductions in average temperature. There is reductions in the 90th percentile temperatures, but that really low criteria of 57 degrees for smoltification is not improved until you get to, I think, the 60 percent alternative. I think we saw some improvement.

WILL ANDERSON: Right. There is some at 60 percent.

DAN WORTH: Yeah.

AMY KENDALL: Dumb question, so where is the fish benefit?

DAN WORTH: We see small improvements in that criteria under the 60 percent alternative, and we see improvements in -- or we see reductions in average temperatures in April, May, and June under the 40 percent alternative. We see reductions in the 90th percentile temperatures in roughly March through June under the 40 percent alternative. So although those lower criteria aren't met, reduction in the highest -- the warmest temperatures is likely going to have positive benefits to fish.

AMY KENDALL: Well, the fish benefit is really measured as a change in temperature and nothing else? So you don't look at actual effects on the fish or the fish populations? It is just if it is colder, then that is a benefit?

DAN WORTH: Not necessarily.

LES GROBER: Well, looking at the increased frequency of achieving certain temperature thresholds that are beneficial of various lifetimes --

AMY KENDALL: Well, that is the same thing I

just asked, only you are looking at it over a broader time.

DAN WORTH: To just clarify, if the average temperature was 100 degrees and we reduced it to 99 degrees or 95 degrees, that would not benefit salmon. So the changes in temperature have to be within the range of temperatures that are a potential benefit to salmon. So we considered changes to temperature and considered if those changes were within ranges --

AMY KENDALL: Right.

DAN WORTH: -- that were beneficial to salmonids.

AMY KENDALL: But you looked at it as just a percent. So if it meets this temperature for X percent of the time as opposed to Y percent of the time, then that is better?

DAN WORTH: Going back to temperature criteria, if those good -- those protective temperature criteria are met more often, we did consider that to be beneficial.

AMY KENDALL: Right. But you didn't actually analyze the effects on fish or fish populations? It is just that if you met this temperature, then that is better?

DAN WORTH: If you met protective temperature

criteria more often, that was considered better.

VALERIE KINCAID: Valerie Kincaid, San Joaquin Tributaries Authority. I have a couple questions about the flow shifting that we talked briefly about. And I think mostly they are clarifying questions. The flow shifting that you went over in your slides was not under an alternative. It is flow shifting within the model; is that correct?

WILL ANDERSON: The flow shifting within the --

within the alternatives that are represented in the model results for the 40, 50, and 60 percent of unimpaired flow incorporate an aspect of the adaptive implementation that moves that February through June flow to the other months to meet the streamflow targets that are specified in the model for that -- what is required to -- or what is determined to meet the objectives of the flow shift.

I don't know if that answers your question.

VALERIE KINCAID: Yeah, it does. So it sounds like that is part of the model. So there is no flow shifting built into the model?

My question is: What are the triggers for that flow shifting? When does it happen? How often does it happen? And how did you develop a mechanism to add flow shifting outside of the February through June period, which is kind of outside of the project period, into the modelling results?

WILL ANDERSON: It was -- so that is the major iterative step after the first -- the unimpaired flow alternative without shifting. When the observations were made that there were higher temperatures at certain times, certain months, and certain year types, then after those temperature results were observed, then flow shifting implementation was derived in the WSE that specified flow targets for those months and those year types to eventually fix the temperature impacts that would occur.

VALERIE KINCAID: Was there a threshold? I mean, the way the model works, is there a threshold at which point flow in the February through June period makes temperatures so high at X point, and then at that X point -- that trigger point we have got a flow shift? Can you tell me what that point is or what would the temperature -- I guess what the temperature would be?

When you see a certain temperature -- I mean, I am assuming what you are saying when you say "iterative" is you run it with the February through June modelling, and then you see temperatures that are too high. And so you say, "Oh, we don't want that. So we are going to flow shift. We are going to move some of the flow outside of that period." What is that trigger

temperature?

WILL ANDERSON: So I would answer your question by saying, no, there is not a trigger temperature. It was -- we see the magnitude in duration of increased temperatures above baseline in the year types, and it is different from each river. And so these were -- the amount of that flow target was determined through trial and error to find a certain number of CFS -- a certain flow target in that month for that particular river that essentially would reduce the amount of time that the temperature criteria would not be met and reduce that so that the project effects would not cause a negative impact.

VALERIE KINCAID: Okay. And then one other follow-up question --

DAN WORTH: Just to follow up on that, the temperature criteria that we were looking at are the same temperature criteria that are described in chapter 7 and chapter 19.

VALERIE KINCAID: Right. I guess I was just asking if there was a -- and I got my answer, but to that point, maybe it is not a temperature. Maybe it is a quantity of days that fall below the temperature requirement. Were you looking to, kind of, optimize at a certain point and a trigger? And it sounds like you said

you just kind of ran it until you came up with something that you liked.

A follow-up question, did you -- is there any modelling in the SED, or did you guys run the model? And if you ran it, did you disclose that it just showed only February through June unimpaired flow, or is there -- is there any run that doesn't include flow shifting? I guess that is a better question.

LES GROBER: Let me just jump in to see if I can add some --

Looks like you need some help over there. Okay.

VALERIE KINCAID: Thanks, Gita.

LES GROBER: There is some -- I think Will even showed a slide on this of some flow shifting when you are lowering reservoir elevations and you have then less need for spill. There is some flow shifting built in -- completely built in because you are not getting the benefit of those spills, and the colder water is part of those spills. That is why there is some built-in flow shifting, particularly at the higher percents of unimpaired flow and in wetter years, the above normal wetter years.

As I recall, most of that was happening even in the Stanislaus. So that is some of the built-in flow shifting. Beyond that, there was some additional

built-in flow shifting just because as you get, again, to the higher percents of unimpaired flows, there is some amount that you would need just to make sure that you are not making temperatures worse in the fall. And that starts happening at -- the 30, 35 percent and above is when we start seeing that.

So we just shifted some larger blocks of water to say, "Well, you can maintain temperatures where they were under the baseline condition." So it is something less than the maximum of flow shifting that is allowed in the program of limitations to assure that by obtaining these higher February through June flows, you weren't going to have an effect other times of the year with increased temperatures.

Again, this is -- it is intended to show that it is possible but not exactly the way it has to happen. Every year is going to be a little bit different, but that is why there is the allowance for above the 30 percent flow shifting of up to 10 percent of the amount over that.

VALERIE KINCAID: That is helpful. Just to be clear, that -- I am assuming that that means that is how you ran it, and there wasn't a run done without that input assumption.

LES GROBER: There is no run done with no flow shifting at all. Correct.

VALERIE KINCAID: Thanks.

DAN WORTH: I am just going to clarify that statement. So the 20 percent has no flow shifting, and the 30 percent has no flow shifting. So those two runs have no flow shifting.

LES GROBER: Yeah. Thank you for that. I just meant for -- nothing at the -- when you get above -- when you are starting at 35 percent and above, then there is some flow shifting built into each.

VALERIE KINCAID: And just out of curiosity, it is interesting that you said the lower percentage runs don't have them. Can you explain that to me, a little bit of why they wouldn't have flow shifting and why the higher flows would?

WILL ANDERSON: Well, it is because of the perturbation in the system. The change due to the project by reoperation was not found to have the negative effects that we start to see in 35 and 40 percent alternatives. So in other words, it wasn't necessary to do that because you don't see as much reduced spill, and the amount of time that the temperature criteria are met did not appear to be as drastic.

And in response to runs and disclosure, there was a lot of prior work that we released as part of the

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O'Loughlin Paris record act request. And there is some runs where these parameters, I believe if I am correct on this, would have been adjusted sometime ago in the runs in the B8 and B9 temperature series that were included on that thumb drive.

I am not directly familiar with what was done there, but there is quite a bit of work that has been disclosed. We did go back and revisit this recently with the latest model WSE. Because all of that was done with a water supply effects model version -- prior version that we then have continued to, kind of, refine it and find the level of demands that we are comfortable with and all of the dynamics that we have done. And so we actually have done additional runs on that at that one slide.

Let's see. For the effects of flow shifting and non-flow shifting, here was something that we recently revisited with our latest model version, which would be apples to apples with what we have published, and I would be happy to disclose that.

Okay. Mr. Shutes?

CHRIS SHUTES: I am just making the observation that I understand what you did with the model, but it seems to me that you need to take some kind of swag at defining what the project is and what the criteria are

that Ms. Kincaid pointed out, what the locations are that you are looking at, what the temperature thresholds are that you are looking at, and some kind of idea of how you determined this other than having a -- since your adaptive management group is not going to be able to look at effects after the fact, some kind of idea of how they are going to, you know -- a process to make a determination if, in fact, that is what you are going to do and if that is really part of the project. It really just doesn't seem like you have defined the project.

WILL ANDERSON: Thank you.

BILL PARIS: Bill Paris, Modesto ID. In response to Ms. Kincaid's question, you had mentioned -- somebody had mentioned minimum flows then in the summer and the fall months that you were looking for. Is that going to be a requirement? Is that sort of an assumption that with the carryover storage requirements that there will be flow requirements on the back end, that if they aren't met through the existing flow schedules that that shifting will have to occur, and those flows will have to be met as a regulatory matter?

LES GROBER: The program implication allows for the flow shifting for the -- say, for the 40 percent, 10 percent of that can be flow shifted. So it is not required, but that -- because there is so much variability in the system and uncertainty, it allows for that quantity, but it is not required. So that is getting back at this is to be managed as a block of water.

BILL PARIS: I understood. And I am not trying to be argumentative, but we had talked before about how, although it is not defined, there will be a carryover storage. I believe I have accurately characterized that. I am asking, even if we don't know the specifics, will there be a related minimum flow requirement?

I mean, again, not to be argumentative but it stands to reason that putting water in storage just to leave it there doesn't make any sense. So if we are going to have this carryover storage, there logically seems to be an implied obligation that at the appropriate times, there will be a higher flow requirement on the back end. And I am just asking if you can kind of --

LES GROBER: There is not envisioned to have a specific flow requirement associated with that carryover.

BILL PARIS: Okay. Thank you.

LEE BERGFELD: Lee Bergfeld with MBK. On the issue of flow shifting, any consideration of how flow shifting interacts with the flood control requirements of the reservoirs? And where I am going with that is in looking through the water supply effects model, it

appears that on the Merced in wet and above normal years, there is always a volume of water that is shifted.

And that can occur even in years when, through the February through June period, the reservoir is at flood control levels. So the ability to "store" that water and meet those shifting requirements at some point in the future, we are already meeting through spill the 40 percent requirement. We can't back off our release to hold that water into storage, and, therefore, it would have to come out of storage and effectively be displacing water stored by Merced MID for the purposes of shifting in the future months.

Any thought process on that? And it gets to some questions by Mr. Shutes and others about, you know, the implementation as you sit and try to figure out how are we going to operate through this and come up with a plan, I believe by January 10th each year, to operate and thinking about that shifting dynamic with the flood control diagram.

LES GROBER: That is an interesting -- please make that comment because I think if I am hearing correctly, there is concern with that. If -- you are saying there would be limited opportunity to flow shift without having some additional -- well, I'm actually not sure.

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I don't think that would fall out to the additional water supply effect. Because we would still -- I think we still -- that is part of the reason it is, perhaps, even overestimated in terms of that water supply effect. I don't think there would be, in the way you have described it, any additional effect. But it certainly is not -- it doesn't seem that it would be an optimal operation in some years, which is why in some specific years, there might be some alternate operation.

LEE BERGFELD: Yes. I guess just my question is whether or not that dynamic had been considered in the analysis. And then to clarify, the water supply effects model is releasing it every year. It is shifting this volume of water in any wet or above normal year, based on my review. That is my understanding. And so it is not overestimating the water -- it may be overestimating the water supply impacts, depending again on how this is actually implemented.

But it also may be overestimating the ability to shift flows if, through the implementation process, it were to be agreed that you can't shift flows when you are spilling at the reservoir. So something for consideration.

LES GROBER: Thank you.

WILL ANDERSON: Well, if there are no further

questions, we are running a little bit ahead of schedule.

LES GROBER: I think this would probably be a good time for a break then and then start with the next module at -- by -- which clock is it? Let's start in about 15 minutes. So 5 until 3:00.

WILL ANDERSON: Thank you.

(Whereupon a break was taken.)

LES GROBER: Okay. Welcome back. Okay. Dan, it is up to you.

DAN WORTH: Good afternoon. My name is Daniel Worth. I am a senior environmental scientist in the division of water rights, and today Brittany and Will and I are going to talk about three of the topics that are represented in chapter 19 of the SED. Specifically we will talk about the temperature benefits, floodplain benefits, and CalSim.

This project is designed to restore the pattern in some limited magnitude of flow that are more closely aligned to the conditions to which native fish species are adapted. The benefits of increased instream flows expected from this project have a functional useful effect and are evaluated and quantified in the SED in two key ways.

First, we evaluated increased detainment of beneficial water temperatures for salmonids over space, more river miles, and time -- more days. Second, we evaluated increased flood inundation also in space and time, meaning more acreage is inundated more of the time, thus benefitting growth and survival of juvenile salmonids.

Water temperature is one of the most important habitat features there are in the San Joaquin basin for native fish. Water temperatures affect behavior, disease, predation, migration, reproduction, growth, smoltification, and having habitats like floodplain or spawning areas are not useful unless temperature conditions are adequate within those areas.

To evaluate potential temperature benefits of the proposed project -- we evaluated temperature benefits of the proposed project. We evaluated temperature statistics in three primary ways. We used the US EPA temperature criteria as a benchmark to evaluate improved temperature conditions. We also evaluated potential changes to average temperatures and changes to the 90th percentile temperatures. First, I will walk through how we used the EPA temperature criteria to evaluate potential changes to habitat for salmon and steelhead.

So we are looking at all of the days in the month of May between 1970 and 2003 at river mile 28.1. And this is a distribution of those seven datum

temperature results. And for this example, we used the EPA's core rearing juvenile criteria of 60.8. You can see from this figure that under baseline conditions, 59 percent of the days in May were less than 60.8 degrees Fahrenheit. This figures shows how the distribution of daily temperatures looks under the 40 percent alternative. Now, you can see that 98 percent of the days have a temperature that is less than 60.8 degrees Fahrenheit.

This figure shows the data for both baseline and the 40 percent unimpaired flow. The shift in data going from baseline to 40 percent unimpaired flow shows that the criteria of 60.8 is met an additional 39 percent of the time. And there is supposed to be a box there that shows you the math, but it disappeared.

So the way this is shown in chapter 19 it looks something like this. The red box on the left shows that temperatures were less than 60.8 degrees Fahrenheit 59 percent of the time during May at this river location. The red box on the right shows that under the 40 percent alternative, temperatures less than 60.8 degrees were met an additional 39 percent of the time. And these numbers are additive. So under the 40 percent unimpaired flow alternative, the temperature criteria are expected to be met 98 percent of the time.

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The table also shows other months and other unimpaired flow scenarios. So I am not expecting you to try to read this, but in chapter 19, you can see this table. It is table 19-6. And I just wanted to show you that that data presented on the last slide is the data that is within the blue box. And that same shift is indicated by the red boxes.

So this data is within the blue box, and this bigger table shows additional months that -- and additional river locations. It shows the confluence at approximately 1/4 river, 1/2 river, 3/4 river, and the dam release going from downstream to upstream. And it is read the same way as that last table. So it is the amount of time that the criteria was met under baseline conditions and then under different unimpaired flow scenarios.

So we showed many river locations, and we showed all times of the year. And we did this for all of the rivers, including the San Joaquin River. The green boxes represent improvement in the amount of time that the US EPA criteria was met, which is greater than 10 percent improvement. So if an alternative met the criteria an additional 10 percent of the time, we highlighted the box green. And if it was met 10 percent less often, then it would have been highlighted red.

ART GODWIN: Art Godwin. I noticed you have temperature improvements in, say, September, and I am wondering what the source of that is. Is that from flow shifting or -- because we are only talking about a February through June flow requirement. So how do you get benefits in September?

DAN WORTH: Yeah. Some of that, if not all of that, is related to flow shifting and possibly shifting a little bit more flow than we needed to shift to exactly match baseline.

ART GODWIN: Thank you.

DAN WORTH: Now, I will just show how we evaluated changes to average temperatures.

UNIDENTIFIED SPEAKER: So we don't think any part of that improvement in the non-February through June could be from the carryover storage increasing?

DAN WORTH: Yes. There is potential improvements from storage. There is potential improvements from flow shifting. Flow shifting does increase storage by default.

UNIDENTIFIED SPEAKER: That too.

DAN WORTH: So it is a combination of factors.

Now, I will discuss how we evaluated changes to average river temperatures. So this is the same data that we looked at before except now we are going to look

at changes to average temperature. Under baseline conditions, the average river temperature in the Tuolumne

River is 59.6 degrees Fahrenheit at this location. Under the 40 percent unimpaired flow scenario, the addition of flow to the river causes average river temperatures to get colder. The average shifts to 55.9 degrees Fahrenheit, and that shift is illustrated here. It is 3.7 degrees colder.

That shift in average river temperature from the previous slide is shown here by the red boxes, and this is an additional table in addition to that last table. Again, all months and multiple river locations are shown in chapter 19. In this table, the green cells that have shifts of one degree or more are highlighted green if they are one degree colder, and they are highlighted red if there were changes that were one degree warmer.

Now, we are going to look at how the 90th percentile temperatures were evaluated. The 90th percentile temperature represents the temperature in which 90 percent of the data is below and 10 percent of the data is above. This provides useful information about the hottest temperatures that fish may experience over some given time period.

Under baseline conditions during May at river mile 28.1, the 90th percentile temperature is 66.2

degrees. Under the 40 percent flow alternative, the 90th percentile temperature shifts to 59.4 degrees, and that is a shift of 6.8 degrees. This table shows all months and all river locations that were evaluated. Again, the confluence, 1/4 river, 1/2 river, 3/4 river, and then the dam release. The red boxes show that same shift as the previous slide.

And on the Tuolumne River, we see particularly large reductions in the 90th percentile temperatures. So there is big reductions in the hottest temperatures on the Tuolumne.

So in summary, there is potential for big improvements in temperature conditions from increased flows. These results include no optimization. Optimizing flow shaping would improve temperatures for key life stages. US EPA criteria were used only as a benchmark and are not proposed as objectives.

Now, we are going to move to floodplains. Floodplains have been shown to be extremely important to native fish. They can improve food availability, predator avoidance. They can result in faster growth and better survival of native fish species, such as the Sacramento splittail spawn, on floodplains between

February through June. We used floodplain versus flow relationships, such as this one, to evaluate potential

improvements to floodplain inundation to the proposed project.

These relationships were developed by the U.S. Fish and Wildlife Service for the Stanislaus and Tuolumne rivers and the State Water Board developed the relationship for the Merced River and CBEC at the request of FISHBIO developed these relationships in the San Joaquin River.

The exceedance table shows one of the ways we evaluated floodplain inundation benefits. On the left side of this table, we show a series of increasing flows.

The next column shows floodplain acreage associated with those flows. These acreage values were estimated by the groups identified on that previous slide.

Now, if you look at the red box on the left side, I will walk you through how this works. The red box that shows 17 percent means that monthly average May flow was greater than 2,000 CFS 17 percent of the time under baseline conditions. We can also say that 17 percent of the May months have a monthly average floodplain inundation greater than 305 acres.

The other red box shows that this flow and the associated floodplain acreage is now exceeded an additional 51 percent of the time under the 40 percent unimpaired flow scenario. Under this scenario, monthly average May flows are greater than 2,000 CFS 68 percent of the time. So again, those values are additive to the baseline. That is the increase or the change in the amount of time that those flows are exceeded. And you will notice there is a stepwise increase in the potential for floodplain improvement as you go from 20 to 60 percent.

The blue box with the red squares on this table shows the information that I have presented on the previous slide. So chapter 19 shows the same information for all months from February to June and for all river lo -- all rivers -- the Stanislaus, the Tuolumne, and the Merced and the San Joaquin River. And you will see from this slide that most of the potential for floodplain improvement, as we modeled flows, occurs from April through June.

This is a figure that summarizes floodplain benefits using a metric called "acre days," which is simply the number of acres inundated per day and added over some time period. This figure shows the annual average acre days from April to June on the Tuolumne River over an 82-year time period. This shows the same annual average acre days of inundation on the Tuolumne River except this shows just the drier water year types.

We typically see the warmest potential

improvements in floodplain inundation during these drier water years. There is potential for large increases in floodplain inundation, especially in dry years. Results are not optimized for floodplain habitat. Bigger results are possible from flow shaping, and flows can be optimized to achieve desired water depths and durations of inundation through that optimization process.

Now, I am going to turn it over to Brittany to talk about CalSim.

BRITTANY KAMMERER: Hi. I'm Brittany Kammerer. I am also a senior environmental scientist here at the water board with the division of water rights. So I am going to briefly go over SALSIM and the simulation model that was developed by the California Department of Fish and Wildlife. So it is something that we looked at in the SED, but it is something that we didn't rely on. So I am going to go over the reasons for that.

So just to give a brief model overview, it tracks daily growth, movement, and survival of Chinook -- fall-run Chinook salmon in the San Joaquin as a function of flow temperature, predation, and other factors. It was designed to estimate changes in juveniles produced by each tributary in a series of modules, and these also include total juveniles out migrating to the Delta, total juveniles entering into the ocean, and also total adults

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returning to the tributaries.

So this is also discussed in the SED. There is some -- yeah. There is some limitations of SALSIM. So I am going to go over what those are to clarify the understanding of limitation. So the first four years are priming years, and I will discuss these in the next few slides. There are also increases that include an ocean crash, which affects adult returns during 2005 to 2009.

And the data used to construct the model has many uncertainties. So there is a number of uncertainties, meaning, for example, the rotary trap data, there is a lack of confidence in that and also some of the movement and survival data used to build the model. And these are some things we have discussed with the CDFW. So they will also be able to answer some questions.

Okay. So the first four years are priming years. So earlier we saw some slides -- or a slide highlighting the relationship between flow and fish abundance in the San Joaquin being related to flow 2.5 years earlier. So if you look at that relationship, it highlights how the first four years are priming years.

So I am going to try to point -- hopefully, this is clear. The 1, 2, and 2.5 years include those first 4 years of priming years. And so the first -- the fifth year is really the first year where you can really accurately use the model. And somehow the last five year box disappeared, but those last five years reflect an ocean crash.

And so in the Pacific Ocean in 2005 and 2006, there was a large ocean crash in the Chinook salmon fisheries, and the fisheries actually closed in 2009. And those are based on the population life histories where returns come back year 1, 2, and 3. So the last five years reflect that ocean crash -- so you can see that in abundance trends in this graph. And this is also in the SED in figure 19-14.

So that is highlighted probably more clearly in this table, where the 16-year average used to build the model -- the 16 years used to build the model are reflected in table 19-13, where you see that 100 fish number that lots of folks have been talking about. And if you include the flow shifting, then the numbers are greatly improved. However, if you look at just those seven years that are effective, the numbers improve quite a bit. So they pretty much double.

So that is one part of why we didn't rely on SALSIM, and it was also not useful for the SED based on the conditions proposed in our SED. So the magnitudes of the flows are greater than the conditions used to build the model. And so these are some things that we have

discussed with the CDFW.

So in its current form, SALSIM was also not very accurate with regards to temperature. So it is oversensitive relative to egg mortality. So for example, it begins to -- we began to see egg mortality around 13 degrees Celsius, which are actually great conditions for Chinook salmon eggs. And similarly, juvenile mortality is undersensitive relative to lethal temperatures.

So the model sees juveniles surviving at 30 degrees Celsius, which are actually lethal for Chinook salmon. So in its current form, it also underestimates the benefits of floodplain inundation during the spring time period. So it doesn't see the increase in acreage that occurs with increased flows.

So to summarize, we looked at the results that SALSIM produces; however, we didn't rely on them. And instead we relied on the results that Dan went over using temperature habitat to evaluate temperature benefits, so the US EPA criteria and also the 90th percentile criteria and also average -- averages. And, likewise, we used floodplain habitat to evaluate floodplain benefits, so primarily acreage.

And with that, I am going to hand it back over to Dan to summarize.

DAN WORTH: So I just wanted to take this

opportunity to say that the focus is often on fall-run Chinook salmon, but I would like to remind everyone that there is other native fish in this basin. There is fish like sturgeon and steelhead and splittail that would benefit tremendously from improved flow conditions in the San Joaquin basins in the tributaries. And although we use fall-run Chinook salmon as an indicator species and they get all of the attention when it comes to press, there is a lot of other really important native fish species in the San Joaquin basin that we expect will benefit tremendously from this proposed project.

So with that, we will take some questions, if there is any questions.

VALERIE KINCAID: Valerie Kincaid, San Joaquin Tributaries Authority. I had a question about floodplain analysis, and do you use the 30-day modelling results for the floodplain?

DAN WORTH: Yes. They were based on monthly average flows.

VALERIE KINCAID: So then -- and you will -- this question will reflect my layperson's view of modelling and daily improvement. But does that mean that if you saw an acre day improvement in the month of June, you would count 30 days? Does that make sense?

DAN WORTH: No.

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VALERIE KINCAID: So if you are doing a monthly estimate and you see floodplain habitat improvements, my guess is you would either have to count it or not. So how does that work?

DAN WORTH: Well, the monthly average flow -- well, first of all, that exceedance table that I showed was based on monthly average flow. To calculate acre days, that monthly average flow gets assigned to each day in that year for that month. So if the monthly average flow is 2,000 CFS for a certain year, every day within that month gets that 2,000 CFS flow to calculate acre days.

VALERIE KINCAID: Okay. So you would count either an entire month of acre days or not?

DAN WORTH: You would calculate an acre day for every day in that month, or you would calculate acre days for every day in that month.

VALERIE KINCAID: And they would be the same quantity of floodplain inundation, wouldn't they? I mean, you wouldn't have one day being higher or lower than the next if you have a monthly?

DAN WORTH: Yes. Every day would be the same.

VALERIE KINCAID: Right. Okay. And then I know this was touched on in another hearing, but can you talk about whether or not or maybe why -- why didn't you look at other aspects of floodplain inundation, like duration and depth and that kind of thing and if you think that is important or not or if all floodplain days are created equal?

DAN WORTH: So we didn't look at duration because we used monthly average flows. So we couldn't evaluate, you know, how often something happened for a ten-day period. So we didn't look at that specifically. And in terms of depths and velocities, this is a big programmatic evaluation over an 82-year time period, and with the flow optimization we talked about, you could try to inundate floodplains to certain depths and certain durations.

We simply tried to show that there is an increased potential for floodplain inundation under these higher alternatives. So the potential increases and things could be optimized in realtime.

VALERIE KINCAID: Thanks.

DORENE D'ADAMO: Dorene D'Adamo for the state board. I have a question about the different models for -- that were used for the San Joaquin and the Merced on floodplain inundation.

DAN WORTH: Okay.

DORENE D'ADAMO: Could you compare them?

DAN WORTH: So in terms of these relationships

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that were developed, I could discuss these more, if you would like.

DORENE D'ADAMO: Well, I am just wanting to better understand. They were done by different agencies. So are they the exact same, or are there differences in the approaches used?

DAN WORTH: So there are differences. So they all developed relationships like this -- floodplain versus discharge relationships. And the relationships developed for the Stanislaus and Tuolumne River were developed by the U.S. Fish and Wildlife Service. And the details of those studies are briefly described in chapter 19 and are cited in chapter 19.

And what the U.S. Fish and Wildlife Services did on the Stanislaus and the Tuolumne is used GIS techniques and provided some additional ground truthing. So it is kind of a mapping exercise with some ground truthing. And they took out things like ponds that are within the floodplain. So they subtracted things out that aren't necessarily floodplains. And then they simply calculate -- they determine where there is an inflection point in river width as discharge increases. So they figure out where a floodplain starts to spill out of a channel onto the floodplain and use mapping techniques to calculate the additional acreage that is outside of the

main river channel. CBEC did a similar type of study. I think they used LIDAR, but I would have to go back and look at exactly what data they used.

And then for the Merced River, we used cross-section data from the HEC5Q temperature model and calculated a similar thing that the U.S. Fish and Wildlife Service calculated on the other two rivers. We determined where there was an inflection point in channel width as you increase discharge and then calculated in-channel acreage of -- I guess just in-channel acreage and then calculated out-of-channel acreage. You can calculate floodplain acreage based on that.

And it is my understanding that on the Merced River, there will be a more detailed study at sometime in the near future.

What is that?

The U.S. Fish and Wildlife Service intends to do a more detailed study on the Merced River.

ROB SHERRICK: Hi. This is Rob Sherrick from HDR. A quick note on the acre days. Since you used a monthly analysis, it seems like it would make more sense to use a metric of acre months, just to be clear about how it was calculated to say that it is a monthly flow rate. It is an acre month, not an acre.

Do you think that you would get different results if you included a duration component, a depth component, and possibly a seven-day following the unimpaired index percent of unimpaired? Do you think that would change these floodplain inundation results and the changes that you see between the alternatives?

LES GROBER: Rather than speculate on what we would see, I just -- we want to bring it back to the program of implementation and the adaptive imputation component. This is meant to show at a programmatic level what you could achieve, you know, first for comparative purposes, baseline versus the alternative. So the things that you were describing would apply to, you know, each of those in terms of the -- some of the variability of the things that you would see.

But perhaps even more importantly, this is intended to be a quantity of water, a budget if you will, February through June to be shaped. So certainly by definition, you could achieve exactly this because if you wanted, you could achieve these kind of static flows on a monthly basis, but the thought is that you could actually achieve something much better by shaping the flows to just get the biggest bang for the buck for the limited quantity of water.

But, you know, comments like this are well taken to, you know, provide comments on thoughts and concerns

that we would be -- are interested in hearing.

ROB SHERRICK: Thank you. The second part has to do with the metric of using the Tuolumne Fish and Wildlife Service numbers for the wetted area for acreage. In the relicensing process, an extensive two-dimensional hydraulic model was developed for the Tuolumne River, and I was just wondering why that wasn't used. It has very detailed information and actually goes a step further and develops usable area and not just wetted area. And so I just wanted to know about that.

LES GROBER: And you can provide, you know, comments on suggestions for things like that, but I keep wanting to bring it back to the programmatic nature of the analysis, you know, looking at the 82 years of data and the subset for the temperature modelling, things like that. There is, you know, many more detailed models. You have more detailed refined analyses, which I think could be useful for the actual operation, but this was intended to show very broadly what the effects and benefits could be.

DAN WORTH: Any questions about temperature, floodplain, SALSIM?

WILL ANDERSON: Or any of the other models for that matter. We will open the floor.

LES GROBER: I just wanted to refer back to a

previous comment/observation about the temperatures for 2005, 2006, 2009, 2010. I think -- was that Amy Kendall that had made those comments? Thank you for those comments and observations, but when we had a huddle here, I just want to point out that that is some of when the -- that is the use of the extended model after the 1922 through 2003, which was principally done to do, kind of, a comparative analysis for drought. You know, how does a full period of record compare to the more recent drought years?

But the comment -- it is a good comment, something that we would be looking into further. Because it certainly -- if that is some of the temperature data that was fed into SALSIM, it could be another thing that has led to some of the results. So it is something that we will look into further. But it is not at that period -- the period used for the benefits analysis and the effects analysis of the SED. That is the core time period of 1992 to 2003.

WILL ANDERSON: And just to be clear, the temperature actually starts in 1970, and we don't have that prior.

LES GROBER: So temperature, of course, is a subset of that. So temperature benefits is 1970 to 2003.

UNIDENTIFIED SPEAKER: My concern is that if we

don't know what is causing the instability, it could be occurring elsewhere, in years other than those. And it could be affecting model results that we just don't see in other -- it just calls into question the stability elsewhere. And just because the results look reasonable -- we need to look into why -- what would have caused that and whether it is affecting other model results.

LES GROBER: True. And the comment itself, we will look into that. But, you know, one of those -- when you refer to the stability, since that was used for other

purposes, very low flow conditions, it could be very much
affected by the meteorology.

But it is something that we will explore. But I
think it is important, you know, just for the core
modelling period. That is where there was the greater
review and rigor for the use for the temperature model
that was at the 1990 through 2003 period as well as for
the 1922 to 2003 for the effects analysis.

DAN WORTH: I will add that in chapter 7, we
show minimum and maximum temperatures under different
scenarios, and we don't see those 100-plus-degree
temperatures. But your point is taken into -- what is
that?

UNIDENTIFIED SPEAKER: The result I am referring to was never plotted.

DAN WORTH: Okay. So we do show other river locations in the San Joaquin River but maybe not that particular river model.

LES GROBER: Are there any further questions? Did we actually end up ahead of schedule?

At least one other point, we had mentioned that there was some interest in the -- you know, continued interest in the reservoir reoperation and what would occur under a situation when there were no reservoir operations. Even though it is not the specific topic for next Monday, we are going to try to have something that would show that so you can, kind of, discern what would happen if you had water as minimum storage as something that tracked the current operation and applied that to the report.

But I think as it has been said a number of times today, among many other things, what you would see is like if you bring that -- if you are drawing it down more frequently, which you would with now the additional demands of both having to make the 40 percent unimpaired flow release or whatever the alternative is in conjunction with trying to maintain levels of delivery, you would have much bigger temperature effects for other times of the year that you don't otherwise see.

But to help discern some of that, we will try to bring some of that to the next meeting.

Board Member Dorene D'Adamo --

DORENE D'ADAMO: Thanks for that reminder that you are going to be looking into that and providing additional information. We got a lot of questions today, and I had asked and I know some of the other board members had asked similar questions last week. And so I would just like to get some information as to timing as to when you think you will have that information available. And then if you could also let folks know what you are thinking in terms of the other requests that we had, and that is looking at overlaying the SED on four years of drought, similar to, say, the last four years. I know that is something that you were going to be gathering some additional information on.

And then I had a question also about the VAMP. So go ahead and answer that, and then I will come back to the VAMP.

LES GROBER: Yeah. We actually started pulling some of that information together because we have a drought chapter but a comparison of what we will have -- and we can bring that to the next workshop as well -- a comparison of some of the averages over critically dry years and compare that to what happens on average, say,

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during the period of record in the most recent drought. And our preliminary analysis shows, just to add value to it, that it is very similar to that more historic drought of '87 to '92. We will bring that to the next workshop as well, even though it is not specifically the topic for the upcoming workshop.

DORENE D'ADAMO: Great. And then before moving onto VAMP, it reminds me of another question I had on last week's workshop -- board workshop, and that is trying to hone in a little bit more on the specific months. In particular, looking at June and the benefits -- the fish benefits of the flows in June and then also looking at the water supply effects for June, I don't know what kind of time would be involved, but it would be good if we could just look at each month. So I don't know if that is something that you were thinking of including in the workshop on the 12th, looking at the individual months, specifically June.

LES GROBER: We tried to cover that. We didn't, I guess, cover that fully today. But I bring this back to another big thought that I have with regard to the proposal, that this is intended to be, in the end, a budget of water for that February through June period. In some of the tables that we have presented today, it shows that there is benefits in June, and I will ask Dan to speak to that in just a moment.

So that is really a two-pronged answer. One, it is the overarching benefit of that February through June budget of water, which ties to many of the comments that we are getting here today. We agree that there is better ways that you can operate the system and optimize the improvements that could be achieved, in particular, if you use that budget of water February through June to get the biggest bang for the buck.

But for the other part, June also has benefits. We heard part of a, you know, presentation at the hearing last Tuesday that, you know, we tend to always focus on various life stages and pushing, you know, the same class size fish out of a certain time. But those old periods are, you know, kind of important.

And now I will hand it off to the biologist to actually make sense of all of that.

DAN WORTH: So if I may, could you switch back to mine for just a second and then go to the end of the presentation? So let me start out with this slide. So this is a daily estimate of passage of unmarked Chinook salmon at a rotary trap near Modesto, and this is done by FISHBIO. Again, this is the lower Tuolumne River. And we see the estimate pass through time from January to June 21st. And this is 2006. It looks like a wetter

year.

And I have put a red line on there, and the red line shows the end of May. And we see that during the June time period, there are certain years that June has quite a few fish migrating downstream. And if you look at multiple years -- so this is '96 through 2005. And this is the Oakdale screw trap on the Stanislaus River.

You will see that in certain years there are quite a few fish that migrate past -- past the end of May. Some of these years, it looks like the data cuts off abruptly, and that might be because the rotary screw trap was pulled. So this might not represent all fish that migrated down the river. Sometimes they pull the rotary screw traps if they aren't catching fish or maybe for other reasons.

But this type of figure shows that for certain years that June is extremely important, especially when you consider different life stages of fish. When you look at the smelts that migrate downstream during any particular year, June can be a very important month for the smelts. And we heard about the importance of different life history strategies -- you know, the fry, the par, and the smelts -- and how it is important to try to protect all of those different strategies.

So in certain years, June is certainly very

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important, and I do want to show this is the Stanislaus River, the Oakdale screw trap. This is data from '95 to 2009. This is -- now, we are looking at fork length of the vertical axis and time or month on the X axis, or the horizontal axis.

And what you can see from this figure is that there is a group of fish that are less than one year old, and they are -- they migrate -- so these are fish that are less than one year old. So they were born sometime earlier in the year. And for these less than one-year-old fish, we see quite a few of them that migrate in June. Steelhead typically migrate later in the year than fall-run Chinook salmon. And so June is particularly important for steelhead.

DORENE D'ADAMO: And do you distinguish between native and hatchery? I know we had some testimony last week where they were able to -- UC Davis and NOAA had some information about being able to distinguish --

DAN WORTH: So for these fish that are shown on this plot here, I'm not sure if they determined the parental origin of these fish. So I'm not sure that they determined where the parents came from. Did the parents come from some other river and then swim into the

Stanislaus and lay their eggs? I'm not sure that these individual fish have had that assessment done.

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DORENE D'ADAMO: Okay. Well, this is helpful. Thank you. And if you could go back to the series of charts, it is kind of hard for me to see. But are those all -- do you have all of the years in which -- this is based on rotary screw tap information?

DAN WORTH: Correct.

DORENE D'ADAMO: And that is just on the Stanislaus?

DAN WORTH: This is the length of all sampled juvenile Chinook salmon at Oakdale on the Stanislaus River in these years, '96 to 2005, And there are individual annual reports for each year. And that probably shows additional information.

DORENE D'ADAMO: On each river?

DAN WORTH: Yes. There are rotary screw trap reports for each river.

DORENE D'ADAMO: Do you have that in the SED in an appendix?

DAN WORTH: So a lot of the fish timing was first evaluated in the scientific basis report, which is appendix C, chapter 3, and that was done in 2012 initially. And there is some additional discussions in chapter 7 about timing.

DORENE D'ADAMO: Okay. And I should have thought about this earlier when we were talking about the water supply effects analysis, but this is an issue that I will be continuing to ask questions on, sort of the bookends of February and June. And I was hoping to, in these workshops, have a little bit of a discussion about -- you know, a more open discussion just because board meetings often don't lend themselves to that kind of a discussion. So to the extent that we have more time today or continuing on into the 12th looking at sort of a comparison between migration and water supply impacts for those bookend months, particularly June.

DAN WORTH: Yeah. And I would just like to add that these are fish that are in the tributaries in these figures and that there is probably some additional benefit of trying to get them down the San Joaquin River. And so it is not just about trying to get fish out of each of these tributaries; it is trying to get them into the Delta.

DORENE D'ADAMO: I understand. I am looking more to get the information about, you know, what are the conditions? You are saying in certain years, it is going to be very important. So I am looking to, kind of, drill down on how many fish, what months, what year type, when is it really important.

I know the individual from UC Davis, a doctor -- I can't remember her name, but in a discussion with her,

she had indicated that, you know, June could be important if there are fish present and, you know, probably this might be something in terms of functional flow, looking at, you know, how to get the fish out, you know, with a more limited use of water.

And that goes back to my question about the water supply effects for the month of June. I keep hearing from the irrigation -- and I know we don't have all of the IDs here -- some discussion about, "What are the water supply effects expected to be in the month of June with a 40 percent of unimpaired flow?"

And I expect the irrigation districts will be telling us their point of view when we go to the upcoming workshops, you know, in Stockton, Modesto, et cetera, but it would be great to have you-all point us in the direction, either telling us what those water supply effects are or pointing us to the documents to let folks know how you view those water supply effects for the month of June.

LES GROBER: Sure. We have heard that comment.

So we can come up with that -- we will try to come up with that amount even as early as the next workshop. But it is -- it is going to be important to present that in balance against the way we have been presenting this as a package in a block of water. Because June -- the reason

that is important is it is going to be not a small water supply effect. Because June is a big month in the San Joaquin River basin, and that cuts both ways.

It is a big month in terms of the benefit and also the -- not necessarily directly just in the month of June but in terms of the budget of water. But it is also -- it is a big month in terms of water supply. So we will try to tease that out so that we can present that at the next meeting.

DORENE D'ADAMO: That would be great. Thanks.

Now, my last question on the VAMP -- and I understand because of the NOP going out in 2009 and that the VAMP was in effect at that time. So I understand why it was included in the baseline, but I think from the perspective of trying to sort of better determine water supply effects, it is not currently in place.

And so I would like to, maybe, get your help on how to best structure a question to you so that we could tease out the VAMP. And in light of the fact that it is not in existence right now, to have it in baseline, it seems to me that it could be skewing the water supply effects. And so could you do a run without the VAMP so that we could get a better determine -- like, right now, the overall average, I can't remember what you -- it is, like, 12 percent on average.

In critically dry years, there is a higher percentage of water supply impact. If we didn't have the VAMP in the baseline, what sort of an adjustment would there be on the average annual water supply impact, and what sort of an adjustment would it look like in the critically dry years? I am just not that familiar with how VAMP functioned. I know they are different year types. And so I am just sitting here, kind of, guessing. I would like to get the benefit of, you know, your view of if the VAMP were not in the baseline.

LES GROBER: Well, and if it is not -- that is not in the baseline, then it begs a question of what else is different. There is always a limit of how much analysis one does, and you look at the full implementation of the plan and the provision of flow being hypothetical just from the Stanislaus. So there is a lot of what-ifs. We can try to tease it out to maybe try to quantify, you know, how much that means, but, you know, we are putting a lot of information together in a short period of time. So we will see what we can do with that.

DORENE D'ADAMO: Right. I mean, otherwise, I am left to kind of figure, you know, talking with folks one-on-one how much was in the VAMP, and then I will do my own calculations. And I would rather not rely on my

math.

LES GROBER: Sure. And it is always a

relative -- it is looking at the relative effect from a baseline, but your point -- I hear your point.

I can return back for your other question. Though we don't have the table, I will just show a couple of charts that Jason can put up in the other PowerPoint to just address your question about the drought years and the recent years.

So here is a series of three time series that are showing -- this is the first for the Stanislaus. And to orient you, it is looking at the full period of record. So now, it is that base model time period, the CalSim period from 1922 to 2003 and also the extended time period to through 2015 to get at, "How does the model time period look," and "How do you compare the most recent drought with past droughts?"

So it is showing the monthly -- oh, no. This is the annual. Sorry. This is the annual runoff, and it is looking at the water year runoff, the February through June runoff, the average runoff for the time period, and the runoff deficit and cumulative runoff deficits. So this is pulled from, I guess, chapter 21 in the SED.

So something to observe there in terms of the cumulative runoff deficit and the runoff deficit, those

two lower bars, it shows that the most recent drought kind of tracks. It is very similar to the drought period from 1987 through 1992. And you see a similar pattern for the Tuolumne and also for the Merced. We will have another table, which will show the summary statistics of these.

And bottom line, what the summary statistic shows is that if you take that five-year drought period, the '87 through '92, it is very similar to the average of all critically dry years. It is actually a little bit wetter just because those -- not all of those dry years were created the same. Some were a little bit wetter than others.

So this is doing a couple of things. So in general, the time period has considered, you know, generally the types of drought -- the magnitude of drought that has happened in the past, though with some slight differences. So we will present more on this at the next meeting.

ART GODWIN: Art Godwin. I want to take this down a notch, if I could. We were talking about lots of modelling scenarios and what-ifs and things that could happen. But do you, Les, see things happening in the real world? How are we going to determine the block of water from February through June as early as January?

How are we going to operate the system on a realtime basis shaping water for temperature, for floodplain, for flow shifting? How are we going to make all of those determinations on a realtime basis and still meet the seven-day average daily max and seven-day running average flows with a block of water? And what happens if we underestimate or overestimate the block?

LES GROBER: I don't know if you have any idea how much I like that question because that is so forward-thinking. And how do we actually do this? Because -- and that is why settlement will be so important for this, too. And it is just the types of things that we need to be thinking about now and in the future.

But a short answer to the start that you described is we already know a lot about the system. We know what we have done in the VAMP. We know that certain time periods are more important than others. That is why we kind of emphasized, you know, high pulse flows, like in an April/May time period. We know that every year is a little bit different. We know that we didn't do everything we could possibly want in the river because there is just not enough water to do it all.

So how do we maximize that beneficial use of water? So to give an example and based on what we do know, we won't know a lot about the hydrology in January or February when plans will have to be prepared, but we will know things like what the carryover storage is, and we will know what is happening out of the window now. So an example would be, "Well, based on what we have in terms of carryover storage and what we know in general, we know that depending on one's perspective" -- I am going to say something. Maybe it will make you smile.

40 percent is not a lot of water. But how do we get the biggest bang for the buck on that? We will want to shoot for a pulse flow that is even higher than that, that is 50 percent of unimpaired flow or something higher than 40 percent. So starting in February and tracking conditions, that is kind of a provisional plan. In April and May, we want to pulse that something bigger than 40 percent of unimpaired flow, which means that we have to

bank some water in the early months, February /March, and kind of watch as the water year unfolds and as we get information of how much is actually there.

So it is kind of a relative plan to have a rough plan of what you plan to do in the big picture and trueing it up as that information comes in and with the requirement being in the end the block of water it would track on the seven-day average, the 40 percent of unimpaired flow. That being said, if a plan is created

and then situations -- things change beyond what had been envisioned in terms of, "It looks like now we have to spill or something because conditions got so good," something like that, all of those contingencies should be identified in the plan.

But, ultimately, you just have to comply with what the elements of the plan are to plan for how you would be shaping the water in that current year. And then it would include elements depending on what the general hydrology is and how it gets tuned up. "Well, we think we will want to save some of this so we have water in the summer and the fall for temperature control."

Every year is going to be different, and this is when all of the models and all of the expertise that sit in this room will have to come to pair to figure out, "How do you actually do this thing now within this budget of water?" But some of these discussions in the much more than two or three minutes that I have described this is the discussion for the STM working group, for the settlement groups to figure out how you would implement this within the construct that the board is presenting.

CHRIS SHUTES: Chris Shutes with CSPA again. A couple of comments, one, if you are not looking at VAMP, I think you need to decide what you are going to put in its place. Are you going to not have anything at all, or

are you going to have D1641, which VAMP basically replaced? That would -- and, I mean, then since D1641, maybe it was implemented in 2012. I don't recall.

But, really, during the drought it wasn't implemented. So was that really the baseline? Because we have been operating under TUCPs at least for the last three years, it becomes pretty hard to figure out where you are going.

The other thing I wanted to mention and remind board member Dorene D'Adamo was that Dr. Sturrock and Dr. Johnson in their presentation last Tuesday talked a lot about the importance of different life stages and sort of going to what Mr. Worth went into, the different timing, and I think the steelhead point is pretty well taken, particularly in the larger years.

In the drier years, the benefit may not be as great because of water temperature and other concerns in the Delta. But, certainly, in the bigger water years, you get a big boost, and conditions maybe not only improve but actually are significantly important for fish, as they are in some cases rearing and in some cases passing through the Delta.

DAN WORTH: And I will just touch on the drier water years. With our temperature benefits analysis, those drier water years are the water years when we see the largest benefits to temperature. It may be possible to make June or at least the end of May going into early June much better for fish in those drier water years.

LES GROBER: Going once? That is right. Any other comments or anything else that if we can we should bring to the next workshop?

GITA KAPAHI: So a couple of things. I did hear from a few folks that they wanted to write out some comments on cards and present those for follow up. So you had mentioned that you were going to put your name and contact information.

Okay. If you want to write those down and give them to program set up, that would be great. There are more cards. If you need one, just holler. I believe the next technical workshop is a week from today, on Monday, the 12th, with a similar format with presentations and comments, et cetera.

Any other --

LES GROBER: I just wanted to -- because I am looking over at the attorneys -- remind everybody again the purpose of this -- and we have gotten some great comments and some great questions. But this can't replace the hearing or the comment period. We are trying to make it to the extent so that we can answer some questions here so that you can provide us with more

targeted comments/questions.

With that being said, you know, the formal responses to any comments/questions that we get will take place when we release the revised draft including a response to comments.

BILL PARIS: This is Bill Paris, Modesto. And this kind of gets to what Les was mentioning now and prior when you said, "anything for the camp for next week." To get to that point, I think it should be less reproducing results that we have already seen and more focused on the analysis and the tools that were used. Much of this was taken right from the SED, and frankly, it wasn't particularly helpful. And it lends to questions more that either you guys aren't expecting or it seems argumentative from our side.

I really would like to see more analysis, more of the tools, the assumptions, how they were used, why they were used, the iterations you went through and less of the results, unless the results can elucidate and illuminate some of those types of analyses. But -- and for long stretches of today, it was just, frankly, a reproduction of results that we have already seen.

So I guess from my own perspective, I would like to see more analysis and more emphasis on the tools at the next workshop. Thank you.

UNIDENTIFIED SPEAKER: Is this slideshow going to be posted tomorrow?

LES GROBER: Well, we will try to post it tomorrow or the next day.

UNIDENTIFIED SPEAKER: Yeah.

LES GROBER: Okay. And in terms of the presentation, I will try to take the comments and provide more information next time, but we are also -- there is a lot of misunderstanding, it seems, of how we have done our work and the work we are showing. So we just want to make sure -- we appreciate that you and many others really get it and want to get into the details of the thing, but we also just want to make sure that we are explaining what we have done so that there isn't misinformation out there.

But thanks. Your comment is well taken.

GITA KAPAHI: With that, I think that we are done for the day. Thank you very much for your thoughtful comments and questions, and we will see you in one week for the next technical workshop. Thank you.

(End of recording.)

♀ 200

I, AMANDA L. JOHNSON, CSR No. 13922, do hereby declare as follows:

That pursuant to the request of Shelly McLean, I did transcribe video files as requested by Shelly McLean.

I declare under the penalty of perjury that the foregoing is transcribed as true and correct to the best of my ability.

DATED at Modesto, California, this ___________ day of __________________, 2016.

____

Amanda L. Johnson

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BEFORE THE CALIFORNIA

STATE WATER RESOURCES CONTROL BOARD

0DRAFT SUBSTITUTE ENVIRONMENTAL DOCUMENT IN SUPPORT OF POTENTIAL CHANGES TO THE WATER QUALITY CONTROL PLAN FOR THE SAN FRANCISCO BAY-SACRAMENTO/SAN JOAQUIN DELTA ESTUARY; SAN JOAQUIN RIVER FLOWS AND SOUTHERN DELTA WATER QUALITY	CITY AND COUNTY OF SAN FRANCISCO’S LIST OF APPENDICES

The City and County of San Francisco (“San Francisco”) hereby provides its List of Appendices to its Comments to the Draft Substitute Environmental Document in Support of Potential Changes to the Bay-Delta Plan:

APPX NO.	**DESCRIPTION**
1	Declaration of Steven R. Ritchie in Support of Comments by the City and County of San Francisco to the Draft Substitute Environmental Document in Support of Potential Changes to the Bay-Delta Plan.
2	Declaration of Matt Moses in Support of Comments by the City and County of San Francisco to the Draft Substitute Environmental Document in Support of Potential Changes to the Bay-Delta Plan.

APPX NO.	**DESCRIPTION**
3	*Bay Area Socioeconomic Impacts Resulting from Instream Flow Requirements for the Tuolumne River*, The Brattle Group, prepared by David Sunding, Ph.D., March 15, 2017.
4	Declaration of Jonathan P. Knapp in Support of Comments by the City and County of San Francisco to the Draft Substitute Environmental Document in Support of Potential Changes to the Bay-Delta Plan.
5	Memo from Leslie Moulton-Post Leslie Moulton-Post, Alisa Moore, Karen Lancelle, Chris Mueller, Environmental Science Associates to San Francisco City Attorney's Office, *CEQA Adequacy Review of the Desalination Water Supply Alternative in the Draft Substitute Environmental Document (SED) in Support of Potential Changes to the Water Quality Control Plan for the San Francisco Bay-Sacramento / San Joaquin Delta Estuary: San Joaquin River Flows and Southern Delta Water Quality*, March 15, 2017.
6	Memo from Leslie Moulton-Post and Jill Hamilton, Environmental Science Associates to San Francisco City Attorney's Office, *Adequacy Review of In-Delta Diversion Alternative Analysis in State Water Board SED*, March 15, 2017.

Dated: March 16, 2017

DENNIS J. HERRERA
City Attorney

By: /s/
JONATHAN P. KNAPP
Deputy City Attorney

Attorneys for the City and County of San Francisco

APPENDIX 1

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BEFORE THE CALIFORNIA

STATE WATER RESOURCES CONTROL BOARD

DRAFT SUBSTITUTE ENVIRONMENTAL DOCUMENT IN SUPPORT OF POTENTIAL CHANGES TO THE WATER QUALITY CONTROL PLAN FOR THE SAN FRANCISCO BAY-SACRAMENTO/SAN JOAQUIN DELTA ESTUARY; SAN JOAQUIN RIVER FLOWS AND SOUTHERN DELTA WATER QUALITY	DECLARATION OF STEVEN R. RITCHIE IN SUPPORT OF COMMENTS BY THE CITY AND COUNTY OF SAN FRANCISCO TO THE DRAFT SUBSTITUTE ENVIRONMENTAL DOCUMENT IN SUPPORT OF POTENTIAL CHANGES TO THE BAY-DELTA PLAN

1. I, Steven R. Ritchie, declare:

2. I am employed as the Assistant General Manager for Water of the San Francisco Public Utilities Commission ("SFPUC"). In this capacity, I am responsible for overseeing water system operations and planning from the Hetch Hetchy Water and Power System ("HHWPS") through the Hetch Hetchy Regional Water System ("RWS") to the City Distribution Division and the management of lands and natural resources.

3. The information contained in this declaration is true of my own personal knowledge, unless stated otherwise, and if called upon to do so, I could and would competently testify thereto.

4. The Raker Act only allows San Francisco to divert water from the Tuolumne River during high flow periods, and requires that San Francisco bypass all flow to the Districts during dry periods. For example, during the recent drought, in FY 2014-2015, San Francisco was only able to divert 22,000 acre-feet ("AF") from the Tuolumne River.

5. The percentage of average reduction in unimpaired flow into the Delta that is attributable to San Francisco's use of water from the Tuolumne River (which, in turn, reduces flow into the San Joaquin River) may be determined by dividing San Francisco's average annual water supply exported from the Tuolumne River, as described in the Final Program Environmental Impact Report for the San Francisco Public Utilities Commission's Water System Improvement Program ("Final WSIP PEIR" or "WSIP")), *i.e.*, 218 million gallons per day ("mgd"), or 244,000 AF/year, (WSIP, at 5.3.1-5), by the total average unimpaired inflow into the Delta, as computed by the California Department of Water Resources, of 29,003,000 AF.[1] Thus, San Francisco's exports from the Tuolumne River account for approximately 0.8 percent of total unimpaired Delta inflow per year. (244,000 AF/29,003,000 AF = 0.8 percent unimpaired flow.) In fact, in recent years, San Francisco has exported less water from the Tuolumne River than the WSIP average, *i.e.*, San Francisco delivered 205 mgd from the Tuolumne River to the Bay Area, or 230,000 AF/year, in fiscal year ("FY") 2012-

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[1] Estimates of Natural and Unimpaired Flows for the Central Valley of California: Water Years 1922-2014, March 2016 (DRAFT), Department of Water Resources, Bay-Delta Office, *available at* https://msb.water.ca.gov/documents/86728/a702a57f-ae7a-41a3-8bff-722e144059d6, at 5-4.

2013, and delivered 150 mgd from the Tuolumne River, or 168,000 AF, in FY 2015-2016. *See* Table J-1, Based Usage (mgd) and Allocation Rates, included hereto as Attachment 1.

6. Although during the 1987-1992 drought San Francisco purchased approximately 107,848 AF of water, San Francisco only procured a small fraction of that amount from either the Modesto Irrigation District ("MID") or the Turlock Irrigation District ("TID," collectively referred to as the "Districts"). The only water transfer completed during the 1987-1992 drought with either of the Districts was a 1990 water transfer from MID to San Francisco for 5,288 AF ("1990 Transfer Agreement"). Although pursuant to the 1990 Transfer Agreement, MID was required to "utilize its best efforts to make available to [San Francisco] up to 20,000 acre-feet of pumped drainage water," (1990 Transfer Agreement, at ¶ 2), MID only made 5,288 AF available to San Francisco for purchase, and of that amount, only 4,891 AF was actually delivered). During the 1987-1992 drought, San Francisco obtained a commitment from the California Department of Water Resources' ("DWR") Drought Emergency Bank for 69,000 AF and from Placer County Water Agency ("PCWA") for 33,560 AF. Of these amounts, only 52,000 AF was actually delivered by DWR, and only 21,042 AF was actually delivered by PCWA. *See* Water Transfer During 1987-1992 Drought Period, included hereto as Attachment 2.

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7. Based on the hydrological record from 1987 through 1992, the Districts would be required, between February and June, to bypass a total of 707,841 AF during the 6-year period under the existing FERC Flow Schedule. Assuming continuation of the 1995 Side Agreement, approximately 365,954 AF of this amount would be bypassed by the Districts on San Francisco's behalf. For example, under a 40 percent unimpaired flow objective, and assuming 1987-1992 hydrology, the Districts would be required to bypass, between February and June, 107,504 AF/year for 6 years, or 645,024 AF, in addition to the FERC flow schedule. Thus, based on the historical 1987-1992 hydrology, and assuming implementation of a 40 percent unimpaired flow objective, between February and June, during the 6-year drought sequence the Districts would be required to bypass approximately 707,841 AF under the existing FERC Flow Schedule and an additional 1,424,328 AF (645,024 AF + 779,304 AF) for a total volume of 2,132,169 AF.

I declare under penalty of perjury, under the laws of the State of California, that the foregoing is true and correct and that if called as a witness I could competently testify thereto.

Executed this 14th day of March, 2017 in San Francisco, California.

Steven R. Ritchie

ATTACHMENT 1

Table J-1
Base Usage (mgd) and Allocation Rates[7]

(1) Usage	(2) Definition	(3) 2010-11	(4) 2011-12	(5) 2012-13[6]	(6) 2013-14	(7) 2014-15	(8) 2015-16
1. Gross S.F. Co. line	B.1	71.7	71.6	71.2	68.4	64.0	61.8
2. Daly City portion	B.2	0.2	0.3	0.3	0.1	0.1	0.1
3. Net S.F.	(1-2)	71.5	71.3	70.9	68.3	63.9	61.7
4. Other suburban raw water	B.4	0.6	0.6	0.5	0.5	0.4	0.4
5. Other suburban treated water	B.5	3.0	3.1	3.1	2.8	2.6	2.2
6. Total other suburban	(4+5)	3.6	3.7	3.6	3.3	3.0	2.6
7. Total City usage	(3+6)	75.1	75.0	74.5	71.6	66.9	64.3
8. Total wholesale usage[1]	B.8	143.7	144.4	148.3	149.6	128.0	110.8
9. Total system usage	(7+8)	218.8	219.4	222.8	221.2	194.9	175.1
10. Wholesale alloc. rate	(8/9)	65.68%	65.82%	66.56%	67.63%	65.67%	63.28%
11. City alloc. rate	(100%-10)	34.32%	34.18%	33.44%	32.37%	34.33%	36.72%
12a. HHWPD input (Oakdale)	B.12	165.9	192.3	205.2	239.7	187.6	150.2
12b. Deliveries to LLNL	B.12	-0.8	-0.7	-0.8	-0.7	-0.6	-0.6
12c. HH to San Ant. Res.	B.12	0.0	-2.1	-7.9	-21.2	-12.1	-4.2
12d. Sunol Valley WTP	B.12	35.8	29.0	21.4	10.1	16.8	27.0
12e. Harry Tracy WTP	B.12	44.5	22.1	26.1	21.2	29.3	35.9
12f. Raw water deliveries	B.12	0.6	0.6	0.5	0.5	0.4	0.4
12g. Deliveries to Coastside Co. WD	B.12	1.7	1.6	1.7	1.9	1.5	1.2
12h. Crys. Sprs. Bal. Res.	B.12	0.0	0.0	0.0	0.0	0.0	0.0
12i. Spill to CS Res.	B.12	-25.8	-23.8	-24.4	-28.5	-31.3	-28.1
12j. Terminal Reservoirs	B.12	0.0	0.0	0.0	0.0	0.0	0.0
12k.Other Sources[2]	B.12	-4.8	2.5	0.0	-0.2	-0.3	-1.0
12k. (1) SCVWD Intertie[3,7]	*B.12*	*-2.6*	*2.5*	*0.0*	*-0.2*	*-0.3*	*-0.4*
12k. (2) EBMUD Intertie[3]	*B.12*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*
12k. (3) Conj. Use Groundwater[4]	*B.12*	*-2.2*	*0.0*	*0.0*	*0.0*	*0.0*	*-0.6*
13. Total system input	B.13	217.1	221.5	221.8	222.8	191.3	180.8
14. Jt. sys. loss red. fact.	(9/13)	1.0000	0.9905	1.0000	0.9928	1.0000	0.9685
15. Daly City red. factor	(3/1)	0.9972	0.9958	0.9958	0.9985	0.9984	0.9984
16. Total suburban	(6+8)	147.3	148.1	151.9	152.9	131.0	113.4
17. Suburban red. factor	(8/16)	0.9756	0.9750	0.9763	0.9784	0.9771	0.9771
18. HHWPD Deliveries above Oakdale[5]	B.18	0.4	0.3	0.4	0.4	0.3	0.3
19. HH Reduction Factor[5]	B.19	99.76%	99.84%	99.81%	99.83%	99.84%	99.80%

1. Total Wholesale Customer usage is adjusted to account for water delivered to Wholesale Customers participating in the groundwater conjunctive use project [line 12k.(3)].

2. Other sources of water were not separately identified in J-tables prior to FY2009-10.

3. Negative values represent water delivered from SFPUC to EBMUD and/or SCVWD. Positive values represent water delivered to SFPUC from EBMUD and/or SCVWD.

4. Negative values represent water delivered to participating Wholesale Customers in lieu of groundwater pumping. Positive values represent water added to the system in the form of increased groundwater pumping by the participating Wholesale Customers or the SFPUC, when SFPUC wells become operational (target date 2016).

5. Not calculated in J-tables prior to FY2009-10.

6. Adjustment Line 8, (7) FY2012-13: Total Wholesale Usage. Line 8 adjusted higher by 0.4 mgd over the Sept. 20, 2013 submitted FY2012-13 Table J-1. The adjustment is due to meter error at CalWater Service - San Mateo.

7. Original FY2014-15 SCVWD Intertie value -0.6 submitted Sep 18, 2015. The revised value -0.3 replaces the original value. Table J-1 with revised value of -0.3 resubmitted on Oct 27, 2015.

11/2/2016

ATTACHMENT 2

Agency Water Was Purchased From	WTR Purchased (AF)	WTR Delivered (AF)	Cost Purchase + Delivery	Water Stored @ Kern	EST Water Delivery Cost	WTR Sold to CDFG	Revenue from Sold WTR		Legal & Assoc.	Pumping & Treat costs	Construct costs	
1990 Placer County Water Agency	10,703	7,492	$1,531,992							$576,884	$777,201	Sunol blowoff location ?
1990 Modesto Irrigation District	5,288	4,891	$746,122							$376,607		
								Insurance	$70,900		$940,000	cost of S.A. turnout
1991 Ca. Drought Emergency Bank	50,000	33,000	$12,310,025	17,000	$4,396,622					$2,541,000		
1991 Placer County Water Agency	22,857	13,550	$4,232,696			5,920	$177,600			$1,043,350		
								Legal/Admin	$571,882			
1992 Ca. Emergency Drought Bank	19,000	19,000	$3,366,824							$1,463,000		
Total	107,848	77,933	$22,187,659	17,000	$4,396,622	5,920	$177,600		$642,782	$6,000,841	$1,717,201	

Placer County water was delivered through Folsom reservoir - carriage water is 20% of purchased water
1992 Ca. Emergency drought water bank $72/AF for water and $105.2/AF for wheeling
amount delivered through SBA direct 4,432 all in October
amount delivered by exchange with San Luis 14,568 Oct- Dec storage fee: $18.60/AF

DWR charged O&M monthly fees on turnouts

PCWA water was surplus
DWR water was ag. Water transferred to urban

WATER PURCHASE SUMMARY RUN DATE: 08-Mar-94
FILE NAME: WTRPURCH

AGENCY WATER WAS PURCHASED FROM	WTR PURCHASED (AF)	WTR DELIVERED (AF)	COST FURCHASE+DEL	WATER STORED @ KERN /AF	EST WATER DELIVERY COST	WATER SOLD TO DFG /AF	REVENUE REC'D FROM DFG		LEGAL & ASSOC FEES	PUMPING & TREATMT COSTS	CONSTRUCT COSTS
1990 PLACER COUNTY WATER AGENCY	10.703	7,492	$1,531,992							$576,884	$777,201
1990 MODESTO IRRIGATION DISTRICT	5,288	4,891	746,122							376,607	
								INSURANCE	70,800		940,000
1991 CALIFORNIA DROUGHT EMERGENCY BANK	50,000	33,000	12,310,025	17,000	$4,396,622					2,541,000	
1991 PLACER COUNTY WATER AGENCY	22,857	13,550	4,232,696			5,920	$177,600			1,043,350	
								LEGAL/ADMIN	571,882		
1992 CALIFORNIA DROUGHT EMERGENCY BANK	19,000	19,000	3,366,824							1,463,000	
TOTAL	107,848	77,933	$22,187,659	17,000	$4,396,622	5,920	$177,600		$642,682	$6,000,841	$1,717,201

DIRECT COST OF DELIVERED WATER PER AF	$282.42
PUMPING AND TREATMENT COSTS PER AF	$77.00
est. based on 92/93 actual:Pump $26;Treat $51	
INDIRECT COSTS FOR DELIVERED WATER PER A	$30.28
TOTAL COST OF WATER DELIVERED PER AF	$389.70

WATER PURCHASE COSTS			
PCWD	3034077	2730611	/AF
MID	237951	50912	
DWR1991	8750000	3560075	$ 124.8
DWR 1992	1368000	19995	
Total	13390028		
purchase cost/a	$124		
net purch cost/	$172		

NOTES:
KERN COUNTY WATER AGENCY CONTRACT TERMS STORES THE WATER UNTIL 12/31/96.
KERN COUNTY WATER AGENCY CONTRACT TERMS CAN BE EXTENDED WITH APPROVALS FROM DWR AND NEGOTIATED ADDITIONAL COSTS.

THE SUNOL TURNOUT IS TEMPORARY, BUT WE HAVE ASKED DWR TO MAKE IT PERMANENT.
IF DWR APPROVES THE REQUEST, CITY PLANNING (DER) WILL NEED TO APPROVE AND SOME ADDITONAL CONTRUCTION WILL BE NEEDED TO DOWNSIZE THE PIPE AND PROTECT IT FROM THE HEAT AND SUN.
IF ALL APPROVALS,PERMITS AND CONSTRUCTION ARE DONE, WE SHOULD ADD THIS TO THE LONGTERM OPERATING AGREEMENT WITH DWR FOR THE SAN ANTONIO TURNOUT.

ALL INDIRECT COSTS CURRENTLY ON THIS SCHEDULE (2/2/94) ARE ESTIMATES

1992 Bank water Total cost 3,366,824
19000 af x $72/af = - $1,368,000 purchase
$1,998,824 wheeling

1,998,824 ÷ 19,000 = $105.20/af
↓
wheeling cost

APPENDIX 2

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BEFORE THE CALIFORNIA

STATE WATER RESOURCES CONTROL BOARD

DRAFT SUBSTITUTE ENVIRONMENTAL DOCUMENT IN SUPPORT OF POTENTIAL CHANGES TO THE WATER QUALITY CONTROL PLAN FOR THE SAN FRANCISCO BAY-SACRAMENTO/SAN JOAQUIN DELTA ESTUARY; SAN JOAQUIN RIVER FLOWS AND SOUTHERN DELTA WATER QUALITY	DECLARATION OF MATT MOSES IN SUPPORT OF COMMENTS BY THE CITY AND COUNTY OF SAN FRANCISCO TO THE DRAFT SUBSTITUTE ENVIRONMENTAL DOCUMENT IN SUPPORT OF POTENTIAL CHANGES TO THE BAY-DELTA PLAN

I, Matt Moses, declare:

1. I am employed as Water Resources Engineer of the Water Enterprise of the San Francisco Public Utilities Commission ("SFPUC"). In this capacity, I am responsible for quantitative analysis for the Regional Water System operated by SFPUC.

2. I have been employed in this capacity at SFPUC for 3 years, and I have 12 years of experience in quantitative analysis of California municipal water supplies.

3. I authored the memorandum entitled "SFPUC Analysis of Proposed Changes to Tuolumne River Flow Criteria." I am personally familiar with the hydrologic records used to prepare the memorandum, which are maintained in the ordinary course of business by the SFPUC in its operation of the Hetch Hetchy Regional Water System. A true and correct copy of the memorandum is attached as Attachment 1, and is based on analysis that I performed in my capacity as a Water Resources Engineer for SFPUC.

I declare under penalty of perjury, under the laws of the State of California, that the foregoing is true and correct and that if called as a witness I could competently testify thereto.

Executed this 14th day of March, 2017 in San Francisco, California.

Matt Moses

ATTACHMENT 1

San Francisco
Water Power Sewer
Services of the San Francisco Public Utilities Commission

March 14, 2017

Subject: **SFPUC Analysis of Proposed Changes to Tuolumne River Flow Criteria**

Prepared by: Matt Moses, Water Resources Engineer

Introduction

The State Water Resources Control Board (SWRCB) released the Recirculated Draft Substitute Environmental Document (SED) in Support of Potential Changes to the Water Quality Control Plan for the San Francisco Bay-Sacramento San Joaquin Delta Estuary, San Joaquin River Flows and Southern Delta Water Quality, in September 2016. Staff at the San Francisco Public Utilities Commission (SFPUC) reviewed the proposed changes and evaluated their effects on the SFPUC Regional Water System (RWS). The results of the SFPUC analysis are presented in this memorandum.

SFPUC used the Hetch Hetchy / Local Simulation Model (HHLSM) to estimate the effects of proposed Tuolumne River flow standards on the SFPUC RWS. The HHLSM model and the water supply planning methodology (including the design drought sequence) are described in the Water Supply System Modeling Report (Steiner, 2007). The methods and results of the modeling analysis used to evaluate the SED alternatives are described below.

SFPUC RWS Service Area Demands

Three levels of service area water demand were simulated for the RWS:

- 265 million gallons per day, as an annual average (MGD), which represents the total contractual obligation to wholesale customers of 184 MGD, plus an estimate of future demand of 81 MGD for the San Francisco retail service area.
- 223 MGD, which was the actual water delivery to the RWS service area (including wholesale and retail) in fiscal year 2012-2013. This was the last complete fiscal year before supply rationing was initiated.
- 175 MGD, which was the actual water delivery to the RWS service area (including wholesale and retail) in fiscal year 2015-2016. This represents a 21.5% reduction from fiscal year 2012-2013 demands. In response to drought conditions, SFPUC requested rationing within the retail

and wholesale service area during this period, and the State of California also mandated rationing for all municipal water agencies during this period. The reduced demand relative to fiscal year 2012-2013 is attributed to these calls for rationing.

These demand levels are used in model simulations to represent the amount of surface water from the SFPUC RWS that would be delivered to the service area in the absence of any water supply shortage. In years when surface water supply is sufficient, the demand is met entirely by delivery of surface water. In years when surface water delivery is insufficient, the demand is met by a combination of surface water delivery, groundwater delivery (from the regional groundwater storage and recovery program in the Westside Basin), and also by delivery of less than the full demand for water supply (or rationing). In the case of the 175 MGD level of demand, any rationing applied in the model simulations should be considered additional to the delivery shortage that is inherently included in that demand assumption (see 3rd bullet above). See the description of the design drought planning methodology for a discussion of how rationing levels are determined. Also, see the SFPUC 2015 Urban Water Management Plan (Chapter 6) for a description of other components of service area demand that are met by conservation, water recycling, and other groundwater supplies.

SFPUC Contribution to Unimpaired Flow Requirement

The contributions that SFPUC would make to the proposed flow standards were calculated for four levels of required flow: 20%, 30%, 40% and 50% of unimpaired flow on the Tuolumne River at La Grange from February through June of each year. Flow shifting and other possible adaptive management adjustments of the unimpaired flow standard are discussed in the SED document, but are not described in sufficient detail to include in model analysis. Therefore flow shifting was not included in the SFPUC analysis. In the SFPUC analysis, the La Grange stream gage was treated as the point of compliance, and accretions and depletions to the Tuolumne River downstream of La Grange were not included in the calculation of required flow.

The calculation of SFPUC contribution to the unimpaired flow requirement included the following considerations:

- The minimum in-stream flow schedule in the existing FERC license at New Don Pedro Reservoir was assumed to be in place. The releases to meet this schedule were assumed to be made by the irrigation districts that operate New Don Pedro Reservoir (Districts) consistent with the existing side agreement between San Francisco and the Districts under the current FERC license.
- The responsibility to meet flows required by the SED alternatives from February through June in excess of the existing FERC schedule was assumed to be shared between SFPUC and the irrigation districts. The SFPUC share is assumed to be 51.7% of the required flow that is in excess of the FERC schedule.

See Figure 1 for additional discussion of the assumed contributions to the proposed unimpaired flow standards.

System Configuration for SFPUC Model Analysis

The SFPUC water supply system was simulated for these analyses as including the facilities described in the 2018 WSIP variant, with two differences noted below. This includes the completion of the suite of WSIP projects. A summary of these facilities is presented in Table 1, and a more detailed description is provided in the Final Program Environmental Impact Report for the San Francisco Public Utilities Commission's Water System Improvement Program (Final WSIP PEIR), in Appendix O3, 2018 WSIP Variant. Two differences from the Final WSIP PEIR, Appendix O3 facility assumptions were incorporated into this analysis:

- In-stream flow releases from Crystal Springs Reservoir to San Mateo Creek were included in this simulation. The average volume of these releases is approximately 3,900 AF per year.
- Annual water supply transfers from the Districts to SFPUC were not included in this analysis. An annual transfer of 2,300 AF was assumed from the Districts to the SFPUC Water Bank Account in the WSIP 2018 simulation.

The same configuration was used for the RWS in each of the SED alternative analyses described here. Three levels of RWS system-wide demand were evaluated (265 MGD, 223 MGD, and 175 MGD), as described above. For each level of system-wide demand, four levels of contribution to a Tuolumne River unimpaired flow standard were evaluated (20%, 30%, 40% and 50%) as described above. A scenario with no additional contribution from the RWS to the Tuolumne River (referred to as the base case) was also evaluated for each of the 3 demand levels considered. Because there are no variations in the system facilities, the results of the simulations at different unimpaired flow standards can be directly compared within each level of system demand, and differences between them may be ascribed to the SED alternatives.

Water Supply Planning Methodology and the Design Drought

SFPUC uses a water supply planning methodology that allows the performance of the RWS to be evaluated for a range of conditions, including varying facility configurations, changes in service area demand and changes in in-stream flow requirements. This methodology involves the simulation of a hydrologic sequence referred to as the design drought, which consists of the hydrology from years 1986 through 1992, followed by the hydrology from years 1976 and 1977. This sequence represents a wet year in which system storage is filled, followed by an 8-year sequence of dry conditions. In applying the SFPUC water supply planning methodology, an initial model simulation of the system is performed for the design drought sequence, using the system configuration to be evaluated. Then the ability of the system to deliver water to the service area through the entire design drought sequence is reviewed. If water supply runs out before the end of the design drought sequence in the initial model run, then system-wide water supply rationing is added and the scenario is re-run. This process continues iteratively until a model simulation of the system is achieved in which the water supply in storage at the end of the design drought sequence is brought to the system "dead pool," where no additional storage is available for delivery (simulated as 96,775 acre-feet). Drawing system storage down to the dead pool without going below it indicates that water supply delivery, including the adjusted amount of rationing, is maintained through the design drought sequence.

Rationing is initiated in the model simulations by comparing the total system storage to threshold values. When total system storage is below a given threshold at the end of the annual snowmelt season (treated as the end of the June timestep), a system-wide water supply rationing level that corresponds to that storage threshold will be initiated for the following year. More than one threshold and corresponding level of rationing can be used, so that increasing levels of rationing can be simulated during an extended dry period. As described above, these storage thresholds and rationing levels are developed uniquely for each specific combination of water supply system facilities, water demand, and in-stream flow responsibility. In configurations with greater net demands for water supply relative to available supplies and total system storage, rationing will be relatively greater and may be initiated at a higher value of total system storage than in configurations with relatively lesser water demands. These unique combinations of rationing and storage levels are established to maintain delivery through the design drought planning sequence for each system configuration evaluated.

Once rationing levels and corresponding storage threshold values are established for a particular system configuration using this methodology, they can be used to simulate the operation of that system through the historical record of hydrology. While the design drought sequence does not occur in the historical hydrology, the rationing and storage threshold values that are adjusted to allow a system configuration to maintain water delivery through the design drought sequence can be used to evaluate system performance in the historical record. The responses of the system to other dry sequences that have occurred historically indicate how the given system configuration would be operated by SFPUC in similar sequences in the future. Through use of this planning method, SFPUC is able to simulate a response to declining water supply in storage that is appropriate for the system conditions being evaluated.

For the current analysis of SED alternatives, this water supply planning methodology, including establishment of rationing levels and storage triggers using the design drought sequence, was performed for each combination of system demand and SED flow alternative evaluated. The resulting rationing levels and triggers were then used to simulate operations in the 91-year hydrologic record from 1921-2011.

Results of SFPUC Model Analysis

The SFPUC water supply planning methodology was applied to 15 water system configurations that were developed to evaluate the effects of the SED proposal. These configurations include the four levels of Tuolumne River flow contribution described above, plus the base case in which no additional flow is released to the Tuolumne River, for a total of 5 SED scenarios. These SED scenarios were evaluated at the 3 levels of SFPUC RWS system demand described above. Levels of rationing and associated system storage thresholds were determined so that each of these 15 scenarios would maintain water supply delivery through the design drought sequence. Then these scenarios were each simulated using the historical hydrologic record from 1920 through 2011.

Water Supply Impacts: Water supply rationing is used as an indicator of negative impact to the SFPUC water supply system. The SFPUC water supply planning methodology was used to set rationing levels for the SED alternatives, as described above. A summary of system-wide water supply rationing is presented for all 15 simulations in Tables 2, 3 and 4. Table 2 presents the SED scenarios evaluated at a RWS demand of 265 MGD. Table 3 presents the SED scenarios evaluated at a RWS demand of 223 MGD. Table 4 presents the SED scenarios evaluated at a RWS demand of 175 MGD. For each level of demand evaluated, the only differences between the simulations are the release requirements at La Grange and the adjusted drought rationing levels that are developed through the water supply planning methodology. The effects of the SED alternatives can be evaluated by comparison of simulation results to the base case.

The results presented in Tables 2 through 4 each demonstrate a pattern of increased water supply rationing corresponding to increased level of SFPUC contribution to the unimpaired flow requirement. Since the total system demands are altered through simulated contribution to the unimpaired flow requirement, the timing and degree of water supply rationing imposed through the water supply planning methodology are also altered.

Table 2 presents the 5 SED scenarios evaluated at a SFPUC system-wide demand of 265 MGD. In the base case (no contribution to an unimpaired flow standard), water supply rationing is required in 10 out of 91 years evaluated, and the highest level of system-wide water supply rationing required is 20%. When SFPUC contribution to a 20% unimpaired flow standard is evaluated, water supply rationing is required in 16 out of 91 years, and the highest level of system-wide rationing required is 40%. This pattern continues as the unimpaired flow requirement is increased. The alternative identified for implementation in the SED is based on a 40% unimpaired flow requirement, which would require the SFPUC system to impose rationing in 24 years out of the 91-year record, and which would include system-wide rationing levels of up to 54% at a demand level of 265 MGD.

Table 3 presents the 5 SED scenarios evaluated at a SFPUC system-wide demand of 223 MGD. In the base case, water supply rationing is not required, because this level of demand is able to be delivered through the SFPUC water supply planning methodology for the system configuration being evaluated (which includes the completed facilities included in the WSIP 2018 variant). A pattern of increased occurrence and magnitude of water supply rationing similar to that described in Table 2 is demonstrated for the SED alternatives shown in Table 3. When SFPUC contribution to a 40% unimpaired flow standard is evaluated, water supply rationing is required in 19 out of 91 years, and the highest level of system-wide rationing required is 49%.

Table 4 presents the 5 SED scenarios evaluated at a SFPUC system-wide demand of 175 MGD. It should be noted, as described above, that this level of system demand represents present conditions during the drought in 2015 and 2016, and therefore already reflects the implementation of drought rationing. No additional rationing is required in the base case run at the 175 MGD demand level, or in the scenario that includes a 20% unimpaired flow requirement. When SFPUC contribution to a 40% unimpaired flow standard is evaluated for this system demand, additional water supply rationing is required in 16 out of 91 years, and the highest level of system-wide rationing required is 32%.

Hydropower Generation Impacts: Optimized power generation at SFPUC facilities involves operational changes at the daily timescale or in smaller time increments, because changes in power demand and power cost occur at those timescales. The monthly time-step model that was used for this analysis was developed at an appropriate time-step to evaluate water supply conditions in the Hetch Hetchy system, but it only provides bulk estimates of the power generation that occurs through use of the system. Therefore, a detailed analysis of all expected changes in SFPUC power generation is not available from these model results. However, one pattern does stand out in the monthly timestep results for power generation: When water supply rationing is implemented in response to reduced system storage in the SED alternatives, SFPUC hydropower generation is reduced at the generation facilities that are situated in-line with the water supply delivery pipeline, specifically Kirkwood Powerhouse and Moccasin Powerhouse. These hydropower generation facilities are operated when water supply deliveries are made from Hetch Hetchy Reservoir to the Bay Area. When water supply rationing is implemented in response to decreased levels of water in storage, it causes less water to be transmitted through these generating facilities, with the result that less power is generated. The water supply planning model used for this analysis is appropriate for evaluation of this pattern; the pattern of reduced power generation during water supply rationing is driven by annual or multi-year shortages in water supply, which are captured by the model.

Table 5 presents the annual average estimates of power generation for SED alternatives at the 265 MGD level of SFPUC system demand. Periods in which rationing was implemented for multiple years were identified, and the annual average generation is presented for each of these periods. Refer to Table 2 for the water supply rationing levels implemented in these simulations. The relative change in generation from the base case is also shown in Table 5 as a percentage. Average decreases in generation at Kirkwood and Moccasin Powerhouses in time periods when rationing was implemented is less than 10% in the SED alternatives that include 20% and 30% unimpaired flow requirements. Generation at Kirkwood and Moccasin Powerhouses decreases by more than 10% in the scenarios that include 40% and 50% unimpaired flow requirements.

Tables 6 and 7 are presented in the same format as Table 5. They show changes in Kirkwood and Moccasin Powerhouse generation for the SED alternatives at 223 MGD SFPUC system demand and 175 MGD system demand, respectively. As shown in Table 6, the 20% and 30% unimpaired flow alternatives do not cause a 10% reduction in generation at Kirkwood and Moccasin Powerhouses. The 40% and 50% unimpaired flow alternatives presented in Table 6 exhibit reduced generation at these facilities on the order of 10%. The power generation results presented in Table 7 do not generally include changes on the order of 10% or greater.

An order-of-magnitude estimate of the monetary cost of these changes in generation can be provided by multiplying the differences in generation by a value representing the price received for power. The average Day Ahead price for power from March 2016 through February 2017 was calculated for this purpose, and rounded to $30 per megawatt-hour. Based on the changes in generation presented in Tables 5 and 6, the monetary cost of decreased generation for the 40% or 50% unimpaired alternatives would be approximately $2 million per year. This cost would be expected to be incurred in years when water supply rationing is implemented in the 40% unimpaired flow alternative.

Comments on Analysis Presented in SED

The following comments describe points of confusion in interpreting the SED document and differences in assumptions and methods between SFPUC staff analysis and the work presented in the SED.

Flow Shifting

The SWRCB proposal calls for minimum streamflow of 30% to 50% of unimpaired flow from February through June of each year, with actual required levels of flow within this range to be determined by a committee, based on criteria to be determined in a program of implementation. From the description in the document, actual implementation of the proposal could include flow shifting from the February - June period to later periods. A time-series of flow shifts is calculated in the SWRCB Water Supply Effects (WSE) model provided with the SED, but it is unclear whether the rules used to develop those flow shifts reflect how similar decisions would be made upon implementation; because these decisions are deferred until later, the actual flow schedule that would be required in future years is not clearly described in the SED document. Therefore, the SFPUC analysis did not include any flow shifting or other deviations from the nominal unimpaired flow fraction from February to June of each year. To evaluate the SED alternatives, the SFPUC calculated the contribution to streamflow that would be made at 20%, 30%, 40% and 50% unimpaired flow standards and incorporated these contributions into the modeling analysis of SFPUC system performance.

Location of Measurement and Compliance

The flow standard proposed by SWRCB for the Tuolumne River would be implemented at the USGS stream gage at Modesto, according to Table 3 of Appendix K of the SED document. However, the amount of flow that would be required by the standard is calculated in the WSE model using the record of unimpaired flow developed for the Tuolumne River at New Don Pedro Reservoir (DWR, 2007), which is located about 35 river miles upstream of the Modesto gage. In the pre-defined alternatives included in the WSE model, it is assumed that natural accretions and other return flows to the Tuolumne River that occur between New Don Pedro Reservoir and the Modesto gage contribute to the compliance with the flow standard, and therefore reduce the amount of required water release at New Don Pedro Reservoir. The compliance standard calculated in the WSE is therefore the unimpaired flow at New Don Pedro Reservoir, to be met at the Modesto gage. But the description of the compliance standard provided in Table 3 of Appendix K is unimpaired flow on the Tuolumne River, with compliance met at the Modesto gage. Unimpaired flow at Modesto is higher than unimpaired flow at La Grange by the amount of natural accretions that occur between the two locations. It is not clearly stated in the SED that compliance would be measured as calculated in the WSE model. In fact, the simple statement of the proposed standard in Appendix K implies otherwise. It is also not clear that the estimated level of accretions and return flows would occur under the changed water use regime proposed in the SED alternatives. For example, reduced agricultural irrigation due to implementation of the SED proposal could cause a reduction in irrigation return flows, which would require more release from New Don Pedro Reservoir to meet the standard, relative to the WSE model assumptions. Increased groundwater pumping could have a similar effect on return flows. As described above, the SFPUC modeling analysis assumed that the La Grange stream gage would be the point of compliance, and that accretions below La Grange would not affect compliance. If an unimpaired flow standard were established at the

Modesto gage without modification to account for return flows, then the analysis presented here will have underestimated the resulting impacts to SFPUC water supply. It is worth noting that the analysis presented in the SED would then have also underestimated these impacts.

Vernalis Flow Standard

An additional in-stream flow requirement of 1,000 cubic feet per second at Vernalis is included in the SED, and is assigned to the water users on the San Joaquin River tributaries. It is likely that this standard would be met most of the time if the proposed alternative (30% to 50% unimpaired flow on the tributaries) were implemented. The few periods in which additional releases from storage could be required to meet the proposed Vernalis standard would be low-flow periods in which the quantity of valley floor accretion to the San Joaquin River becomes important. The degree to which accretions to the San Joaquin River from natural inflow and agricultural return flows would be modified in low-flow periods if the proposed SED alternative were implemented is unknown. As discussed above for the Tuolumne River, changes in irrigation practice and groundwater pumping could cause important changes to these accretions to the San Joaquin River during low-flow periods. SFPUC could not realistically evaluate the need for additional releases from storage to meet the Vernalis requirement in dry years. It is possible that the SFPUC analysis of water supply impacts is underestimated because contribution to the Vernalis flow standard is not included.

Impact Analysis

In the analysis of SFPUC water supply presented in Appendix L of the SED, RWS operation including the proposed flow standards is approximated by subtracting the calculated amount of contribution to the unimpaired flow standard from the historical value of the SFPUC water bank account balance in New Don Pedro Reservoir. Impacts to the system are then estimated using two different approaches: One method assumes that SFPUC only has a responsibility to contribute to the stream flow requirement when an estimated value of the water bank account balance is positive. The other assumes that SFPUC would contribute at all times. In both cases, the calculation is used to estimate the amount of water that SFPUC would need to purchase or otherwise develop. Both methods included in the SED quantify this amount of water to purchase as the estimated volume below zero to which the water bank account has fallen in these analyses. One of the effects of these methods of quantification is that contributions to meet the proposed flow standards that do not cause the re-calculated water bank account balance to become negative are not counted as impacts, even if those contributions represent a significant volume reduction in the re-calculated storage of the RWS. This happens in 1987 in the analysis presented in the SED, which is particularly significant because this is the first dry year in a long sequence of dry years in the historic record. Similar impacts to SFPUC water storage occur in other dry years (1994, 2002) in the analysis presented in the SED, but these impacts are not quantified in the analysis presented in Appendix L, apparently because the re-calculated water bank account balance is greater than zero. Use of a different metric that includes the contribution of water supply from SFPUC storage in all years would improve the analysis presented in the SED. For reference, Tables 8 and 9 are provided, which show the average annual volume of contribution from SFPUC system storage that is required under the SED alternatives.

By contrast, the SFPUC model analysis simulates the actual operation of the RWS, which includes making releases from upstream reservoirs to keep the water bank account balance positive, and also includes the implementation of rationing when total system storage becomes depleted. In these simulations, the effect on RWS storage of making contributions to the proposed flow standards is dispersed through the system, instead of being captured entirely in the water bank account. As described above in the discussion of the SFPUC water supply planning methodology, the need for water supply rationing on the RWS is based on the total value of system storage. The estimated system-wide rationing, driven by changes in storage, are used to quantify the effects of the proposed flow standards. As shown in Tables 2, 3 and 4, water supply rationing is applied in the same dry years noted above (1987, 1994, 2002) as a result of SFPUC contribution to the SED proposed alternative.

Table 1 – Notes on System Configuration for Model Simulations

SFPUC RWS System Components as Included in Model Simulations for SED Analysis	Notes
Completed WSIP Transmission Projects	Full pipeline capacity and periodic outages for pipeline inspection and maintenance were assumed.
Completed WSIP Reservoir Capacity	Calaveras Reservoir construction was assumed to be complete in these simulations. Full storage capacity at Calaveras is 31,500 MG (97,000 AF); full storage capacity at Crystal Springs Reservoir is 22,150 MG (68,000 AF).
Completed Treatment Plant Expansions	Full capacity is 160 MGD at SVWTP, 140 MGD at HTWTP.
Westside Basin Conjunctive Use	The regional conjunctive use project is represented in model simulations as a reduction in Peninsula surface water demand in dry years and a corresponding increased surface water delivery to facilitate groundwater recharge in some wet years. A supply equivalent to 7.2 MGD is assumed to be available over an extended drought sequence.
SF Groundwater	SFGW is expected to begin operating in 2017. This is represented as a 4 MGD reduction in retail surface water demand in all years at the 265 MGD level of demand.
SF Recycled Water	Projects in development. Represented as a 3.9 MGD demand reduction in all years at the 265 MGD level of demand.
SF Conservation	Considered to be ongoing. Represented as a demand reduction.
Tuolumne River Transfer from New Don Pedro to SFPUC – Not Included	No agreements for transfers are in place as of March 2017.
BDPL and SJPL Maintenance	Represented as periodic capacity constraints.
Calaveras Instream flow and ACDD Bypass Flow	Due to begin when Calaveras Reservoir is brought online following construction.
Crystal Springs Instream flow	Began in Jan. 2015.
Upper Alameda Creek Recapture Project	Due to begin operation when releases from Calaveras Reservoir for the instream flow requirement are started.
Minimum Instream Flows below Hetch Hetchy System Reservoirs	Instream flow releases per USFWS permits.
FERC Minimum Flows below LaGrange	Releases for compliance with the 1995 FERC schedule were assumed to continue per the current agreement between CCSF, MID and TID.
Releases to meet SED minimum instream flow February through June	Releases greater than required in the 1995 FERC flow schedule are assumed to be shared per 4th agreement by CCSF, MID and TID. No flow shifting outside of the February through June window was assumed.

Table 1 summarizes important system configuration details. For background information and additional configuration details, see Water Supply System Modeling Report (Steiner, 2007) and the Final WSIP PEIR (CCSF, 2008).

Table 2 – Comparison of SFPUC RWS Annual Water Supply Delivery Capability for the SED Alternatives at an Annual Demand of 265 MGD

SFPUC Fiscal Year (July-June)	Base Case			20% UF at La Grange			30% UF at La Grange			40% UF at La Grange			50% UF at La Grange		
	TAF/yr	MGD	Rationing (% of Total)	TAF/yr	MGD	Rationing (% of Total)	TAF/yr	MGD	Rationing (% of Total)	TAF/yr	MGD	Rationing (% of Total)	TAF/yr	MGD	Rationing (% of Total)
FY20-21	297	265	0%	297	265	0%	297	265	0%	297	265	0%	297	265	0%
FY21-22	297	265	0%	297	265	0%	297	265	0%	297	265	0%	297	265	0%
FY22-23	297	265	0%	297	265	0%	297	265	0%	297	265	0%	297	265	0%
FY23-24	297	265	0%	297	265	0%	297	265	0%	297	265	0%	297	265	0%
FY24-25	297	265	0%	238	212	20%	209	186	30%	179	160	40%	91	82	69%
FY25-26	297	265	0%	297	265	0%	297	265	0%	297	265	0%	297	265	0%
FY26-27	297	265	0%	297	265	0%	297	265	0%	297	265	0%	91	82	69%
FY27-28	297	265	0%	297	265	0%	297	265	0%	297	265	0%	297	265	0%
FY28-29	297	265	0%	297	265	0%	297	265	0%	297	265	0%	297	265	0%
FY29-30	297	265	0%	297	265	0%	209	186	30%	179	160	40%	91	82	69%
FY30-31	297	265	0%	238	212	20%	209	186	30%	179	160	40%	91	82	69%
FY31-32	267	238	10%	209	186	30%	179	160	40%	135	121	54%	91	82	69%
FY32-33	297	265	0%	297	265	0%	297	265	0%	297	265	0%	91	82	69%
FY33-34	297	265	0%	297	265	0%	297	265	0%	179	160	40%	91	82	69%
FY34-35	297	265	0%	238	212	20%	179	160	40%	179	160	40%	91	82	69%
FY35-36	297	265	0%	297	265	0%	297	265	0%	297	265	0%	297	265	0%
FY36-37	297	265	0%	297	265	0%	297	265	0%	297	265	0%	297	265	0%
FY37-38	297	265	0%	297	265	0%	297	265	0%	297	265	0%	297	265	0%
FY38-39	297	265	0%	297	265	0%	297	265	0%	297	265	0%	297	265	0%
FY39-40	297	265	0%	297	265	0%	297	265	0%	297	265	0%	297	265	0%
FY40-41	297	265	0%	297	265	0%	297	265	0%	297	265	0%	297	265	0%
FY41-42	297	265	0%	297	265	0%	297	265	0%	297	265	0%	297	265	0%
FY42-43	297	265	0%	297	265	0%	297	265	0%	297	265	0%	297	265	0%
FY43-44	297	265	0%	297	265	0%	297	265	0%	297	265	0%	297	265	0%
FY44-45	297	265	0%	297	265	0%	297	265	0%	297	265	0%	297	265	0%
FY45-46	297	265	0%	297	265	0%	297	265	0%	297	265	0%	297	265	0%
FY46-47	297	265	0%	297	265	0%	297	265	0%	297	265	0%	297	265	0%
FY47-48	297	265	0%	297	265	0%	297	265	0%	297	265	0%	297	265	0%
FY48-49	297	265	0%	297	265	0%	209	186	30%	179	160	40%	91	82	69%
FY49-50	297	265	0%	297	265	0%	297	265	0%	297	265	0%	297	265	0%
FY50-51	297	265	0%	297	265	0%	297	265	0%	297	265	0%	91	82	69%
FY51-52	297	265	0%	297	265	0%	297	265	0%	297	265	0%	297	265	0%
FY52-53	297	265	0%	297	265	0%	297	265	0%	297	265	0%	297	265	0%
FY53-54	297	265	0%	297	265	0%	297	265	0%	297	265	0%	297	265	0%
FY54-55	297	265	0%	297	265	0%	297	265	0%	297	265	0%	297	265	0%
FY55-56	297	265	0%	297	265	0%	209	186	30%	179	160	40%	91	82	69%
FY56-57	297	265	0%	297	265	0%	297	265	0%	297	265	0%	297	265	0%
FY57-58	297	265	0%	297	265	0%	297	265	0%	297	265	0%	297	265	0%
FY58-59	297	265	0%	297	265	0%	297	265	0%	297	265	0%	297	265	0%
FY59-60	297	265	0%	297	265	0%	297	265	0%	297	265	0%	297	265	0%
FY60-61	297	265	0%	238	212	20%	209	186	30%	179	160	40%	91	82	69%
FY61-62	267	238	10%	209	186	30%	179	160	40%	135	121	54%	91	82	69%
FY62-63	297	265	0%	297	265	0%	297	265	0%	179	160	40%	91	82	69%
FY63-64	297	265	0%	297	265	0%	297	265	0%	297	265	0%	297	265	0%
FY64-65	297	265	0%	297	265	0%	297	265	0%	179	160	40%	91	82	69%
FY65-66	297	265	0%	297	265	0%	297	265	0%	297	265	0%	297	265	0%
FY66-67	297	265	0%	297	265	0%	297	265	0%	297	265	0%	297	265	0%
FY67-68	297	265	0%	297	265	0%	297	265	0%	297	265	0%	297	265	0%
FY68-69	297	265	0%	297	265	0%	297	265	0%	297	265	0%	297	265	0%
FY69-70	297	265	0%	297	265	0%	297	265	0%	297	265	0%	297	265	0%
FY70-71	297	265	0%	297	265	0%	297	265	0%	297	265	0%	297	265	0%
FY71-72	297	265	0%	297	265	0%	297	265	0%	297	265	0%	297	265	0%
FY72-73	297	265	0%	297	265	0%	209	186	30%	179	160	40%	91	82	69%
FY73-74	297	265	0%	297	265	0%	297	265	0%	297	265	0%	297	265	0%
FY74-75	297	265	0%	297	265	0%	297	265	0%	297	265	0%	297	265	0%
FY75-76	297	265	0%	297	265	0%	297	265	0%	297	265	0%	297	265	0%
FY76-77	267	238	10%	238	212	20%	209	186	30%	179	160	40%	91	82	69%
FY77-78	238	212	20%	209	186	30%	179	160	40%	135	121	54%	91	82	69%
FY78-79	297	265	0%	297	265	0%	297	265	0%	297	265	0%	297	265	0%
FY79-80	297	265	0%	297	265	0%	297	265	0%	297	265	0%	297	265	0%
FY80-81	297	265	0%	297	265	0%	297	265	0%	297	265	0%	297	265	0%
FY81-82	297	265	0%	297	265	0%	297	265	0%	297	265	0%	297	265	0%
FY82-83	297	265	0%	297	265	0%	297	265	0%	297	265	0%	297	265	0%
FY83-84	297	265	0%	297	265	0%	297	265	0%	297	265	0%	297	265	0%
FY84-85	297	265	0%	297	265	0%	297	265	0%	297	265	0%	297	265	0%
FY85-86	297	265	0%	297	265	0%	297	265	0%	297	265	0%	297	265	0%
FY86-87	297	265	0%	297	265	0%	297	265	0%	297	265	0%	297	265	0%
FY87-88	297	265	0%	238	212	20%	209	186	30%	179	160	40%	91	82	69%
FY88-89	267	238	10%	209	186	30%	179	160	40%	135	121	54%	91	82	69%
FY89-90	267	238	10%	238	212	20%	179	160	40%	135	121	54%	91	82	69%
FY90-91	238	212	20%	209	186	30%	179	160	40%	135	121	54%	91	82	69%
FY91-92	238	212	20%	209	186	30%	179	160	40%	135	121	54%	91	82	69%
FY92-93	238	212	20%	179	160	40%	150	134	49%	135	121	54%	91	82	69%
FY93-94	297	265	0%	297	265	0%	297	265	0%	297	265	0%	297	265	0%
FY94-95	297	265	0%	238	212	20%	209	186	30%	135	121	54%	91	82	69%
FY95-96	297	265	0%	297	265	0%	297	265	0%	297	265	0%	297	265	0%
FY96-97	297	265	0%	297	265	0%	297	265	0%	297	265	0%	297	265	0%
FY97-98	297	265	0%	297	265	0%	297	265	0%	297	265	0%	297	265	0%
FY98-99	297	265	0%	297	265	0%	297	265	0%	297	265	0%	297	265	0%
FY99-00	297	265	0%	297	265	0%	297	265	0%	297	265	0%	297	265	0%
FY00-01	297	265	0%	297	265	0%	297	265	0%	297	265	0%	297	265	0%
FY01-02	297	265	0%	297	265	0%	297	265	0%	297	265	0%	297	265	0%
FY02-03	297	265	0%	297	265	0%	297	265	0%	297	265	0%	91	82	69%
FY03-04	297	265	0%	297	265	0%	297	265	0%	297	265	0%	297	265	0%
FY04-05	297	265	0%	297	265	0%	297	265	0%	297	265	0%	297	265	0%
FY05-06	297	265	0%	297	265	0%	297	265	0%	297	265	0%	297	265	0%
FY06-07	297	265	0%	297	265	0%	297	265	0%	297	265	0%	297	265	0%
FY07-08	267	238	10%	238	212	20%	209	186	30%	179	160	40%	91	82	69%
FY08-09	297	265	0%	297	265	0%	297	265	0%	179	160	40%	91	82	69%
FY09-10	297	265	0%	297	265	0%	297	265	0%	297	265	0%	297	265	0%
FY10-11	297	265	0%	297	265	0%	297	265	0%	297	265	0%	297	265	0%

Yellow highlights indicate that water provided to the RWS includes supply from of the Westside Basin conjunctive use groundwater project.

Red highlights indicate that water supply rationing is implemented. The years in which rationing occurs also include use of the Westside Basin groundwater project.

Table 3 – Comparison of SFPUC RWS Annual Water Supply Delivery Capability for the SED Alternatives at an Annual Demand of 223 MGD

SFPUC Fiscal Year (July-June)	Base Case			20% UF at La Grange			30% UF at La Grange			40% UF at La Grange			50% UF at La Grange		
	TAF/yr	MGD	Rationing (% of Total)	TAF/yr	MGD	Rationing (% of Total)	TAF/yr	MGD	Rationing (% of Total)	TAF/yr	MGD	Rationing (% of Total)	TAF/yr	MGD	Rationing (% of Total)
FY20-21	250	223	0%	250	223	0%	250	223	0%	250	223	0%	250	223	0%
FY21-22	250	223	0%	250	223	0%	250	223	0%	250	223	0%	250	223	0%
FY22-23	250	223	0%	250	223	0%	250	223	0%	250	223	0%	250	223	0%
FY23-24	250	223	0%	250	223	0%	250	223	0%	250	223	0%	250	223	0%
FY24-25	250	223	0%	250	223	0%	188	168	25%	151	135	39%	94	84	62%
FY25-26	250	223	0%	250	223	0%	250	223	0%	250	223	0%	250	223	0%
FY26-27	250	223	0%	250	223	0%	250	223	0%	250	223	0%	250	223	0%
FY27-28	250	223	0%	250	223	0%	250	223	0%	250	223	0%	250	223	0%
FY28-29	250	223	0%	250	223	0%	250	223	0%	250	223	0%	250	223	0%
FY29-30	250	223	0%	250	223	0%	250	223	0%	151	135	39%	94	84	62%
FY30-31	250	223	0%	250	223	0%	188	168	25%	151	135	39%	94	84	62%
FY31-32	250	223	0%	225	201	10%	166	148	34%	151	135	39%	94	84	62%
FY32-33	250	223	0%	250	223	0%	250	223	0%	250	223	0%	250	223	0%
FY33-34	250	223	0%	250	223	0%	250	223	0%	250	223	0%	94	84	62%
FY34-35	250	223	0%	250	223	0%	188	168	25%	151	135	39%	94	84	62%
FY35-36	250	223	0%	250	223	0%	250	223	0%	250	223	0%	250	223	0%
FY36-37	250	223	0%	250	223	0%	250	223	0%	250	223	0%	250	223	0%
FY37-38	250	223	0%	250	223	0%	250	223	0%	250	223	0%	250	223	0%
FY38-39	250	223	0%	250	223	0%	250	223	0%	250	223	0%	250	223	0%
FY39-40	250	223	0%	250	223	0%	250	223	0%	250	223	0%	250	223	0%
FY40-41	250	223	0%	250	223	0%	250	223	0%	250	223	0%	250	223	0%
FY41-42	250	223	0%	250	223	0%	250	223	0%	250	223	0%	250	223	0%
FY42-43	250	223	0%	250	223	0%	250	223	0%	250	223	0%	250	223	0%
FY43-44	250	223	0%	250	223	0%	250	223	0%	250	223	0%	250	223	0%
FY44-45	250	223	0%	250	223	0%	250	223	0%	250	223	0%	250	223	0%
FY45-46	250	223	0%	250	223	0%	250	223	0%	250	223	0%	250	223	0%
FY46-47	250	223	0%	250	223	0%	250	223	0%	250	223	0%	250	223	0%
FY47-48	250	223	0%	250	223	0%	250	223	0%	250	223	0%	250	223	0%
FY48-49	250	223	0%	250	223	0%	250	223	0%	151	135	39%	94	84	62%
FY49-50	250	223	0%	250	223	0%	250	223	0%	250	223	0%	250	223	0%
FY50-51	250	223	0%	250	223	0%	250	223	0%	250	223	0%	250	223	0%
FY51-52	250	223	0%	250	223	0%	250	223	0%	250	223	0%	250	223	0%
FY52-53	250	223	0%	250	223	0%	250	223	0%	250	223	0%	250	223	0%
FY53-54	250	223	0%	250	223	0%	250	223	0%	250	223	0%	250	223	0%
FY54-55	250	223	0%	250	223	0%	250	223	0%	250	223	0%	250	223	0%
FY55-56	250	223	0%	250	223	0%	250	223	0%	250	223	0%	94	84	62%
FY56-57	250	223	0%	250	223	0%	250	223	0%	250	223	0%	250	223	0%
FY57-58	250	223	0%	250	223	0%	250	223	0%	250	223	0%	250	223	0%
FY58-59	250	223	0%	250	223	0%	250	223	0%	250	223	0%	250	223	0%
FY59-60	250	223	0%	250	223	0%	250	223	0%	250	223	0%	250	223	0%
FY60-61	250	223	0%	250	223	0%	188	168	25%	151	135	39%	94	84	62%
FY61-62	250	223	0%	225	201	10%	166	148	34%	151	135	39%	94	84	62%
FY62-63	250	223	0%	250	223	0%	250	223	0%	250	223	0%	250	223	0%
FY63-64	250	223	0%	250	223	0%	250	223	0%	250	223	0%	250	223	0%
FY64-65	250	223	0%	250	223	0%	250	223	0%	250	223	0%	250	223	0%
FY65-66	250	223	0%	250	223	0%	250	223	0%	250	223	0%	250	223	0%
FY66-67	250	223	0%	250	223	0%	250	223	0%	250	223	0%	250	223	0%
FY67-68	250	223	0%	250	223	0%	250	223	0%	250	223	0%	250	223	0%
FY68-69	250	223	0%	250	223	0%	250	223	0%	250	223	0%	250	223	0%
FY69-70	250	223	0%	250	223	0%	250	223	0%	250	223	0%	250	223	0%
FY70-71	250	223	0%	250	223	0%	250	223	0%	250	223	0%	250	223	0%
FY71-72	250	223	0%	250	223	0%	250	223	0%	250	223	0%	250	223	0%
FY72-73	250	223	0%	250	223	0%	250	223	0%	151	135	39%	94	84	62%
FY73-74	250	223	0%	250	223	0%	250	223	0%	250	223	0%	250	223	0%
FY74-75	250	223	0%	250	223	0%	250	223	0%	250	223	0%	250	223	0%
FY75-76	250	223	0%	250	223	0%	250	223	0%	250	223	0%	250	223	0%
FY76-77	250	223	0%	250	223	0%	188	168	25%	151	135	39%	94	84	62%
FY77-78	250	223	0%	195	174	22%	166	148	34%	151	135	39%	94	84	62%
FY78-79	250	223	0%	250	223	0%	250	223	0%	250	223	0%	250	223	0%
FY79-80	250	223	0%	250	223	0%	250	223	0%	250	223	0%	250	223	0%
FY80-81	250	223	0%	250	223	0%	250	223	0%	250	223	0%	250	223	0%
FY81-82	250	223	0%	250	223	0%	250	223	0%	250	223	0%	250	223	0%
FY82-83	250	223	0%	250	223	0%	250	223	0%	250	223	0%	250	223	0%
FY83-84	250	223	0%	250	223	0%	250	223	0%	250	223	0%	250	223	0%
FY84-85	250	223	0%	250	223	0%	250	223	0%	250	223	0%	250	223	0%
FY85-86	250	223	0%	250	223	0%	250	223	0%	250	223	0%	250	223	0%
FY86-87	250	223	0%	250	223	0%	250	223	0%	250	223	0%	250	223	0%
FY87-88	250	223	0%	250	223	0%	188	168	25%	151	135	39%	94	84	62%
FY88-89	250	223	0%	225	201	10%	188	168	25%	151	135	39%	94	84	62%
FY89-90	250	223	0%	225	201	10%	188	168	25%	151	135	39%	94	84	62%
FY90-91	250	223	0%	195	174	22%	166	148	34%	127	113	49%	94	84	62%
FY91-92	250	223	0%	195	174	22%	166	148	34%	127	113	49%	94	84	62%
FY92-93	250	223	0%	195	174	22%	166	148	34%	127	113	49%	94	84	62%
FY93-94	250	223	0%	250	223	0%	250	223	0%	250	223	0%	250	223	0%
FY94-95	250	223	0%	250	223	0%	188	168	25%	151	135	39%	94	84	62%
FY95-96	250	223	0%	250	223	0%	250	223	0%	250	223	0%	250	223	0%
FY96-97	250	223	0%	250	223	0%	250	223	0%	250	223	0%	250	223	0%
FY97-98	250	223	0%	250	223	0%	250	223	0%	250	223	0%	250	223	0%
FY98-99	250	223	0%	250	223	0%	250	223	0%	250	223	0%	250	223	0%
FY99-00	250	223	0%	250	223	0%	250	223	0%	250	223	0%	250	223	0%
FY00-01	250	223	0%	250	223	0%	250	223	0%	250	223	0%	250	223	0%
FY01-02	250	223	0%	250	223	0%	250	223	0%	250	223	0%	250	223	0%
FY02-03	250	223	0%	250	223	0%	250	223	0%	250	223	0%	250	223	0%
FY03-04	250	223	0%	250	223	0%	250	223	0%	250	223	0%	94	84	62%
FY04-05	250	223	0%	250	223	0%	250	223	0%	250	223	0%	250	223	0%
FY05-06	250	223	0%	250	223	0%	250	223	0%	250	223	0%	250	223	0%
FY06-07	250	223	0%	250	223	0%	250	223	0%	250	223	0%	250	223	0%
FY07-08	250	223	0%	250	223	0%	250	223	0%	250	223	0%	94	84	62%
FY08-09	250	223	0%	250	223	0%	250	223	0%	151	135	39%	250	223	0%
FY09-10	250	223	0%	250	223	0%	250	223	0%	250	223	0%	94	84	62%
FY10-11	250	223	0%	250	223	0%	250	223	0%	250	223	0%	250	223	0%

Yellow highlights indicate that water provided to the RWS includes supply from of the Westside Basin conjunctive use groundwater project.

Red highlights indicate that water supply rationing is implemented. The years in which rationing occurs also include use of the Westside Basin groundwater project.

Table 4 – Comparison of SFPUC RWS Annual Water Supply Delivery Capability for the SED Alternatives at an Annual Demand of 175 MGD

SFPUC Fiscal Year (July-June)	Base Case			20% UF at La Grange			30% UF at La Grange			40% UF at La Grange			50% UF at La Grange		
	TAF/yr	MGD	Rationing (% of Total)	TAF/yr	MGD	Rationing (% of Total)	TAF/yr	MGD	Rationing (% of Total)	TAF/yr	MGD	Rationing (% of Total)	TAF/yr	MGD	Rationing (% of Total)
FY20-21	196	175	0%	196	175	0%	196	175	0%	196	175	0%	196	175	0%
FY21-22	196	175	0%	196	175	0%	196	175	0%	196	175	0%	196	175	0%
FY22-23	196	175	0%	196	175	0%	196	175	0%	196	175	0%	196	175	0%
FY23-24	196	175	0%	196	175	0%	196	175	0%	196	175	0%	196	175	0%
FY24-25	196	175	0%	196	175	0%	196	175	0%	158	141	20%	119	106	39%
FY25-26	196	175	0%	196	175	0%	196	175	0%	196	175	0%	196	175	0%
FY26-27	196	175	0%	196	175	0%	196	175	0%	196	175	0%	196	175	0%
FY27-28	196	175	0%	196	175	0%	196	175	0%	196	175	0%	196	175	0%
FY28-29	196	175	0%	196	175	0%	196	175	0%	196	175	0%	196	175	0%
FY29-30	196	175	0%	196	175	0%	196	175	0%	196	175	0%	119	106	39%
FY30-31	196	175	0%	196	175	0%	196	175	0%	158	141	20%	119	106	39%
FY31-32	196	175	0%	196	175	0%	196	175	0%	158	141	20%	119	106	39%
FY32-33	196	175	0%	196	175	0%	196	175	0%	196	175	0%	196	175	0%
FY33-34	196	175	0%	196	175	0%	196	175	0%	196	175	0%	196	175	0%
FY34-35	196	175	0%	196	175	0%	196	175	0%	158	141	20%	119	106	39%
FY35-36	196	175	0%	196	175	0%	196	175	0%	196	175	0%	196	175	0%
FY36-37	196	175	0%	196	175	0%	196	175	0%	196	175	0%	196	175	0%
FY37-38	196	175	0%	196	175	0%	196	175	0%	196	175	0%	196	175	0%
FY38-39	196	175	0%	196	175	0%	196	175	0%	196	175	0%	196	175	0%
FY39-40	196	175	0%	196	175	0%	196	175	0%	196	175	0%	196	175	0%
FY40-41	196	175	0%	196	175	0%	196	175	0%	196	175	0%	196	175	0%
FY41-42	196	175	0%	196	175	0%	196	175	0%	196	175	0%	196	175	0%
FY42-43	196	175	0%	196	175	0%	196	175	0%	196	175	0%	196	175	0%
FY43-44	196	175	0%	196	175	0%	196	175	0%	196	175	0%	196	175	0%
FY44-45	196	175	0%	196	175	0%	196	175	0%	196	175	0%	196	175	0%
FY45-46	196	175	0%	196	175	0%	196	175	0%	196	175	0%	196	175	0%
FY46-47	196	175	0%	196	175	0%	196	175	0%	196	175	0%	196	175	0%
FY47-48	196	175	0%	196	175	0%	196	175	0%	196	175	0%	196	175	0%
FY48-49	196	175	0%	196	175	0%	196	175	0%	196	175	0%	119	106	39%
FY49-50	196	175	0%	196	175	0%	196	175	0%	196	175	0%	196	175	0%
FY50-51	196	175	0%	196	175	0%	196	175	0%	196	175	0%	196	175	0%
FY51-52	196	175	0%	196	175	0%	196	175	0%	196	175	0%	196	175	0%
FY52-53	196	175	0%	196	175	0%	196	175	0%	196	175	0%	196	175	0%
FY53-54	196	175	0%	196	175	0%	196	175	0%	196	175	0%	196	175	0%
FY54-55	196	175	0%	196	175	0%	196	175	0%	196	175	0%	196	175	0%
FY55-56	196	175	0%	196	175	0%	196	175	0%	196	175	0%	196	175	0%
FY56-57	196	175	0%	196	175	0%	196	175	0%	196	175	0%	196	175	0%
FY57-58	196	175	0%	196	175	0%	196	175	0%	196	175	0%	196	175	0%
FY58-59	196	175	0%	196	175	0%	196	175	0%	196	175	0%	196	175	0%
FY59-60	196	175	0%	196	175	0%	196	175	0%	196	175	0%	196	175	0%
FY60-61	196	175	0%	196	175	0%	196	175	0%	158	141	20%	119	106	39%
FY61-62	196	175	0%	196	175	0%	177	158	10%	158	141	20%	119	106	39%
FY62-63	196	175	0%	196	175	0%	196	175	0%	196	175	0%	196	175	0%
FY63-64	196	175	0%	196	175	0%	196	175	0%	196	175	0%	196	175	0%
FY64-65	196	175	0%	196	175	0%	196	175	0%	196	175	0%	196	175	0%
FY65-66	196	175	0%	196	175	0%	196	175	0%	196	175	0%	196	175	0%
FY66-67	196	175	0%	196	175	0%	196	175	0%	196	175	0%	196	175	0%
FY67-68	196	175	0%	196	175	0%	196	175	0%	196	175	0%	196	175	0%
FY68-69	196	175	0%	196	175	0%	196	175	0%	196	175	0%	196	175	0%
FY69-70	196	175	0%	196	175	0%	196	175	0%	196	175	0%	196	175	0%
FY70-71	196	175	0%	196	175	0%	196	175	0%	196	175	0%	196	175	0%
FY71-72	196	175	0%	196	175	0%	196	175	0%	196	175	0%	196	175	0%
FY72-73	196	175	0%	196	175	0%	196	175	0%	158	141	20%	119	106	39%
FY73-74	196	175	0%	196	175	0%	196	175	0%	196	175	0%	196	175	0%
FY74-75	196	175	0%	196	175	0%	196	175	0%	196	175	0%	196	175	0%
FY75-76	196	175	0%	196	175	0%	196	175	0%	196	175	0%	196	175	0%
FY76-77	196	175	0%	196	175	0%	196	175	0%	158	141	20%	119	106	39%
FY77-78	196	175	0%	196	175	0%	177	158	10%	158	141	20%	119	106	39%
FY78-79	196	175	0%	196	175	0%	196	175	0%	196	175	0%	196	175	0%
FY79-80	196	175	0%	196	175	0%	196	175	0%	196	175	0%	196	175	0%
FY80-81	196	175	0%	196	175	0%	196	175	0%	196	175	0%	196	175	0%
FY81-82	196	175	0%	196	175	0%	196	175	0%	196	175	0%	196	175	0%
FY82-83	196	175	0%	196	175	0%	196	175	0%	196	175	0%	196	175	0%
FY83-84	196	175	0%	196	175	0%	196	175	0%	196	175	0%	196	175	0%
FY84-85	196	175	0%	196	175	0%	196	175	0%	196	175	0%	196	175	0%
FY85-86	196	175	0%	196	175	0%	196	175	0%	196	175	0%	196	175	0%
FY86-87	196	175	0%	196	175	0%	196	175	0%	196	175	0%	196	175	0%
FY87-88	196	175	0%	196	175	0%	196	175	0%	158	141	20%	119	106	39%
FY88-89	196	175	0%	196	175	0%	177	158	10%	158	141	20%	119	106	39%
FY89-90	196	175	0%	196	175	0%	196	175	0%	158	141	20%	119	106	39%
FY90-91	196	175	0%	196	175	0%	177	158	10%	133	118	32%	75	67	62%
FY91-92	196	175	0%	196	175	0%	177	158	10%	133	118	32%	75	67	62%
FY92-93	196	175	0%	196	175	0%	177	158	10%	133	118	32%	75	67	62%
FY93-94	196	175	0%	196	175	0%	196	175	0%	196	175	0%	196	175	0%
FY94-95	196	175	0%	196	175	0%	196	175	0%	158	141	20%	119	106	39%
FY95-96	196	175	0%	196	175	0%	196	175	0%	196	175	0%	196	175	0%
FY96-97	196	175	0%	196	175	0%	196	175	0%	196	175	0%	196	175	0%
FY97-98	196	175	0%	196	175	0%	196	175	0%	196	175	0%	196	175	0%
FY98-99	196	175	0%	196	175	0%	196	175	0%	196	175	0%	196	175	0%
FY99-00	196	175	0%	196	175	0%	196	175	0%	196	175	0%	196	175	0%
FY00-01	196	175	0%	196	175	0%	196	175	0%	196	175	0%	196	175	0%
FY01-02	196	175	0%	196	175	0%	196	175	0%	196	175	0%	196	175	0%
FY02-03	196	175	0%	196	175	0%	196	175	0%	196	175	0%	196	175	0%
FY03-04	196	175	0%	196	175	0%	196	175	0%	196	175	0%	196	175	0%
FY04-05	196	175	0%	196	175	0%	196	175	0%	196	175	0%	196	175	0%
FY05-06	196	175	0%	196	175	0%	196	175	0%	196	175	0%	196	175	0%
FY06-07	196	175	0%	196	175	0%	196	175	0%	196	175	0%	196	175	0%
FY07-08	196	175	0%	196	175	0%	196	175	0%	196	175	0%	119	106	39%
FY08-09	196	175	0%	196	175	0%	196	175	0%	196	175	0%	196	175	0%
FY09-10	196	175	0%	196	175	0%	196	175	0%	196	175	0%	196	175	0%
FY10-11	196	175	0%	196	175	0%	196	175	0%	196	175	0%	196	175	0%

Yellow highlights indicate that water provided to the RWS includes supply from of the Westside Basin conjunctive use groundwater project.

Red highlights indicate that water supply rationing is implemented. The years in which rationing occurs also include use of the Westside Basin groundwater project.

Table 5 – Comparison of SFPUC Hydropower Generation for the SED Alternatives at an Annual RWS Demand of 265 MGD

Time Period	Base Case	20% UF at La Grange		30% UF at La Grange		40% UF at La Grange		50% UF at La Grange	
	Average Annual Generation at Kirkwood and Moccasin Powerhouses (MWh)	Average Annual Generation at Kirkwood and Moccasin Powerhouses (MWh)	Average Change from Base Case (%)	Average Annual Generation at Kirkwood and Moccasin Powerhouses (MWh)	Average Change from Base Case (%)	Average Annual Generation at Kirkwood and Moccasin Powerhouses (MWh)	Average Change from Base Case (%)	Average Annual Generation at Kirkwood and Moccasin Powerhouses (MWh)	Average Change from Base Case (%)
FY 1929-30 through FY 1934-35	885,000	868,000	-2%	843,000	-5%	807,000	-9%	753,000	-15%
FY 1960-61 through FY 1962-63	860,000	815,000	-5%	801,000	-7%	766,000	-11%	742,000	-14%
FY 1976-77 through FY 1977-78	744,000	726,000	-2%	704,000	-5%	670,000	-10%	591,000	-21%
FY 1987-88 through FY 1994-95	846,000	818,000	-3%	796,000	-6%	766,000	-9%	740,511	-12%

Table 5 presents the average annual generation (in megawatt-hours) that was simulated at the Kirkwood and Moccasin Powerhouses for the years indicated at an annual system demand of 265 MGD. These powerhouses are located on the water supply delivery pathway between Hetch Hetchy Reservoir and the SFPUC service area, which allows power generation while water deliveries are made. During periods of water supply rationing (See Table 2), the flow of water through these powerhouses is reduced, and generation is also reduced.

Table 6 – Comparison of SFPUC Hydropower Generation for the SED Alternatives at an Annual RWS Demand of 223 MGD

Time Period	Base Case	20% UF at La Grange		30% UF at La Grange		40% UF at La Grange		50% UF at La Grange	
	Average Annual Generation at Kirkwood and Moccasin Powerhouses (MWh)	Average Annual Generation at Kirkwood and Moccasin Powerhouses (MWh)	Average Change from Base Case (%)	Average Annual Generation at Kirkwood and Moccasin Powerhouses (MWh)	Average Change from Base Case (%)	Average Annual Generation at Kirkwood and Moccasin Powerhouses (MWh)	Average Change from Base Case (%)	Average Annual Generation at Kirkwood and Moccasin Powerhouses (MWh)	Average Change from Base Case (%)
FY 1929-30 through FY 1934-35	854,000	848,000	-1%	828,000	-3%	798,000	-7%	767,000	-10%
FY 1960-61 through FY 1962-63	825,000	814,000	-1%	782,000	-5%	781,000	-5%	767,000	-7%
FY 1976-77 through FY 1977-78	761,000	739,000	-3%	694,000	-9%	657,000	-14%	600,000	-21%
FY 1987-88 through FY 1994-95	839,000	818,000	-3%	789,000	-6%	766,000	-9%	740,611	-12%

Table 6 presents the average annual generation (in megawatt-hours) that was simulated at the Kirkwood and Moccasin Powerhouses for the years indicated at an annual system demand of 223 MGD. These powerhouses are located on the water supply delivery pathway between Hetch Hetchy Reservoir and the SFPUC service area, which allows power generation while water deliveries are made. During periods of water supply rationing (See Table 3), the flow of water through these powerhouses is reduced, and generation is also reduced.

Table 7 – Comparison of SFPUC Hydropower Generation for the SED Alternatives at an Annual RWS Demand of 175 MGD

Time Period	Base Case	20% UF at La Grange		30% UF at La Grange		40% UF at La Grange		50% UF at La Grange	
	Average Annual Generation at Kirkwood and Moccasin Powerhouses (MWh)	Average Annual Generation at Kirkwood and Moccasin Powerhouses (MWh)	Average Change from Base Case (%)	Average Annual Generation at Kirkwood and Moccasin Powerhouses (MWh)	Average Change from Base Case (%)	Average Annual Generation at Kirkwood and Moccasin Powerhouses (MWh)	Average Change from Base Case (%)	Average Annual Generation at Kirkwood and Moccasin Powerhouses (MWh)	Average Change from Base Case (%)
FY 1929-30 through FY 1934-35	809,000	812,000	0%	810,000	0%	797,000	-1%	774,000	-4%
FY 1960-61 through FY 1962-63	779,000	777,000	0%	768,000	-1%	768,000	-1%	761,000	-2%
FY 1976-77 through FY 1977-78	725,000	725,000	0%	710,000	-2%	669,000	-8%	622,000	-14%
FY 1987-88 through FY 1994-95	810,000	809,000	0%	797,000	-2%	772,000	-5%	745,463	-8%

Table 7 presents the average annual generation (in megawatt-hours) that was simulated at the Kirkwood and Moccasin Powerhouses for the years indicated at an annual system demand of 175 MGD. These powerhouses are located on the water supply delivery pathway between Hetch Hetchy Reservoir and the SFPUC service area, which allows power generation while water deliveries are made. During periods of water supply rationing (See Table 4), the flow of water through these powerhouses is reduced, and generation is also reduced.

Table 8 – Average Annual Contribution from SFPUC System Storage, as Calculated from Record

SFPUC Contribution to Flow Standard Calculated from Unimpaired Flow Record (AF)
Average Contribution from Feb-Jun of Each Year

Tuolumne River Unimpaired Flow Standard, Feb-Jun	Critical	Dry	Below Normal	Above Normal	Wet	Average in 91-year Record	Average during 6-Year Drought (1987-92)
Base	0	0	0	0	0	0	0
20%	42,902	50,362	66,868	82,300	135,242	82,927	49,329
30%	80,028	97,818	126,641	158,410	244,131	154,130	90,175
40%	117,470	146,358	191,356	239,106	354,479	227,663	131,021
50%	155,253	194,938	256,920	320,986	465,048	301,699	172,026

Annual averages presented in Table 8 are calculated using a 91-year record of unimpaired flow on the Tuolumne River from 1921 through 2011. Averages by water year type are presented for years in that record, according to San Joaquin Valley Water Year Hydrologic Classification (per D-1641). SFPUC contribution to the unimpaired flow standards is calculated as described on Figure 1.

Table 9 – Average Annual Contribution from SFPUC System Storage, as Simulated in System Model

Simulated SFPUC Contribution to Flow Standard After Accounting for Spills (AF)
Average Contribution from Feb-Jun of Each Year (simulated demand of 265 MGD)

Tuolumne River Unimpaired Flow Standard, Feb-Jun	Critical	Dry	Below Normal	Above Normal	Wet	Average in 91-year Record	Average during 6-Year Drought (1987-92)
Base	0	0	0	0	0	0	0
20%	42,293	37,427	41,276	11,909	5,002	24,313	48,939
30%	78,684	79,251	94,208	34,645	12,130	52,702	89,265
40%	116,137	131,201	157,446	74,532	24,885	89,505	129,884
50%	154,153	181,782	223,041	137,969	42,760	132,750	170,755

Annual averages presented in Table 9 are from 91-year simulations of the SFPUC water supply system using the hydrologic record from 1921 through 2011. Averages by water year type are presented from the simulations using San Joaquin Valley Water Year Hydrologic Classification (per D-1641). The simulation of the SFPUC reservoir system allows in-stream flow requirements to be met first by any water that spills from storage, and requires releases from storage to meet the remainder of the SFPUC responsibility for flow. The inclusion of spill accounting in Table 9 is the only difference from Table 8. Note that the SFPUC responsibility is greatly diminished in wetter year types in Table 9, relative to Table 8, and is substantially the same in the drier year types.

Figure 1 – Example Calculation of SFPUC Contribution to Unimpaired Flow Standards Proposed in SED

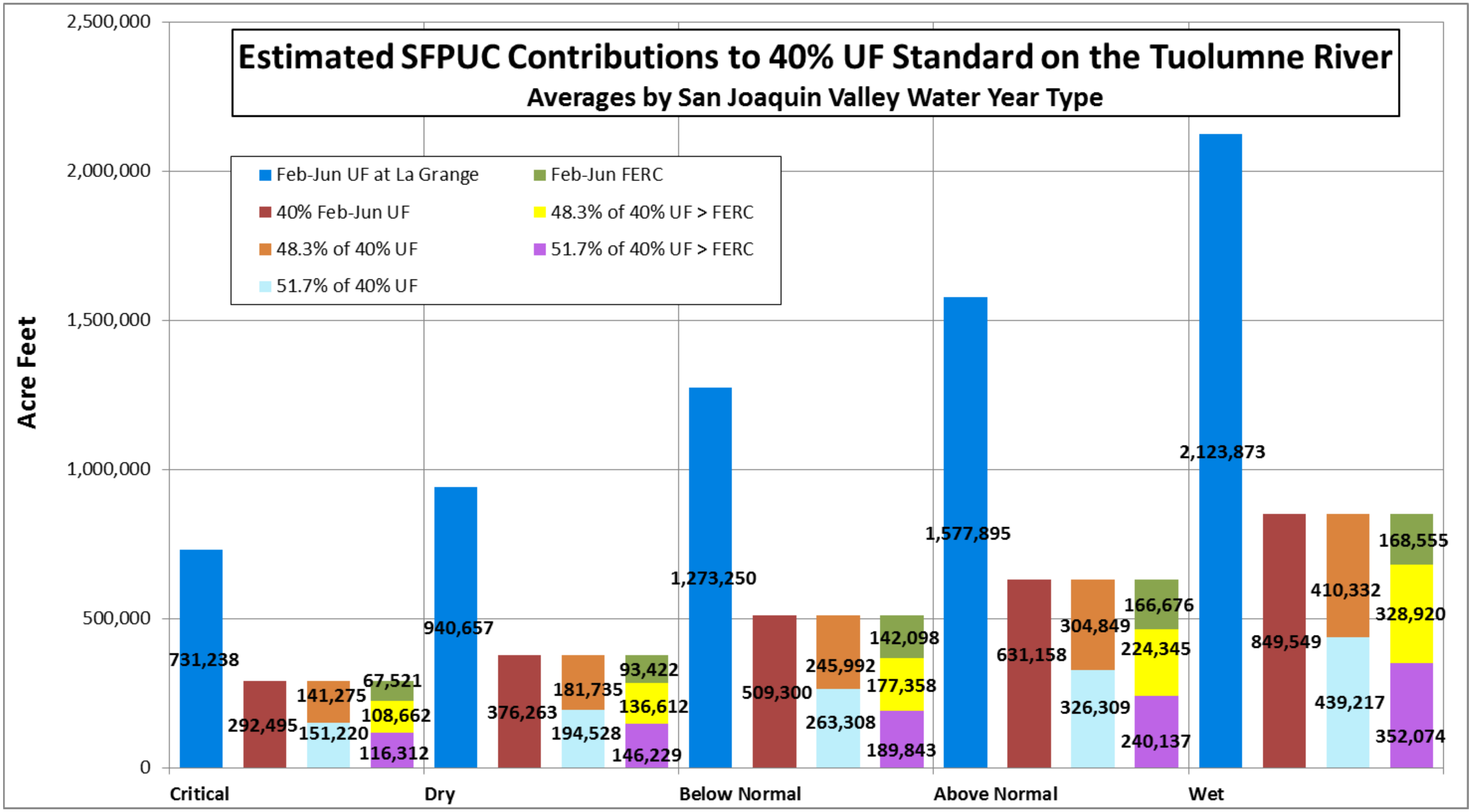

Figure 1 presents average values of unimpaired flow (UF) on the Tuolumne River at La Grange, summed for the period from February through June, for San Joaquin Valley water year types (Feb-Jun UF at La Grange). Also shown is the volume equal to 40% of the total unimpaired flow at La Grange from February through June (40% Feb-Jun UF), which is the estimated SED flow proposal. That volume is then shown split into fractions equal to 51.7% and 48.3% of 40% of unimpaired flow (51.7% of 40% UF; 48.3% of 40% UF). Finally, the volume from February through June of the current FERC release schedule at La Grange is shown averaged by water year type (Feb-Jun FERC), and the remaining difference between the FERC schedule and 40% of unimpaired flow is shown split into fractions of 51.7% and 48.3% (51.7% of 40% UF > FERC; 48.3% of 40% UF > FERC). For the current evaluation of SED alternatives, the SFPUC contribution was calculated for each month using the method described for the “51.7% of 40% UF > FERC” values. All averages shown in Figure 1 are calculated for water years 1921 through 2011.

APPENDIX 3

Bay Area Socioeconomic Impacts Resulting from Instream Flow Requirements for the Tuolumne River

PREPARED FOR

San Francisco Public Utilities Commission

PREPARED BY

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THE Brattle GROUP

This report was prepared for the San Francisco Public Utilities Commission. All results and any errors are the responsibility of the authors and do not represent the opinion of The Brattle Group or its clients.

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Introduction

This report concerns the socioeconomic impacts of current and projected dry-year water shortages within the Hetch Hetchy Regional Water System ("RWS") service area in the San Francisco Bay Area. The RWS is owned and operated by the San Francisco Public Utilities Commission ("SFPUC") and has a service territory that includes the City and County of San Francisco ("CCSF" or "San Francisco"), and that of the SFPUC's 26 wholesale customers in San Mateo, Santa Clara and Alameda Counties ("Wholesale Customers").[1]

The water shortages evaluated in this report result from instream flow requirements proposed to be imposed for the Tuolumne River by the State Water Resources Control Board. These shortages are likely to be coincident with dry-year conditions in which non-RWS water supplies otherwise available to the CCSF and the Wholesale Customers are reduced.[2] Specifically, we examine shortages for the 30%, 40% and 50% unimpaired flow scenarios, as well as under baseline conditions.

Socioeconomic impacts are assessed from the perspective of the households and businesses that consume water provided by the RWS. The socioeconomic impact analysis focuses on several standard measures of impact under both current and projected future demands: economic welfare, business sales, and employment.3 The method used to estimate these impacts is described in the report *Socioeconomic Impacts of Water Shortages within the Hetch Hetchy Regional Water System Service Area*, prepared by The Brattle Group in 2014. The version of the impact model used in this report has been updated to incorporate the Plan Bay Area projections of population and employment, and the most recent estimates of household income from the U.S. Census Bureau.

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[1] The RWS also serves Cordilleras Mutual Water Company on a wholesale basis; however due to their small size they were not included in this analysis. In addition, the SFPUC serves one wholesale customer outside San Francisco, Groveland Community Service District in Tuolumne County, as well as retail customers in the Town of Sunol and Lawrence Livermore National Laboratory in Alameda County. These outside San Francisco accounts represent a small fraction of overall RWS demands, and consequently, socioeconomic impacts on these customers are not estimated in this report.

[2] Non-RWS supplies reference supplies available to service demand that are not provided by the RWS system.

[3] Business sales are measured as revenues generated in the following sectors: manufacturing, wholesale trade, information, real estate and rental and leasing, professional, scientific, and technical services, educational services, health care and social assistance, arts, entertainment, and recreation, accommodation and food services, and other services (except public administration).

These figures are used in the forecast of 2040 water demands for San Francisco and the Wholesale Customers.

Shortage Calculations

The estimation of socioeconomic impacts resulting from water shortages occurs via a multi-step process. Water shortages (defined as total demand minus available supply) are estimated relative to two different levels of baseline demand. First, the impacts of instream flow criteria are evaluated under a demand of 223 mgd on the RWS, which corresponds to the pre-drought, normalized level of demand on the RWS.[4] Second, impacts are evaluated under RWS demand of 265 mgd, which is equal to the SFPUC's maximum supply commitment to the RWS customers. This level of demand is also consistent with forecasts of RWS demand developed by The Brattle Group projected to occur in 2040.

For both the pre-drought and 2040 analyses, RWS demands are calculated taking into account the current and anticipated alternative water supplies, including active conservation, available to SFPUC and the Wholesale Customers for both normal and dry years. That is, RWS demand is calculated as a residual, or total demand minus available alternative supplies. Table 1 displays the amount of dry-year alternative supplies for CCSF and the Wholesale Customers, for both the 223 and 265 mgd demand scenarios. These figures were provided by SFPUC and BAWSCA.

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[4] Pre-drought, normalized demand represents current demand under normal economic and weather conditions.

Table 1
Dry Year Alternative Supplies and Active Conservation
(mgd)

	Recycled Supplies	Total Alternative Supplies	Active Conservation
223 MGD			
Wholesale Customers	10.24	69.26	
CCSF	0.00	2.20	
265 MGD			
Wholesale Customers	17.81	81.46	15.00
CCSF	4.00	9.00	5.20

The figures in Table 1 indicate that alternative supplies are projected to increase significantly in the RWS service area over the next two decades. Despite this increase, it will be demonstrated in subsequent sections of this report that future losses resulting from reduced RWS deliveries are somewhat larger than at present.

To calculate shortages for each agency, water supplies available from the RWS in each unimpaired flow scenario and hydrological traces[5] are first allocated between the CCSF and the Wholesale Customers in aggregate, based on the Water Shortage Allocation Plan adopted as part of the 25-year 2009 Water Supply Agreement (WSA). The supplies available to the Wholesale customers collectively are then allocated among the individual Wholesale Customers in proportion to an Allocation Basis.[6] For the purposes of estimating the socioeconomic impacts of water shortages, available supplies for each agency are then allocated across the following sectors: single-family residential (SFR), multi-family residential (MFR), commercial and industrial (CI), dedicated irrigation (DI), and other.

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[5] A hydrologic trace is a sequence of RWS water supplies available over the historic hydrology, assuming a given level of demand.

[6] The Allocation Basis for each Wholesale Customer is calculated based on two components: the fixed Wholesale Customers' Individual Supply Guarantee, as stated in the WSA, and the variable Base/Seasonal Component, calculated using the monthly water use for three consecutive years prior to the onset of the drought for each of the Wholesale Customers for all available water supplies.

This method yields estimates of water shortage specific to each sector and Wholesale Customer, for each unimpaired flow scenario and each year in the hydrological trace. Economic relationships that translate these shortages into estimates of social welfare, output, and employment losses are then applied. These economic impact relationships, which are conceptually similar to dose-response functions used in medical research, are developed through econometric analyses of past water use behavior.

Tables 2 displays the maximum shortages for each sector evaluated across the historic hydrology and assuming a 223 mgd level of RWS demand. Maximum shortages occur in 1992 conditions, reflecting the severe water supply restrictions occurring at the end of the six-year drought lasting from 1987 to 1992.

Table 2
Maximum Shortages under RWS Demand of 223 MGD
(mgd/percent)[7]

	CCSF							Wholesale					
	DI	SFR	MFR	CI	Other	Total		DI	SFR	MFR	CI	Other	Total
Base Case	0.00 0%	0.00 0%	0.00 0%	0.00 0%	0.00 0%	0.00 0%	Base Case	0.00 0%	0.00 0%	0.00 0%	0.00 0%	0.00 0%	0.00 0%
30% Unimpaired	0.00 0%	4.92 30%	6.88 30%	6.31 30%	1.13 7%	19.24 25%	30% Unimpaired	13.91 67%	31.79 32%	5.51 15%	7.86 15%	3.98 16%	63.05 27%
40% Unimpaired	0.00 0%	8.19 50%	11.46 50%	7.74 37%	5.22 30%	32.62 42%	40% Unimpaired	14.19 69%	42.43 42%	11.74 32%	13.65 26%	5.91 23%	87.92 37%
50% Unimpaired	0.00 0%	10.65 65%	13.61 59%	10.52 50%	8.70 50%	43.49 56%	50% Unimpaired	14.19 69%	50.82 50%	15.39 41%	19.96 38%	7.75 30%	108.12 46%

Table 3 displays the same information for the 265 mgd level of demand. The percent shortages are fairly equivalent to those in Table 2, reflecting the fact that both total demand and non-RWS supplies are projected to grow over the coming two decades.

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[7] San Franicisco dedicated irrigation accounts are characterized by sector (residential or commercial and industrial). Thus, shortages to dedicated irrigation ("DI") are taken through shortages to SFR, CI, and other. For the wholesale customers, dedicated irrigation usage is separated by source, namely whether irrigation accounts are serviced by recycled water or other supplies. When determining shortages, the model first allocates conservation to dedicated irrigation not serviced by recycled water and reduces this amount by 100%.

Table 3
Maximum Shortages under RWS Demand of 265 MGD
(mgd/percent)[8]

	CCSF							Wholesale					
	DI	SFR	MFR	CI	Other	Total		DI	SFR	MFR	CI	Other	Total
Base Case	0.00 0%	1.36 6%	0.00 0%	0.00 0%	0.00 0%	1.36 2%	Base Case	9.43 46%	31.18 25%	7.06 15%	8.26 12%	0.78 2%	56.72 19%
30% Unimpaired	0.00 0%	8.43 38%	7.87 30%	7.74 30%	4.94 30%	28.98 32%	30% Unimpaired	9.43 46%	60.14 44%	25.18 36%	27.63 29%	14.61 25%	136.98 37%
40% Unimpaired	0.00 0%	10.99 50%	9.94 38%	7.74 30%	4.94 30%	33.62 37%	40% Unimpaired	9.43 46%	66.16 47%	28.69 39%	30.43 33%	15.74 28%	150.45 40%
50% Unimpaired	0.00 0%	13.24 60%	13.12 50%	12.91 50%	8.24 50%	47.50 52%	50% Unimpaired	9.43 46%	80.22 57%	35.45 46%	41.78 42%	23.90 40%	190.79 49%

Subsequent sections of the report detail the economic implications of water shortages caused by the Tuolumne River instream flow requirements detailed in the SED. Before reporting these impact calculations, however, it is instructive to consider the magnitude of these projected shortages in comparison to Plan Bay Area growth projections.

Water Availability and Growth Projections

The Plan Bay Area contains projections of employment and population to 2040. Tables 4 and 5 display these projections by county. In general, Plan Bay Area anticipates significant growth of employment over this period, particularly in Alameda, San Francisco and Santa Clara counties.

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[8] *Id.*

Table 4
Plan Bay Area Employment Growth by County
(from 2010 levels)

County	No Project	Main Streets	Connected Neighborhoods	Big Cities
Alameda	38%	40%	39%	39%
San Francisco	42%	44%	46%	42%
San Mateo	17%	20%	18%	18%
Santa Clara	41%	39%	39%	42%

Source: Plan Bay Area 2040, http://planbayarea.org/.
The scenarios above are described as follows:
"No Project" illustrates trends under currently adopted local general plans and zoning.
"Main Streets" places future population and employment growth in the downtowns in all Bay Area cities.
"Connected Neighborhoods" places future population and employment growth in medium-sized cities.
"Big Cities" concentrates future population and employment growth within San Jose, San Francisco and Oakland.

Plan Bay Area anticipates a similar pattern of population growth, with more population growth projected to occur in San Francisco and Santa Clara counties than is the case with job growth.

Table 5
Plan Bay Area Population Growth by County
(from 2010 levels)

County	No Project	Main Streets	Connected Neighborhoods	Big Cities
Alameda	29%	35%	36%	24%
San Francisco	34%	40%	36%	46%
San Mateo	25%	29%	25%	23%
Santa Clara	28%	34%	37%	73%

Source: Plan Bay Area 2040, http://planbayarea.org/.
The scenarios above are described as follows:
"No Project" illustrates trends under currently adopted local general plans and zoning.
"Main Streets" places future population and employment growth in the downtowns in all Bay Area cities.
"Connected Neighborhoods" places future population and employment growth in medium-sized cities.
"Big Cities" concentrates future population and employment growth within San Jose, San Francisco and Oakland.

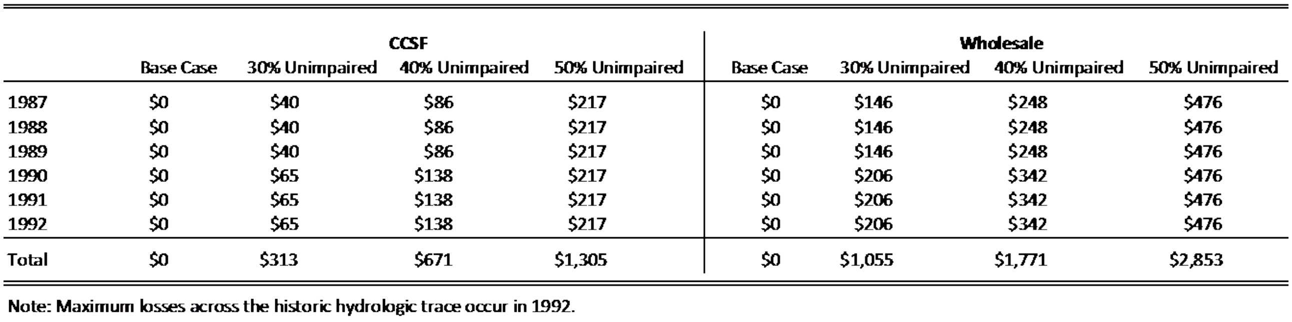
The large maximum shortages displayed in Tables 2 and 3 call these growth patterns into question. In San Francisco County, for example, it is questionable whether a projection of 42% job growth is realistic given that businesses in the city can expect 50% water shortages in a multi-year drought. Similarly, it is dubious that developers in Santa Clara County would be willing or able to build enough housing units to support up to 73% growth in population, when those same households would be subjected to 56% water restrictions during the driest periods. The apparent mismatch between Bay Area growth projections and expected dry-year shortages raises the question of whether the instream flow restrictions in the SED would alter patterns of growth in the Bay Area.

Economic Impacts: Welfare Losses

Welfare loss estimates are based on relationships that capture the amount consumers would pay to avoid a shortage of a given magnitude. Economists refer to this value as “willingness to pay” (“WTP”). Consumers’ WTP to avoid a water shortage is estimated by observing how consumers have responded to price changes in the past. Water rates increase over time and vary across agencies. By observing how consumption changes as water rates change, we can estimate the “price elasticity of demand”, or the responsiveness of demand to price. This price elasticity can then be used to determine how much consumers would be willing to pay to achieve various levels of consumption, and conversely how much they would be willing to pay to avoid reducing their consumption levels.[9]

Separate price elasticities are used for different sectors and agencies to account for variation in responsiveness to price. Resulting welfare loss estimates for the CCSF and the Wholesale Customers in aggregate, under pre-drought normalized demand, are presented below in Table 6. The tables in this report display impacts for the 1987-1992 drought, which is the period of the most significant shortages over the hydrologic record

Table 6
Welfare Losses Associated with RWS Demand of 223 MGD
($ millions)



	CCSF				Wholesale			
	Base Case	30% Unimpaired	40% Unimpaired	50% Unimpaired	Base Case	30% Unimpaired	40% Unimpaired	50% Unimpaired
1987	$0	$40	$86	$217	$0	$146	$248	$476
1988	$0	$40	$86	$217	$0	$146	$248	$476
1989	$0	$40	$86	$217	$0	$146	$248	$476
1990	$0	$65	$138	$217	$0	$206	$342	$476
1991	$0	$65	$138	$217	$0	$206	$342	$476
1992	$0	$65	$138	$217	$0	$206	$342	$476
Total	$0	$313	$671	$1,305	$0	$1,055	$1,771	$2,853

Note: Maximum losses across the historic hydrologic trace occur in 1992.

Over the 1987-92 drought, impacts for San Francisco range from $313 million to over $1.3 billion in lost welfare. For the Wholesale Customers, equivalent losses range from $1.1 billion to

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[9] For more on the specific method used to determine residential and business WTP and welfare loss, see Buck, S., M. Auffhammer, S. Hamilton and D. Sunding, “Measuring Welfare Losses from Urban Water Supply Disruptions,” *Journal of the Association of Environmental and Resource Economists* (September 2016): 743-778.

$2.9 billion. Welfare loss estimates under projected RWS demand of 265 mgd are presented below in Table 7.

Table 7
Welfare Losses Associated with RWS Demand of 265 MGD
($ millions)

	CCSF				Wholesale			
	Base Case	30% Unimpaired	40% Unimpaired	50% Unimpaired	Base Case	30% Unimpaired	40% Unimpaired	50% Unimpaired
1987	$0	$71	$137	$480	$0	$428	$580	$1,209
1988	$0	$137	$283	$480	$160	$580	$874	$1,209
1989	$0	$137	$283	$480	$160	$580	$874	$1,209
1990	$6	$137	$283	$480	$296	$580	$874	$1,209
1991	$6	$137	$283	$480	$296	$580	$874	$1,209
1992	$6	$220	$283	$480	$296	$771	$874	$1,209
Total	$18	$841	$1,552	$2,882	$1,206	$3,518	$4,950	$7,254

Note: Maximum losses across the historic hydrologic trace occur in 1992.

Welfare losses are significantly larger in the 265 mgd case. For CCSF, welfare losses from the 30% - 50% Unimpaired Flow scenarios range from $841 million to $2.9 billion. For San Francisco's Wholesale Customers, losses range from $3.5 billion to $7.3 billion over the 1987-92 hydrology.

It has been suggested that the low level of RWS water sales occurring in 2015-16 could be used to evaluate impacts assuming a "new normal" level of RWS demand of 175 mgd. This approach would be highly misleading for several reasons. The figure of 175 mgd was the level of actual purchases of RWS water during the drought – it is not a level of demand. Given prevailing rates and economic conditions, customers would have preferred to purchase more water during this period, but were prevented from doing so by the Governor's mandate to reduce water usage as implemented by the State Water Resources Control Board. The actual demand during the drought was the 223 mgd employed in this report. Restricting purchases below this amount results in economic losses of the type presented in this report. To call a restricted level of purchases the new level of demand simply assumes away any economic loss.

In 2015-16, the Wholesale Customers reduced residential consumption by around one-quarter in response to the Governor's mandate. In San Francisco, residential consumption changes by roughly half this amount due to the already low level of consumption in the city. In the 30% Unimpaired scenario, residential cutbacks reach 38% in San Francisco and 44% in the Wholesale Customer service area under the 223 mgd level of RWS demand, well beyond the shortages experienced by customers in the service area during the severe recent drought.

Economic Impacts: Business Output and Employment Losses

The other measures of socioeconomic impact evaluated are sales and employment. Business output, defined as the value of sales of all business establishments in a particular area, is a standard way of measuring economic activity. Employment is another summary measure of economic activity and is defined as the number of full-time equivalent jobs in the given area. Dry-year shortages have the potential to influence business sales and employment when businesses are forced to curtail their water consumption.

Changes in output under each scenario are based on the shortages incurred by the CI sector in each Wholesale Customer's service territory. Given a CI water shortage, county-specific output multipliers[10] are used to translate a percent change in water availability to the CI sector into a percent change in business revenue. Separate multipliers are used for relatively moderate shortages (below 15%) and for more severe shortages (over 15%), to account for the fact that an additional cut back in water supply becomes more difficult to manage the further supply has already been reduced.

Averaging multipliers across the industries included in the analysis (see footnote 3), based on their share of annual payroll in the Wholesale Customers' service territories, each percent shortage under 15% translates into 0.038% lower sales revenue in the commercial sector, and 0.128% lower sales revenue in the industrial sector. Each percent shortage above 15% translates into a sales revenue reduction of 0.402% in the commercial sector and 0.470% in the industrial sector. Resulting output losses under pre-drought normalized demand are shown in Table 8 below.

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[10] MHB Consultants, Inc., "The Economic Impact of Water Delivery Reductions on the San Francisco Water Department's Commercial and Manufacturing Customers," 1994. Tables 13 and 14 (pp. 48, 50).

Table 8
Output Losses Associated with RWS Demand of 223 MGD
($ millions)

	CCSF				Wholesale			
	Base Case	30% Unimpaired	40% Unimpaired	50% Unimpaired	Base Case	30% Unimpaired	40% Unimpaired	50% Unimpaired
1987	$0	$0	$6,597	$14,589	$0	$4,012	$6,630	$33,447
1988	$0	$0	$6,597	$14,589	$0	$4,012	$6,630	$33,447
1989	$0	$0	$6,597	$14,589	$0	$4,012	$6,630	$33,447
1990	$0	$6,597	$9,315	$14,589	$0	$6,212	$16,282	$33,447
1991	$0	$6,597	$9,315	$14,589	$0	$6,212	$16,282	$33,447
1992	$0	$6,597	$9,315	$14,589	$0	$6,212	$16,282	$33,447
Total	$0	$19,792	$47,738	$87,536	$0	$30,671	$68,736	$200,681

Note: Maximum losses across the historic hydrologic trace occur in 1992.

Table 8 indicates that under pre-drought levels of demand, commercial and industrial shortages result in output losses of between $19.8 and $87.5 billion for San Francisco, and from $30.7 to over $200 billion in the Wholesale Customers service area. Output losses under projected 2035 demand are shown in Table 9 below.

Table 9
Output Losses Associated with RWS Demand of 265 MGD
($ millions)

	CCSF				Wholesale			
	Base Case	30% Unimpaired	40% Unimpaired	50% Unimpaired	Base Case	30% Unimpaired	40% Unimpaired	50% Unimpaired
1987	$0	$0	$3,465	$18,240	$0	$8,640	$14,164	$50,960
1988	$0	$3,465	$8,248	$18,240	$561	$14,164	$35,179	$50,960
1989	$0	$3,465	$8,248	$18,240	$561	$14,164	$35,179	$50,960
1990	$0	$3,465	$8,248	$18,240	$4,158	$14,164	$35,179	$50,960
1991	$0	$3,465	$8,248	$18,240	$4,158	$14,164	$35,179	$50,960
1992	$0	$8,248	$8,248	$18,240	$4,158	$28,654	$35,179	$50,960
Total	$0	$22,109	$44,707	$109,440	$13,596	$93,952	$190,057	$305,759

Note: Maximum losses across the historic hydrologic trace occur in 1992.

As expected, losses under 265 mgd demand are larger than assuming pre-drought demands. For CCSF, output losses over the 1987-92 drought total between $22.1 and $109.4 billion. For the Wholesale Customer service area, output losses range from $94.0 to $305.8 billion over this same period.

Using a similar method, agency-specific multipliers[11] are used to translate shortages in the CI sectors into changes in employment. Job losses under pre-drought normalized demand conditions are presented in Table 10.

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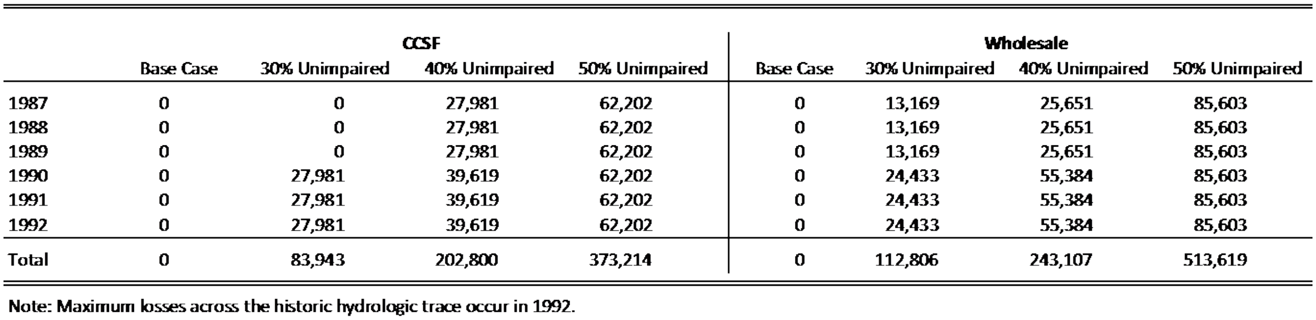
[11] MHB Consultants, Inc., "The Economic Impact of Water Delivery Reductions on the San Francisco Water Department's Commercial and Manufacturing Customers," 1994. Tables 13 and 14 (pp. 48, 50).

Table 10
Job Losses Associated with RWS Demand of 223 MGD
(full-time equivalent jobs)

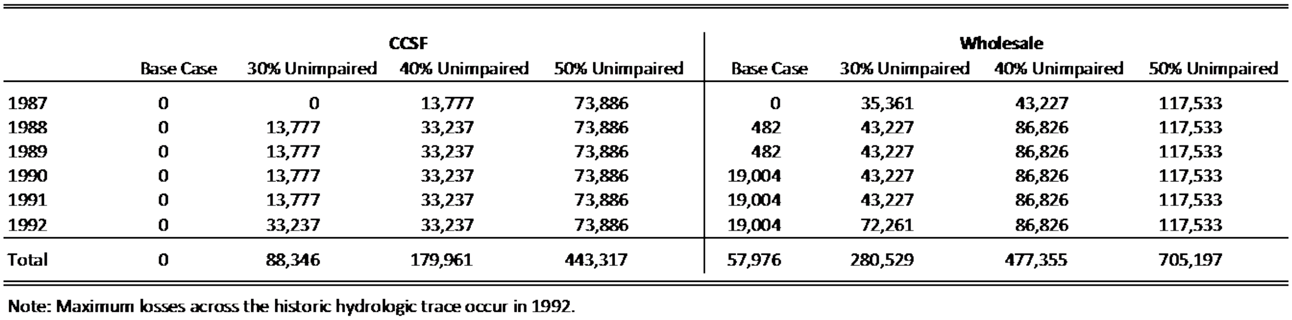


	CCSF				Wholesale			
	Base Case	30% Unimpaired	40% Unimpaired	50% Unimpaired	Base Case	30% Unimpaired	40% Unimpaired	50% Unimpaired
1987	0	0	27,981	62,202	0	13,169	25,651	85,603
1988	0	0	27,981	62,202	0	13,169	25,651	85,603
1989	0	0	27,981	62,202	0	13,169	25,651	85,603
1990	0	27,981	39,619	62,202	0	24,433	55,384	85,603
1991	0	27,981	39,619	62,202	0	24,433	55,384	85,603
1992	0	27,981	39,619	62,202	0	24,433	55,384	85,603
Total	0	83,943	202,800	373,214	0	112,806	243,107	513,619

Note: Maximum losses across the historic hydrologic trace occur in 1992.

For CCSF, job losses under 1987-92 hydrology range from 83,943 annual FTE over the six-year drought, to 373,214 under the 50% Unimpaired Flow scenario. For the Wholesale Customers, annual FTE losses are between 112,806 and 513,619 under the same conditions. Job losses under RWS demands of 265 mgd are shown in Table 11.

Table 11
Job Losses Associated with RWS demand of 265 MGD
(full-time equivalent jobs)



	CCSF				Wholesale			
	Base Case	30% Unimpaired	40% Unimpaired	50% Unimpaired	Base Case	30% Unimpaired	40% Unimpaired	50% Unimpaired
1987	0	0	13,777	73,886	0	35,361	43,227	117,533
1988	0	13,777	33,237	73,886	482	43,227	86,826	117,533
1989	0	13,777	33,237	73,886	482	43,227	86,826	117,533
1990	0	13,777	33,237	73,886	19,004	43,227	86,826	117,533
1991	0	13,777	33,237	73,886	19,004	43,227	86,826	117,533
1992	0	33,237	33,237	73,886	19,004	72,261	86,826	117,533
Total	0	88,346	179,961	443,317	57,976	280,529	477,355	705,197

Note: Maximum losses across the historic hydrologic trace occur in 1992.

As in the case of output losses, job losses are larger in the 265 mgd demand case than under pre-drought demands. San Francisco job losses range from 88,346 annual FTE to 443,317 annual FTE. Losses are significantly larger for the Wholesale Customers and range from 280,529 to 705,197 lost annual FTE over the six-year drought.

Rate Impacts from Water Shortages

SFPUC and the Wholesale Customers recover fixed costs through volumetric rates. That is, rate structures in the Bay Area are such that water rates are well in excess of variable operating costs. As a result, when sales fall through supply restrictions, water rates must increase to balance water utility budgets.

For the 265 mgd demand scenario, water rates in CCSF will need to increase by 4% in the 30% Unimpaired case, by 7% in the 40% Unimpaired case, and by 16% in the 50% Unimpaired case. For the Wholesale Customers, rates will need to increase by 6% in the 30% Unimpaired case, by 9% in the 40% Unimpaired case, and by 15% in the 50% Unimpaired case. Even with these significant rate increases, which come on top of some of the highest water rates among California water utilities, cities will be forced to make heavier use of balancing accounts and other financial reserves to cope with the budgetary instability caused by less reliable water supplies.

Comparison to SWRCB Economic Analysis

The economic analysis contained in Chapters 20 and 16 and Appendix L of the SED is unrealistic and should not be relied upon by the SWRCB as a basis for decision-making. The main analysis in Chapter 20 largely assumes away the real problem faced by San Francisco and its Wholesale Customers by positing that dry-year transfers with MID and TID can replace lost supplies. This approach is overly simplistic, and ignores recent experience with transfers among Tuolumne River users. By artificially minimizing the economic impacts of the contemplated instream flow regulations, the SED places Bay Area water consumers at significant risk of large future water shortages and economic losses.

The SED assumes that in dry periods like 1987-92, SFPUC is able to purchase more than 200,000 acre-feet annually at a price of $1,000 per acre-foot to replace lost RWS supplies. This assumption is unrealistic and contrary to recent experience. SFPUC's Water System Improvement Program (WSIP) evaluated dry-year water transfers from MID and TID of 25 mgd. Subsequent analysis revised this volume down to a mere 2 mgd, and SFPUC and the Districts were unable to agree on the terms of a transfer of even this minimal amount. Indeed, during the last drought, CCSF and the Wholesale Customers endured significant reductions of per capita water use and even then were unable to acquire transfer water from MID and TID.

Conclusions

Over the next 25 years, forecasted growth in the residential, commercial, and industrial sectors will strain the RWS's ability to meet the water needs of homes and businesses in its service territory. Currently, the RWS provides nearly all of the water for the CCSF and approximately 65% of the water demanded by Wholesale Customers. Fourteen of the 26 Wholesale Customers receive 100 percent of their water supply from the RWS. Collectively, the RWS supplies nearly three-quarters of the water demanded by the entire customer base in the RWS service area.

Low per capita water use reveals a substantial investment in water conservation measures including installation of water-efficient appliances, and suggests subsequent conservation may be expensive and result in smaller water savings. Per capita residential use in the RWS service area is 44 gallons per capita per day (gpcd) in San Francisco and 77 gpcd across all sectors. Average per capita residential consumption in the Wholesale Customer service area was 64.7 gpcd in FY 2014-15 and gross per capita consumption was 105.7 gpcd. By comparison, at the peak in FY 1986-87, gross per capita consumption in the Wholesale Customer service area was 186.5 gpcd. Further, residential consumption in the RWS service area is well below the statewide average of 76.6 gpcd. Similarly, while many water agencies have invested in non-RWS supplies, subsequent investments may call on expensive technologies with less-certain results. For these reasons, current and projected future non-RWS water supplies are not sufficient to mitigate the adverse impacts of reduction in RWS supplies, especially since these reductions will likely coincide with shortages on non-RWS supplies. In fact, welfare losses due to reductions on RWS supply are larger in part because these reductions would come at a time when the non-RWS supplies are also stressed.

Overall, the analysis reveals that even after accounting for growth in non-RWS supplies under dry-year conditions, reductions on RWS supplies have the potential to cause significant socioeconomic impacts in the Bay Area. Welfare losses to customers, lost economic output from area businesses, and reductions in employment are likely to result from interruptions in water supply. The magnitude and duration of these impacts will depend on growth, climate, conservation, and investment in non-RWS supplies, but the impacts from instream flow requirements examined in this report are likely to constitute a major disruption to the Bay Area economy.

CAMBRIDGE
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APPENDIX 4

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Attorneys for the City and County of San Francisco

BEFORE THE CALIFORNIA

STATE WATER RESOURCES CONTROL BOARD

DRAFT SUBSTITUTE ENVIRONMENTAL DOCUMENT IN SUPPORT OF POTENTIAL CHANGES TO THE WATER QUALITY CONTROL PLAN FOR THE SAN FRANCISCO BAY-SACRAMENTO/SAN JOAQUIN DELTA ESTUARY; SAN JOAQUIN RIVER FLOWS AND SOUTHERN DELTA WATER QUALITY	DECLARATION OF JONATHAN P. KNAPP IN SUPPORT OF COMMENTS BY THE CITY AND COUNTY OF SAN FRANCISCO TO THE DRAFT SUBSTITUTE ENVIRONMENTAL DOCUMENT IN SUPPORT OF POTENTIAL CHANGES TO THE BAY-DELTA PLAN

I, Jonathan P. Knapp, declare:

1. I am employed as a Deputy City Attorney with the San Francisco City Attorney's Office.

2. On behalf of the City and County of San Francisco and the San Francisco Public Utilities Commission ("San Francisco"), I submitted a request for public records to the State Water Resources Control Board ("State Water Board") on October 14, 2016 concerning the State Water Board's proposed amendment to the Water Quality Control Plan for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary and the draft revised Substitute Environmental Document ("SED") for the proposed amendment ("PRA Request"). The PRA Request is included hereto as Attachment 1.

3. In the PRA Request, among other documents, San Francisco sought "[a]ll public records containing information that served as the basis for Staff's conclusion that the volume of water identified in the 2016 Draft SED, Appendix L, at page L-21, Table L.4.-2, would be available for purchase by San Francisco from the Modesto Irrigation District and Turlock Irrigation District (collectively referred to as the 'Districts') during a six-year drought if LSJR Alternatives 2, 3, or 4 were implemented." (*See* Attachment 1, at 1.)

4. In response to this request, the State Water Board provided, among other documents, an electronic copy of an April 21, 1995 agreement between San Francisco and the Districts that requires San Francisco to make annual payments to the Districts in return for the Districts meeting all the minimum flow requirements provided for in a 1996 settlement agreement related to the Districts' Federal Energy Regulatory Commission license for the Don Pedro Hydroelectric Project ("1995 Side Agreement").

5. In the PRA Request San Francisco also sought "[a]ll public records containing information that served as the basis for Staff's analysis in the 2016 Draft SED that identify 'recent water purchases involving both [Modesto Irrigation District ('MID'] and [Turlock Irrigation District ('TID'], as well as by other agricultural districts in California, as stated in the 2016 Draft SED at page

20-48, including, but not limited to, the price of the water and volume(s) transferred." (*See* Attachment 1, at 1-2.)

6. In response to this request, the State Water Board provided, among other documents, an electronic copy of the Agricultural Water Management Plan 2015 Update for the Modesto Irrigation District.

7. San Francisco also requested "[a]ll public records containing information that served as the basis for Staff's analysis of the possible effects of LSJR Alternatives on hydropower generation, including, but not limited to, hydropower generation by San Francisco." (*See* Attachment 1, at 3.)

8. In response to this request, the State Water Board provided, among other documents, an e-mail chain that includes an e-mail dated August 15, 2016 from Nicole L. Williams, Senior Environmental Planner, ICF International, to State Water Board staff members William Anderson and Timothy Nelson. The e-mail chain is included hereto as Attachment 2.

9. I received the State Water Board's response to the PRA request. The State Water Board responded via a series of letters that included USB flash drives with electronic copies of documents. I personally reviewed these letters and the documents provided. The information contained in this declaration is true of my own personal knowledge.

I declare under penalty of perjury, under the laws of the State of California, that the foregoing is true and correct and that if called as a witness I could competently testify thereto.

Executed this 16th day of March, 2017 in San Francisco, California.

Jonathan P. Knapp

ATTACHMENT 1

CITY AND COUNTY OF SAN FRANCISCO
DENNIS J. HERRERA
City Attorney

OFFICE OF THE CITY ATTORNEY
JONATHAN P. KNAPP
Deputy City Attorney

Direct Dial: (415) 554-4261
Email: jonathan.knapp@sfgov.org

October 14, 2016

<u>*Sent Via U.S. Mail and Electronic Mail*</u>
Tom Howard
Executive Director
State Water Resources Control Board
1001 I Street
Sacramento, CA 95814-0100
Tom.Howard@waterboards.ca.gov

RE: *Public Records Act Request*

Dear Mr. Howard,

This office represents the San Francisco Public Utilities Commission ("SFPUC"), operator of the Hetch Hetchy Regional Water System ("RWS"). On behalf of the SFPUC and the City and County of San Francisco ("San Francisco"), we respectfully submit this request for records pursuant to the California Public Records Act, Government Code Sections 6250, *et seq*., and Article I, Section 3 of the California Constitution.

The State Water Resources Control Board ("State Water Board") released proposed updates to the Water Quality Control Plan for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary ("Plan Amendment") and the draft revised Substitute Environmental Document for the Plan Amendment ("2016 Draft SED") on September 15, 2016. The 2016 Draft SED recognizes that under two of the proposed Lower San Joaquin River alternatives ("LSJR Alternatives"), *i.e*., LSJR Alternatives 3 and 4 – that would require 40 to 60-percent of the unimpaired flow of the Tuolumne River to remain in the river from February through June – San Francisco's rights to divert water from the Tuolumne River may be significantly impacted. In order to ascertain the information relied on by State Water Board Staff ("Staff") as the basis for its analyses of water supply and economic impacts to San Francisco and its wholesale customers, San Francisco submits the following request for public records.

As used herein, "public records" has the definition of "Public records" prescribed in Government Code Section 6252(e).

San Francisco requests the following information:

1. All public records containing information that served as the basis for Staff's conclusion that the volume of water identified in the 2016 Draft SED, Appendix L, at page L-21, Table L.4.-2, would be available for purchase by San Francisco from the Modesto Irrigation District and Turlock Irrigation District (collectively referred to as the "Districts") during a six-year drought if LSJR Alternatives 2, 3, or 4 were implemented.

2. All public records containing information that served as the basis for Staff's analysis in the 2016 Draft SED that identify "recent water purchases involving both [Modesto Irrigation District ("MID")] and [Turlock Irrigation District ("TID")], as well as by other

agricultural districts in California," as stated in the 2016 Draft SED at page 20-48, including, but not limited to, the price of the water and volume(s) transferred.

3. All public records containing information that served as the basis for Staff's estimate of the $1,000/acre-foot of water purchase price used in Staff's analysis of the contemplated water transfer to San Francisco, as analyzed in the 2016 Draft SED.

4. All public records containing information that served as the basis for, and depicts Staff's analysis of, the scope of environmental impact to the Districts that would result were the Districts to transfer the volumes of water identified in the 2016 Draft SED, Appendix L, at page L-21, Table L.4.-2, during a six-year drought if LSJR Alternatives 2, 3, or 4 were implemented.

5. All public records containing information that served as the basis for Staff's analysis of the economic, environmental, and legal feasibility of San Francisco developing, constructing and operating an in-Delta diversion facility as described in the 2016 Draft SED. (See *e.g.*, 2016 Draft SED, at page 16-68.)

6. All public records containing information that served as the basis for Staff's conclusion that "changing circumstances since 2008 (e.g., Pelagic Organism Decline, climate change, California WaterFix, and the State Water Board's Final Report on the Development of Flow Criteria for the Sacramento Delta Flow Criteria [citation omitted])," as stated at page 16-68 of the 2016 Draft SED, merit consideration of the referenced in-Delta diversion project as a feasible source of replacement water supply for San Francisco in the 2016 Draft SED.

7. All public records containing information that served as the basis for Staff's analysis of the cost to San Francisco of water to be diverted via the proposed in-Delta diversion facility discussed in the 2016 Draft SED.

8. All public records containing information that served as the basis for, and depicts Staff's analysis of, the permitting process and scope of environmental impact from a desalination facility at Mallard Slough with a capacity of 56,000 acre-feet/year, as contemplated in the 2016 Draft SED. (*See* 2016 Draft SED, at page 16-74.)

9. All public records containing information that served as the basis for Staff's analysis of the cost to San Francisco of water to be obtained from San Francisco's participation in the development and construction of a desalination plant at Mallard Slough, as contemplated in the 2016 Draft SED.

10. All public records containing information and analysis that served as the basis for Staff's conclusion that the "Regional Groundwater Storage and Recovery project would yield over 60 TAF per drought cycle" for San Francisco, as stated at page L-20 of the 2016 Draft SED, if LSJR Alternatives 3 or 4 were implemented.

11. All public records containing information that served as the basis for Staff's development of conceptual elements for adaptive implementation of each of the LSJR Alternatives, including criteria that would drive decision-making about whether to require more flow

or less flow on the tributary rivers, and criteria that would result in deferring flow releases from the specified February-June period until later in the year.

12. All public records containing information that served as the basis for Staff's representation of adaptive implementation in the Water Supply Effects model, and all public records containing information regarding and depicting Staff's analysis of the model results.

13. All public records containing information that served as the basis for Staff's analysis of the possible effects of LSJR Alternatives on hydropower generation, including, but not limited to, hydropower generation by San Francisco.

14. All public records containing information that served as the basis for Staff's analysis of the possible effects of LSJR Alternatives on California electric grid reliability, including any consideration of impacts to the electric grid related to the implementation of the State Water Board's "Once Through Cooling" Policy.

15. All public records containing information that served as the basis for Staff's calculation of unimpaired flow of the Tuolumne River at Modesto.

16. All public records containing information that served as the basis for Staff's analysis of water use along the lower San Joaquin River between the Stanislaus, Tuolumne and Merced rivers ("SJR Tributaries") and Vernalis, including analysis of measures and actions to ensure that the environmental goals of the proposed Plan Amendment are achieved.

17. All public records containing information that served as the basis for Staff's analysis of the amount of water from the SJR Tributaries that is expected to reach Vernalis under each proposed LSJR Alternative.

18. All public records containing information that served as the basis for Staff's analysis of the amount of water that is expected to contribute to Delta outflow from the SJR Tributaries under each proposed LSJR Alternative, and the amount of water that is expected to be diverted from the Delta under each LSJR Alternative.

19. All public records containing information that served as the basis for Staff's conclusion that flows from the Upper San Joaquin River, including flows released from Friant Dam, would not be considered in its analysis of the proposed Plan Amendment and the LSJR Alternatives.

20. More specifically, all public records containing information that served as the basis for Staff's conclusion that although "[f]lows released from Friant Dam for fish protection or for flood control would contribute to the [San Joaquin River] flow at Vernalis," such flows "are not part of the plan amendments or alternatives evaluated [by Staff]." 2016 Draft SED, at page 2-2.

21. All public records containing information that served as the basis for Staff's conclusion that "[w]hen the percentage of unimpaired flow requirement is insufficient" to meet the

> "minimum base flow of 1,000 cfs, based on a minimum 7-day running average, at Vernalis at all times," then "the Stanislaus River shall provide 29 percent, the Tuolumne River 47 percent and the Merced River 24 percent of the additional total outflow needed to achieve and maintain the required base flow at Vernalis." (2016 Draft SED, Appendix K, at page 29).

Pursuant to Government Code Section 6253(b), we ask that you make the public records identified above "promptly available" upon our payment of any required copying or statutory fees. To the extent possible, we would prefer to receive the requested public records in electronic format. San Francisco is willing to pay any reasonable costs for the production of the requested public records, and/or provide a deposit in advanced, as necessary.

We believe that no express provisions of law exist that exempt the public records from disclosure. As you determine whether this request seeks copies of disclosable public records, be mindful that Article 1, Section 3(b)(2) of the California Constitution requires you to broadly construe a statute, court rule, or other authority if it furthers the right of access to the information we have requested, and to narrowly construe a statute, court rule, or other authority if it limits our right of access.

If a portion of the information we have requested is exempt from disclosure by express provisions of law, Government Code Section 6253(a) additionally requires segregation and deletion of the material in order that the remainder of the information may be released. If you determine that an express provision of law exists to exempt from disclosure all or a portion of the material we have requested, Government Code Section 6253(c) requires that the State Water Board notify San Francisco of the reasons for the determination not later than 10 days from your receipt of this request. In "unusual circumstances," as specifically defined in Government Code Section 6253(c), this deadline may be extended by no more than 14 days. Notably, Government Code Section 6253(d) prohibits the use of the 10-day period, or any provisions of the Public Records Act, "to delay or obstruct the inspection or copying of public records."

Thank you for your prompt attention to our request.

Very truly yours,

DENNIS J. HERRERA
City Attorney

Jonathan P. Knapp
Deputy City Attorney

Sent Via Electronic Mail Only

cc: Michael Lauffer, State Water Board Chief Counsel
Michael Carlin, Deputy General Manager and Chief Operating Officer, SFPUC
Steven Ritchie, Assistant General Manager, Water Enterprise, SFPUC
Ellen Levin, Deputy Manager, Water Enterprise, SFPUC

ATTACHMENT 2

From: Huber, Anne
To: Williams, Nicole; Anderson, William@Waterboards; Nelson, Timothy@Waterboards
Cc: Lindsay, Larry@Waterboards; Landau, Katheryn@Waterboards; Crain, Pat
Subject: RE: SWRCB Phase I SED: follow up on priority list and Appendix J comments - Hydroelectric parameters
Date: Friday, August 26, 2016 9:37:12 AM
Attachments: tri-dam_project_article_409.pdf
Merced draft FERC EIS.pdf
Merced River Hydroelectric Project - Fact Sheet.pdf
Oakdale and South San Joaquin Irrigation Dist Application additional water.pdf
Scoping Document 1 for La Grange Hydroelectric Project No. 14581.pdf
Hydropower parameter info.docx

Hi All,

Pat Crain and I looked for maximum flow capacity and head information for Tulloch, La Grange, McSwain, and Merced Falls hydroelectric facilities. I have attached some relevant documents (as many as I think will go through with email). We have one additional document, the Tri-Dam Project construction report, which is too big for email. The Word file includes our notes. Here's a summary of what we saw:

Merced Falls

- Flow capacity in WSE = 1,750 cfs - This number is in the Merced FERC draft EIS
- WSE Head = 26 feet - FERC draft EIS says that Merced Falls has a normal impoundment elevation of 344 feet, and that the max height of the dam is 34 feet. 26 feet seems reasonable, but we didn't see it explicitly mentioned anywhere.

McSwain

- Flow capacity in WSE = 2,700 cfs - This number is in the Merced ID fact sheet and the Merced FERC draft EIS
- WSE head = 54 feet - This number is in the Merced ID fact sheet

La Grange

- Flow capacity in WSE = 1,250 cfs - scoping document 1 indicates capacity of 580 cfs. Not clear if additional capacity was added later.
- WSE head = 50 feet - scoping document 1 indicates head of 115 feet. Not clear if this is a specification for the turbine or actual head, although info indicates that it may be the actual head (info from Pat regarding scoping document 1: the output matches what they report for max power production from the plant. If you look at the site you will see that the plant is actually run off a canal quite a way from the dam [Figure 2]. The dam is 131 feet high, so it makes sense that further down the canal the penstocks would be lower, so the 115 feet make sense to me.)

Tulloch

- Flow capacity in WSE = 1,700 cfs - Recreation plan for Black Creek Arm day use area indicates capacity of 1,800 cfs.
- WSE head = 149 feet - Summary report on the Tri-Dam Project indicates maximum head of 153 feet, so 149 may be reasonable.

-----Original Message-----
From: Williams, Nicole
Sent: Thursday, August 25, 2016 8:54 PM
To: Anderson, William@Waterboards; Nelson, Timothy@Waterboards
Cc: Lindsay, Larry@Waterboards; Landau, Katheryn@Waterboards; Huber, Anne
Subject: RE: SWRCB Phase I SED: follow up on priority list and Appendix J comments

Hi All - we have dug up some answers to this. Anne is going to compile and will send around for your consideration.

Cheers, Nicole

NICOLE L. WILLIAMS
Senior Environmental Planner
ICF INTERNATIONAL
o 916.231.9614
icfi.com
-----Original Message-----
From: Williams, Nicole
Sent: Monday, August 22, 2016 8:58 AM
To: 'Anderson, William@Waterboards'; Nelson, Timothy@Waterboards
Cc: Lindsay, Larry@Waterboards; Landau, Katheryn@Waterboards; Huber, Anne
Subject: RE: SWRCB Phase I SED: follow up on priority list and Appendix J comments

Okay. I'm going to see if someone here can help track this down through FERC documents or something else. Unless someone else has a better idea...?

-----Original Message-----
From: Anderson, William@Waterboards [mailto:William.Anderson@waterboards.ca.gov]
Sent: Saturday, August 20, 2016 12:18 AM
To: Nelson, Timothy@Waterboards; Williams, Nicole
Cc: Lindsay, Larry@Waterboards; Landau, Katheryn@Waterboards; Huber, Anne
Subject: RE: SWRCB Phase I SED: follow up on priority list and Appendix J comments

I also looked but did not find the mythical res ops folder. -Will A.

From: Nelson, Timothy@Waterboards
Sent: Friday, August 19, 2016 4:43 PM
To: Williams, Nicole; Anderson, William@Waterboards
Cc: Lindsay, Larry@Waterboards; Landau, Katheryn@Waterboards; huber, anne@icfi.com
Subject: RE: SWRCB Phase I SED: follow up on priority list and Appendix J comments

Hello Nicole,

I looked for the folder on the S drive, but could not find it. Will is in training until next Friday as well (he may be in late sometimes). He is likely the one to have the hard copy folder.

Tim

From: Williams, Nicole [mailto:Nicole.Williams@icfi.com]
Sent: Friday, August 19, 2016 2:48 PM
To: Anderson, William@Waterboards; Nelson, Timothy@Waterboards
Cc: Lindsay, Larry@Waterboards; Landau, Katheryn@Waterboards; huber, anne@icfi.com
Subject: RE: SWRCB Phase I SED: follow up on priority list and Appendix J comments

Hi Will and Tim, We modified some language in Appendix J, but wanted to follow up with highlighted below. Any luck? Cheers, Nicole

NICOLE L. WILLIAMS
Senior Environmental Planner
ICF INTERNATIONAL
o 916.231.9614
icfi.com
From: Williams, Nicole
Sent: Tuesday, August 16, 2016 11:36 AM
To: 'Anderson, William@Waterboards'; 'Nelson, Timothy@Waterboards'
Cc: 'Lindsay, Larry@Waterboards'; 'Landau, Katheryn@Waterboards'; Huber, Anne
Subject: RE: SWRCB Phase I SED: follow up on priority list and Appendix J comments

Hi Will and Tim, I looked at the Feb 2012 version and the Public Version of Appendix J and the public version of Appendix F.1 (since Lucas suggested maybe they were in an older version X). I do not see references related to head and flow capacity.

Did either of you look in the folder (network) or hard copy folder Lucas called “reservoir operations” as he suggested in the email? Find anything?

Are our next steps: looking at FERCE documentation? Look at the dam websites?

Cheers, Nicole

NICOLE L. WILLIAMS
Senior Environmental Planner
ICF INTERNATIONAL
o 916.231.9614
icfi.com

From: Anderson, William@Waterboards [mailto:William.Anderson@waterboards.ca.gov]
Sent: Tuesday, August 16, 2016 8:14 AM

To: Williams, Nicole
Subject: RE: SWRCB Phase I SED: follow up on priority list and Appendix J comments

Nicole, the purple box is from the WSE model where Lucas entered these constants that Tim was referring to in the original comment. I was just running to ground with all the info I currently have. - Will A.

From: Williams, Nicole
Sent: Monday, August 15, 2016 10:36 PM
To: 'Anderson, William@Waterboards'; 'Nelson, Timothy@Waterboards'
Cc: 'Lindsay, Larry@Waterboards'; 'Landau, Katheryn@Waterboards'; Huber, Anne
Subject: RE: SWRCB Phase I SED: follow up on priority list and Appendix J comments

Hum…had I read past your email I would have answered my own question.

I'll see if I can dig up an older version of the appendix and see if that sheds any light on it.

Cheers, Nicole

From: Williams, Nicole
Sent: Monday, August 15, 2016 10:00 PM
To: 'Anderson, William@Waterboards'; Nelson, Timothy@Waterboards
Cc: Lindsay, Larry@Waterboards; Landau, Katheryn@Waterboards; Huber, Anne
Subject: RE: SWRCB Phase I SED: follow up on priority list and Appendix J comments

Thanks Will. I'm a little confused about the purple box of numbers below – that's from the calcs worksheet? So Lucas is saying they weren't pulled from the FERC relicense documentation?

Cheers, Nicole

NICOLE L. WILLIAMS
Senior Environmental Planner
ICF INTERNATIONAL
o 916.231.9614
icfi.com
From: Anderson, William@Waterboards [mailto:William.Anderson@waterboards.ca.gov]
Sent: Monday, August 15, 2016 3:22 PM
To: Williams, Nicole; Nelson, Timothy@Waterboards
Cc: Lindsay, Larry@Waterboards; Landau, Katheryn@Waterboards; Huber, Anne
Subject: FW: SWRCB Phase I SED: follow up on priority list and Appendix J comments

Nicole:

See below comments from Lucas.

I have not worked with these values (WSE "Hydropower_Calcs" worksheet; columns O, S, W, AA rows 3-4), and I do not know the source. It would be worth corroborating them from available information (the FERC license documentation). They do appear reasonable.

[cid:image001.png@01D1FA38.D48DCB30]

Regarding page J-5. Your solution sounds reasonable.

Additional notes based on my cursory look at App. J:
In the intro 2nd paragraph "elevations head" should be "elevation head."
Need to cite a source for the hydropower Eqn. J-1 (although any general hydro text would do, it's fairly universal) and efficiency "assumed to be 80 percent in for all facilities". Could clarify units that head is in ft, weight of water is (62.4 lb. / cu. ft.), remove the symbol before the γ, and Q is in cfs.

-Will A.

From: Sharkey, Lucas@Waterboards
Sent: Monday, August 15, 2016 2:18 PM
To: Anderson, William@Waterboards
Subject: RE: SWRCB Phase I SED: follow up on priority list and Appendix J comments

They are not in the Appendix? Is it JUST the Head and Flow ? Flow I think came from the FERC documents on those rivers. They generally had a maximum flow through the pipe works. It was not scientific and may not have been based on the actual turbines in each of those dams. They could also just be from one of the Dam websites. If I had info, it should be in a folder (network) or hard copy folder I called "reservoir operations".
Not sure why I did not document that anywhere?? Sure it is not in an old "Appendix X" version?

Head (Tailwater/elevation of turbine to operating capacity of dam). If I had the info from the FERC documents, I used that. But if I did not, I believe the Head is possibly a guestimate from looking at the aerials, and topo maps at each dam. I know Tulloch and or Goodwin have a operational curve, but it appears I simplified and assumed these were non-operational dams, or operated with such fluctuation that it would likely not change. They are re-regulating dams for the most part and do not store water for more than several hours/days allowing the ability to release steady flows down river and the Big dams to ramp up flows every night for maximum energy when price is highest if even by fractions of cents.

There is also a chance they came from CALSIM, but less likely.

Lucas

From: Anderson, William@Waterboards
Sent: Monday, August 15, 2016 1:46 PM
To: Sharkey, Lucas@Waterboards
Subject: FW: SWRCB Phase I SED: follow up on priority list and Appendix J comments

Lucas,
Any clue as to the first part? TIA.

-Will A.

From: Williams, Nicole [mailto:Nicole.Williams@icfi.com]
Sent: Monday, August 15, 2016 11:32 AM
To: Anderson, William@Waterboards; Nelson, Timothy@Waterboards
Cc: huber, anne@icfi.com<mailto:anne@icfi.com>; Landau, Katheryn@Waterboards; Lindsay, Larry@Waterboards
Subject: SWRCB Phase I SED: follow up on priority list and Appendix J comments

Hi Will and Tim, Tim made the following two comments on the priority list related to Appendix J.

- First there are some constants used in WSE for head and flow capacity at the following reservoirs: Tulloch, La Grange, McSwain, and Merced Falls. However, these constants are not mentioned in the appendix and I don't know their source. Anne and I think the constants came from Lucas a long, long time ago (galaxy far, far away…). So we thought checking with Will might be the first step to find out if Will came across anything like this in his unpacking/repacking/reorganizing of WSE (if Tim hasn't already checked with Will)?

- The following paragraph from page J-5 of the appendix: Hydropower generated from facilities on reservoirs upstream of the rim dams on the Stanislaus and Tuolumne Rivers is assumed to be unaffected by the LSJR alternatives. The storage capacity of these upstream reservoirs, as needed to shift flows between spring and summer months, is limited and much less than such capacity available downstream in the major reservoirs and is therefore assumed to have no changes in operation. The Merced River has no major hydropower reservoirs upstream of Lake McClure (New Exchequer Dam). Is this still ok even though we say in chapter 14 that impacts are significant and unavoidable with regards to lower reservoir levels in the extended plan area? Good catch. We will edit the text in Appendix J to remove that reservoirs/dams upstream of the rim dams would be unaffected by the LSJR alternatives and to reflect that given the relatively small amount of hydropower generated upstream when compared to the rim dams (Table J-1)) this information was not modeled and Appendix J only focuses on modeling changes associated with the rim dams. In addition, we could add a sentence that says the upstream hydropower effects are qualitatively discussed in the EPA section of Chapter 14 (so people don't think we've left it out).

Let us know what you think.

Cheers, Nicole

NICOLE L. WILLIAMS | Senior Environmental Planner | (o) 916.231.9614 | (m) 530.867.0470 | nicole.williams@icfi.com<mailto:nicole.williams@icfi.com> | icfi.com<http://www.icfi.com/> ICF

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APPENDIX 5

ESA

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www.esassoc.com

date March 15, 2017

to San Francisco City Attorney's Office

cc Ellen Levin – SFPUC, Rob Donlan – Ellison and Schneider

from Leslie Moulton-Post, Alisa Moore, Karen Lancelle, Chris Mueller

subject CEQA Adequacy Review of the Desalination Water Supply Alternative in the Draft Substitute Environmental Document (SED) in Support of Potential Changes to the Water Quality Control Plan for the San Francisco Bay-Sacramento / San Joaquin Delta Estuary: San Joaquin River Flows and Southern Delta Water Quality

Purpose

This memo evaluates the environmental analyses contained in the State Water Resources Control Board's (SWRCB) Substitute Environmental Document in Support of Potential Changes to the Water Quality Control Plan for the San Francisco Bay-Sacramento/San Joaquin Delta Estuary: San Joaquin River Flows and Southern Delta Water Quality (SED) Recirculated Draft (SCH#2012122071). Specifically, this memo addresses the adequacy of the SWRCB's description and analysis of environmental impacts in the SED of a desalination project option to replace some or all the significant water supply reduction to the San Francisco Public Utilities Commission (SFPUC) that would result from implementation of the Lower San Joaquin River (LSJR) Alternatives 3 or 4 described and evaluated in the SED.

The SED's description of a water supply desalination option for the SFPUC builds on information developed for another project – the Bay Area Regional Desalination Project (BARDP). Thus, this memo provides and overview of the BARDP, describes how the BARDP concept is identified and referenced in the SED analysis, and identifies feasibility concerns, constraints, and unresolved issues associated with this project concept as envisioned in the SED. The memo relies on the following information sources:

- Recirculated Draft Substitute Environmental Document in Support of Potential Changes to the Water Quality Control Plan for the San Francisco Bay-Sacramento San Joaquin Delta Estuary, September 2016 (SED), Section 16.2.6 *Water Supply Desalination*, Appendix H, *Supporting Materials for Chapter 16*, and Appendix L, *City and County of San Francisco Analysis* (referred to as the SED)
- Bay Area Regional Desalination Project Site Specific Analyses Final Report Delta Modeling Tasks, Contra Costa Water District (CCWD), January 2014 (referred to as BARDP Site Specific Delta Modeling Report)
- Bay Area Regional Desalination Project Institutional Task Technical Memorandum #2, Analysis of Feasible Scenarios, September 29, 2011 (Analysis of Feasible Scenarios)
- *Pilot Testing at Mallard Slough Pilot Plant Engineering Report*, Prepared by MWH for the Bay Area Regional Desalination Project, June 2010 (Pilot Plant Report)
- SFPUC *Water System Improvement Program Final Program Environmental Impact Report* (WSIP PEIR) Chapter 8, WSIP Variants and Impact Analysis

- *Bay Area Regional Desalination Project Feasibility Study*, prepared for CCWD, East Bay Municipal Utility District (EBMUD), SFPUC, and Santa Clara Valley Water District (SCVWD) by URS, July 2007
- Supplement to the Precise Development Plan and Desalination Plant Project Final Environmental Impact Report, City of Carlsbad, California, San Diego County Water Authority (Lead Agency), August 2016

Background Information: Regional Desalination Project

The SED indicates that a desalination plant on the order of 50 million gallons per day (mgd) capacity would be needed to fully compensate for the water supply shortfall that would result from the SWRCB's proposed water quality plan revisions under select alternatives (LSJR Alternatives 3 and 4). The SED description of a water supply desalination option for the SFPUC builds on the description and studies completed to date on the Bay Area Regional Desalination Project (BARDP). The 50+ mgd desalination project concept envisioned in the SED is twice the size of the BARDP's 20 mgd plant proposed for the existing Mallard Slough Pump Station site. Given the SED's reliance on the BARDP description and studies, background about the BARDP is provided below.

Bay Area Regional Desalination Project

The BARDP was initiated in 2003 as a joint effort by the Bay Area's five largest water agencies[1] to explore the potential for a regional desalination project to provide an additional water source, diversify the area's water supply, and foster long-term regional sustainability. To date, the agencies have completed pre-feasibility studies to identify potential fatal environmental or technical flaws, feasibility and institutional studies, and pilot testing. Over this period the agencies have refined their water demands for the project and narrowed the number of possible sites for the desalination plant. The most recent iteration of the BARDP was evaluated by the Contra Costa Water District in the BARDP Site Specific Delta Modeling Report, which evaluated impacts of a desalination plant operating at the Mallard Slough Pump Station site that would divert 25 mgd for 11 months each year[2] during all hydrologic years, for an annual diversion of 26,100 AFY. The plant would operate with an expected 80 percent recovery rate, producing 20 mgd or 20,900 AFY of desalinated product water. Brine generated by desalination, estimated to be about 20 percent of the intake water volume (about 5 mgd), would be blended with effluent from the Central Contra Costa Sanitary District (CCCSD) or Delta Diablo Sanitation District (DDSD) wastewater treatment plants before release into Suisun Bay.[3]

Since the 2014 BARDP Site Specific Delta Modeling Report, regional water supply planning for the five water agencies has shifted its focus to center on a broader planning effort known as Bay Area Regional Reliability, the purpose of which is to identify projects and processes to enhance water supply reliability across the region, leverage existing infrastructure investments, facilitate water transfers during critical shortages, and improve

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[1] The BARDP member agencies are SFPUC, CCWD, East Bay Municipal Utilities District (EBMUD), Santa Clara Valley Water District (SCVWD), and Zone 7 Water Agency (Zone 7).

[2] Operation of all CCWD intakes, including at the Mallard Slough Pump Station, is restricted during a 30-day no-diversion period pursuant to a biological opinion issued by the U.S. Fish and Wildlife Service and National Marine Fisheries Service and an incidental take permit issued by the California Department of Fish and Wildlife. The default timing assumed for the no-diversion period is April 1-30, but can be changed by the fishery agencies (BARDP Site Specific Delta Modeling Report, pp. 73-74).

[3] DDSD discharges into New York Slough; however its capacity is more limited and according to the BARDP Site Specific Delta Modeling Report would only be able to accommodate the projected volume of BARDP brine until 2015 under its current NPDES permit. CCCSD discharges to Suisun Bay.

climate change resiliency. While the BARDP per se has not progressed further, it is included in the projects to be considered in this regional planning effort.[4]

The 20 mgd desalination facility evaluated in the BARDP Site Specific Delta Modeling Report at the Mallard Slough Pump Station site was found to be technically feasible based on a pilot study implemented in 2008-2009 at the site. The pilot study focused on select key feasibility questions, first and foremost questions about the source water quality, treatability, and ability of the treatment process to reliably produce the desired finished water quality that would meet participating agencies standards and be compatible for blending into their existing water distribution systems. The pilot study also assessed the potential for impacts to listed fish species known to occur in the area of the proposed intake (delta smelt and longfin smelt) as a result of entrainment or impingement, as well as questions related to brine disposal, including the technical and regulatory feasibility of potential options for blending and disposal of brine via existing local wastewater outfalls and the potential impacts of such brine disposal in terms of water quality impacts and impacts to sensitive aquatic resources including listed species.

The pilot study verified the technical feasibility of a desalination facility diverting 25 mgd at Mallard Slough (producing 20 mgd of product water) to meet the water quality targets of partner agencies despite the complex water quality of the delta in that area (due to tidal effects within San Francisco and Suisun Bays).[5] Specifically, the pilot study: (1) found that the two types of pretreatment systems it evaluated could produce suitable product water quality, although additional site-specific study would be needed to determine certain parameters when the full-scale site is identified; (2) determined the two-stage desalination process that would meet treated water quality goals with a high recovery rate throughout the range of salinity variation expected for the BARDP; (3) identified opportunities for managing brine; (4) evaluated two methods for post-treatment stabilization, both of which produced stable product water that could be blended with EBMUD aqueduct water and CCWD multi-purpose pipeline water; and (5) evaluated water quality based on water at the intake location in Mallard Slough, while noting that water quality elsewhere in Suisun Bay could be different, if the intake were located there. The pilot study included finished water compatibility studies to verify the compatibility of the desalinated product water that would be conveyed in EBMUD and CCWD pipelines; biological sampling, which identified the potential to entrain longfin smelt and delta smelt larvae at certain times of the year; and toxicity studies to evaluate the toxicity of the brine on selected organisms.

Following the pilot study, the BARDP Site Specific Delta Modeling Report included site-specific analyses for a 20 mgd plant to evaluate (1) potential water quality impacts of the desalination facility and brine disposal; (2) potential impacts on sensitive fish populations; and (3) conjunctive operation of the desalination facility with the Los Vaqueros Reservoir. That study concluded that the desalination project at that location was technically feasible and identified the following unresolved issues that would need to be addressed during subsequent phases of project development, environmental evaluation and permitting:

- **Institutional**
    - Additional coordination between the five BARDP partner agencies would be required during dry years when partner demand exceeded both available BARDP production capacity and storage. Excess

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[4] SFPUC, *2015 Urban Water Management Plan for the City and County of San Francisco*, June 2016, p. 7-8, Section 7.4.2.

[5] MWH, *Pilot Testing at Mallard Slough Pilot Plant Engineering Report*, Prepared for the Bay Area Regional Desalination Project, June 2010.

BARDP production can be stored in Los Vaqueros Reservoir in non-drought years through an exchange with CCWD, and the stored BARDP water can be released from the reservoir in drought years. Under current EBMUD system limitations on timing and flow rates, not all drought year demands of the partner agencies can be met with the use of water stored in the existing 160,000 acre-foot-capacity Los Vaqueros Reservoir.[6] When the annual partner demand exceeds both the available BARDP production capacity and storage, deliveries to the partners would be less than the demand. The BARDP Site Specific Delta Modeling Report did not make any assumptions about how water would be allocated among partners during shortages. It was expected that the allotment of water during shortages would be negotiated if the BARDP partnership continues forward. Possible options when demand exceeds supply include all partners receiving an equal percent reduction of their stated demand, all partners equally dividing the available supply, or only a subset of partners receiving water during drought years.[7]

  - During critically dry years BARDP operations would need to be coordinated with the Central Valley Project, State Water Project, and the City of Antioch (upstream water users) to ensure water quality standards in the Bay Delta are met.[8]

  - Modeling conducted for the CCWD feasibility study optimized delivery of the stored water by delivering bulk releases on a schedule compatible with CCWD system operating rules up to the maximum pipeline intertie capacity, and delivering the stored water based on agencies' annual demand at the earliest available opportunity each year. This modeling assumed that "EBMUD has sufficient flexibility to wheel water to the other partners on this schedule [deliver the stored BARDP water that will be needed in a given year to meet specified demands at the earliest available opportunity each year], or otherwise exchange the BARDP deliveries with local storage for short periods of time, and that the other partners have local storage or other flexibility within their systems to absorb the water when it is delivered." The physical capacity of local storage or other options for the agencies to absorb deliveries on the schedule that was modeled would need to be verified.

- **Water Quality**

  - To confirm that operation of a new desalination plant at Mallard Slough would be able to comply with Bay-Delta water quality regulations, additional modeling would be required as new Delta water projects and regulatory programs are planned, including the new flow criteria for the Delta set by the SWRCB as part of the update to the Water Quality Control Plan for the San Francisco Bay-Sacramento San Joaquin Delta Estuary and the California WaterFix (then called the Bay-Delta Conservation Plan).[9]

  - Additional modeling would also be required to better characterize near field brine impacts on water quality.[10]

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[6] BARDP Site Specific Delta Modeling Report, p 113, Section 3.1

[7] BARDP Site Specific Delta Modeling Report, p. 122, Section 3.5.

[8] BARDP Site Specific Delta Modeling Report, p. 27, Section 1.10.

[9] BARDP Site Specific Delta Modeling Report, p. 27, Section 1.10.

[10] BARDP Site Specific Delta Modeling Report, p. 20, Section 1.8.

- **Fisheries**
    - Future project planning and evaluation studies need to more specifically analyze both general environmental impacts of project construction and operation to aquatic species to identify appropriate project design features and mitigation measures and, specifically need to address impacts to listed species to achieve compliance with state and federal endangered species regulations. Regarding potential fish entrainment, the BARDP Site Specific Delta Modeling Report found that changes to operations and intake design could reduce or avoid impacts to fisheries and that a "preferred combination of minimization and avoidance measures will be evaluated if the project proceeds with an environmental impacts analysis at a later date in the future."[11]

SED Water Supply Desalination Option

Chapter 16 describes the SED evaluation of "other indirect actions" associated with the Lower San Joaquin River Alternatives 2, 3 and 4. It identifies actions the regulated community, including the City and County of San Francisco (CCSF), could take to reduce potential reservoir or water supply effects associated with implementing the LSJR alternatives, including "desalination of ocean or brackish water." Chapter 16 considers a desalination treatment plant at the Mallard Slough site identified for the BARDP, operating during all hydrologic years, but having a capacity of approximately 50,000 or 56,000 AFY (SED p. 16-74) (i.e., a plant that would divert approximately 50 mgd of raw water, as compared to the 20 mgd plant diverting 26,100 AFY assumed in the BARDP Site Specific Delta Modeling Report).

The SED's description of the Water Supply Desalination option is presented in Section 16.2.6 on pages 16-70 to 16-75 and is based primarily on information presented in several studies prepared as part of the BARDP, in particular, the 2014 BARDP Site Specific Delta Modeling Report, the Final Draft Bay Area Regional Desalination Project Greenhouse Gas Analysis by Kennedy/Jenks,[12] and the SFPUC's Water System Improvement Program Final Program Environmental Impact Report (WSIP PEIR). The SED also briefly summarizes impacts that were identified for the Poseidon Desalination Facility in Carlsbad, California (San Diego County), a 56,000 AFY facility the SED suggests is closer to the size that would be needed to address water supply shortfalls under LSJR alternatives.

General Comments on Feasibility of the SED Water Supply Desalination Option

The SED assumes that it is feasible to construct and operate a desalination facility approximately twice the size of that evaluated for the BARDP (diverting 50,000 to 56,000 AFY of raw water or about 50 mgd), located at the Mallard Slough site evaluated for the BARDP pilot study and BARDP Site Specific Delta Modeling Report. However, the SED does not substantiate the assumption that this larger, 50 mgd desalination facility is feasible at

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[11] BARDP Site Specific Delta Modeling Report, p. 70, Section 2.1.

[12] Kennedy/Jenks Consultants, *Final Draft Bay Area Regional Desalination Project Greenhouse Gas Analysis*, Prepared for Bay Area Regional Desalination Project, 11 January 2013.

the Mallard Slough site. Concerns about the feasibility of the desalination plant option envisioned in the SED include the following:

- **Site Size.** Would the desalination project envisioned in the SED fit at the assumed Mallard Slough site? A 2007 feasibility study conducted for the BARDP concluded that the CCWD property at Mallard Slough could not accommodate a desalination plant that could treat 65 mgd of raw water, which would require about 18.5 acres.[13] The SED does not provide an estimate of the size of the site needed for the large plant it envisions; however, based on the 2007 study it is assumed that siting a larger facility at Mallard Slough would likely require the purchase of additional land. This in turn would require identifying an appropriate adjacent parcel and willing seller and could displace existing habitat or other land uses. The area surrounding Mallard Slough appears largely to consist of wetlands. The SED did not address the feasibility of expanding the CCWD site to accommodate a larger desalination plant.

- **Water rights**. It is not apparent that sufficient water rights and licenses would be available or could be obtained to withdraw the amount of water proposed for the SED desalination project. Specifically, in order to operate a desalination plant at Mallard Slough with a production capacity greater than 22,400 AFY, additional water rights would need to be obtained and that process “could take over 10 years.”[14]

- **Larger intake**. A larger intake would be needed for plant larger than the 20 mgd facility proposed in the BARDP studies, as the capacity of the existing intake is 40 mgd. The feasibility of siting and permitting the construction and operation of a larger intake at Mallard Slough is uncertain given constraints identified for the 20 mgd plant and is not addressed in the SED.

- **Brine Discharge**. The BARDP studies identify brine blending and discharge constraints for a 20 mgd plant that would be further exacerbated by a larger facility. Blending the amount of brine generated by a larger facility with the dry weather outflows of the two wastewater treatment plants currently proposed to be used by the BARDP (CCCSD or DDSD) would exceed the discharge capacities of either plant, affecting the feasibility of the SED proposal if brine dilution is a necessary condition for water quality purposes. The SED assumes that the approximately 10 mgd of brine generated by a larger desalination facility could be discharged via CCCSD or DDSD[15] outfalls. Table 1-5 of the BARDP Site Specific Delta Modeling Report identifies the projected treatment plant flows for DDSD and CCCSD.[16] As indicated there, under their current NPDES permits, DDSD does not have capacity to accommodate this amount of additional flow now and by 2020 CCCSD would not have capacity to accommodate 10 mgd of additional flow.
    - 2015 dry weather discharge at DDSD was estimated to be 16.4 mgd and its NPDES permitted discharge capacity is 16.5 mgd.

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[13] URS, *Bay Area Regional Desalination Project Feasibility Study*, July 2007.

[14] *Bay Area Regional Desalination Project Institutional Task Technical Memorandum #2: Analysis of Feasible Scenarios*, September 19, 2011, p. 9, Section III.C.

[15] Regarding the outfalls identified for BARDP brine discharge in the BARDP Site Specific Delta Modeling Report, the SED refers to brine disposal at “CCWD or DDWD” [*sic*]. The BARDP modeling report evaluated the effects of discharging brine with CCCSD and DDSD effluent via those plant’s outfalls.

[16] BARDP Site Specific Delta Modeling Report, p. 18.

  - By 2020 CCCSD's dry weather discharge is projected to be 44 mgd, and its NPDES permitted discharge capacity is 53.8 mgd.

  The BARDP Site Specific Delta Modeling Report indicates that CCCSD would be unable to accommodate the anticipated 5 mgd of brine from the BARDP by 2030. The larger SED plant would accelerate the time by which an alternative disposal strategy would need to be developed and its potential water quality impacts evaluated. The SED fails to address this or the probability of whether a new or larger-capacity outfall would be required or permitted in the Delta.

- **Water storage and distribution**. Conjunctive operation of Los Vaqueros Reservoir (whereby excess desalinated product water would be stored in non-drought years and released for use in drought years) would be subject to existing EBMUD system limitations on timing and flow rates. The BARDP Site Specific Delta Modeling Report found that 71 percent of drought-year demands could be met with the use of interannual storage in the reservoir, and that pretreatment of water to be released to EBMUD's system could increase this level to 84 percent.[17] While the BARDP Site Specific Delta Modeling Report concluded that EBMUD infrastructure had adequate capacity to wheel this percentage of needed supplies to partner agencies during a drought, given the existing limitations it is reasonable to expect that EBMUD infrastructure will constrain deliveries of the much higher volumes of water that would need to be delivered to CCSF and potentially other agencies during drought periods under LSJR Alternatives 3 and 4. In addition to physical capacity limitations, the two existing interties that link other water systems to the SFPUC system – the EBMUD/SFPUC Emergency Interie in Hayward and the SFPUC/SCVWD Emergency Intertie in Milpitas – were constructed to allow water transfers during emergencies. Use of these interties on a regular basis would require new memoranda of understanding between the affected agencies, and potentially additional environmental review, or other permits and approvals.

Adequacy of Environmental Analysis

Inconsistent Information and Unclear Application of Other Environmental Studies

Section 16.2.6 of the SED describes and tries to make use of several environmental impact analyses prepared for different iterations of a BARDP desalination plant over the past decade as well as the certified EIR prepared for the much larger Carlsbad desalination plant located in a very different geography on the coast in southern California. The SED provides only a vague indication of how these other project analyses might apply to the desalination water supply option the SED anticipates would be needed as an "additional action" to address drought-period supply shortfalls under LSJR alternatives. Citing the BARDP Site Specific Delta Modeling Report, Section 16.2.6 presents information on a desalination project with a "maximum capacity of 28,000 AFY" (SED p. 16-71), and under "Summary of Potential Action" (pp. 16-72 to 16-73) describes a desalination project similar to the BARDP described in the BARDP Site Specific Delta Modeling Report: it would be located at Mallard Slough, store excess water in normal and wet years in Los Vaqueros Reservoir, and meet demands of BARDP partner agencies consistent with information presented in the BARDP modeling report. (This

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[17] BARDP Site Specific Delta Modeling Report, p 5, Executive Summary.

information presented in the SED is generally consistent with but not identical to the project evaluated in the BARDP Site Specific Delta Modeling Report.[18])

The SED discussion of "Potential Environmental Effects" (pp. 16-73 to 16-75) describes the significant impacts the 2008 WSIP PEIR identified for the BARDP evaluated in the PEIR as part of a WSIP variant. As summarized in the SED, the PEIR determined that operation of the BARDP would result in potentially significant and unavoidable impacts on hydrology and water quality, biological resources, and energy resources; and that significant impacts associated with the following resources could likely be reduced to less than significant with the implementation of mitigation measures: land use and visual quality; geology, soils, and seismicity; air quality; cultural resources; GHG emissions; hazards; noise and vibration; traffic, transportation, and circulation; public services and utilities; recreational resources; and agricultural resources."

The SED discussion of potential environmental effects then summarizes the results of the 2014 BARDP Site Specific Delta Modeling Report and the 2013 Kennedy/Jenks analysis of greenhouse gas emission (which evaluated the same BARDP project as the BARDP Site Specific Delta Modeling Report), stating that the BARDP modeling report found that changes in ambient water quality associated with BARDP operations and brine disposal were too small to be accurately measured in the field and that during most conditions operations would not have a significant impact on water quality or beneficial uses. To avoid impacts during critically dry water years, the BARDP Site Specific Delta Modeling Report stated that BARDP operations would need to be coordinated with operations of the CVP, SWP, and the City of Antioch. The SED notes that the greenhouse gas analysis quantified GHG emissions from BARDP operations and identified measures and projects to reduce potential GHG emissions.

The discussion presented in Chapter 16 suggests that the site-specific BARDP Site Specific Delta Modeling Report and Kennedy/Jenks analysis for the 26,100 AFY BARDP largely address concerns about significant unavoidable impacts that were identified in the WSIP PEIR for the 20 mgd BARDP. However, the SED does not address how the conclusions of the BARDP analyses it cites could change with a larger water supply desalination project. The SED acknowledges that a larger facility than those evaluated in BARDP studies would be needed. The SED states that a larger facility "(e.g., 56,000 AF/y) would have similar *types* of construction and operation impacts" (emphasis added) but fails to acknowledge or address how the *magnitude* or *significance* of such impacts may change with a larger desalination facility and, considering such changes, whether a larger plant would be permitable or otherwise feasible. The SED states that the "[l]ong-term operational impacts of a large desalination facility with a capacity of 56,000 AFY would be similar in nature to those described in the feasibility studies as well as in the WSIP PEIR for the BARDP," and identifies the following as the primary impacts of a desalination facility:

- Biological resources impacts due to marine life entrainment and brine discharge
- Air Quality/GHG/Energy impacts due to energy demand of treatment
- Routine transport and disposal of hazardous materials due to use of additional chemicals for treatment
- Impacts on open space and recreation areas

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[18] Differences between the BARDP described in the 2014 feasibility study and the SED discussion of the BARDP at Mallard Slough include daily and annual diversion rates: the BARDP Site Specific Delta Modeling Report identifies a diversion rate of 25 mgd (not 21 mgd as stated in the SED) and annual diversions of 26,100 AFY (not 28,000 AFY) based on diversions occurring 11 months per year (BARDP Site Specific Delta Modeling Report, p. 114, Section 3.3).

The SED does not indicate the significance of these impacts. As discussed above, the BARDP feasibility studies and WSIP PEIR reach different conclusions as to the significance of several of these impacts.

Regarding a larger desalination facility, the SED points to a project-level EIR recently completed for a desalination plant on the coast in Carlsbad, California (San Diego County). That analysis determined that the only significant unavoidable impacts were cumulative regional impacts on air quality for the production of ozone and PM10, and that impacts on the following resources would be less than significant after mitigation: cultural resources, hazards and hazardous materials, hydrology and water quality, land use and planning, and traffic and circulation. The SED acknowledges that “there are many geographic differences between the San Francisco Bay–Delta and Carlsbad,” but fails to address the implications of such differences (such as existing environmental stresses on the Delta and the presence in the Delta of endangered species), and appears to dismiss such differences because the analysis of the Carlsbad facility identified “similar environmental impacts” to those identified for the BARDP.

The SED discussion of a water supply desalination option to address LSJR alternatives only summarizes conclusions of the other project analyses that have reached differing conclusions about the significance of impacts in key topic areas. The SED indicates that the *types* of impacts would be similar. The SED discussion in Chapter 16 draws *no* conclusions as to significance of the impacts the larger 50 mgd desalination plant at Mallard Slough envisioned in the SED would have, and does not connect the discussion of the various analyses to impact summary Table ES-22 presented in the Executive Summary.

The summary of impacts presented in the SED Executive Summary, Table ES-22, CEQA Significance Summary of LSJR Alternatives – Other Indirect Actions, for “Water Supply Desalination” indicates that during operations the water supply desalination option would have significant unavoidable impacts related to biological resources, greenhouse gas emissions, hydrology and water quality, and utilities and service systems. According to the table, potentially significant and unavoidable impacts could occur during construction for the following topics: aesthetics, agriculture and forestry resources, air quality, cultural resources, geology and soils, hazards and hazardous materials, land use and planning, public services, recreation, and transportation and traffic; and would have no impacts on mineral resources or population and housing. No text is provided explaining these impact conclusions or linking them to the discussion in Section 6.2.6.

While the basis for the conclusions in the summary table is not obvious, it is reasonable to assume that the severity of many of the impacts identified for the BARDP would increase with a larger plant, and that some *additional* impacts may remain significant after mitigation. Considering the significant unavoidable impacts that were identified in the WSIP PEIR and the impacts and issues that remain to be addressed following the BARDP Site Specific Delta Modeling Report, it is reasonable to expect that a desalination plant at Mallard Slough with twice the intake capacity assumed for the BARDP could have significant unavoidable impacts on biological resources including endangered species, water quality and hydrology, and potentially significant unavoidable impacts related to greenhouse gas and air pollutant emissions. Energy demand for a large plant could result in adverse impacts on utilities and service systems, which may be the reason the SED executive summary table identifies this impact significant and unavoidable.

The inadequacy of the impact analysis thus raises additional questions about the feasibility of the desalination plant anticipated in the SED because, given its probable environmental impacts, it is far from obvious such a plant could be permitted.

Failure to Adequately Address or Identify Impacts

- Because the SED largely relies on the BARDP Site Specific Delta Modeling Report, which addresses effects of a smaller desalination project, the SED fails to adequately address or identify the impacts of the larger desalination project envisioned in the SED, as follows:

  - The water quality and hydrology modeling conducted for the BARDP Site Specific Delta Modeling Report assumed a facility with half the capacity of that proposed in the SED. Without providing any support for the statement, the SED asserts that "a facility that is larger than the BARDP (e.g. 56,000 AF/y) would have similar types of construction and operation impacts" and does not address the effect of the larger plant. While it is reasonable to assume that a larger facility would have similar *types* of impacts, arguably the *severity,* and potentially the significance, of some impacts would increase with a larger project.

  - The SED states that "the increased electrical demand as a result of a larger design capacity…could result in increases in GHG emissions and air quality impacts under operating conditions" presumably compared to the impact associated with the amount of GHG emissions identified for the BARDP, but does not elaborate on the environmental implications of the increased electrical or energy demand.

  - Pumping rates greater than the 25 mgd diversion volume evaluated in the BARDP Site Specific Delta Modeling Report could result in exceedance of 0.2 feet per second approach velocity[19], which is the limit on approach velocity established by the USFWS to protect delta smelt.[20] The SED fails to address the potential impact of increased intake volume related to compliance with approach velocity requirements and smelt entrainment. The SED also fails to discuss whether other measures identified in the BARDP modeling report to reduce the risk of entrainment (such as adaptively determining the BARDP diversion rate based on real-time field monitoring, decreasing the slot size of the Mallard Slough Pump Station screen, and relocating the intake to the main channel) would also be effective and feasible for the larger facility.

  - Although the capacity of the existing intake is 40 mgd,[21] the SED fails to address potential impacts associated with construction of a new intake having the capacity to accommodate the 50 mgd source water diversion rate needed for the larger facility. Temporary disturbance of bottom sediments could cause water quality degradation from chemicals in sediments or construction materials during intake construction. The capacity of the existing 40 mgd pump station would also need to be increased, which could also result in construction-related impacts.

  - The SED assumes that brine generated by a larger facility would be blended with the dry weather outflows of the two wastewater treatment plants currently proposed to be used by the BARDP (CCCSD or DDSD). However, the larger proportion of brine generated by the larger desalination plant to treatment plant outflow would potentially result in greater water quality impacts than currently discussed in the SED, which does not provide meaningful, substantive consideration of the water quality impacts of increased brine discharge. (See also the discussion under General Comments

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[19] BARDP Site Specific Delta Modeling Report, p. 73, Table 2-1.

[20] BARDP Site Specific Delta Modeling Report, p. 78, Section 2.5.5

[21] MWH, *Pilot Testing at Mallard Slough Pilot Plant Engineering Report*, p. 1-22.

    on Feasibility above regarding potential capacity constraints related to using the outfalls for brine discharge.)

  - The SED cites the BARDP Site Specific Delta Modeling Report conclusion that “during critically dry water years, BARDP operations would need to be coordinated with CVP, SWP, and the City of Antioch operations to avoid impacts” on water quality from brine discharge (SED p. 16-74), but does not provide meaningful, substantive consideration of the potential for such coordination to successfully avoid water quality impacts, given the larger source water intake and brine discharge volumes. It is reasonable to expect that doubling the brine discharge alone would make avoidance of impacts substantially more challenging, and increase the likelihood that water quality impacts would not be avoided.

  - The SED acknowledges that desalination facilities “are typically relatively energy intensive” and therefore a larger facility would increase GHG and air pollutant emissions, but fails to evaluate the effects of the energy requirements of the larger desalination facility envisioned in the SED on local or regional energy supplies or facilities or whether it would result in the need for additional capacity. The discussion of impacts identified in the WSIP PEIR (SED p. 16-74) states that mitigation “could likely” reduce impacts on public services and utilities to a less than significant level, whereas SED Table ES-22 indicates that the impacts of desalination plant operations on utilities and service systems are expected to be significant and unavoidable. No meaningful explanation is provided for either conclusion.[22]

- The SED fails to adequately consider the potential for operations at the desalination plant to result in impacts related to the use of chemical transport and storage, dismissing the increase in chemical use as negligible because the desalination plant would likely be constructed within or adjacent to existing treatment facilities (SED p. 16-74). However, as stated on p. 16-71, the SED analysis assumes the desalination plant and intake would be “located at the existing Mallard Slough intake/pump station site.” The pump station is not within or adjacent to a water treatment facility, and chemical use at the pump station would likely be much more limited than at a treatment facility. In addition, the type of chemicals needed for operation of a reverse osmosis desalination plant may differ from those used at a traditional water treatment plant. In addition, the area from the pump station site at the end of Mallard Slough to Suisun Bay appears largely to be wetlands, which may be particularly vulnerable to the effects of an accidental hazardous materials spill. Therefore the SED characterization of the increase in chemical use and storage at the proposed desalination plant site is unsupported.

Impacts associated with different geographies

The SED acknowledges, but does not describe in any detail or draw any conclusions about the geographical differences between the San Francisco Bay-Delta and coastal Carlsbad and how these differences might affect impacts. The differences in geography (as well as differences in some project facilities) that could affect typical desalination plant impacts include:

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[22] Complicating the referenced discussion on p. 16-74, is the fact that the discussion refers to SED Appendix H, which largely consists of a table of measures identified in the WSIP PEIR to mitigate the impacts of the WSIP *Advanced Disinfection Project*. Appendix H acknowledges that additional measures may be needed for desalination facility impacts, but it does not discuss either impacts or mitigation related to increased power demand.

- **Brine disposal location.** The Carlsbad project disposes brine through the adjacent power plant's existing cooling water discharge system to the ocean, where mixing conditions disperse the discharged brine. Modeling conducted for the Carlsbad EIR showed "the importance of 'in-the-pipe' dilution and natural mixing conditions as a means of diluting and dispersing the [reverse osmosis] plant discharge."[23] By contrast, the 50 mgd desalination project assumed in the SED would dispose of brine by blending with WWTP effluent (assuming available outfall capacity) prior to release into Suisun Bay. Thus, the hydrology and water quality issues would be different. Whereas the Carlsbad plant uses an existing power plant outfall located in an area with natural mixing conditions that speed the dilution of the discharge, the WWTP outfalls that may be used in Suisun Bay are likely to be located in lower energy environments with lower mixing potential compared to the ocean. In addition, the mixing or in-pipe dilution ratios for the Carlsbad facility are not discussed and could be very different than the SED desal option. There could be a higher brine-to-effluent ratio at the Delta WWTP outfalls resulting in less dilution prior to discharge compared to the brine-to-cooling water ratio at Carlsbad, which could affect the degree of potential impact. The Delta is already a stressed estuarine ecosystem that could be more sensitive to a steady influx of brine than would the ocean environment. If the purpose of including information about the conclusions of the Carlsbad analysis was to suggest that a large plant in the Delta would have similar less than significant impacts, the SED analysis was deficient in not providing more information on how differences in geography could change conclusions about impacts.

- **Intake location.** Impingement and entrainment of aquatic species at open water intakes are key concerns associated with desalination plant operations. The Carlsbad project does not require a new intake; instead it diverts spent cooling water from an adjacent power plant's cooling water discharge system as its source water. The power plant intake draws water from a constructed lagoon and discharges to the ocean. According to the Carlsbad EIR (pages 4.3-35 and 4.3-42), the desalination plant operation would not require the power plant to increase the quantity of water withdrawn nor would it increase the velocity of the water withdrawn and therefore would have no impingement-related impacts. The only entrainment impacts the Carlsbad plant would have are to organisms that survived the power plant intake and cooling system. The EIR found that because the additional effect on larval fishes would be very low and because the most frequently entrained species had widespread distribution and high reproductive potential, the ecological effects due to any additional entrainment from the desalination plant was less than significant. As discussed in the section above, unlike the Carlsbad plant, a new intake would be required for the desalination plant envisioned in the SED at the Mallard Slough site. The magnitude of effects of an open water intake depends in part on the sensitivity of the specific area. The Delta is recognized to be an important ecosystem that provides habitat for endangered species and is already under considerable environmental stress. Therefore, entrainment and impingement effects of an intake in the Delta would very likely have greater impacts on endangered or other special status species than an intake at Carlsbad.

- **Air basin status.** In reference to the Carlsbad facility, the SED states that "[c]umulative regional impact [*sic*] on air quality for the production of ozone and PM10 were determined to be significant and unavoidable," which would presumably indicate that the SED has determined the air quality impact of the proposed larger facility would be significant and unavoidable based on production of ozone and PM10. This conclusion from the Carlsbad facility environmental analysis is based on the existing air quality in

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[23] City of Carlsbad, Supplement to the Precise Development Plan and Desalination Plant Project Final Environmental Impact Report, Section 4.3 Biological Resources, page 4.5-50.

the Carlsbad air basin. The San Francisco Bay Air Basin, to which the SED facility would contribute emissions, is also designated non-attainment for state and federal standards for PM2.5, which is not discussed in the SED impact evaluation. Moreover, the SED Executive Summary impact table ES-22, CEQA Significance Summary of LSJR Alternatives – Other Indirect Actions, indicates that the SED Water Supply Desalination project would not have significant unavoidable air quality impacts during operations. The SED also fails to explain the conclusion reflected in Table ES-22 that the air quality impact of desalination facility operations would not be significant, or if significant, could be mitigated.

APPENDIX 6

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date	March 15, 2017
to	San Francisco City Attorney's Office
from	Leslie Moulton-Post, Jill Hamilton, and Chris Mueller
subject	Adequacy Review of In-Delta Diversion Alternative Analysis in State Board SED

Purpose

This memo evaluates the environmental analyses contained in the State Water Resources Control Board's (SWRCB) Substitute Environmental Document in Support of Potential Changes to the Water Quality Control Plan for the San Francisco Bay-Sacramento/San Joaquin Delta Estuary: San Joaquin River Flows and Southern Delta Water Quality (SED) Recirculated Draft (SCH #2012122071). Specifically, this memo addresses the adequacy of the SWRCB's description and analysis of environmental impacts of an in-Delta diversion project to replace San Francisco's reduced water supply if Lower San Joaquin River (LSJR) Alternatives 3 or 4 described and evaluated in the SED are approved and implemented.

Background Information: SED Description and Evaluation of In-Delta Diversion

Chapter 16 (Section 16.2.5) describes the SED evaluation of "other indirect actions" associated with the Lower San Joaquin River Alternatives 2, 3 and 4. It identifies actions the regulated community -- including the City and County of San Francisco (CCSF) -- could take to reduce potential reservoir or water supply effects associated with implementing the LSJR alternatives, including the "Transfer/Sale of Surface Water" that could purportedly be implemented through in-Delta Diversions. The SED's description of the in-Delta Diversion option is presented on pages 16-68 and 16-69 and is based on one of several potential water supply options presented in the San Francisco Public Utility Commission's (SFPUC) Water Supply Options (WSO) Report, published in 2007. That report evaluated numerous potential alternatives to the SFPUC's proposed Water System Improvement Program (WSIP), which was approved in 2008. Specifically, the description in the SED is based on the WS3-1 alternative described in Section 5.2 of the WSO Report and Section 5.1 of WSO Report Appendix C, and would include a new Delta intake drawing from either the California Aqueduct or the Delta-Mendota Canal, a pumping plant, pipeline, Delta water treatment plant (WTP), and a new blending facility. Like the 2007 WSO report, the SED assumes that the 18-acre WTP and blending facility would be located at the SFPUC's Tesla Portal. The SED acknowledges that the design capacity of the WS3-1 alternative would not completely offset the supply shortages.[1] The SED's analysis of the environmental impacts of the in-Delta Diversion option, presented on pages 16-69 and 16-70, incorporates some of the environmental analysis conducted for WS3-1 (presented in

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[1] On page 16-68 the SED states, "This design capacity would replace a portion of the supplies potentially reduced by the higher range of the LSJR alternatives (i.e., LSJR 4) and would likely be needed *in addition to other supplies* under certain LSJR alternatives given the amount of water potentially needed by the SFPUC…." On page 16-69 the SED states "The size of the project *may need to be larger than* what was examined in the WSO report …." [Emphasis added.]

Appendix H [Environmental Evaluations] of Appendix C of the WSO report, and Attachment 2 of Appendix H of the SED). Table 16-38 (beginning on page 16-309) identifies potential mitigation measures that could be implemented for construction and operation of the in-Delta Diversion option, among other options.

General Comments of Adequacy of Description, Feasibility and Environmental Evaluation of In-Delta Diversion Option

ESA has identified several deficiencies in the description and the analysis of the in-Delta Diversion option presented in the SED, as follows.

Feasibility. The SED does not substantiate the assumption that the in-Delta Diversion option is feasible. The SED identifies some of the factors identified in the WSO report that are critical to the feasibility of this option while ignoring others. The WSO report (page 5-11) clearly states that "In the case of the Delta diversion alternative, the likelihood of obtaining a long-term water sale contract and a through-Delta wheeling contract is considered extremely low. Furthermore, any Delta wheeling agreement would be subject to environmental pumping restrictions, and the SFPUC would be considered last in line" behind CVP or SWP contractors. In the performance evaluation of the Delta diversion option (Table 5-2, page 5-8), the WSO report indicates that "Dry year purchases may be especially difficult to negotiate," that there would be a "Potential diminution of supply from potential regulatory 'droughts' associated with the ESA [Endangered Species Act]," and that with the In-Delta Diversion the SFPUC would experience a "Risk of not serving full demand within [the] modeled delivery window." Regarding the competition the SFPUC would face in obtaining additional supplies, the detailed evaluation of the WS3-1 option in Appendix C of the WSO report recognizes that "SWP and CVP contractors are looking for supplemental water supplies, particularly during drought years…"

Recognizing that it was "highly unlikely" that the SFPUC would achieve year-round diversions (WSO report page 5-1), the WSO analysis assumed that at best the SFPUC would be limited to receiving its annual Delta water supply during a three-month period, and sized facilities accordingly. Yet the WSO report (WSO report, Appendix C, page 5-7) also indicates that the in-Delta diversion project may have even less than a three-month period during which water could be diverted, and that the proposed facilities may therefore need to be larger than those described. Larger facilities, if feasible, could cause additional and/or more severe environmental impacts, including disturbance or loss of agricultural land, wildlife habitat, or open space, because a larger area would be needed for larger-capacity diversion and treatment facilities; increased energy demand with associated air quality and GHG-related impacts; and increased potential for soil erosion and associated degradation of surface water quality, among other potential effects. The potential need for or feasibility of larger facilities and associated impacts were not addressed in the SED. The WSO analysis stated that additional studies would be needed to determine whether the SFPUC could accommodate the diversion of the 28,000 acre-feet per year (afy) annual supply over a period less than three months. As the SED acknowledges (Draft 2016 SED at 16-68), the volume of water considered in the WSO report (28,000 afy) is substantially less than the reductions of SFPUC deliveries that could occur in drought years under LSJR alternatives.

Outdated Information About Facility Site Availability. The analysis presented in the SED relies on outdated information and, therefore, fails to provide a complete analysis of feasibility and environmental effects. As indicated in the sources listed at the end of the table included in SED Appendix H, Attachment 2 (Annual Delta Diversion – Environmental Issues), the environmental investigations were conducted in 2004 and 2005. No attempt was made to verify whether substantive changes have occurred in the physical or regulatory settings, which in turn affect the feasibility of the project and impact significance. After approving the WSIP in 2008, the SFPUC has proceeded to implement many of the Capital Improvement Projects called for in the WSIP, including several at and in the immediate vicinity of the facility locations identified in the SED. As a result, much of the area identified for the 18-acre water treatment plant at the Tesla Portal is now occupied by other facilities, a fact that undermines the conclusion in the SED that this site could accommodate the needed facilities. (The WSO report acknowledges that other WSIP projects are planned at Tesla and that locations would need to be coordinated.) This information was readily available had the EIR preparers consulted Google Earth. Further, implementation of the San Joaquin Pipeline System Project may have constrained the SFPUC's ability to site another large-diameter pipeline within the San Joaquin Pipelines right-of-way, another new fact raising a substantial project feasibility issue.

Inadequate Environmental Analysis and Failure to identify Significant Impacts. The westernmost portion of the San Joaquin Pipeline System Project, one of the SFPUC's WSIP projects, substantially overlaps with the locations identified for the Delta Diversion facilities. The San Joaquin Pipeline System Project includes various pipeline improvements between Foothill Tunnel at Oakdale Portal and the Coast Range Tunnel at Tesla Portal as well as facility improvements at Tesla Portal. The project includes a new pipeline beginning west of the San Joaquin River and ending west of Tesla Portal. Presumably the SFPUC's pipeline right-of-way west of the Delta Mendota Canal is similar to (or the same as) the alignment assumed in the SED for the in-Delta Diversion option. The EIR for the San Joaquin Pipeline System Project,[2] which the City and County of San Francisco certified in 2009, identifies several significant impacts *not identified in the SED* that implementation of the Delta Diversion facilities would most likely also have, including the following:

- Impacts to the following special status species were not identified in the SED for Delta Diversion Facilities:
    - Special status bats
    - American badger
    - White-tailed kite
    - Northern Harrier
    - Golden Eagle
    - Aleutian cackling goose
    - Loggerhead shrike
    - Tricolored Blackbird
    - Raptors and migratory birds
    - Western Pond Turtle
    - San Joaquin whipsnake and California Horned Lizards
- Impacts to paleontological resources due to excavation in fossil bearing soils
- Impacts to historic resources. The EIR identifies the following facilities are potentially eligible for the National Register of Historic Places and California Register of Historic Places
    - Delta Mendota Canal
    - California Aqueduct
    - San Joaquin Pipelines 1 and 2

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[2] San Francisco Planning Department, *Final Environmental Impact Report, San Joaquin Pipeline System Project,* State Clearinghouse No. 2007032138, San Francisco Case No. 2007.0118E, June 11, 2009.

- Air Quality: potential exposure to emissions and odors from pockets of methane and hydrogen sulfide that could be encountered and released during tunneling operations for crossing under Interstate 5, Interstate 580, Chrisman Road, and potentially under other infrastructure.

- Utilities and Public Services: Pipeline construction could result in potential damage to or disruption of regional and local public utilities including natural gas pipelines, electric lines, oil pipelines, and local water lines that cross or extend along the SJPL right-of-way west of the Delta Mendota Canal and California Aqueduct (SJPL FEIR, at 4.13-32 and Figures 4.13-1(d) and 4.13-1(e)).

Selective Inclusion and Exclusion of Information. The SED chooses to include some information from the WSO report concerning environmental impacts but excludes other information. The SWRCB selected information in an appendix of an appendix to the WSO report without referencing discussions of environmental issues identified in the main body of the WSO report. The material relied on in Appendix H of Appendix C of the WSO report focuses on impacts associated with facility construction; it does not address effects of facility operation on the Delta and elsewhere. With respect to impacts to the Delta, the WSO report (Table 5-2, page 5-8) acknowledges that the hydrologic and biological effects to the Delta from operation of a Delta Diversion are unknown. Table 5-2 (page 5-8 to 5-9) also identifies numerous water quality issues and effects on water users and seismic risks associated with the use Delta supplies. The Delta is subject to liquefaction; an earthquake could result in widespread levee failures, impairing the ability of the CVP and SWP to operate. Potential impacts to the SFPUC include service interruptions, construction of new facilities to alleviate the risk of failure and service interruptions during its construction, and higher costs. Several other examples where the description and analysis of the Delta Diversion seem to lack objectivity are identified in the detailed comments presented below.

Inappropriate Basis for Conclusions Regarding Impact Significance. As indicated in some of the detailed comments presented below, the SED makes inappropriate comparisons to draw conclusions about the significance of impacts associated with the Delta Diversion option. Elsewhere, unsubstantiated, conclusory statements are also relied on.

Impacts Associated with Differences in Project Characteristics. The SED acknowledges that the Delta Diversion as characterized in the WSO report would not have sufficient capacity to offset the supply shortages associated with some of the LSJR Alternatives; thus, the SED relies on environmental evaluation of a smaller project than would be needed. However, the report does not provide meaningful, substantive consideration of the differences, in terms of how the in-Delta Diversion would be implemented under the SED compared to the WSO concept, and how the impacts disclosed might also differ if the project were of a larger capacity.

Specific Comments on SED Description and Environmental Evaluation of In-Delta Diversion

1. The statement in the SED discussion of In-Delta Diversions (SED, page 16-68) that "Reductions in surface water diversions *are possible* [emphasis added] as a result of approving an LSJR alternative and the respective program of implementation" is an understatement. It is reasonably foreseeable that reductions in surface water diversions would be an inevitable consequence of approval and implementation of LSJR Alternatives 2, 3 or 4 because, as the analysis presented in SED Appendix L shows, CCSF would have a water bank deficit under baseline conditions based on both (1) analysis of a six-year drought and (2) the 21-year period of record (SED Appendix L Tables L.4-2 and L.4-3, respectively). In both cases (each analyzed

under two scenarios[3]), the deficits would increase under Alternatives 2, 3, and 4. Moreover, the description of every other indirect and additional action identified in Chapter 16 indicates that reductions in surface water diversions *are* *expected* as a result of approval and implementation of an LSJR alternative (Draft 2016 SED, page 16-5, 16-16, 16-40, 16-48, 16-70 and 16-75).

2. The statement (SED, page 16-68) that the project as described in the WSO "would require relatively little new infrastructure" mischaracterizes this option, which would require a new intake on the Delta Mendota Canal or California Aqueduct, a pumping plant, a large-diameter (60-inch) pipeline, a new water treatment plant occupying 18 acres, and a blending facility.

3. The SED states (SED, page 16-68) "These reductions in surface water could potentially affect SFPUC by reducing some portion of its current water supply obtained from the Tuolumne River *during a 6-year drought* [emphasis added], as described in Appendix L, *City and County of San Francisco Analyses*." However, the analysis prepared by Matt Moses (2017) indicates that the modeling conducted by SWRCB underestimates the severity of water shortages that would affect San Francisco.[4]

4. The SED states (SED, page 16-68) "As described in SFPUC documents, specifically the Water Supply Options (WSO) report (SFPUC 2007), SFPUC has several options for augmenting or increasing its water supply including diverting water from the Sacramento–San Joaquin Delta (Delta)." It would be more accurate to say that SFPUC has *evaluated* several options for augmenting or increasing its water supply, some of which – including in-Delta diversions – the SFPUC concluded had an extremely low chance of successful implementation (see WSO report page 5-11). The SED fails to support why this option is now considered feasible.

5. The SED states (SED, page 16-68): "In the 2008 WSIP Programmatic Environmental Impact Report (PEIR), SFPUC concluded that the in-Delta diversion option was infeasible, in part, because it would not achieve consistent year-round diversions due to uncertainties regarding the availability of water supplies and pumping capacities (SFPUC 2008). Nonetheless, a discussion of this possible water supply option has been included in light of the changing circumstances since 2008 (e.g., Pelagic Organism Decline, climate change, California WaterFix, and the State Water Board's *Final Report on the Development of Flow Criteria for the Sacramento Delta Flow Criteria* [State Water Board 2010])."

    a. The discussion selectively addresses some of the reasons why this potential alternative in the WSIP PEIR was found to be infeasible but ignores others. For example, the PEIR also states (page 9-126) that because of the numerous institutional and regulatory uncertainties associated with this alternative (largely dependent on how and where the SFPUC would purchase the water), it was unknown if this alternative could achieve the WSIP level of service goals for delivery and water supply reliability. The PEIR also notes that the quality of Delta water supplies would be lower than water in the Hetch Hetchy system, and that while this alternative would avoid or reduce impacts on Tuolumne River resources that would occur under the WSIP (as proposed), "it would result in other, distinct significant environmental impacts on the Delta and associated environmental resources (e.g., fisheries, aquatic habitat and species, riparian habitat, and water quality affecting other beneficial

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[3] The scenarios consist of two potential interpretations of responsibilities under the Fourth Agreement between CCSF, Turlock Irrigation District, and Modesto Irrigation District.

[4] For example, assuming San Francisco was responsible for bypassing flow in compliance with a 40 percent unimpaired flow objective on the Tuolumne River, and a reoccurrence of 1987-1992 hydrology, San Francisco's water supply would be reduced by 129,884 afy for each of the 6 years of the drought, resulting in a loss of an additional 10,884 afy, or 65,304 acre-feet in total for the 6-year period, as compared to the State Water Board's calculations. *See* Declaration of Matt Moses in Support of Comments by the City and County of San Francisco to the Draft Substitute Environmental Document in Support of Potential Changes to the Bay-Delta Plan ("Moses Decl."), Attachment 1, *SFPUC Analysis of Proposed Changes to Tuolumne River Flow Criteria*, March 2017 (referred to below as "SFPUC Analysis of Changes to Flow Criteria"), at 16, Table 9. *C.f.* SED, Appendix L, at L-21, Table L.4-2 (where the SED estimates that, assuming a reoccurrence of 1987-1992 hydrology, the largest potential water supply reduction San Francisco could experience if the State Water Board implemented a 40 percent unimpaired flow objective on the Tuolumne River would be 119,000 afy for each year of a 6-year drought).

uses).” Regarding impacts associated with facility construction and operation, the PEIR found that the Delta Diversion alternative would neither avoid nor lessen the effects that would result from construction and operation of WSIP improvement projects, and that facilities beyond those required for the WSIP would need to be constructed and operated. The PEIR states that these facilities would be located in a combination of open space, rural settings, and dense urban settings, resulting in a range of additional environmental impacts. Thus, the Delta Diversions alternative was eliminated from further consideration in the WSIP PEIR because it would have uncertain water supply reliability and an unknown ability to reduce impacts on Tuolumne River resources, as well as significant additional environmental impacts.

   b. The discussion does not explain here – or anywhere -- how the “changing circumstances” now render this potential alternative feasible. While the referenced changed or changing circumstances would be reasons to reassess the potential feasibility and impacts of an alternative previously considered feasible, all of the circumstances in this list raise concerns of more restrictive environmental conditions and therefore greater project impacts and/or stricter regulation that likely make a new in-Delta diversion even less feasible. In addition, the California WaterFix has not yet been approved and implemented, and as such its characteristics may change. We are not aware of any information in the record for the WaterFix proceeding which suggests that project could serve additional users such as the SFPUC or make through-Delta transfers and in-Delta diversions more feasible.

6. The SED states (SED, at 16-68): “A delta diversion project would potentially allow SFPUC to use any of the rivers that flow into the Delta as a water supply source, instead of the Tuolumne River. Under this type of project, it is anticipated water would be purchased from any user upstream from the Delta or from a State Water Project (SWP) or Central Valley Project (CVP) contractor south of the Delta. A new connection to either the California Aqueduct or the Delta-Mendota Canal would be constructed to accommodate the transfer.”

   This subject text implies that flows from the Lower San Joaquin and Sacramento Rivers are a readily available water supply source. CCSF is not currently a CVP or SWP contractor. As a result, the WSO (Appendix C, pp. 5-3 – 5-8) identifies numerous constraints regarding supply availability and reliability that are not addressed in the SED. These include:

   a. “The SWP and CVP provide preference to existing contractor deliveries and diversions... non-contractor diversions are considered the lowest priority (the SFPUC is a non-contractor for both projects).” (WSO Report Appendix C at 5-5.) Both the SWP and CVP systems are already oversubscribed under current conditions; thus, it is questionable just how readily available long-term contracts are. According to the DWR’s *State Water Project Final Delivery Capability Report 2015* (page 127, Table 6-4), the estimated long term average deliveries to SWP contractors under existing conditions is only 62 percent of the contractors’ maximum Table A amounts, and far less than this (28 to 33 percent) during dry periods. As stated in the WSIP PEIR (page 9-26),

      > *The agencies with the rights to the greatest quantities of water in the state, the U.S. Bureau of Reclamation (USBR) and California Department of Water Resources (DWR), would not be sources of new water supply contracts/agreements because of their commitments to existing contractors and to the protection, restoration, and enhancement of fish and wildlife habitat. Challenges to water purchases and transfers pertain to restrictions associated with entitlements, contracts, and water rights; permitting requirements; effects caused by the cessation of water application to an area (e.g., land fallowing, economic impacts); Delta pumping restrictions; and wheeling arrangements.*

      The SWRCB did not contact either DWR or USBR as to whether these agencies consider the in-Delta diversion as characterized in the SED to be feasible, or whether water released from either state or federal water project storage would be available for transfer to non-contractors. At a minimum, the SED should acknowledge that the ability of the SFPUC to secure one or more long-term water contracts is speculative and outside the control of the SFPUC. This is a matter of public record.

b. Given that these systems are already oversubscribed, it is reasonable to conclude that any long-term transfer of contract water, or any other water rights or supplies, would be strongly opposed by existing downstream SWP and CVP contractors, in-Delta diverters, etc.

c. Any such long-term transfer of contract water should include an analysis of system hydraulics and hydrologic assumptions, under varying conditions, quantitatively demonstrating the effects of such transfers on downstream contractors, in-Delta diverters, etc. Alternatively, the SED should acknowledge that downstream contractors may be adversely affected.

7. Section 16.2.5 includes the following statement: “The size of the [in-Delta diversion] project may need to be larger than what was examined in the WSO report.” As noted above, the SED does not provide any information that demonstrates this alternative is feasible, nor has it substantiated assertions that changing conditions make an in-Delta diversion option more feasible today than in 2005. This statement, indicating that the diversion would need to be larger than that considered and rejected for the WSIP PEIR, further undermines the SED conclusion that the in-Delta diversion is a feasible option to offset the supply shortages to the SFPUC associated with some of the LSJR Alternatives.

8. The statement that, “Effects associated with exporting water from the Delta are being debated and analyzed by U.S. Bureau of Reclamation (USBR), DWR, and various fisheries agencies as part of the California WaterFix process” (SED, at 16-69) implies that those analyses are evaluating an in-Delta diversion by the SFPUC as part of California WaterFix. While the WaterFix identifies SWRCB’s Delta Water Quality Control Plan update as a cumulative project (and the SED identifies the WaterFix as a cumulative project), there is no evidence that in-Delta diversions by the SFPUC discussed in SED Chapter 16 were modeled or considered feasible in WaterFix analyses.

9. The SED states (SED, page 16-69):

> “If water was purchased from a contractor upstream of the Delta, there may be an increase in Delta exports, which could affect Delta fish. This effect would likely be very small due to the size (39 cfs to SFPUC versus 10,000 cfs of combined exports) and would be minimized by operating under current fisheries agencies and State Water Board regulations and requirements.”

It is a well-established principle in analyzing impacts under CEQA that the relevant question to be addressed is not the relative amount of change compared to adverse effects that have already occurred, but whether any additional amount of impact should be considered significant in light of the existing conditions. To claim that the effect of diverting 39 cubic feet per second would be “very small” is not a substitute for an actual analysis of the effects. Moreover, to claim that the effect would be “minimized” by operating under current fisheries agencies and State Water Board requirements does not prove that the diversion *can be* consistent with these restrictions.

10. The SED’s analysis (SED, page 16-69) of the ability of the existing power grid to support pumping and treatment operations and, consequently, the need for new electrical facilities is inadequate and based on an inappropriate basis of comparison, as indicated in the following text:

> “Potable water treatment and pumping facilities are typically relatively energy intensive; however, the overall increased electrical load would be extremely small compared to the existing electrical load from

> the large Delta export pumps. Therefore, it is unlikely to require the construction of major new power generation or transmission facilities."

Whether the overall increased electrical load (which is not quantified even in the broadest terms in the SED) would be small compared to the existing electrical load from Delta export pumps is immaterial and fails to answer the question of whether the existing facilities have remaining capacity or if new power generation or transmission facilities are needed. Indeed, with implementation of LSJR Alternatives 3 or 4 the CCSF would have even less energy at their disposal for operating the regional water system but greater energy needs due to additional pumping and treatment requirements, potentially increasing power generation demands.[5]

11. The SED states (SED, page 16-70) "The operation of Delta diversion facilities may require a slight increase in chemical transport and storage; however, because the facilities would likely be constructed within or adjacent to existing treatment facilities, the increase would be negligible compared to existing chemical use and transport at these locations." The statement inappropriately characterizes the effect of risks associated with increased chemical transport and storage as negligible based on the "small" increase in chemical use without either quantifying, even in the most general terms, what the increase in chemical use is, much less what the chemicals are. The existing "treatment" facilities at Tesla Portal simply provide disinfection; they do not provide filtration or include a water filtration plant. Delta water would require filtration and the full range of chemicals used by a modern filter plant. The WTP that would need to be constructed would therefore contain substantially more hazardous materials (water treatment chemicals) than existing operations at the Tesla Portal.

12. The SED states (SED, page 16-70) that, "The Delta diversion facilities would be constructed in areas that are already disturbed by urban development, and most facilities would be located within existing facility footprints and rights-of-way." This statement overlooks the fact that the SFPUC has already developed much of the area identified in the WSO for other facilities at the Tesla Portal, and thus is inaccurate and misleading.

13. The SED states (SED, Appendix L, City and County of San Francisco Analyses, page L-24), "This, or other in-Delta diversions, may be able to divert water that was left in the Tuolumne River as a result of increased instream flows under LSJR Alternatives 2, 3, or 4. The water rights and contractual obligations of SFPUC and other water right holders would need to be determined." Such an option would have all the adverse environmental effects of in-Delta diversions identified above: It would require substantial new infrastructure, including a new intake, pumping plant, large-diameter (60-inch) pipeline, WTP occupying 18 acres, and a blending facility; to treat Delta water the new WTP would contain substantially more hazardous water treatment chemicals than existing disinfection operations at the Tesla Portal; this option would likewise increase energy demand for pumping and water treatment; and would face constraints on space for the new facilities at the Tesla Portal.

    As discussed above, this in-Delta diversion option would also have effects on Delta biological resources and hydrology that have not been evaluated. Such an option would be similar to "WSIP7," one of the 28 alternatives evaluated as part of WSIP planning, except that WSIP7 called for withdrawing SFPUC water that had been left in the Tuolumne River from the lower Tuolumne River, near its confluence with the San Joaquin River, rather than from the Delta. During WSIP planning, WSIP7 was retained for additional analysis in the 2007 WSO report as alternative WS3-2. In addition to environmental impacts, the 2007 WSO report identified the following source water availability and reliability issues associated with alternative WS3-2,

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[5] *See* Comments by the City and County of San Francisco to the Draft Substitute Environmental Document in Support of Potential Changes to the Bay-Delta Plan ("San Francisco's Comment"), at 63 (explaining that "if San Francisco was responsible for complying with a new unimpaired flow objective on the Tuolumne River, then during dry hydrologic conditions the SFPUC would be compelled to implement water supply rationing in order to preserve system storage. Consequently, less water would flow through the SFPUC's water supply delivery pipeline, thereby reducing hydropower generation at facilities situated along the route of the delivery pipeline, *i.e.*, Kirkwood Powerhouse and Moccasin Powerhouse.").

> which would also apply to this alternative: it would require renegotiation of water rights with the Modesto Irrigation District and Turlock Irrigation District; agreement with all interested parties including resource agencies for releasing water to the lower Tuolumne; and state approval for diverting SFPUC water at the diversion point (in this case, the Delta rather than the lower Tuolumne River); and SFPUC would lose rights to water spilled from the New Don Pedro Water Bank (2007 WSO Report Table 5-2, at 5-8). Thus, while the statement in SED Appendix L that water rights and contractual obligations of the SFPUC and others "would need to be determined" is correct, it understates the uncertainty that would be inherent in such negotiations and the potential for the SFPUC to negotiate the right to recapture from the Delta water that had been left in the Tuolumne River, while retaining SFPUC's ability to use the New Don Pedro water bank, among other concerns.

In conclusion, as the above comments indicate, the SED has failed to substantiate its assumption that an in-Delta Diversion option is feasible and to adequately address the environmental impacts that would result from such an option. The SED analysis of environmental impacts associated with the in-Delta Diversion option must be expanded and revised to adequately evaluate the impacts outlined above and identify feasible mitigation measures where appropriate to address significant impacts.

ATTACHMENT 2:

SFPUC ALTERNATIVE

City and County of San Francisco
San Francisco Public Utilities Commission

Alternative to promote the expansion of fall-run Chinook salmon and *Oncorhynchus mykiss* populations in the lower Tuolumne River while maintaining water supply reliability

March 2017

1 INTRODUCTION

The Turlock and Modesto Irrigation Districts (Districts) have funded over 200 publically available studies relevant to salmonids and their habitat in the lower Tuolumne River, including a recent set of studies and models developed by the Districts in the course of the Federal Energy Regulatory Commission (FERC) relicensing of the Don Pedro Project (FERC No. 2299). The publically available studies include investigations of river substrate composition, geomorphology, riparian habitats, floodplain habitats, hydrologic studies, predation studies, *Oncorhynchus mykiss (O. mykiss)* population studies, and fall-run Chinook and *O. mykiss* redd surveys. In addition, the Districts fund numerous publically reported monitoring efforts and compile these data to understand trends in salmonid populations and habitat conditions.

In this document, the San Francisco Public Utilities Commission (SFPUC) proposes a comprehensive alternative for management of salmonids within the lower Tuolumne River, based primarily on lower Tuolumne River specific studies and relevant scientific literature. This alternative is designed to:

1. Promote the expansion and maintenance of fall-run Chinook salmon and *O. mykiss* populations in the lower Tuolumne River;
2. Maintain water supply reliability for users of the Tuolumne River.

Components of the alternative include:

- **Habitat management** – proposed measures to improve existing physical habitats;
- **Predation management –** proposed measures to reduce the detrimental effects of non-native predators on salmonids;
- **Environmental flow management** – proposed releases from Don Pedro Reservoir that are designed to improve habitat conditions;
- **Hatchery management** – proposed measures to reduce undesirable effects of current hatchery practices on the lower Tuolumne River fall-run Chinook population.

The anticipated outcomes of the alternative are also evaluated, along with an analysis of estimated water supply effects on the SFPUC's Hetch Hetchy Regional Water System.

2 HABITAT MANAGEMENT

2.1 Coarse Sediment Augmentation

2.1.1 Issue Description

Spawning gravel studies (Stillwater Sciences 2013a and McBain & Trush 2004) report downstream movement and loss of spawning gravels on the lower Tuolumne River. Stillwater Sciences (2013a) reported a relatively slow loss of coarse sediment in a 12.4-mile long reach below La Grange Dam. From river mile (RM) 45 to RM 52, there was a reported loss of roughly 8,000 tons of coarse material between 2005 and 2012. High flow events in 2006 and 2011 locally scoured the bed and redistributed fine and coarse sediment.

Stillwater Sciences (2013a) indicates that at a flow of approximately 225 cubic feet per second (cfs), current spawning gravel theoretically supports 25,000 to 30,000 female fall-run Chinook spawners and 800,000 *O. mykiss* between RM 23 and 52. However, fall-run Chinook salmon population modeling (Stillwater Sciences 2013b) suggests that fall-run Chinook spawning may become limiting at escapements in excess of approximately 10,000 female spawners due to superimposition and preference for upstream locations. Additional gravel in the upper reaches of the lower Tuolumne River should provide capacity for larger escapements.

2.1.2 Resource Goals

- Increase spawning habitat quantity and quality throughout the gravel-bedded reach;
- Increase capacity and productivity of spawning habitat;

2.1.3 Measure

Undertake a two-phase, ten-year program of gravel augmentation from RM 39 to RM 52 (Figure 1); conduct annual fall-run and *O. mykiss* spawning surveys; conduct a repeat spawning gravel study (similar to Stillwater Sciences 2013a) in 10 years to identify and guide the scope of future actions. The total five-year Phase I program could contribute approximately 70,000 cubic yards of coarse sediment, or 100,000 tons as compared to a loss over eight years of 8,000 tons, or 1,000 tons/year. The Phase II program would use monitoring data to make determinations on future locations and quantities.

2.1.4 Potential Implementation Issues

During placement, turbidity levels will increase. However, if placement coincided with smolt outmigration, this may produce a positive result by potentially reducing predator sight feeding effectiveness.

2.1.5 Cost

Capital and monitoring costs of $17,000,000 over ten years.[1]

2.2 Experimental Gravel Cleaning

2.2.1 Issue Description

Spawning gravel studies (Stillwater Sciences 2013a and McBain & Trush 2004) report quality of spawning gravels can be adversely affected by in-filling of coarse sediment by fines which can impede hyporheic flows through redds and affect egg viability.

2.2.2 Resource Goals

Improve quality of spawning gravels through a program of experimental gravel cleaning to remove fine sediments. The primary sources of these fine sediments are intermittent tributaries (e.g., Peaslee and Gasburg creeks) entering the lower Tuolumne River below La Grange Diversion Dam.

2.2.3 Measure

Conduct a five-year program of experimental gravel cleaning using a gravel ripper and pressure wash operated from a backhoe to reduce embedded fine sediment in spawning gravels between RM 42 and 52 (Figure 1). Each year of this experimental method would consist of three weeks of cleaning pre-selected gravel patches coinciding with May pulse flows and smolt outmigration to provide increased turbidity, potentially reducing predation. Cleaned areas will be monitored each year following gravel cleaning.

Gravel cleaning operations in high infill areas integrated with pulse flows will maximize benefit to outmigrating salmon by inducing a sediment plume. Gravel cleaning areas will be coordinated with redd surveys to minimize impact to *O. mykiss.*

Gravel cleaning has the potential to expand availability of high quality gravel, which would improve spawning and egg incubation for fall-run Chinook and *O. mykiss*. Lower Tuolumne River field experiments using emergence traps showed average egg to emergence survival of 32% (TID/MID 1992b). New gravel is assumed to provide 50% emergence survival and cleaned gravel emergence

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[1] The assignment of costs associated with implementing the SFPUC alternative has not been determined.

survival is assumed to be 40% based on TID/MID (1992b). No direct estimates of survival to emergence for gravel augmentation sites are available for the Tuolumne.

2.2.4 Potential Implementation Issues

For short periods, increased turbidity may exceed state water quality standards, but the benefits to spawning success and smolt survival are likely to outweigh any lasting effects of short-term increased turbidity. Cleaning performed in May to avoid impacts to remaining *O. mykiss* redds. Redds are located at riffles, which are likely not subject to silt deposition.

2.2.5 Cost

Capital and monitoring cost of $2,400,000 over five years.

2.3 *O. mykiss* Habitat Complexity

2.3.1 Issue Description:

Large Woody Debris (LWD) is limited in the lower Tuolumne River (Stillwater Sciences 2013c). LWD captured by Don Pedro Reservoir does not possess the size that would constitute favorable LWD-induced habitat in the lower Tuolumne River. The role of LWD in habitat formation decreases with increases in channel width; average lower Tuolumne River width is 119 ft (Stillwater Sciences 2013c). Of the 505 pieces tallied by Stillwater Sciences (2013c) within Don Pedro Reservoir and below La Grange Dam, none were longer than 52 ft and 80% of LWD within the lower Tuolumne River was located in habitat not preferred by *O. mykiss* (runs and pools).

However, *O. mykiss* spawning and rearing habitat in the upper reaches of the lower Tuolumne River could potentially be improved by introduction of suitably sized boulder material for the purpose of introducing greater instream structure and complexity. Interstitial spaces in cobble and boulder substrate are a key attribute for *O. mykiss* winter habitat suitability (Hartman 1965; Chapman and Bjorn 1969; Meyer and Griffith 1997). Juvenile *O. mykiss*, adult *O. mykiss*, and juvenile Chinook salmon are expected to benefit from the increased habitat diversity, cover, and localized hydraulic complexity that introduced boulder material would provide.

2.3.2 Resource Goals

Increase complexity of physical instream habitat between RM 42 and RM 50 to primarily benefit juvenile *O. mykiss*.

2.3.3 Measure

Source and place boulder-size stone between RM 42 and 50 (see Figure 1). The program would take place over five years and consist of boulder placement in select sub-reaches each summer followed by monitoring through the next fall and spring to evaluate use. Annual snorkel surveys would be conducted to examine boulder habitat use and localized substrate conditions. Boulder size would be approximately 1- to 1.5-cubic yards. Stream margin placement would be preferred; suitably sized LWD may be added to boulder areas to increase complexity.

2.3.4 Potential Implementation Issues

Boulder placement could potentially interfere with recreational use. Selection of sub-reaches for placement and location of boulders should be accomplished with input from a team of biologists, engineers, and recreational users.

2.3.5 Cost

$1.7 million over five years.

2.4 Riparian Vegetation Planting

2.4.1 Issue Description

A stream's riparian corridor provides benefits to freshwater aquatic systems and the biota that live within and around it (Welsch 1991).

Physical conditions and processes in the lower Tuolumne River currently support natural recruitment of some native riparian species, such as narrow-leaf willow and box elder, while other native riparian plants, such as Fremont cottonwood Goodding's black willow, and other willow species show limited natural recruitment (Stillwater Sciences 2013d). Limited recruitment of these species outside of actively replanted restoration areas is evidenced by the lack of young cohorts observed during both the 1996 and 2012 riparian vegetation field surveys (McBain & Trush 2000 and Stillwater Sciences 2013d). However, the growth and survival of these species in large, actively replanted restoration sites (e.g. Grayson Ranch and Big Bend) demonstrate that active restoration can be a workable means of bringing these native community types back to the lower Tuolumne River.

2.4.2 Resource Goals

Maintain and expand native riparian vegetation community types along the lower Tuolumne River.

2.4.3 Measure

Provide a lump sum of $500,000 for the purpose of implementing a focused native riparian vegetation planting program. The program should focus on native riparian species such as Fremont cottonwood, Goodding's black willow, shining and red willow, which exhibit lower rates of natural recruitment. At a replanting cost assumed to be $3,000/acre, this measure would support restoration of 12 miles of shoreline assuming a 100-foot-wide shoreline zone.

2.4.4 Potential Implementation Issues

Landowner cooperation and approval must be obtained.

2.4.5 Cost

One time cost of $500,000

2.5 Water Hyacinth

2.5.1 Issue Description

Infestations of water hyacinth (*Eichhornia crassipes*) can adversely affect water quality, adult salmon migration, salmon outmigration monitoring, and other uses of the river including recreation. Dense growths of water hyacinth can obstruct and disrupt the adult fall-run Chinook salmon migration, and may be a significant factor influencing salmon escapement counts in the SJR tributaries (TID/MID 2014 and FishBio 2014).

2.5.2 Resource Goals

Assist California Department of Boating and Waterways with water hyacinth removal efforts on the lower Tuolumne River to reduce hyacinth's effects on native aquatic resources and uses affected by water hyacinth infestations.

2.5.3 Measure

Provide monetary or personnel support for water hyacinth removal efforts on the lower Tuolumne River.

2.5.4 Potential Implementation Issues

None identified.

2.5.5 Cost

$100,000/year during years when uses are significantly impaired.

3 PREDATION MANAGEMENT

3.1 Fish Counting & Barrier Weir

3.1.1 Issue Description

Monitoring studies (snorkeling and seine surveys) and predation studies conducted in 1992 and 2012 (TID/MID 1992a and FishBio 2013a) indicate a persistent and substantial population of non-native fish species, including black bass and striped bass, in the lower Tuolumne River. Striped bass have been documented ranging throughout the lower Tuolumne River, up to La Grange Diversion Dam. Striped bass are highly mobile and account for approximately 15% of the loss due to predation on the lower Tuolumne River (FishBio 2013a).

Low juvenile Chinook salmon survival has been documented on the lower Tuolumne River, and predation by non-native predators appears to be a major contributor to high rates of juvenile mortality (FishBio 2013a). From 2007 through 2013, the smolt survival index[2] on the lower Tuolumne River averaged 9.5%, and ranged from 2.7% to 28%. From 2008 through 2013, fry survival index averaged 5.4%, and for four of the years was less than 1%. A recent otolith study indicates fry leaving the Tuolumne River are poorly represented in future escapement, indicating a potential survival advantage for fish emigrating at larger sizes (Stillwater Sciences 2016).

3.1.2 Resource Goals

Manage the adverse impact of predation by non-native bass on fall-run Chinook salmon. A corollary benefit would likely be reduced predation on juvenile *O. mykiss*.

3.1.3 Measure

A permanent counting and barrier weir would be installed at RM 25.8 (Figure 1), and will serve multiple purposes. The weir would prohibit the upstream movement of striped bass (primarily) and other bass species into the prime rearing areas for juvenile Chinook and *O. mykiss*. By preventing bass movement upstream of RM 25.8, predation above that point is expected to be reduced. Striped bass will likely congregate below the barrier, and would be the target of suppression and removal efforts (see predator suppression and removal measure below) prior to spring outmigration pulse flows (see outmigration pulse measure below).

Installation of the weir, combined with implementation of the predator suppression and removal measure described below is expected to reduce predation on lower Tuolumne River juvenile Chinook. The permanent weir will have other benefits, including acting as the new counting weir, which would be usable year round and not require removal when flows exceed 1,500 cfs. The 5 foot high weir will include a Denil-type fishway and counting window, allow species separation, and provide a salmon viewing opportunity for the public.

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[2] Computed as the percent of smolts passing the Waterford rotary screw trap (RST) (located at RM 29.8) divided by the percent of smolts passing the Grayson RST (located at RM 5.2). The fry survival index is computed similarly.

3.1.4 Potential Implementation Issues

The weir may be viewed to be in conflict with river recreation, but this is not necessarily the case. The weir would be fitted with a safe passage chute for non-motorized craft, and not require a portage. Motorized craft would be excluded but such use is low under present conditions.

3.1.5 Cost

Capital cost of $12 million; monitoring cost of $320,000/year.

3.2 Predator Suppression and Removal

3.2.1 Issue Description

See issue description in Fish Counting & Barrier Weir measure above.

3.2.2 Resource Goals

Substantially reduce the adverse impact of predation by non-native fish on fall-run Chinook salmon. A corollary benefit would likely be reduced predation on juvenile *O. mykiss*.

3.2.3 Measure

Non-native bass species would be targeted for active removal above and below the barrier weir (Figure 1). Removal efforts directly below the barrier weir would increase immediately before implementing an outmigration pulse flow (see outmigration pulse flow measure below).

Removal efforts may include derbies and bounties. Other efforts would include advocating for season extensions, higher bag limits, and smaller catchable size. These efforts, if successful, would likely reduce bass abundance, particularly above the barrier weir, and over time, improve fall-run Chinook juvenile survival. Based on 2012 population estimates (FishBio 2013a), to remove 10% of the current black bass population would require capture of about 660 fish. Monitoring would consist of black bass abundance surveys every three years.

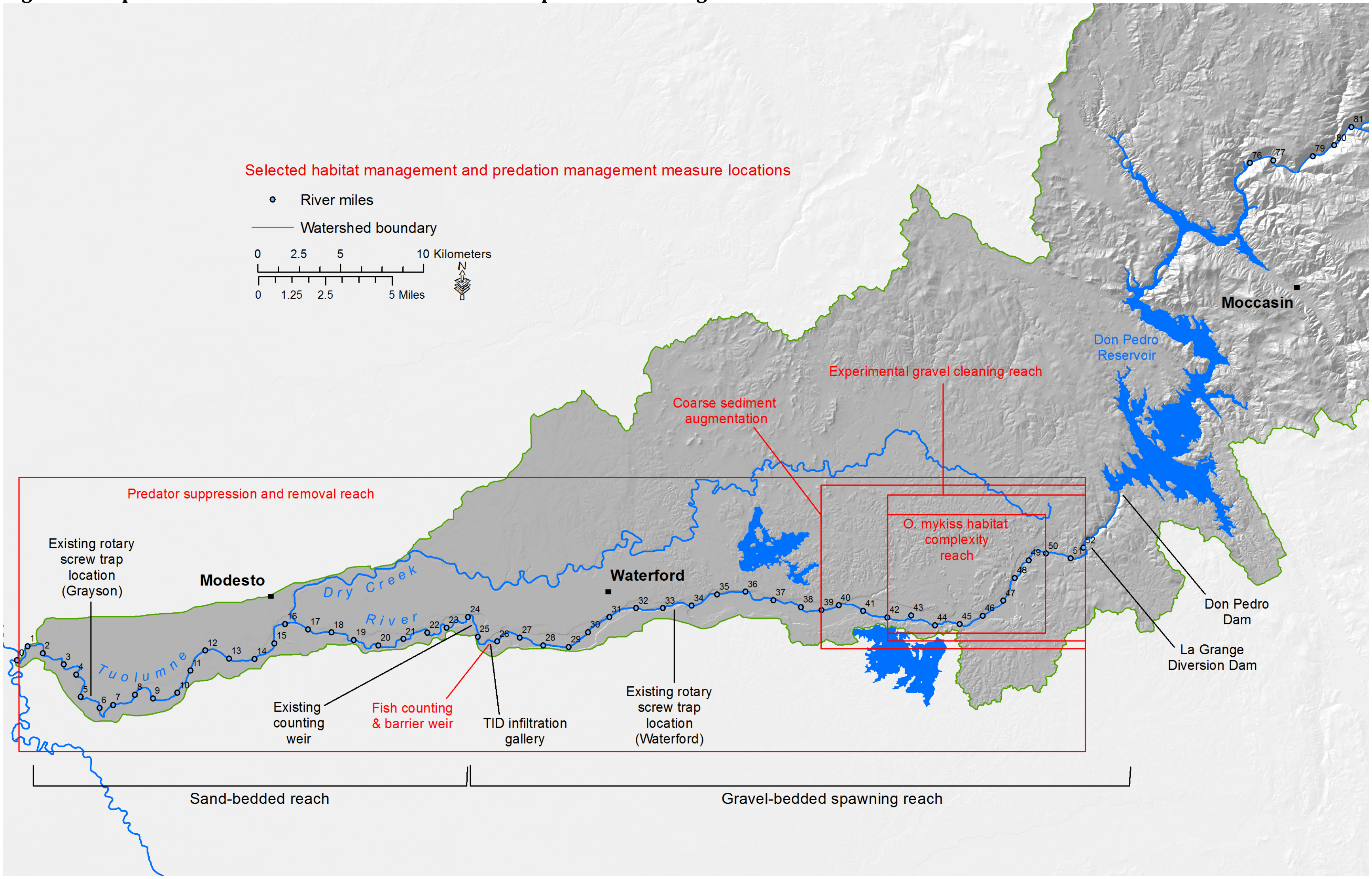
3.2.4 Potential Implementation Issues

Parties interested in striped bass and black bass fishing may object to changes in regulations and potential population reductions.

3.2.5 Cost

Capital cost of $150,000; annual cost of $115,000/year.

Figure 1. Map of selected SFPUC alternative habitat and predation management measures.



4 ENVIRONMENTAL FLOW MANAGEMENT

All proposed releases described below would be made from Don Pedro Reservoir; accretion is not assumed to contribute to meeting the proposed release requirements. All cited weighted useable area (WUA) percentages are derived from Stillwater Sciences (2013e).

4.1 Water year typing

The instream flow schedule described below uses the 5 water year types of the San Joaquin Valley Water Year Hydrologic Classification, as defined in the current Bay-Delta Water Quality Control Plan (Revised Water Right Decision 1641, SWRCB 2000).

4.2 Summer *O. mykiss* Rearing (June 1 – September 30)

4.2.1 Issue Description

Monitoring indicates that rainbow trout (*Oncorhynchus mykiss*, or *O. mykiss*) are generally found in habitats upstream of RM 42 with peak fry densities occurring in May, June, and possibly into July (Stillwater Sciences 2013f, 2013g). Summertime flow management for *O. mykiss* juveniles requires striking a balance between hydraulic and temperature habitat suitability. Higher flows in early summer (June through mid- July) tend to push weaker-swimming fry to downstream areas, increasing their vulnerability to predation and subsequent higher temperatures (Stillwater Sciences 2013f, 2013g); thus, lower flows are incorporated into this flow measure from June 1 to July 15, with slightly higher flows from July 16 to September 30.

4.2.2 Resource Goals

Increase and maintain the lower Tuolumne River *O. mykiss* population by balancing habitat capacity with summer water temperature management in the predominant *O. mykiss* reach of RM 42 to RM 50.

4.2.3 Measure[3]

From June 1 to July 15 (*O. mykiss* fry rearing)

- W, AN, BN water years - 150 cfs (78% WUA)
- D, C water years - 100 cfs (85% WUA).

From July 16 to September 30 (*O. mykiss* juvenile rearing)

- W, AN, BN water years - 250 cfs (96% WUA)
- D, C water years - 175 cfs (99% WUA).

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[3] Turlock Irrigation District (TID) has installed an infiltration gallery (IG) at about RM 25.9. The proposed *O. mykiss* rearing flows are conditioned on TID using the IG to recapture a portion of the summertime flows: 50 cfs would be withdrawn from June 1 to July 15 during BN, AN and W water years, and up to 100 cfs would be withdrawn during all water years from July 16 to Sept 30. *O. mykiss* typically occupy the reach between RM 42 and 50 during the summertime period, thus the infiltration gallery would likely not impact core *O. mykiss* habitat.

4.3 Fall-Run Chinook Spawning (October 1 through December 15)

4.3.1 Issue Description

Improved spawning success is expected to increase the number of juveniles, which will promote increased outmigration numbers.

4.3.2 Resource Goals

- Improve spawning habitat for adult fall-run Chinook.

Mid-October through mid-December is the primary spawning period for fall-run Chinook. Combined with measures to improve quantity and quality of spawning gravels, this flow schedule improves overall spawning habitat. Improved spawning success will increase the number of juveniles, which will promote increased outmigration numbers.

4.3.3 Measure

In 2012, 95% of all redds were established between October 29 and November 29 (FishBio 2013b). Peak spawning occurred the week of November 12. In 2012/2013, 1.4% of redds were documented after December 15 and in 2014/2015, it was 5.8%. At a flow of 250 cfs, spawning habitat is 95% of maximum WUA and at 175 cfs it is 80% of maximum WUA.

From October 1 to December 15:

- W, AN, and BN water years – 250 cfs
- D and C water years – 175 cfs

4.4 Fall-Run Chinook Fry-Rearing (December 16 through February 28)

4.4.1 Issue Description

Many fall-run Chinook leave the Tuolumne River as fry, which are not well represented in returning adults (<5%) (Stillwater Sciences 2016). In recent years, parr and smolt sized emigrants represented the vast majority of returning Tuolumne-origin adults, implying a survival advantage for fish emigrating at larger sizes (Stillwater Sciences 2016). Retaining more fry in the upper river reaches of the lower Tuolumne River to grow to smolt size is expected to increase natural escapement, other factors being equal. Fry habitat is not a factor limiting Chinook populations on the lower Tuolumne River (Stillwater Sciences 2013b).

4.4.2 Resource Goals

- Increase suitable fry rearing habitat in the lower Tuolumne River.
- Increase the number of fry remaining in the upper reaches of the lower Tuolumne River.

4.4.3 Measure

Fry emergence peaks in late January through mid-February (Stillwater Sciences 2013b, 2013f). Fry habitat is greatest at 50 cfs, and decreases to 88% WUA at 100 cfs and at 150 cfs it is 75%, continuing to decrease at higher flows. Long term seining data since 2001 shows higher flows during the fry rearing period tend to push fry downriver, increasing vulnerability to predators and higher temperatures in May (Stillwater Sciences 2013b). In-channel fry habitat is not limiting in the gravel bedded reaches of lower Tuolumne River at these flows.

For the period December 16 to February 28:

- W, AN, and BN water years – 175 cfs
- D and C water years – 150 cfs

4.4.4 Potential Implementation Issues

Reducing flows for the benefit of the fry life stage has the potential to affect egg viability of late spawners. However, based on spawning surveys and depth of redd pots, the small change in stage is unlikely to affect localized flows or result in desiccation. Monitoring will be required to confirm spawning timing and minimize impact to egg viability

4.4.5 Cost

Redd surveys and egg viability monitoring at a cost of $50,000/year.

4.5 Fall-Run Chinook Juvenile Rearing (March 1 – April 15)

4.5.1 Issue Description

Increasing the population of rearing juvenile salmon in the upper reaches of the lower Tuolumne River will increase number of smolts and outmigration numbers.

4.5.2 Resource Goals

- Increase suitable juvenile rearing habitat in the gravel bedded reaches of the lower Tuolumne River.
- Increase the number of juveniles remaining in the upper reaches of the lower Tuolumne River.

4.5.3 Measure

Hydraulically suitable habitat for juvenile fall-run Chinook rearing is maximized at 150 cfs and exceeds 97% WUA at flows from 100 to 200 cfs. Juvenile habitat at these flows is not limiting. The majority of in-river Chinook have reached at least parr size by the end of March (Stillwater Sciences 2013b). Juveniles have substantially better swimming ability and river temperatures are also favorable during this time period (Stillwater Sciences 2013b, 2013f).

From March 1 through April 15:

- BN, AN, W water years - 200 cfs
- D and C water years - 150 cfs

4.5.4 Potential Implementation Issues

Greater numbers of *O. mykiss* may be spawning during this time frame. At 200 cfs, spawning habitat it is just under 80% of maximum WUA. At 400 cfs it is 98%; however, Chinook juvenile habitat is reduced to 80% of maximum at 400 cfs.

4.6 Fall-run Chinook Outmigration Baseflow (April 16 through May 31)

4.6.1 Issue Description

Increasing the population of rearing juvenile salmon in the upper reaches of the lower Tuolumne River will increase number of smolts and outmigration numbers.

4.6.2 Resource Goals

Maintain favorable conditions in the upper reaches of the lower Tuolumne River for juvenile salmon, including growth and reduced predation (in combination with predation management measures).

4.6.3 Measure

Hydraulically suitable habitat for juvenile fall-run Chinook rearing is maximized at 150 cfs and exceeds 97% WUA at flows from 100 to 200 cfs. At 250 cfs, it drops to 92%. Many fall-run Chinook are large parr by mid-April. Juvenile habitat at these flows is not limiting. Increasing flows above those provided through April 15 serve to keep river temperatures favorable. For example, at RM 29, a flow of 250 cfs maintains river temperatures below 24°C until maximum daily air temps exceed 85°F. At these flows, *O. mykiss* spawning habitat will increase from 78% to 87% of maximum WUA.

From April 16 to May 31:

- BN, AN, W water years – 250 cfs
- D and C water years – 175 cfs

4.7 Outmigration Pulse (April/May)

4.7.1 Issue Description

All other factors being equal, greater numbers of outmigrants should result in greater and more consistent numbers of returning adults.

4.7.2 Resource Goals

Increase outmigration success of fall-run Chinook salmon in the Tuolumne River.

4.7.3 Measure

With the onset of smoltification, juveniles will emigrate volitionally or due to one or more hypothesized cues. To encourage this movement and to increase survival, pulse flows would be provided which are carefully timed to coincide with the periods when large numbers of fish are of large parr or smolt size, circa >65 mm. Included in this measure is the close monitoring of spawning timing and river temperatures, supplemented by snorkel surveys or seining, to calibrate size-at-smoltification for the purpose of timing the spring pulse flows. RST monitoring would continue to inform estimated smolt survival in response to pulse flows. Timing pulse flows to when large numbers of juveniles are likely motivated to move, combined with spawning gravel improvements and predator control measures, is expected to substantially improve Tuolumne River outmigration survival. The pulse flow volumes are as follows:

- W and AN WYs - 150 TAF
- BN and D WYs - 100 TAF
- First year C WY - 35 TAF, subsequent sequential C WYs - 11 TAF

4.7.4 Potential Implementation Issues

Balancing with *O. mykiss* use of river habitats for spawning and rearing. Adding habitat complexity may reduce potential effects.

4.7.5 Cost

Monitoring costs are approximately $300,000 per year.

4.8 Gravel Mobilization

4.8.1 Issue Description

Spawning gravel studies (Stillwater Sciences 2013a and McBain & Trush 2004) report reductions in quality of coarse sediment due to reduced scale and frequency of high flows. Gasburg and Peaslee creeks are likely sources of fine sediment causing gravel infilling, which can impede hyporheic flows through redds and reduce egg viability. Under past and present flow regimes, gravel mobilization occurs less frequently than under pre-project conditions due to a reduced frequency of high flow events as a result of the Don Pedro Project's flood control purposes.

4.8.2 Resource Goals

- Improve the quality of spawning gravels via more frequent gravel mobilization and transport releases.

Increasing the frequency of gravel mobilization events is expected to enhance fall-run Chinook and *O. mykiss* productivity by periodically flushing accumulated fines from spawning gravels.

4.8.3 Measure

During Wet ("W") and/or Above Normal ("AN") water years when adequate spills are forecasted to be available, provide two to four days of releases between 6,000 and 7,000 cfs as measured at the La Grange USGS gage to mobilize spawning gravels. This measure will increase the frequency of gravel mobilization compared to existing spill operations.

Bedload transport measurements on the Trinity River in northern California and Rush Creek in eastern California show that coarse and fine bedload transport rates are steady for 2–3 days, then drop by 50% or more thereafter (McBain & Trush 2006). Minimum thresholds for significant bed mobility at Riffle 4B on the lower Tuolumne River are estimated to be between 5,400 and 6,880 cfs (McBain and Trush 2000, 2004).

4.8.4 Potential Implementation Issues

Flows in this range have been reported to affect crop production in certain areas below RM 10.

4.8.5 Cost

Operational and monitoring cost of $10,000 per year.

5 HATCHERY MANAGEMENT

5.1.1 Issue Description

Current management of production hatcheries in the Central Valley is incompatible with any effort to increase and maintain natural populations of fall-run Chinook salmon. Since the 1980's the state's hatcheries, in particular, have released juvenile fall-run Chinook further away from hatcheries ("off-site" releases) with increasing frequency to avoid mortality from predation, water diversions, and poor water quality (Huber and Carlson 2015). This practice has promoted unacceptably high rates of straying (California HSRG 2012), up to 8 times greater (Kormos et al. 2012 and Palmer–Zwahlen et al. 2013) than the estimated background rate of 5-10% (Cramer 1991) for on-site releases.

There is broad concern that off-site releases and resultant high rates of straying have led to introgression of hatchery and natural fall-run Chinook populations, reducing the fitness of both, masking natural fall-run Chinook population declines, and decreasing population productivity, abundance, and life history diversity. Fall-run Chinook salmon appear to be genetically similar in the Central Valley (Williamson and May 2005), which is at least partly due to off-site releases (Garza et al. 2008). Christie et al. (2014) found that early generation hatchery salmonid reproductive success can average around half of natural population reproductive success when spawning in the wild, which may reduce the fitness of an entire population. Widespread straying due to off-site releases probably limits opportunities for local adaptation to tributary conditions (Garza et al. 2008). While the suitability of functional juvenile migration corridors must be addressed, it is clear that the practice of off-site release must end (California HSRG 2012).

Stray hatchery fall-run Chinook now make up a large proportion of adults returning to the Tuolumne River, where no hatchery exists, and the proportions of hatchery fish have been increasing in recent years (Stillwater Sciences 2016). While current hatchery management has in some years resulted in short-term increases in adult returns, current policies are a threat to the long-term future viability of all natural fall-run Chinook populations and undermine the effectiveness of measures implemented to improve physical habitat conditions in Central Valley rivers and the Delta, including those described above for the lower Tuolumne River.

5.1.2 Resource Goals

- Reduce undesirable impacts of stray hatchery fall-run Chinook salmon on any remaining natural fall-run Chinook salmon in the lower Tuolumne River.

5.1.3 Measure

To reduce the undesirable impacts of existing production hatchery practices on fall-run Chinook salmon, the California Department of Fish and Wildlife, National Marine Fisheries Service, and United States Fish and Wildlife Service urgently need to:

- Implement the recommendations of the California Hatchery Scientific Review Group (California HSRG 2012), including the cessation of off-site releases.
- Explore methods for managing non-native predators and their preferred habitats in the Delta and tributaries to reduce hatchery and natural juvenile salmonid mortality.
- Implement 100% marking and tagging at all Central Valley hatcheries to allow for accurate accounting of returning hatchery vs. natural adult fall-run Chinook.
- Concurrent with 100% marking, explore the possible development of a mark-selective fall-run Chinook salmon fishery to support the re-establishment and protection of all natural Central Valley fall-run Chinook salmon populations.

5.1.4 Potential Implementation Issues

California HSRG (2012) identifies several issues that limit the ability of state-operated hatcheries, in particular, to meet hatchery program goals, and provides recommendations to overcome these issues. California HSRG (2012) also provides a number of implementation recommendations and describes areas of needed research.

6 ANTICIPATED OUTCOMES

A series of computer models relying on site-specific, empirical data collected over the last 20 years have been developed for the lower Tuolumne River. These models enable users to evaluate future conditions under different alternatives. The models were developed in consultation with resource agencies, including the State Water Resource Control Board, during the Federal Energy Regulatory Commission (FERC) relicensing of the Don Pedro Project (FERC No. 2299). Certain components of the SFPUC alternative were analyzed using these models to estimate relative comparisons to a base case representing current conditions on the lower Tuolumne River.

The base case is described in the Don Pedro Project Final License Application, Exhibit B, Appendix B. See individual model reports listed below for each model's base parameterization. The base case and model documentation are available online at www.donpedro-relicensing.com.

Models relevant to the SFPUC alternative include:

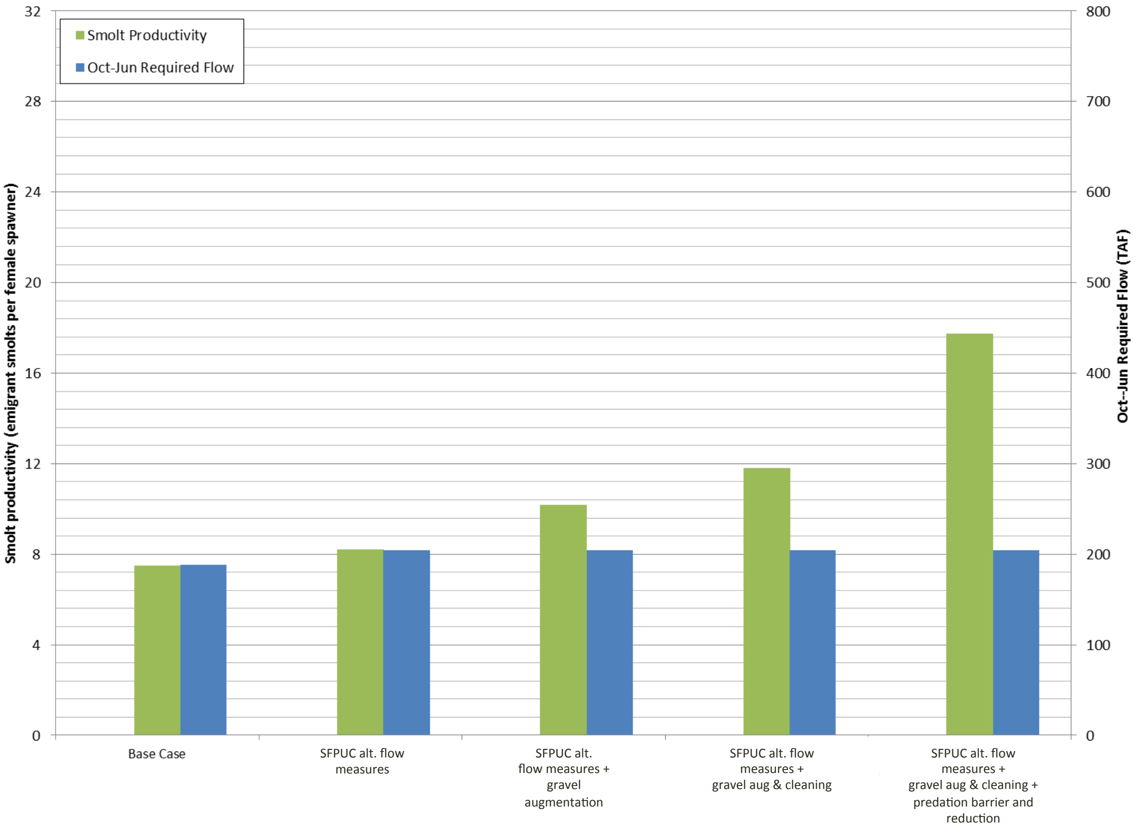
- W&AR-02: Project Operations/Water Balance Model (Steiner 2013);
- W&AR-03: Don Pedro Reservoir Temperature Model (HDR 2013);
- W&AR-16: Lower Tuolumne River Temperature Model (Stillwater Sciences 2013h); and,
- W&AR-06: Tuolumne River Chinook Salmon Population Model (Stillwater Sciences 2013b).

SFPUC alternative flow management measures were applied to the Project Operations, Reservoir Temperature, River Temperature, and in-river Chinook Salmon Population models. To simulate the implementation of selected SFPUC alternative habitat and predation management measures on fall-run Chinook salmon, parameter changes (modified from the base case) described below were also applied to the Chinook Salmon Population Model:

- Gravel Augmentation – Spawning gravel areas were increased in 4 locations to represent the results of Phase I, including 51,627 ft^2 at RM 51 (riffle A5/A6), 205,990 ft^2 at RM 47 (Basso Pool), 206,294 ft^2 RM 44 (Bobcat Flat) and 5,052 ft^2 at RM 41.7 (Turlock Lake State Recreation Area). For these added gravel areas, emergence to survival was increased from 32% to 50%, assuming only a modest increase in newly placed gravel quality.
- Gravel Cleaning – Cleaned patches at the end of the five-year experimental program were represented by a modest increase from 32% survival to emergence in the base case to 40% for the SFPUC alternative for all non-augmented gravels in the reach from RM 42-52.
- Predator Removal and Barrier Weir – These measures were modeled as a 15% decrease in predation rate upstream of the proposed RM 25.8 barrier weir, and a 5% decrease below.

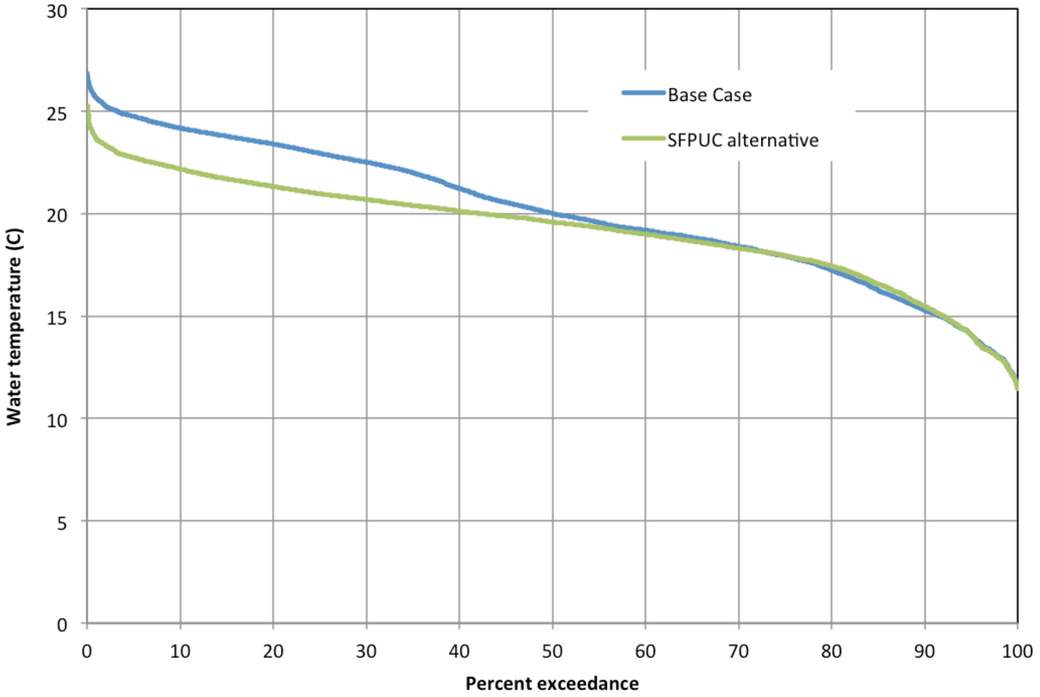
Results of the modeling exercise suggest that proposed flow management measures, combined with modeled representations of selected habitat and predation management measures may provide a significant relative increase in fall-run Chinook smolt productivity, represented by the number of emigrant smolts per female spawner, relative to the base case (Figure 2).

Figure 2. Tuolumne River Chinook Salmon Population Model (Stillwater Sciences 2013b) output illustrating average smolt productivity estimates and October-June release volumes under the base case and SFPUC alternative.



Output of the River Temperature Model indicates improved summer temperature conditions for *O. mykiss* relative to the base case (Figure 3). Recent work by Verhille et al (2016) found lower Tuolumne River *O. mykiss* juveniles within 95% of optimum metabolic performance between 18 and 24°C and optimum between 21 and 22°C. Effects of SFPUC alternative measures have not been evaluated at the population level for *O. mykiss*.

Figure 3. Lower Tuolumne River temperature model (Stillwater Sciences 2013h) output showing 7 day average daily maximum water temperature exceedence values at RM 39.5, June through September, for the base case and SFPUC alternative flow management measures.



7 WATER SUPPLY EFFECTS

The SFPUC performed water supply analysis for the Hetch Hetchy Regional Water System (RWS) to evaluate the effects of the proposed SFPUC alternative. The modeling methodology used for this analysis was as described in the memorandum titled "*SFPUC Analysis of Proposed Changes to Tuolumne River Flow Criteria*" dated March 14, 2017, attached. Analysis was performed for three levels of RWS system-wide demand: 265 million gallons per day (MGD), 223 MGD, and 175 MGD. Within each level of demand, two scenarios were evaluated: the current conditions or "base case", and the flow management measures in the SFPUC alternative. No other changes were made to system configuration within each level of demand, which allows the results of simulations for like demands to be compared to evaluate the effects of the SFPUC alternative.

Water supply rationing is used as an indicator of negative impact to the SFPUC water supply system. Through application of the SFPUC water supply planning methodology, decreased water supply in system storage in dry years will lead to increased occurrence and magnitude of rationing. Tables 7-1, 7-2 and 7-3 present system-wide rationing in the base case and the SFPUC alternative for system demands of 265 MGD, 223 MGD and 175 MGD, respectively. As shown in Table 7-1, system-wide rationing is required for the base case in 10 out of 91 years in the historical record, and the largest magnitude of rationing required in this sequence is 20%. In the SFPUC alternative, system-wide rationing is required in 15 years out of 91, and the largest magnitude of rationing is 25%. As shown in Table 7-2, rationing is not required in the base case at a system demand of 223 MGD, but 10% rationing is required in 3 years out of 91 in the SFPUC alternative. Rationing is not required for the base case or SFPUC alternative at 175 MGD.

Table 7-1: Comparison of SFPUC RWS Annual Water Supply Delivery Capability for Current Conditions (Base Case) and SFPUC Alternative at an Annual Demand of 265 MGD. Yellow highlights indicate that water provided to the RWS includes supply from of the Westside Basin conjunctive use groundwater project. Red highlights indicate that water supply rationing is implemented. The years in which rationing occurs also include use of the Westside Basin groundwater project.

SFPUC Fiscal Year (July-June)	Base Case at 265 MGD Total Deliveries			SFPUC Alternative Total Deliveries		
	TAF/yr	MGD	Rationing (% of Total)	TAF/yr	MGD	Rationing (% of Total)
FY20-21	297	265	0%	297	265	0%
FY21-22	297	265	0%	297	265	0%
FY22-23	297	265	0%	297	265	0%
FY23-24	297	265	0%	297	265	0%
FY24-25	297	265	0%	253	226	15%
FY25-26	297	265	0%	297	265	0%
FY26-27	297	265	0%	297	265	0%
FY27-28	297	265	0%	297	265	0%
FY28-29	297	265	0%	297	265	0%
FY29-30	297	265	0%	297	265	0%
FY30-31	297	265	0%	297	265	0%
FY31-32	267	238	10%	253	226	15%
FY32-33	297	265	0%	297	265	0%
FY33-34	297	265	0%	297	265	0%
FY34-35	297	265	0%	253	226	15%
FY35-36	297	265	0%	297	265	0%
FY36-37	297	265	0%	297	265	0%
FY37-38	297	265	0%	297	265	0%
FY38-39	297	265	0%	297	265	0%
FY39-40	297	265	0%	297	265	0%
FY40-41	297	265	0%	297	265	0%
FY41-42	297	265	0%	297	265	0%
FY42-43	297	265	0%	297	265	0%
FY43-44	297	265	0%	297	265	0%
FY44-45	297	265	0%	297	265	0%
FY45-46	297	265	0%	297	265	0%
FY46-47	297	265	0%	297	265	0%
FY47-48	297	265	0%	297	265	0%
FY48-49	297	265	0%	297	265	0%
FY49-50	297	265	0%	297	265	0%
FY50-51	297	265	0%	297	265	0%
FY51-52	297	265	0%	297	265	0%
FY52-53	297	265	0%	297	265	0%
FY53-54	297	265	0%	297	265	0%
FY54-55	297	265	0%	297	265	0%
FY55-56	297	265	0%	297	265	0%
FY56-57	297	265	0%	297	265	0%
FY57-58	297	265	0%	297	265	0%
FY58-59	297	265	0%	297	265	0%
FY59-60	297	265	0%	297	265	0%
FY60-61	297	265	0%	253	226	15%
FY61-62	267	238	10%	253	226	15%
FY62-63	297	265	0%	297	265	0%
FY63-64	297	265	0%	297	265	0%
FY64-65	297	265	0%	297	265	0%
FY65-66	297	265	0%	297	265	0%
FY66-67	297	265	0%	297	265	0%
FY67-68	297	265	0%	297	265	0%
FY68-69	297	265	0%	297	265	0%
FY69-70	297	265	0%	297	265	0%
FY70-71	297	265	0%	297	265	0%
FY71-72	297	265	0%	297	265	0%
FY72-73	297	265	0%	297	265	0%
FY73-74	297	265	0%	297	265	0%
FY74-75	297	265	0%	297	265	0%
FY75-76	297	265	0%	297	265	0%
FY76-77	267	238	10%	253	226	15%
FY77-78	238	212	20%	223	199	25%
FY78-79	297	265	0%	297	265	0%
FY79-80	297	265	0%	297	265	0%
FY80-81	297	265	0%	297	265	0%
FY81-82	297	265	0%	297	265	0%
FY82-83	297	265	0%	297	265	0%
FY83-84	297	265	0%	297	265	0%
FY84-85	297	265	0%	297	265	0%
FY85-86	297	265	0%	297	265	0%
FY86-87	297	265	0%	297	265	0%
FY87-88	297	265	0%	253	226	15%
FY88-89	267	238	10%	253	226	15%
FY89-90	267	238	10%	253	226	15%
FY90-91	238	212	20%	223	199	25%
FY91-92	238	212	20%	223	199	25%
FY92-93	238	212	20%	223	199	25%
FY93-94	297	265	0%	297	265	0%
FY94-95	297	265	0%	253	226	15%
FY95-96	297	265	0%	297	265	0%
FY96-97	297	265	0%	297	265	0%
FY97-98	297	265	0%	297	265	0%
FY98-99	297	265	0%	297	265	0%
FY99-00	297	265	0%	297	265	0%
FY00-01	297	265	0%	297	265	0%
FY01-02	297	265	0%	297	265	0%
FY02-03	297	265	0%	297	265	0%
FY03-04	297	265	0%	297	265	0%
FY04-05	297	265	0%	297	265	0%
FY05-06	297	265	0%	297	265	0%
FY06-07	297	265	0%	297	265	0%
FY07-08	267	238	10%	253	226	15%
FY08-09	297	265	0%	297	265	0%
FY09-10	297	265	0%	297	265	0%
FY10-11	297	265	0%	297	265	0%

Table 7-2: Comparison of SFPUC RWS Annual Water Supply Delivery Capability for Current Conditions (Base Case) and SFPUC Alternative at an Annual Demand of 223 MGD. Yellow highlights indicate that water provided to the RWS includes supply from of the Westside Basin conjunctive use groundwater project. Red highlights indicate that water supply rationing is implemented. The years in which rationing occurs also include use of the Westside Basin groundwater project.

SFPUC Fiscal Year	Base Case at 223 MGD Total Deliveries			SFPUC Alternative Total Deliveries		
	TAF/yr	MGD	Rationing (% of Total)	TAF/yr	MGD	Rationing (% of Total)
FY20-21	250	223	0%	250	223	0%
FY21-22	250	223	0%	250	223	0%
FY22-23	250	223	0%	250	223	0%
FY23-24	250	223	0%	250	223	0%
FY24-25	250	223	0%	250	223	0%
FY25-26	250	223	0%	250	223	0%
FY26-27	250	223	0%	250	223	0%
FY27-28	250	223	0%	250	223	0%
FY28-29	250	223	0%	250	223	0%
FY29-30	250	223	0%	250	223	0%
FY30-31	250	223	0%	250	223	0%
FY31-32	250	223	0%	250	223	0%
FY32-33	250	223	0%	250	223	0%
FY33-34	250	223	0%	250	223	0%
FY34-35	250	223	0%	250	223	0%
FY35-36	250	223	0%	250	223	0%
FY36-37	250	223	0%	250	223	0%
FY37-38	250	223	0%	250	223	0%
FY38-39	250	223	0%	250	223	0%
FY39-40	250	223	0%	250	223	0%
FY40-41	250	223	0%	250	223	0%
FY41-42	250	223	0%	250	223	0%
FY42-43	250	223	0%	250	223	0%
FY43-44	250	223	0%	250	223	0%
FY44-45	250	223	0%	250	223	0%
FY45-46	250	223	0%	250	223	0%
FY46-47	250	223	0%	250	223	0%
FY47-48	250	223	0%	250	223	0%
FY48-49	250	223	0%	250	223	0%
FY49-50	250	223	0%	250	223	0%
FY50-51	250	223	0%	250	223	0%
FY51-52	250	223	0%	250	223	0%
FY52-53	250	223	0%	250	223	0%
FY53-54	250	223	0%	250	223	0%
FY54-55	250	223	0%	250	223	0%
FY55-56	250	223	0%	250	223	0%
FY56-57	250	223	0%	250	223	0%
FY57-58	250	223	0%	250	223	0%
FY58-59	250	223	0%	250	223	0%
FY59-60	250	223	0%	250	223	0%
FY60-61	250	223	0%	250	223	0%
FY61-62	250	223	0%	250	223	0%
FY62-63	250	223	0%	250	223	0%
FY63-64	250	223	0%	250	223	0%
FY64-65	250	223	0%	250	223	0%
FY65-66	250	223	0%	250	223	0%
FY66-67	250	223	0%	250	223	0%
FY67-68	250	223	0%	250	223	0%
FY68-69	250	223	0%	250	223	0%
FY69-70	250	223	0%	250	223	0%
FY70-71	250	223	0%	250	223	0%
FY71-72	250	223	0%	250	223	0%
FY72-73	250	223	0%	250	223	0%
FY73-74	250	223	0%	250	223	0%
FY74-75	250	223	0%	250	223	0%
FY75-76	250	223	0%	250	223	0%
FY76-77	250	223	0%	250	223	0%
FY77-78	250	223	0%	225	201	10%
FY78-79	250	223	0%	250	223	0%
FY79-80	250	223	0%	250	223	0%
FY80-81	250	223	0%	250	223	0%
FY81-82	250	223	0%	250	223	0%
FY82-83	250	223	0%	250	223	0%
FY83-84	250	223	0%	250	223	0%
FY84-85	250	223	0%	250	223	0%
FY85-86	250	223	0%	250	223	0%
FY86-87	250	223	0%	250	223	0%
FY87-88	250	223	0%	250	223	0%
FY88-89	250	223	0%	250	223	0%
FY89-90	250	223	0%	250	223	0%
FY90-91	250	223	0%	225	201	10%
FY91-92	250	223	0%	250	223	0%
FY92-93	250	223	0%	225	201	10%
FY93-94	250	223	0%	250	223	0%
FY94-95	250	223	0%	250	223	0%
FY95-96	250	223	0%	250	223	0%
FY96-97	250	223	0%	250	223	0%
FY97-98	250	223	0%	250	223	0%
FY98-99	250	223	0%	250	223	0%
FY99-00	250	223	0%	250	223	0%
FY00-01	250	223	0%	250	223	0%
FY01-02	250	223	0%	250	223	0%
FY02-03	250	223	0%	250	223	0%
FY03-04	250	223	0%	250	223	0%
FY04-05	250	223	0%	250	223	0%
FY05-06	250	223	0%	250	223	0%
FY06-07	250	223	0%	250	223	0%
FY07-08	250	223	0%	250	223	0%
FY08-09	250	223	0%	250	223	0%
FY09-10	250	223	0%	250	223	0%
FY10-11	250	223	0%	250	223	0%

Table 7-3: Comparison of SFPUC RWS Annual Water Supply Delivery Capability for Current Conditions (Base Case) and SFPUC Alternative at an Annual Demand of 175 MGD. Yellow highlights indicate that water provided to the RWS includes supply from of the Westside Basin conjunctive use groundwater project. Red highlights indicate that water supply rationing is implemented. The years in which rationing occurs also include use of the Westside Basin groundwater project.

SFPUC Fiscal Year	Base Case at 175 MGD Total Deliveries			SFPUC Alternative Total Deliveries		
	TAF/yr	MGD	Rationing (% of Total)	TAF/yr	MGD	Rationing (% of Total)
FY20-21	196	175	0%	196	175	0%
FY21-22	196	175	0%	196	175	0%
FY22-23	196	175	0%	196	175	0%
FY23-24	196	175	0%	196	175	0%
FY24-25	196	175	0%	196	175	0%
FY25-26	196	175	0%	196	175	0%
FY26-27	196	175	0%	196	175	0%
FY27-28	196	175	0%	196	175	0%
FY28-29	196	175	0%	196	175	0%
FY29-30	196	175	0%	196	175	0%
FY30-31	196	175	0%	196	175	0%
FY31-32	196	175	0%	196	175	0%
FY32-33	196	175	0%	196	175	0%
FY33-34	196	175	0%	196	175	0%
FY34-35	196	175	0%	196	175	0%
FY35-36	196	175	0%	196	175	0%
FY36-37	196	175	0%	196	175	0%
FY37-38	196	175	0%	196	175	0%
FY38-39	196	175	0%	196	175	0%
FY39-40	196	175	0%	196	175	0%
FY40-41	196	175	0%	196	175	0%
FY41-42	196	175	0%	196	175	0%
FY42-43	196	175	0%	196	175	0%
FY43-44	196	175	0%	196	175	0%
FY44-45	196	175	0%	196	175	0%
FY45-46	196	175	0%	196	175	0%
FY46-47	196	175	0%	196	175	0%
FY47-48	196	175	0%	196	175	0%
FY48-49	196	175	0%	196	175	0%
FY49-50	196	175	0%	196	175	0%
FY50-51	196	175	0%	196	175	0%
FY51-52	196	175	0%	196	175	0%
FY52-53	196	175	0%	196	175	0%
FY53-54	196	175	0%	196	175	0%
FY54-55	196	175	0%	196	175	0%
FY55-56	196	175	0%	196	175	0%
FY56-57	196	175	0%	196	175	0%
FY57-58	196	175	0%	196	175	0%
FY58-59	196	175	0%	196	175	0%
FY59-60	196	175	0%	196	175	0%
FY60-61	196	175	0%	196	175	0%
FY61-62	196	175	0%	196	175	0%
FY62-63	196	175	0%	196	175	0%
FY63-64	196	175	0%	196	175	0%
FY64-65	196	175	0%	196	175	0%
FY65-66	196	175	0%	196	175	0%
FY66-67	196	175	0%	196	175	0%
FY67-68	196	175	0%	196	175	0%
FY68-69	196	175	0%	196	175	0%
FY69-70	196	175	0%	196	175	0%
FY70-71	196	175	0%	196	175	0%
FY71-72	196	175	0%	196	175	0%
FY72-73	196	175	0%	196	175	0%
FY73-74	196	175	0%	196	175	0%
FY74-75	196	175	0%	196	175	0%
FY75-76	196	175	0%	196	175	0%
FY76-77	196	175	0%	196	175	0%
FY77-78	196	175	0%	196	175	0%
FY78-79	196	175	0%	196	175	0%
FY79-80	196	175	0%	196	175	0%
FY80-81	196	175	0%	196	175	0%
FY81-82	196	175	0%	196	175	0%
FY82-83	196	175	0%	196	175	0%
FY83-84	196	175	0%	196	175	0%
FY84-85	196	175	0%	196	175	0%
FY85-86	196	175	0%	196	175	0%
FY86-87	196	175	0%	196	175	0%
FY87-88	196	175	0%	196	175	0%
FY88-89	196	175	0%	196	175	0%
FY89-90	196	175	0%	196	175	0%
FY90-91	196	175	0%	196	175	0%
FY91-92	196	175	0%	196	175	0%
FY92-93	196	175	0%	196	175	0%
FY93-94	196	175	0%	196	175	0%
FY94-95	196	175	0%	196	175	0%
FY95-96	196	175	0%	196	175	0%
FY96-97	196	175	0%	196	175	0%
FY97-98	196	175	0%	196	175	0%
FY98-99	196	175	0%	196	175	0%
FY99-00	196	175	0%	196	175	0%
FY00-01	196	175	0%	196	175	0%
FY01-02	196	175	0%	196	175	0%
FY02-03	196	175	0%	196	175	0%
FY03-04	196	175	0%	196	175	0%
FY04-05	196	175	0%	196	175	0%
FY05-06	196	175	0%	196	175	0%
FY06-07	196	175	0%	196	175	0%
FY07-08	196	175	0%	196	175	0%
FY08-09	196	175	0%	196	175	0%
FY09-10	196	175	0%	196	175	0%
FY10-11	196	175	0%	196	175	0%

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