CITY AND COUNTY OF SAN FRANCISCO

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March 29, 2013

Via Electronic and U.S. Mail
Jeanine Townsend
Clerk to the Board
State Water Resources Control Board
P.O. Box 100
Sacramento, CA 95814-0100
commentletters@waterboards.ca.gov

> Re: Comment Letter – Bay Delta Plan SED

Dear Ms. Townsend:

I write on behalf of the City and County of San Francisco ("CCSF") and its Public Utilities Commission ("SFPUC")[1] to address the draft Substitute Environmental Document ("SED") prepared for the potential changes to the water quality control plan for the San Francisco Bay-Sacrament/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. Most relevant to the SFPUC are the draft SED Chapters 5 and 13, which attempt to analyze the environmental impacts of the proposed action on water supply and service providers, and Appendix H, which attempts to analyze the environmental impacts of replacement water supplies and infrastructure. Accordingly, this comment letter focuses on these portions of the draft SED. The SFPUC appreciates this opportunity to comment on the draft SED.[2]

As explained in more detail below, the draft SED fails to satisfy the California Environmental Quality Act's ("CEQA") mandate to analyze the whole of a project and to provide an accurate and stable project description, and therefore, it contains an inadequate environmental analysis in violation of CEQA. The project description and environmental setting are incomplete, inadequate and misleading because the draft SED improperly and inaccurately limits the scope of analysis of the Tuolumne River to the area below the Don Pedro Project[3], and excludes the SFPUC's upstream facilities and service area. In addition, the draft SED assumes, without supporting evidence, that the proposed action will not affect or modify the SFPUC's

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[1] The Public Utilities Commission is the department of the City and County of San Francisco responsible for managing and operating the City's water, clean water and power utilities.
[2] CCSF also made a presentation to the SWRCB on the adequacy of the SED at its March 21, 2013 public hearing. CCSF's PowerPoint is enclosed as Attachment A
[3] Although the name "New Don Pedro" is frequently applied to the project, FERC ordered the project name changed to "Don Pedro" in 1973.

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operations. These deficiencies preclude an adequate analysis of environmental impacts and compliance measures. In addition, the proposed program of implementation does not satisfy the requirements of the Water Code and does not allow analysis of the full scope of the environmental impacts of the proposed action.

Detailed Comments on Draft SED and Proposed Bay-Delta Plan Amendment

I.   The SFPUC's Water Infrastructure and Operations on the Tuolumne River

The SFPUC operates numerous water supply and hydroelectric facilities in the Tuolumne River watershed upstream of the Don Pedro Project, including O'Shaughnessy Dam and Hetch Hetchy Reservoir, Eleanor Dam and Lake Eleanor, Cherry Valley Dam and Lake Lloyd, and associated tunnels, pipes, powerhouses and smaller reservoirs ("the Hetch Hetchy Project"). Water in Hetch Hetchy Reservoir, Lake Eleanor, and Lake Lloyd is used to meet instream flow requirements, the Districts' water entitlements, and to provide hydropower for San Francisco's municipal load, the District's municipal and agricultural pumping loads, and for sale to public entities. Except in emergencies, Hetch Hetchy Reservoir is the only SFPUC Tuolumne River facility supplying water to the Regional Water System, providing on average 85% of deliveries to San Francisco and other Bay Area cities. The U.S. Environmental Protection Agency and the California Department of Health Services have approved the use of Hetch Hetchy Reservoir water without requiring filtration at a treatment plant. In the event emergencies necessitate water from Lake Eleanor or Lake Lloyd be diverted into the Regional Water System for delivery to the Bay Area, filtration of all water delivered from the Hetch Hetchy Project is required.

The SFPUC provides retail water delivery service within the CCSF and to the 26 member agencies of the Bay Area Water Supply and Conservation Agency ("BAWSCA"). The SFPUC Regional Water System serves residential, commercial, industrial and government customers in five counties –San Francisco, Alameda, San Mateo, Santa Clara, and Tuolumne. The SFPUC also has a water bank account in Don Pedro Reservoir under the Fourth Agreement, by and among the SFPUC, Modesto Irrigation District and Turlock Irrigation District (collectively, "the Districts").[4] The water bank account is a physical solution that allows the SFPUC to satisfy its water rights obligations to the Districts under the Raker Act and to other senior water rights holders.[5] The water bank account facilitates the SFPUC's deliveries from the Hetch Hetchy Project to approximately 2.6 million customers of the Regional Water System.

II.   Plan Area, Project Description and Environmental Setting

The draft SED does not include SFPUC's Hetch Hetchy Project facilities upstream of the Don Pedro Project and the SFPUC's service area in the "plan area" analyzed in the draft SED. Figure 1-2 shows the plan area, which excludes the areas on the Tuolumne above the Don Pedro Project. Figure 2.5 shows the service areas for several water districts that divert from the three

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[4] The Fourth Agreement is enclosed as Attachment B.

[5] Pursuant to the Fourth Agreement the SFPUC releases an additional 66 cubic-feet-per-second to satisfy the water rights of the Waterford Irrigation District, which was merged with Modesto Irrigation District in 1978.

eastside tributaries but excludes the SFPUC's service areas in Tuolumne County and the Bay Area.

A. Failure to Consider the Full Environmental Setting

CEQA requires a description of the environmental setting, which is normally the baseline physical conditions by which a lead agency determines whether an impact is significant. (14 CCR § 15125(a).) "Knowledge of the regional setting is critical to an assessment of environmental impacts," and the draft SED "must permit the significant effects of the project to be considered in the full environmental context." (14 CCR § 15125(c).) Here, the draft SED failed to consider the full environmental context because it did not describe the upstream facilities of the SFPUC in adequate detail and excluded the SFPUC's service area from consideration. For example, the description of the environmental setting for water supply conditions, surface hydrology conditions, and water quality conditions in Chapter 5 ignores the upper Tuolumne River upstream of the Don Pedro Project, other than a cursory reference. This description mentions the SFPUC's upstream diversions but focuses on the operation of the Don Pedro Project and other facilities downstream. (Draft SED, at p. 5-22.) In addition, the draft SED excludes the SFPUC's service area from the description of the environmental setting for water supply in Chapter 5 and the environmental setting for service providers in Chapter 13; however, the environmental setting discussion does include the Central Valley Project ("CVP") and State Water Project ("SWP") exports and export service areas. (Draft SED, at pp. 5-22 – 5-26, 13-1.)

B. Inconsistent and Confusing Project Description

The project description should be accurate and consistent throughout the environmental document. In fact, "[a]n accurate, stable and finite project description is the *sine qua non* of an informative and legally sufficient EIR." (*County of Inyo v. City of Los Angeles* (1977) 71 Cal.App.3d 185, 193.) An inconsistent project description confuses the public and commenting agencies, drawing "a red herring across the path of public input." (*Id.* at 197-198.) The draft SED contains a confusing project description because it acknowledges that there are water diversions and facilities upstream of the rim dams, which may affect flows draining to the reservoirs of the rim dams, while at the same time disclaiming that the proposed action will affect those diversions.

The draft SED concludes that the amendments to the Bay-Delta Plan "could directly affect portions of the SJR Basin and Delta that drain into, divert from, or otherwise obtain beneficial use (e.g. surface water supplies) from the following water bodies", including the "Tuolumne River from and including New Don Pedro Reservoir to the confluence of the LSJR." (Draft SED, at p. 1-2.) Furthermore, Chapter 2 provides a brief description of the SFPUC's facilities on the Tuolumne River although they are outside the plan area because the upper Tuolumne River "is drained by the Tuolumne River." (Draft SED p. 2-16.) "Obviously, meeting [a flow] objective may be achieved, among other ways, by reducing the amount of water that upstream water right holders divert from the watercourse or by increasing the amount of water released into the watercourse." (*State Water Resources Control Board Cases* (2006) 136

Cal.App.4th 674, 701-702.) Despite this obvious logic, the draft SED concludes without substantial evidence, and contrary to its own conclusions elsewhere, that diverters upstream of Don Pedro Reservoir will not be affected by the revised flow objectives. This is an incorrect assumption and leads to a flawed environmental impact analysis.

C. Incorrect Assumptions About the Project Description

An incorrect assumption about the project description can lead to failure to recognize and analyze potentially significant impacts and to adopt mitigation measures to address them. Downplaying the effects of a changed policy or failing to consider the ultimate consequences that the policy would have on the physical environment is a violation of CEQA's requirement to analyze the whole project and to provide an analysis of the effects of the project at the earliest possible stage in the planning process. (*City of Redlands v. County of San Bernardino* (2002) 96 Cal.App.4th 398, 410.)

The draft SED contains several incorrect assumptions about the project description which result in disregarding or downplaying the effect that the proposed revised SJR flow objectives will have on the physical environment. For example:

- The draft SED characterizes CCSF as a contracting water district with the Districts as the primary water rights holders and surface water diverters. (Draft SED, at p. 13-5.) This is an inaccurate characterization. CCSF holds its own water rights to the Tuolumne River and does not receive water under contract with the Districts. The Raker Act requires CCSF to recognize the prior rights of the Districts and the Fourth Agreement simply established an accounting procedure to implement the Districts' water entitlements. The Districts hold all rights to divert and store water at the Don Pedro Project. San Francisco has neither the means nor the right to divert water into the Hetch Hetchy Project from Don Pedro Reservoir.

- The draft SED describes CCSF's storage allocation under the Fourth Agreement as a "740-TAF water right", although it is not a water right but rather a water bank account in Don Pedro Reservoir that allows CCSF to satisfy the Districts' entitlement to daily natural flow. (See Fourth Agreement, Article 7, 7(a).) In addition, the statement that SFPUC has a right to store or a water bank credit for 740 thousand acre-feet-per-year in Don Pedro Reservoir in incorrect. The SFPUC has the right to a maximum water bank credit of 570 TAF at any time, and has the right to an additional credit in the water bank of up to 170 TAF when and only when storage in Don Pedro Reservoir physically encroaches into space reserved for flood control. (See Fourth Agreement, Article 5.) The United States Army Corps of Engineers flood control manual requires the Districts to maintain 340 TAF of flood control space in the Don Pedro Project from October 7th to April 27th of the following year, unless additional space and time are indicated by snowmelt parameters. The SFPUC does not include the 170 TAF in its operational planning for the Regional Water System because the additional credit occurs infrequently, is intermittent, and cannot be carried past October 6th.

- The draft SED states: "The 740-TAF water right is senior to TID and MID water rights." (Draft SED, at p. 13-5.) This is incorrect; the Districts have senior water rights to natural flows in the Tuolumne River, which the draft SED recognizes elsewhere, and possess rights to all water stored in Don Pedro Reservoir. (See Draft SED, at p. 5-22; Fourth Agreement, Article 7(g).) In any water rights proceeding to implement this water quality objective, the rule of priority, any applicable exceptions to that rule, and the obligations between the parties established by statute and agreement will be taken into account, and the draft SED should not draw conclusions in its current analysis about how water rights issues will be addressed between the SFPUC and the Districts. (*El Dorado Irr. Dist. V. State Water Resources Control Bd.* (2006) 142 Cal.App.4th 937, 944.)

- The draft SED calculates that CCSF's share of water rights under the Fourth Agreement's Water Bank Account is usually greater than the aqueduct diversions, and on this basis concludes that it will not be impacted by the revised flow objectives. (Draft SED, at pp. 5-88, 5-89, 5-90.) Even if the draft SED's calculations and estimates were correct, whether or not CCSF will be affected by the revised flow objectives depends on a variety of complex and interdependent factors and not simply a comparison between the limits of the water bank account and the SFPUC's most recent diversion volumes. [6]

III.   Flawed Environmental Impacts Analysis

An inadequate description of the environmental setting precludes the proper analysis of project impacts. (*Galante Vineyards v. Monterey Peninsula Water Management Dist.* (1997) 60 Cal.App.4th 1109, 1121-1122.) "[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.) Because the project description incorrectly assumes that the SFPUC's operations will not be affected or modified, the draft SED fails to consider the impacts of reduced water supply on the SFPUC, its customers and contracting agencies, the resulting economic impacts on the Bay Area, and the environmental impacts of replacement water supply and infrastructure.

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[6] "The average calculated water rights for CCSF were about 750 TAF/y, about 40 percent of the Tuolumne River unimpaired flow of 1,853 TAF/y for the 1922–2003 period (Environmental Defense 2004). This is higher than the average aqueduct diversion of about 290 TAF/y, so much of this water is stored in Don Pedro and eventually transferred or spilled during flood-control releases. The current CCSF demand for water is about 290 TAF. (Environmental Defense 2004). This CCSF diversion is therefore about 15 percent of the average unimpaired flow." (p. 5-22).

This cursory analysis is unfounded and confusing in no small part because using simple averages misrepresents the situation where the SFPUC gets little or no water in extended droughts. During extended droughts the Regional Water System demand remains the same, but water availability can be far less than demand. As noted during the hearing, the SFPUC is heavily dependent on storage. If CCSF has a share of responsibility for the proposed action, and the Regional Water System already experiences shortages in deliveries, then an additional downstream demand can only exacerbate such shortages.

A. Unsupported Conclusion that the SFPUC's Operations Will Not Be Affected
    or Modified

The conclusion that the water supply, operations and water infrastructure of CCSF will
not be affected by the proposed flow objectives is not supported by substantial evidence, and
thus violates Public Resources Code section 21168.5. "[A]rgument, speculation, unsubstantiated
opinion or narrative, evidence that is clearly inaccurate or erroneous" is not considered
substantial evidence. (Pub. Res. Code §21080(e)(1).) The draft SED offers only conclusory and
unsupported statements and inaccurate assumptions to support its conclusion that the SFPUC's
water operations will not be affected by the proposed action.

The draft SED estimates that the upstream "CCSF diversion is… about 15 percent of the
average unimpaired flow," and that "[i]n some dry years, very little of the Tuolumne's
unimpaired flow belongs to CCSF, and CCSF would have to withdraw from its water bank to
meet the Raker Act entitlements." (Draft SED, at p. 5-22.) Nonetheless, the draft SED concludes
that CCSF's water supply operations will not be affected by the proposed flow objectives even
though the preferred alternative will require 35 percent of unimpaired flow to remain in the
stream and affect the Tuolumne River by a water supply change of close to 20 percent from
baseline. (Draft SED, at pp. 5-22, 5-85.)

Furthermore, the draft SED recognizes that, in the event revised water release
requirements in a FERC license for the Don Pedro Project adversely affect the Districts' water
rights, the Fourth Agreement provides that there will be a re-allocation of storage credits so as to
apportion such burdens on the following basis: 51.7121% to CCSF and 48.2879% to the
Districts. (Draft SED, at p. 5-54.) The draft SED also concludes that "[s]ome portion of the
increased release flows from New Don Pedro Reservoir could be shared by CCSF" and that
"[t]he water accounting for New Don Pedro Reservoir would likely be modified by the LSJR
alternatives." (Draft SED, at pp. 5-56, 5-88.) Contrary to its other conclusions and unsupported
by substantial evidence, however, the draft SED inexplicably concludes that "the upstream CCSF
operations (storage, hydropower, and water diversion) are expected to be unchanged" and that
changing the bank account "would not likely interfere with the CCSF diversions." (Draft SED,
at pp. 5-56, 5-88, 5-89, 5-90.)

SFPUC's analysis of the proposed action 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 re-
allocation of water bank credits so as to apportion an additional burden on CCSF of 51.7121%.[7]
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 AF for each of the six years of
the drought. This additional annual reduction in supply – when added to reductions in deliveries

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[7] In presenting potential water supply and socioeconomic effects from certain interpretations of the Raker Act and
the Fourth Agreement San Francisco does not thereby waive arguments it may have about how the Raker Act or
Fourth Agreement should or will be interpreted in future proceedings before the SWRCB or other bodies.

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%. (Attachment C, CCSF Exposure to SWRCB 35 Percent February-June Flow Requirement by Daniel B. Steiner, Consulting Engineer.)

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.[8] The area served by the SFPUC Regional Water System is one of the largest centers of employment and economic activity in the United States. There are over 1.6 million jobs located in the service area. Firms located in the service area produce over $280 billion in goods and services each year.

The impacts of such levels of rationing on the Bay Area economy are staggering. The Bay Area would experience job losses of 139,146 from Regional Water System water delivery reductions of 41%, and 188,000 from reductions of 51%. The lost sales associated with 41% and 51% rationing are $37 and $49 billion respectively. Further, with respect to lost consumer and producer surplus, the potential rationing would result in significant impacts of $324 million in the 41% rationing scenario and $471 million annually in the 51% rationing scenario. It should be noted that the SFPUC already includes rationing of up to 20% as a policy and practice in its water supply strategy to address shortages during droughts. (Attachment D, Answering Testimony of David L. Sunding on Behalf of San Francisco Public Utilities Commission Before the Federal Energy Regulatory Commission (Don Pedro Project P-2299, September 2009, and attachments thereto.)

The draft SED similarly concludes that that CCSF is not expected to need to construct or expand new water treatment facilities or water supply infrastructure, which is not supported by any, let alone substantial, evidence. (Draft SED, at p. 13-33 – 13-34.) The draft SED assumptions outlined above are flawed, not supported by substantial evidence, and conflict with other conclusions in the draft SED. The draft SED must analyze the feasibility and cost of developing 111,700 AF in drought water supply to replace existing supplies for the Regional Water System, and must account for the environmental impacts associated with developing such supplies.[9]

It is misleading for the draft SED to equate CCSF's estimated average annual water deliveries to the maximum available water account in Don Pedro Reservoir or to the average amount of water available to CCSF. Reaching conclusions using such a comparison reveals a lack of understanding of the operations of the SFPUC and the allocation and use of water among Tuolumne River interests. The SFPUC's actual operations and water bank accounting is done on a daily basis, depending on the amount of daily natural flow in the Tuolumne River, whereas

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[8] The levels of rationing were the result of a joint NMFS, USFWS and CDFG proposal presented to FERC for potential interim flow requirements for the Don Pedro Project. (INCLUDE CITE TO FERC LIBRARY)

[9] For an analysis of the feasibility and impacts associated with various alternatives for developing 25,000 AFY in new supplies for Regional Water System customers see Chapter 9 CEQA Alternatives and Chapter 13 pages 13-22 to 13-26 Water Supply Options in the *Program Environmental Impact Report for the Water System Improvement Program, October 30, 2008* (available at http://www.sf-planning.org/index.aspx?page=1829)

service area demands occur differently during different times of year. (See Raker Act, Sect. 8(c); Fourth Agreement, Article 7(a).)

Finally, the SED is flawed in assuming water bank accounting will be changed or modified by the SFPUC and the Districts if the SWRCB adopts the proposed action. (pp. 5-88, 5-89, 5-90, and 5-56) The Fourth Agreement provides that CCSF shall not be entitled to have a debit balance in its Water Bank Account without prior approval of the Districts and that the Districts own and has exclusive control of the withdrawal and release of the water in Don Pedro Reservoir. (Fourth Agreement, Article 7(e), (g).) Therefore, the SFPUC does not have complete control over its water bank account – and certainly not the unilateral right to modify the Fourth Agreement – and further cannot unilaterally adjust the operation of the Don Pedro Reservoir to satisfy any release obligations resulting from the flow objectives or to avoid adverse impacts to its ability to meet Regional Water System service area demand.

B.   Failure to Analyze Reasonably Foreseeable Consequences

Project descriptions and related impact assessments should account for the reasonably foreseeable consequences of proposed projects. (*Laurel Heights Improvement Assn v. Regents of Univ. of Cal.* (1988) 47 Cal.3d 376, 396.) Future effects of a project must be included in the environmental analysis required by CEQA when they are a reasonably foreseeable consequence of the initial project and they will likely change the scope or nature of the initial project or its environmental effects. (*Id.* at 395; See also *Santiago County Water Dist. v. County of Orange* (1981) 118 Cal.App.3d 818, 829; *San Joaquin Raptor/Wildlife Rescue Center v. County of Stanislaus* (1994) 27 Cal. App. 4th 713, 734 (holding that the failure to consider the expansion of the wastewater treatment plant as part of the project under consideration resulted in an inaccurate project description and incomplete identification and analysis of the environmental effects of the development project).)

The draft SED is flawed because it fails to analyze the reasonably foreseeable consequences to CCSF from the proposed revised SJR flow objectives. As described above, the draft SED concludes that the water accounting between the Districts and the SFPUC will likely change as a result of the revised flow objectives and that CCSF will share some portion of the increased release flows from Don Pedro Reservoir. Therefore, it is reasonably foreseeable that water supply from the Tuolumne River which is available to the SFPUC to divert and deliver to its service area will be reduced. In fact, the draft SED concludes that under Alternative 3, 40% unimpaired flow contribution from each tributary, surface water diversions on the Tuolumne River would be reduced and could result in the construction of new or expanded water supply infrastructure, the construction of which could result in significant environmental impacts, and that this impact is significant and unavoidable. (Draft SED, at p. 13-2.) However, the draft SED did not analyze any impacts of the SFPUC's having to construct replacement water supplies or infrastructure because of the flawed assumptions and inadequate project description discussed above. (Draft SED, at pp. 13-33 – 13-34.)

In addition, the draft SED analyzed whether the flow objective alternatives would result in substantial changes to San Joaquin inflows to the Delta such that decreased water supplies

would be available to service providers relying on CVP/SWP exports. The draft SED concludes
that impacts would be less than significant because under alternatives 3 and 4, flows would
increase and that under alternative 2, there would be only a slight decrease in flow from the
Stanislaus River. (Draft SED, at p. 13-38.) It 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. As
stated above, the SFPUC Regional Water System serves residential, commercial, industrial and
governmental customers across four counties in the Bay Area – San Francisco, Alameda, San
Mateo and Santa Clara. The draft SED's failure to analyze reasonably foreseeable potential
impacts to the SFPUC and the BAWSCA member agencies and their service areas is due to an
inaccurate project description and results in an incomplete identification and analysis of the
environmental effects of the project. This failure extends to cumulative impacts as well, as the
draft SED's analysis of cumulative impacts fails to include projects within the geographic scope
or otherwise related to the SFPUC and contracting service providers. (See Draft SED, at pp. 13-
44 – 13-46.) This failure extends to the draft SED's economic analysis in Chapter 18, which
does not analyze the economic impacts to the SFPUC's hydropower operations or to the
economy of the San Francisco Bay Area from potential future water shortages or costs associated
with developing replacement water supplies, and instead focuses on the regional effects from
changes to agricultural production and hydropower generation of other facilities. (See Draft
SED, at pp. 18-10, 18-20.)

        Although the draft SED evaluated the anticipated methods of compliance, including the
anticipated replacement facilities that may be needed by service providers, in Appendix H, it did
not analyze several unique factors about the SFPUC because it assumed that the SFPUC would
not need to implement any of the methods of compliance. For example, water diverted by the
SFPUC from the Tuolumne River is provided to the SFPUC retail agency as well as 26 member
agencies spanning four counties and 2.6 million urban water customers. In addition, water
agencies in the Bay Area already have implemented many effective water conservation programs
and the feasibility of additional water conservation programs in the event of future water
shortages is uncertain.[10] The SFPUC and the member agencies of BAWSCA, SFPUC's
wholesale customers, have committed significant resources to developing alternative water
supplies to meet current water supply shortfalls and future anticipated demands. These projects
produce minimal yields (varying from 1,000 AFY to 4,000 AFY on average) and would not
produce nearly enough supply to address a 111,700 AFY drought year deficiency that could
result from the State Board's proposal.

IV.   Implementation Plan

        The proposed program of implementation described in Appendix K would require 35
percent of unimpaired flow from February to June from each of the Merced, Tuolumne and
Stanislaus Rivers on a 14-day running average, unless otherwise modified by the State Water

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[10] CCSF's 85.5 average gross per capita daily water usage ("gpcd") and its wholesale customers' 130.4 gpcd in 2010
were below the statewide average of 160.2 gpcd, and well below the City of Sacramento's average of 207 gpcd.

Board through the adaptive management framework, and base flows of 1,000 cfs on a 14-day running average at Vernalis during the February through June period. (Appendix K, p. 3.) However, the "specific measures to achieve, monitor, and evaluate compliance with the percent unimpaired February through June flow requirements" are not included in the program of implementation; rather, an Implementation Workgroup will develop recommendations to be included in an Implementation Plan to be submitted to the Executive Director of the State Water Board for approval within 180 days of the Office of Administrative Law's approval of this amendment to the Bay-Delta Plan. (Appendix K, p. 4.) Furthermore, that Implementation Plan "will then be considered in State Water Board water right proceedings, FERC licensing proceedings, or other implementation actions to achieve the February through June flows." (Appendix K, p.4.)

The program of implementation does not meet the Water Code's requirements for the contents of such a program, which should include a description of the actions which are necessary to achieve the objectives, including recommendations for appropriate action by any entity, a time schedule for the actions to be taken, and a description of surveillance to determine compliance with the objectives. (Water Code § 13242.) The proposed program of implementation does not identify necessary actions or particular entities to take action because the development of the Implementation Plan has been deferred. Delaying the development of specific measures until after the completion of CEQA review is an impermissible failure to analyze the whole project under CEQA and results in "piecemealing" the project by separating out a future phase of the project and allowing it to be adopted without any environmental review at a later date. (*Rural Land Owners Assn v. Lodi City Council* (1983) 143 Cal.App.3d 1013, 1025; *Laurel Heights Improvement Assn v. Regents of Univ. of Cal.* (1988) 47 Cal.3d 376, 396.)

Conclusion

The SFPUC pledges to work cooperatively with State Water Board staff and other stakeholders to develop a more defensible SED and program of implementation. The SFPUC urges the State Water Board to ensure that the public and other agencies are fully informed regarding the potentially far reaching impacts of these proposed flow objectives on the water supply of the Regional Water System and the Bay Area economy. The SFPUC appreciates this opportunity to comment and thanks the State Water Board staff for their efforts.

Very truly yours,

DENNIS J. HERRERA
City Attorney

signed in original

Donn W. Furman
Deputy City Attorney

plus: encls.

City and County of San Francisco Comments on the State Water Resources Control Board 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

March 21, 2013
Ellen Levin, Deputy Manager, Water Enterprise
Donn Furman, Deputy City Attorney, San Francisco
Dan Steiner, Consultant
David Sunding, Consultant

SFPUC Water System

- ## SFPUC owns and operates a regional water system (RWS)

  - Serves 2.6 million people in San Francisco, San Mateo, Alameda Santa Clara and Tuolumne Counties

  - The system currently delivers an annual average of 238 mgd

  - 85% is from the Tuolumne River through Hetch Hetchy reservoir

  - 15% is from the combined Alameda and Peninsula watersheds through five reservoirs: Calaveras, San Antonio, Crystal Springs, San Andreas and Pilarcitos

  - During drought Hetch Hetchy can provide up to 93% of total water delivered

  - The Hetch Hetchy system also generates peaking capacity of ~400 MW of hydroelectric power

SFPUC Water System

- The RWS is operated under a water first policy
  - Codified in Water Code section 73504(b); the San Francisco Charter; and the SFPUC's Water Supply Agreement with its wholesale customers

- The SFPUC level of service goals:
  - Require no greater than 20% rationing in any one year of a drought
  - Improve use of new water sources and drought management including use of groundwater, recycled water, conservation and transfers

- The Water Supply Agreement contains a Water Shortage Allocation Plan for shortages up to 20%
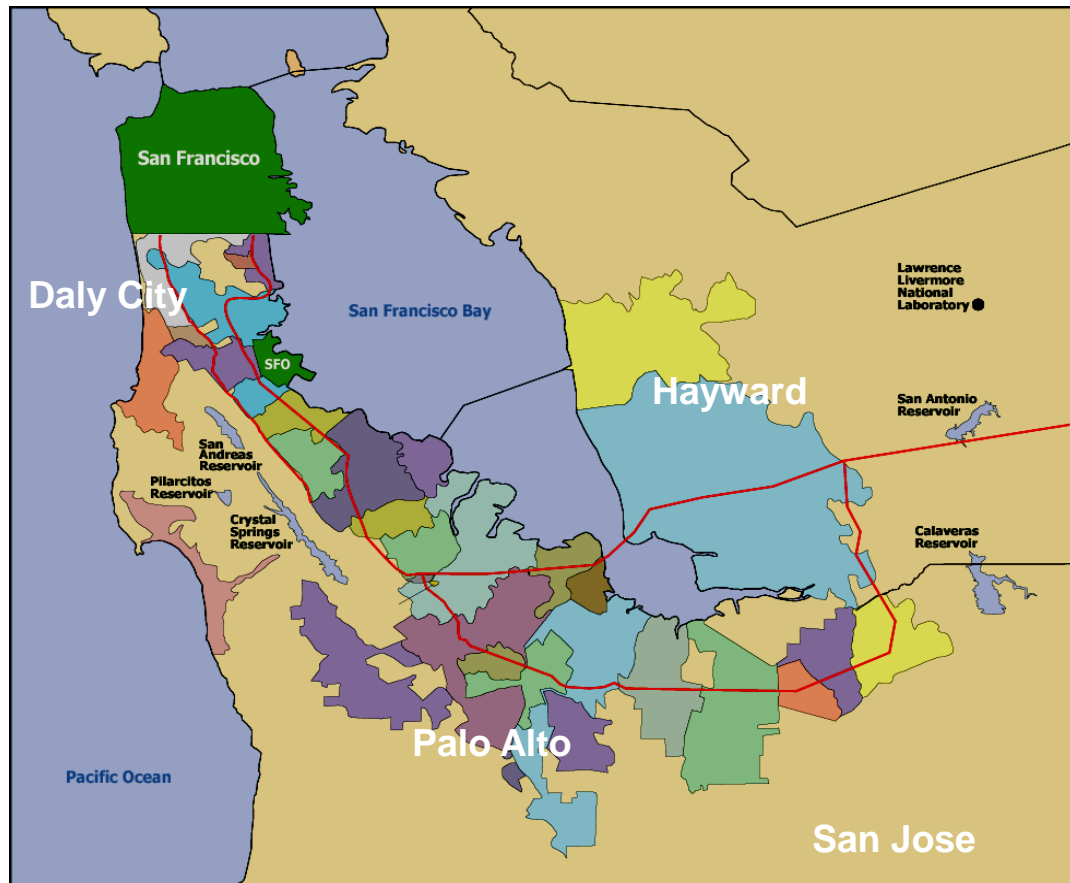
SFPUC Service Area Demands

- ## San Francisco Retail Demand – FY 2010-11 demand 78 mgd
  - 96% from SFPUC Regional Water System supplies
  - 4% from groundwater

- ## Wholesale Customer Service Area – FY 2010-11 demand 220.91 mgd
  - 64% from SFPUC Regional Water System supplies
  - 12.8% from groundwater
  - 3% from recycled water
  - 3.4% from surface water
  - 15.9% from other sources (State Water Project, Santa Clara Valley Water District)

FY 2009/10 Gross Per Capita Use

SFPUC – Retail — 85.5 gpcd

SFPUC – Wholesale Customers (weighted average) — 130.4 gpcd

Statewide (weighted average) — 160.2 gpcd

City of Sacramento — 207 gpcd
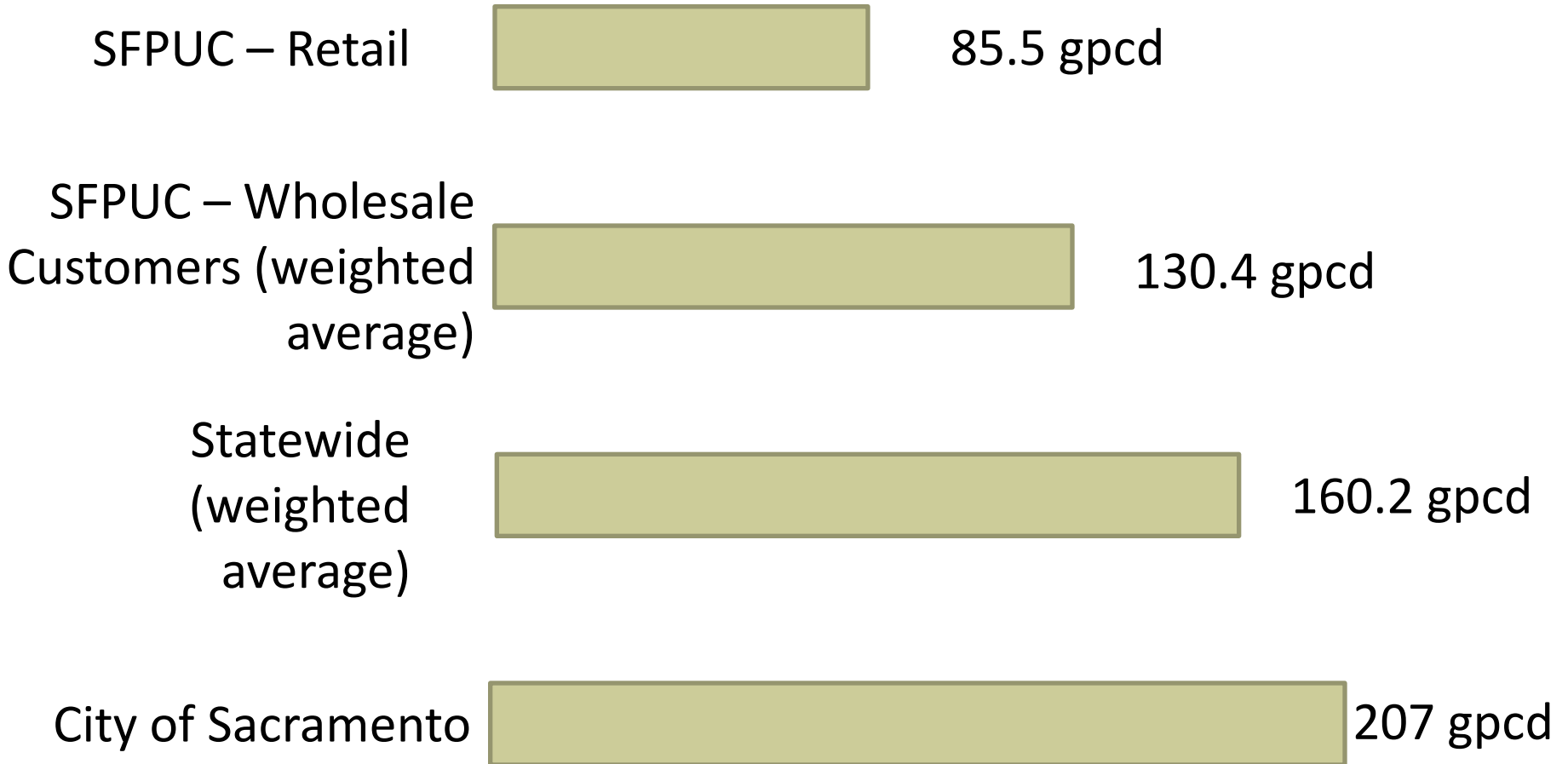
Current SFPUC per capita use is low compared to peers
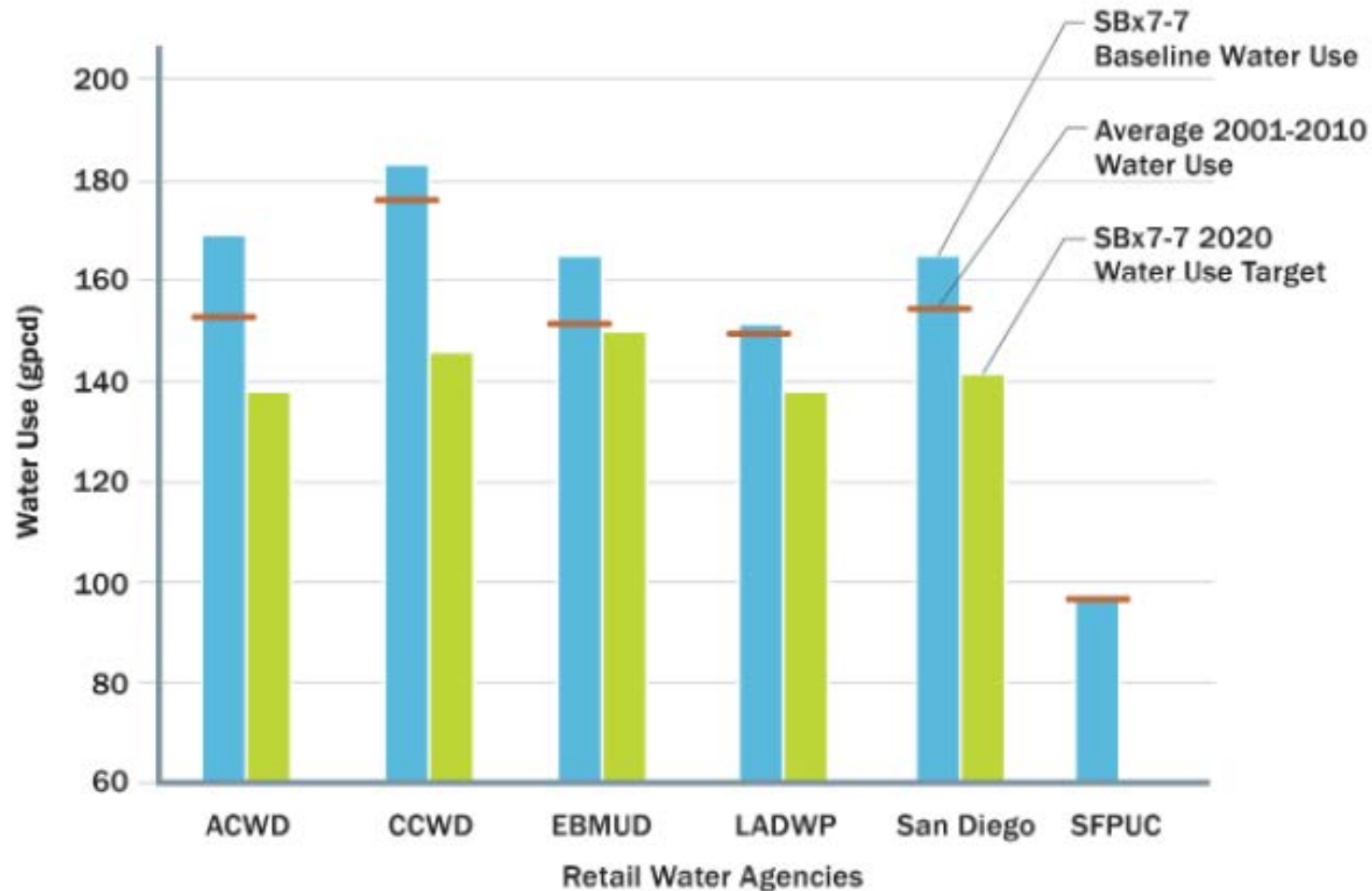
Source of figure: CUWA Water Supply Reliability Report; Data from 2010 UWMPs

Water Supply Shortfalls: Drought and Future Demand

- Drought
  - Water Shortage Allocation Plan allocates water between the Retail and Wholesale customers up to 20% shortage on the RWS
  - Wholesale customers have an allocation agreement amongst themselves
  - Certain wholesale customers experience 40% shortage with a 20% shortage on the RWS
  - Requires SFPUC and its wholesale customers to develop water supplies to meet these shortages

- Future Demand
  - Retail and Wholesale customers will have demand growth
  - Requires the development of water supplies to meet future demand

Alternative Water Supply Development to Meet Current and Future Demand

- ## SFPUC Projects:
  - Recycled water projects
  - Other non-potable supply development in San Francisco including graywater reuse, rainwater harvesting, stormwater capture, and foundation drainage use
  - Groundwater development in San Francisco
  - Water conservation programs
  - Conjunctive use project to meet dry-year needs
  - Regional desalination
  - Water transfers

Alternative Water Supply Development to Meet Current and Future Demand

- ## Wholesale Customer Service Area Projects:
  - Recycled water projects
  - Groundwater projects
  - Local capture and reuse including rainwater harvesting, stormwater capture and graywater reuse
  - Conservation programs
  - Desalination projects including coastal projects, Bay water projects and brackish groundwater desalination
  - Water transfers

Raker Act and Fourth Agreement

Hetch Hetchy Project Release Requirements for Downstream Water Rights

- Raker Act requires San Francisco to release water to meet prior water rights of MID and TID whenever such water can be beneficially used by the Districts

- San Francisco releases an additional 66 cfs to satisfy other prior downstream water rights that are now included in the Districts' water entitlements

- Districts' entitlement to their portion of natural daily flow under the Raker Act and the Fourth Agreement is measured at La Grange Dam

- Hetch Hetchy Project Release requirement is:
  - **2416 cfs or natural flow, whichever is less; or**
  - **4066 cfs or natural flow, whichever is less, for 60 days from April 15 to June 13**

Daily Allocation of Tuolumne River Runoff
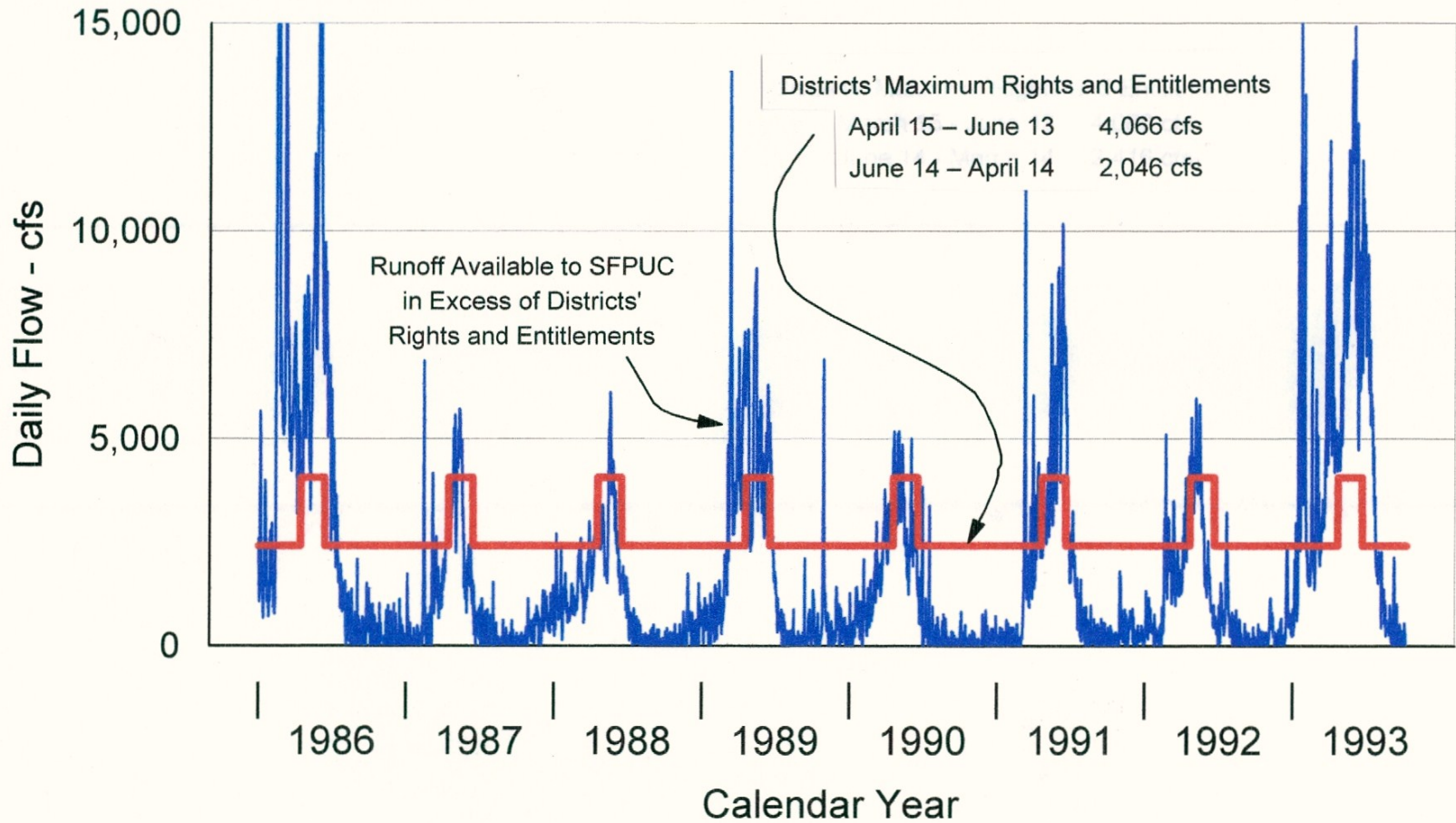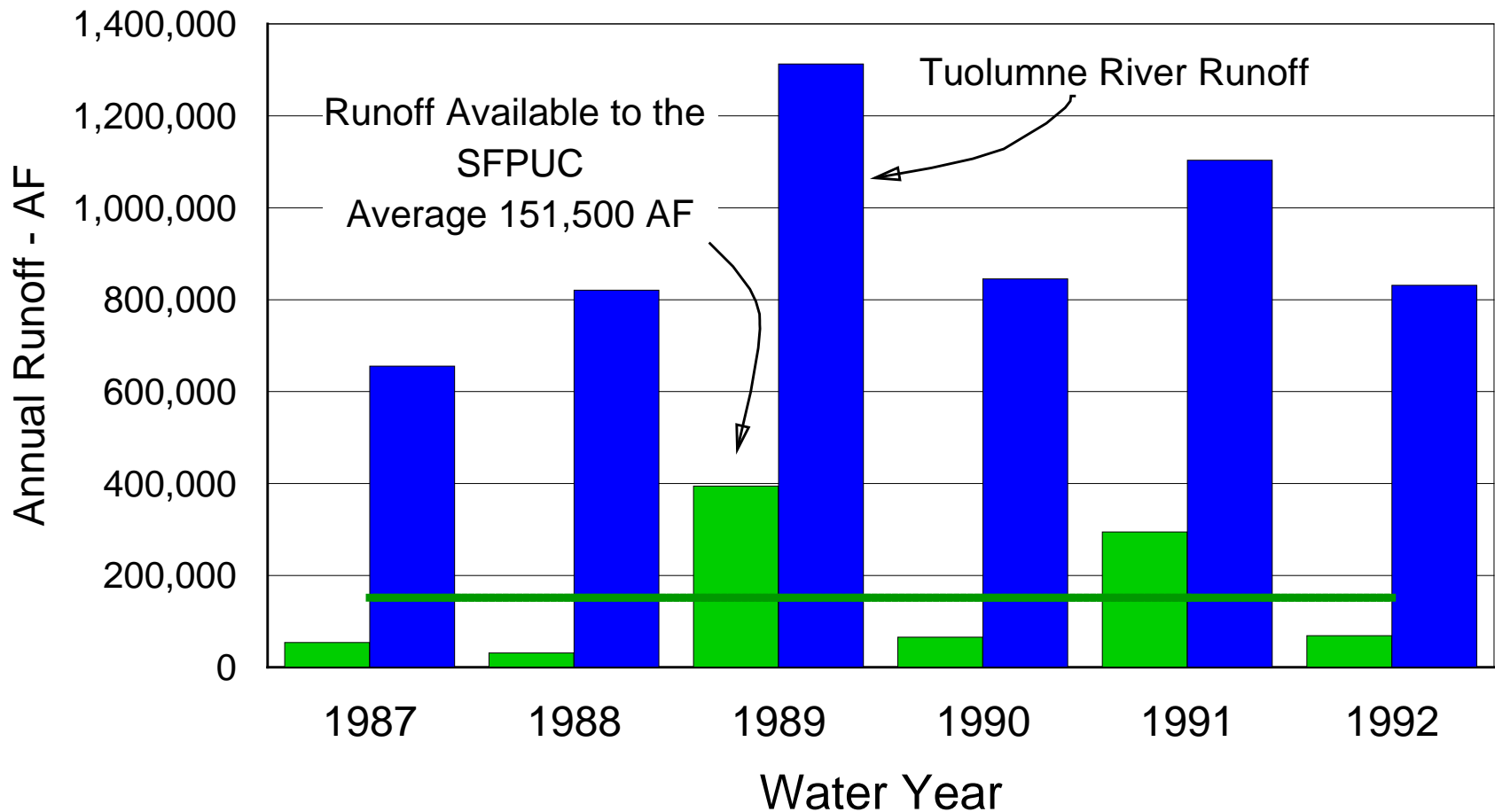
Don Pedro Project

- San Francisco paid over half the construction cost for the Don Pedro Project

- Agreements between Modesto Irrigation District , Turlock Irrigation District, and San Francisco set the parties' rights and obligations for Don Pedro Project

- The Districts own and exercise exclusive control and use of all water released by San Francisco into Don Pedro Reservoir

- The Districts hold all water rights at Don Pedro Reservoir

- San Francisco holds no water rights at Don Pedro Reservoir

Don Pedro Water Bank

- Through the Fourth Agreement the parties established a Don Pedro water bank account into which San Francisco may "pre-release" water to meet the Districts' water entitlements

- The water bank allows San Francisco to deliver water to its customers at a time when it might otherwise have to release water to meet the Districts' water entitlements

- San Francisco may have a maximum water bank credit of up to 570 TAF at any time

- San Francisco has a right to an additional credit of 170 TAF, but only if and when Don Pedro Reservoir may encroach into flood storage

  - Infrequent, intermittent, and cannot be carried past October 6

- San Francisco may not have a negative water bank balance without Districts' prior consent

Fourth Agreement Reservation Clause for Future FERC-ordered Fish Flow Requirements

- ***Article 8:*** The Districts and City recognize that Districts, as licensees under the [FERC] license for the New Don Pedro project, have certain responsibilities regarding the water release conditions contained in said license, and that such responsibilities may be changed pursuant to further proceedings before the [FERC]. As to these responsibilities, as they exist under the terms of the proposed license or as they may be changed pursuant to further proceedings before the [FERC], Districts and City agree:

- … (b) **That 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 [FERC] license requirements, and that the [FERC] 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.**

- "San Francisco has the right to store 740 AFY in New Don Pedro Reservoir." (p. 2-17)

- "Some portion of the increased release flows from New Don Pedro Reservoir could be shared by CCSF. This may require changing the water bank account but would not likely interfere with the CCSF diversions because its share of water rights is usually greater than the aqueduct diversions." (pp. 5-88, 5-89, 5-90)

- "The water accounting for New Don Pedro Reservoir would likely be modified by the Lower San Joaquin River alternatives, but the upstream CCSF operations (storage, hydropower, and water diversion) are expected to be unchanged." (p. 5-56)

The SED Is Inadequate

- The SED mischaracterizes and misstates how the Don Pedro Water Bank Account works

- The SED assumes that Don Pedro Water Bank accounting under the Fourth Agreement will need to be modified in order to implement the Lower San Joaquin River flow objectives, but fails to analyze the effects that reduced Hetch Hetchy Project water supplies will have in the San Francisco Bay Area except in a cursory fashion

- ***In presenting potential water supply and socioeconomic effects from certain interpretations of the Raker Act and the Fourth Agreement San Francisco does not thereby waive arguments it may have about how the Raker Act or Fourth Agreement should or will be interpreted in future proceedings.***

Water Supply Impacts

CCSF Water Supply Planning and Water Delivery Reliability

- Adopted levels of service

- Drought Planning Sequence

- Forecasting and operating procedures to provide assurance water deliveries could be sustained during drought

CCSF Water Supply

- Consists of runoff from its watersheds and other resources, reservoir storage is important

- CCSF supply from the Tuolumne River is limited by the Raker Act and Fourth Agreement

- The amount of runoff and storage available during drought is limited and is less than full delivery demands and storage objectives

Projected CCSF Water Delivery Shortages with Current Demands

- Procedures establish the level of shortages needed to balance supplies with deliveries over the entire multi-year drought planning sequence

- There is no water left in the CCSF system at the end of the drought planning sequence

- At current demand, the recurrence of the 1987-1992 (6-year) drought leads to requiring 10 percent shortages in year 2, and for each year thereafter

Projected CCSF Water Delivery Shortages with SED 35% Flow Requirement

- The SED preferred alternative is assumed to be a flow requirement defined below La Grange Dam equal to the greater of existing FERC flow requirements or 35 percent of the Tuolumne River unimpaired flow during February through June

- The total incremental required release (above existing FERC requirements) below La Grange Dam is approximately 216,000 acre-feet per year which is the average over the Year 1 (1986) through Year 6 (1992) period

- The CCSF system is assumed to provide the Districts with approximately 52% of the incremental required release, 111,700 acre-feet per year

- CCSF distributes the incremental shortages across the entire Year 1 through Year 6 period at a constant rate

Required Lower Tuolumne River Flow

CCSF Water Deliveries and Shortages						
Projected Year	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Existing System Demand (MGD)	238	238	238	238	238	238
Existing System Shortage %	0	10	10	10	10	10
Existing System Delivery (MGD)	238	214	214	214	214	214
Existing System Delivery (Acre-feet/year)	266,600	239,700	239,700	239,700	239,700	239,700
Additional Reduction (Acre-feet)	111,700	111,700	111,700	111,700	111,700	111,700
Remaining Delivery (Acre-feet)	154,900	128,000	128,000	128,000	128,000	128,000
Remaining Delivery (MGD)	138	114	114	114	114	114
Remaining Delivery compared to Existing Demand (%)	58	48	48	48	48	48
Shortage after Additional Release (%)	42	52	52	52	52	52
System reaction to annual reductions in water supply assumes the 6 years of annual impact are averaged over the entire 6 year period (111,700 acre-feet/year), and that deliveries will be reduced each year by the average annual impact.						

52% of the difference between current FERC required flows and SED 35% flows

Socioeconomic Impacts of Rationing on the SFPUC Service Area

SFPUC's role as a provider of water

- The SFPUC Regional Water System provides retail water delivery to San Francisco and wholesale delivery to Alameda, San Mateo and Santa Clara Counties

  CCSF:
  - 147,000 residential accounts
  - 21,600   non-residential accounts

  27 wholesale agencies:
  - 1.7 million people
  - Over 30,000 C&I accounts

- Composition of demand on SFPUC supply:

  60% residential   7% industrial

  19% commercial   14% government and other

Importance to the Bay Area Economy

- SFPUC RWS is one of the largest centers of employment & economic activity in the U.S.

- Service area accounts for firms with:
  - Over 1.6 million jobs
  - Over $280 billion in goods and services

- Due to the Bay Area's semi-arid climate, economic activity is dependent on imported water

Evaluation of Socio-economic Impacts

- **Consumer surplus:** Difference between what a consumer is willing to pay and what is actually paid

- **Producer surplus:** Revenues in excess of levels adequate to keep producing goods or services

- **Economic responsiveness:** Job and sales response to water rationing

Economic Model

- **Comprehensive accounting.** Model all recipients of SFPUC RWS (CCSF, 24 cities & 2 private utilities)

- **Sectorial demands.** Model reflects demand in the residential, commercial, industrial and institutional sectors

- **Shortage allocation.** For each customer class, ration water across sectors to minimize losses

Statistical Analysis of Demand

- ## Residential sector:
  - Accounts for 60% of water use in the SFPUC RWS.
  - Experiences the highest levels of rationing

- ## Estimate a detailed demand relationship for residential water use in the RWS
  - Models demand response to price, income, climate, residential density, and local demand factors

Summary of Welfare Impacts

Annual welfare losses under various shortage levels:

% Shortage	Loss	Potential Implication
10	$53,000,000	Eliminate outdoor household water-use, and curtail indoor household water-use.
20	$119,000,000	Daily showers and other basic household uses significantly reduced or eliminated.
41	$324,000,000	Survival threatened in some locations; migration required. Significant cuts to C&I sector.
51	$471,000,000	Human survival threshold surpassed without dramatic cuts in C&I sector.

Summary of Economic Impacts

Annual job & sales losses under various shortage levels:

% Shortage	Employment	Sales (billions)
10	3,922	$1.8
20	6,562	$3.1
41	139,146	$37
51	188,000	$49

F O U R T H   A G R E E M E N T.

Between

THE   CITY   AND   COUNTY   OF   SAN   FRANCISCO

and

THE TURLOCK IRRIGATION DISTRICT AND THE MODESTO IRRIGATION DISTRICT

JUNE, 1966

(FULLY EXECUTED COPY)

FOURTH AGREEMENT

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F O U R T H   A G R E E M E N T

Between

THE CITY AND COUNTY OF SAN FRANCISCO

and

THE TURLOCK IRRIGATION DISTRICT AND THE MODESTO IRRIGATION DISTRICT

THIS AGREEMENT, made by and between the CITY AND COUNTY OF SAN FRANCISCO,
a municipal corporation, acting by and through its Public Utilities Commission,
hereinafter called "City," and the TURLOCK IRRIGATION DISTRICT and the MODESTO
IRRIGATION DISTRICT, organized pursuant to the Irrigation District Law of the
State of California, acting by and through their respective Boards of Directors,
hereinafter called "Districts,"

WITNESSETH THAT:

1. WHEREAS, Districts and City own and operate certain water conservation
facilities on the Tuolumne River for the purposes of domestic, municipal and
industrial water supply, irrigation, flood control and the generation of electric
power, and have operated said facilities effectively and harmoniously for many
years; and

2. WHEREAS, in that certain agreement dated February 29, 1940, known as
the "First Agreement," Districts and City did formally agree to continue to
cooperate in a program of conservation of the waters of the Tuolumne River for
their mutual benefit, and to recognize the provisions of the Act of Congress of
December 19, 1913, known as the Raker Act (38 Stat. 242), as applying to
Districts and City without waiving any of their rights; and,

3. WHEREAS, in that certain agreement dated November 22, 1943, known as
the "Second Agreement," Districts and City did formally agree to continue the
development of the Tuolumne River by cooperating in the building of the Cherry

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River Project and New Don Pedro Project and all appurtenant projects involving the use of Tuolumne River water; and,

4. WHEREAS, in that certain agreement dated June 30, 1949, known as the "Third Agreement," Districts and City did formally agree that the Districts have existing prior rights to the waters of the Tuolumne River and its tributaries, and agreed to provide for the storage, management and control of the waters of the Tuolumne River and its tributaries in such a manner as to assure, insofar as feasible, the availability of sufficient water to meet the requirements of Districts and City; and that toward this end City would first construct the Cherry Valley Project, after which the New Don Pedro Project, to be owned by Districts, would be constructed as provided by supplemental agreement; and did further agree upon their respective flood control responsibilities under a proposed contract with the United States through its Corps of Engineers, U. S. Army; and

5. WHEREAS, the United States of America, pursuant to the Flood Control Act of December 22, 1944, has entered into a contract with Districts and City dated August 29, 1949, and certified by the Federal Government on September 26, 1949, as supplemented by Supplemental Agreement No. 1, dated June 4, 1956, hereinafter called "Federal Contract," under which, in consideration for certain financial contributions to be made by the Federal Government, Districts and City agreed to provide for Tuolumne River flood control by making certain modifications in their then existing facilities and operations and by constructing the Cherry Valley Reservoir and the New Don Pedro Reservoir with New Don Pedro to provide not less than 340,000 acre feet for flood control; and

6. WHEREAS, the Cherry Valley Reservoir has been successfully completed by the City; and

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7. WHEREAS, the Legislature of the State of California has, pursuant to Chapter 282, Statutes of 1965, authorized a Davis-Grunsky Act grant of up to Seven Million Dollars ($7,000,000) for recreational functions and enhancement of fish and wildlife in connection with the construction of the New Don Pedro Reservoir; the above amount to be further increased by an estimated amount of Five Hundred Thousand Dollars ($500,000) for the provision of initial water supply and sanitary facilities under the provisions of said Davis-Grunsky Act; thereby making a grant of approximately Seven Million Five Hundred Thousand Dollars ($7,500,000) available from the State of California; and

8. WHEREAS, studies indicate that further conservation of Tuolumne River flows to provide for the needs of the Districts and the City can be accomplished by building the New Don Pedro Reservoir to its maximum capacity of approximately 2,030,000 acre feet; and

9. WHEREAS, the electors of the Districts and of the City have authorized the issuance of bonds to secure the estimated funds necessary to construct the New Don Pedro Project; and

10. WHEREAS, following application by the Districts and a hearing, the Federal Power Commission has ordered the issuance of a license to the Districts for the New Don Pedro Project (Turlock Irrigation District and Modesto Irrigation District Project No. 2299, 31 FPC510, 1128 (1964), containing certain conditions, including the filing of an agreement between Districts and City for Commission approval relating to the allocation of the total cost of the project and the acquisition of storage space in the reservoir, which proceedings have been affirmed by the United States Court of Appeals for the Ninth Circuit (California, et al. v. FPC 345 F2d 917 (1965); and

11. WHEREAS, it is now necessary to set forth the respective responsibilities of the Districts and the City in the New Don Pedro Project;

NOW, THEREFORE, the parties hereto do mutually agree as follows:

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ARTICLE 1. SCOPE OF AGREEMENT

This agreement is intended to supplement and, to the extent of any incon-
sistency therewith, amend the provisions contained in the aforementioned First,
Second and Third Agreements between Districts and City, to the end that the New
Don Pedro Project, hereinafter called Project, may be constructed for the purpose
of conserving water for the irrigation, domestic, municipal and industrial use
requirements of the parties hereto; for flood control; for the generation of
hydroelectric power; and for recreation, fish and wildlife. This Agreement
shall continue in force until modified or canceled by mutual consent of the
parties hereto.

ARTICLE 2. RIGHTS OF PARTIES

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. Districts and City agree to recognize and
abide by the provisions of the Raker Act as applying to Districts and City.

ARTICLE 3. THE BOARD OF REVIEW

Districts and City agree to cooperate fully to expedite the early completion
of the Project, the planning and construction of which shall be under the general
supervision and control of Districts. In order to keep the parties hereto fully
advised regarding design progress and construction a Board of Review is hereby
created. The Board shall be composed of three persons, one to be appointed by each
of the parties hereto. The Board shall establish its own operating procedures.
At least once each month the Board shall meet with Districts' project repre-
sentatives and review progress and scheduling of the construction work, the
expenditure and availability of funds, proposed contract modifications, and the
matters falling within paragraphs I A, I D, and II of Appendix A of this Agreement.
The Board shall arrange to have minutes kept for each of its meetings, and shall
report the results of each of such meetings to the parties. The Board shall also

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make such recommendations to the parties as it sees fit to the end that a high level of cooperation is maintained among the parties and each is kept fully informed.

ARTICLE 4. FISCAL PROTECTION AND HOLD HARMLESS CLAUSES

Districts shall not award any construction contracts prior to the execution of this Agreement and its certification pursuant to Section 86 of City's Charter, nor prior to City's review and approval of the plans and specifications of such construction contracts, which approval shall not be unreasonably withheld. Districts shall proceed with planning and construction expeditiously and diligently until completion thereof, and City shall cooperate with Districts at all times to that end.

It is mutually understood and agreed that the program and conditions of this Agreement are subject on the part of City and Districts to such action as may be required by law or as required by applicable fiscal budgetary provisions of law governing City and Districts or by the necessity of bond issues, and further subject to execution of the supplemental agreement to the Federal Contract provided in Article 3b therein.

Districts agree to assume any City obligations under the Federal Contract for the construction of the New Don Pedro Project and further agree to assume all of City's obligations under the Federal Contract for flood control operation when the New Don Pedro Project is completed, provided City has made its contribution to the cost of the Project as set forth herein. Districts shall hold and save harmless City, its officers, agents, and employees, from liability of any nature or kind for and on account of any claim for damages arising as a result of the work performed or failure to meet the terms of the Federal Contract respecting the New Don Pedro Project. The New Don Pedro Project shall be owned solely by Districts, and Districts agree to maintain and operate it at their own expense, all in accordance with the terms and conditions herein.

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The Districts shall have no liability for damages and shall be relieved of any obligations under this Agreement, if such damage is caused, or the performance of such obligations is prevented, by war, strikes, inability to obtain required materials, acts of God, or other causes beyond their control.

ARTICLE 5. RESERVOIR STORAGE CAPACITY

The New Don Pedro Reservoir shall be constructed to a capacity of approximately 2,030,000 acre feet; which capacity shall include 1,120,000 acre feet of Districts' storage, of which 309,000 acre feet is below minimum power pool; 570,000 acre feet storage space for use by City; and 340,000 acre feet for flood control storage space. Such portion of the 340,000 acre feet flood control storage space as is not reserved for flood control at any time shall be available 50% to Districts and 50% to City for conservation storage, thereby entitling City to a maximum of 740,000 acre feet of storage space, hereinafter called "exchange storage space."

ARTICLE 6. FLOOD CONTROL OPERATIONS

(a) Until the Project is constructed and in operation, both Districts and City agree to operate their existing reservoirs for purposes of flood control, in addition to conservation, in accordance with the provisions of the Federal Contract. City shall have the right to intercept and store water due Districts under the Raker Act and shall endeavor to maintain, insofar as feasible, sufficient storage in its reservoirs to protect Districts from loss of both irrigation and power water by reason of Districts' flood control operations. Upon demand of Districts, City agrees to release from City's reservoirs, through its powerhouses or otherwise, any or all water due Districts under the Raker Act: provided that all storage credits shall be terminated at such times as existing Don Pedro Reservoir spills or on October 31 of each year, at which time City shall own all water stored in its reservoirs.

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(b) Upon completion of the New Don Pedro Reservoir, all obligations of the City and the Districts to operate any of their other reservoirs for flood control shall be terminated, and the entire flood control operation shall be transferred to the New Don Pedro Reservoir.

(c) Districts shall operate New Don Pedro Reservoir for flood control in accordance with the requirements of the Federal Contract and the applicable and valid regulations and orders of the Corps of Engineers of the United States Army. The maximum amount of space in the reservoir to be reserved for such flood control purposes is 340,000 acre feet.

ARTICLE 7. WATER ACCOUNTING

It is agreed that a principal benefit to be derived by City in return for its payment of a substantial part of the cost of the project shall be the right of City to release water to Districts when it can be stored in New Don Pedro Reservoir in advance of the time when a release thereof is required under the Raker Act and the right of City subsequently to intercept or divert equivalent quantities of water which would otherwise be required to be released to Districts, the City's advance releases being stored by Districts in New Don Pedro Reservoir and withdrawn therefrom by Districts for use in place of natural flow subsequently intercepted by City. The following provisions shall take effect upon the completion of New Don Pedro Reservoir and shall continue in effect thereafter throughout the term of this Agreement:

(a) A "Water Bank Account" shall be established and maintained by the parties in a manner to be approved by them from time to time. The Water Bank Account shall contain a detailed record of all advance releases credited to City and all debits charged to City as hereinafter provided, together with the net balance, if any, remaining to the credit of the City at all times. The Water Bank Account shall be maintained on a daily basis or such other basis as the parties may agree upon from time to time.

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(b) Whenever the inflow to the New Don Pedro Reservoir from all sources
exceeds whichever of the following is the smaller:

(1) The computed daily natural flow of the Tuolumne River at
LaGrange Dam (as defined in the Raker Act), or

(2) The entitlement of the Districts under the Raker Act plus
sixty-six (66) cubic feet per second,

then the excess shall be deemed to be natural flow of the Tuolumne River
released by City to Districts in advance of the time when the release thereof
is required under the Raker Act, and such excess shall be credited to City
as "advance releases" and shall be treated as hereinafter provided.

(c) Whenever and to the extent that City has a credit balance in its
Water Bank Account City may intercept and divert waters of the Tuolumne River
above New Don Pedro Reservoir in quantities which will reduce the inflow into
New Don Pedro Reservoir to less than the smaller of the two quantities
hereinabove defined in paragraph (b) hereof, and the amount by which such
inflow is so reduced below the smaller of said two quantities shall be
charged to City in its Water Bank Account.

(d) The losses of water in storage in New Don Pedro Reservoir through
evaporation and seepage shall be computed on a daily basis, and on each day
when the City has a net credit balance in its Water Bank Account there shall
be deducted from such balance that proportion of the day's evaporation and
seepage losses which is equal to the proportion that the City's net credit
balance in the Water Bank Account at the beginning of the day bears to the
total volume of water then in storage in New Don Pedro Reservoir.

(e) Except with the prior consent of Districts, City shall never be entitled to have a debit balance in its Water Bank Account. With the Districts' prior approval City may create debit balances in its Water Bank Account on a temporary basis for the purpose of securing water which is necessary to maintain City's operations, but such debit balances shall be restored by City through advance releases as soon as practicable, and City shall compensate Districts in a manner to be mutually agreed upon for any damages or losses which may be suffered or incurred by Districts as a result of such action by City.

(f) The net credit balance of the City in its Water Bank Account shall never be permitted to exceed at any one time 570,000 acre feet plus one-half of the permitted encroachment in the flood control space. Whenever the City's net credit in its Water Bank Account shall equal or exceed the above, then, and so long as that condition continues, there shall be no credit to the City for advance releases pursuant to paragraph (b) hereof.

(g) Districts shall own and have exclusive control and use of all water released by City to Districts in advance pursuant to paragraph (b) hereof, may store such water in and withdraw such water from New Don Pedro Reservoir at such times and in such amounts as Districts shall see fit from time to time.

(h) For the purposes of computation, the daily natural flow of the Tuolumne River shall be deemed to be that flow which would have occurred at LaGrange Dam had no facilities of City and Districts been constructed on the Tuolumne River watershed.

(i) All computations, schedules, records and formulae used in measuring advance releases and establishing the net balance in the City's Water Bank Account from time to time shall be subject to examination and review by

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authorized representatives of the parties hereto at all reasonable times.
Monthly reports shall be made to the parties showing the results of all such
computations and the status of the Water Bank Account on a daily basis. The
correctness of each such monthly report shall be deemed to be conclusively
established as between the parties in the absence of objection by any party
within ninety (90) days after the delivery of such report. In the event of
any objection within said period the parties shall endeavor to resolve the
objection by mutual agreement, but if they are unable to do so within a
reasonable time then upon request of any party the matter shall be referred
to a panel of three qualified arbitrators, one appointed by City, one by
Districts, and the third by the two so chosen, and the decision of a majority
of the arbitrators shall be final and binding upon all parties.

ARTICLE 8. WATER RELEASES; APPORTIONMENTS.

The Districts and City recognize that Districts, as licensees under the
Federal Power Commission license for the New Don Pedro Project, have certain
responsibilities regarding the water release conditions contained in said
license, and that such responsibilities may be changed pursuant to further
proceedings before the Federal Power Commission. As to these responsibilities,
as they exist under the terms of the proposed license or as they may be
changed pursuant to further proceedings before the Federal Power Commission,
Districts and City agree:

(a) That any burdens or changes in conditions imposed on account of
benefits accruing to City shall be borne by City.

(b) That 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

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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.

In the event City and Districts cannot agree that there has been such an adverse
effect and the extent thereof, these issues shall be determined by arbitration
as provided in Article 7 (i) above.

(c) That in the event of such adverse effects on Districts' water entitle-
ments, and the consequent necessity for distribution of burden therefor as pro-
vided in the foregoing subparagraph b, Districts shall forthwith seek modi-
fication by the Federal Power Commission of the water release conditions of said
license.

ARTICLE 9. DETERMINATION OF COSTS AND COST ACCOUNTING

(a) _Estimated Costs._ Estimated Project costs made in March 1966 form the
basis for the allocations of costs to the parties as made herein. The parties,
however, recognize and agree that the costs to be defrayed in accordance with
the allocations made shall be the actual costs of construction of the Project.

(b) Actual Costs. Actual costs of construction shall be those expenditures
required in order to build the Project. In addition to the actual costs of all
physical facilities, including lands, together with any relocations or replace-
ments of facilities which Project construction may require, actual costs shall
include but not be restricted to, the costs of administration, preliminary in-
vestigation, engineering, legal services and construction management.

(c) Accounting and Procedures. The Districts shall set up an
accounting procedure for the Project satisfactory to the City, which
shall be in accordance with the uniform system of accounts of the Federal
Power Commission. Prior to awarding of any contracts for construction
of the New Don Pedro Project the Districts shall select a bank or
banks in which to establish accounts for all funds received and paid out
in connection with the Project. Such funds shall be kept in bank accounts

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separated from all other funds of the Districts. Funds covering the cost of the Project shall be deposited in these accounts by the Districts and City prior to awarding of contracts. Any interest accruing shall be credited to the City and Districts as their pro rata share of deposits earned. All payments for the Project shall be disbursed from these funds and any unused amounts at the completion of the Project shall be returned to the City and Districts as their credits indicate. The Districts shall render monthly statements to the City showing the distribution of all funds and the City's share of same. In addition, the Controller of the City shall have the right to make any investigation, inspection or audit which he may deem necessary. For the purpose of simplification, contracts awarded for construction work shall be itemized so far as practical, to separate items for City participation from items in which City does not participate.

(d) _Reporting_. Each party agrees that at any time, upon written request by any of the other parties, it will report the amount of funds it has available for disbursement under the terms of this Agreement. Districts agree that at any time upon written request they will furnish to City up-to-date Project cost estimates, certified statements as to Project costs actually incurred, and information as to their budgetary programs for the New Don Pedro Project.

ARTICLE 10. _RESPONSIBILITIES AS TO PROJECT COSTS_.

(a) _Separable Costs_. Of the total Project costs, Districts shall pay the costs of acquiring the site for the New Don Pedro Dam and all lands and interests in lands to be occupied by the New Don Pedro Reservoir. Districts shall also pay all costs of the Project facilities installed for the purpose of generating hydroelectric power and for operation and maintenance activity at the New Don Pedro Dam.

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The costs of any modification to City's structures at Red Mountain Bar which may be necessary as a result of the construction of the New Don Pedro Project shall be borne by City. Estimates of these costs are set forth in Section I, Groups B, C and E of Appendix A incorporated herein by this reference. Each agency shall bear its own cost of interest charges during construction.

(b) <u>Common Costs</u>. All Project costs other than those set forth in Article 10a above shall be considered "Common Costs" to be shared by Districts and City as agreed upon herein. For purposes of cost sharing determination, common costs shall be in three general categories as follows:

(1) <u>Construction Costs Allocated by Third Agreement</u> - which shall include costs of: construction of a dam and appurtenances to impound a reservoir, including site clearing, of approximately 2,030,000 acre feet of capacity: including all access roads.

(2) <u>Construction and Related Costs of Additions to Project</u>
<u>Not Anticipated at Time of Third Agreement</u> -

which shall include costs of the relocation and reconnection, to include right of way acquisition, of all State and County highways and roads; the relocation, including right of way acquisition, or removal of any power and telephone lines or other facilities public or private; fishery studies; utilizing or acquiring, or gaining access to public lands; a recreational use plan together with facilities provided thereunder as approved by the Federal Power Commission; and any reconstruction which may be required by State or Federal authority at some future time.

(3) <u>Other Costs</u> - which shall include but not be restricted to costs of: preliminary engineering, legal and administrative activity; insurance, construction bonds; taxes; permits and inspections; accounting; public relations;

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and administration, engineering, legal and management of construction. Estimates of common costs, insofar as these items have been identified or are available, are set forth in Sections IA, ID and II of Appendix A.

(c) Sharing of Common Costs. The sharing of Common Costs, as defined in Article 10b, shall be as follows with regard to both "construction" and "other" costs:

(1) Construction Costs Allocated by Third Agreement - shall be shared in the ratio of the estimated cost of constructing a 1,200,000 acre foot dam and reservoir to a 2,030,000 acre foot dam and reservoir, which on the basis of past studies and cost estimates yields percentages of 82.1582% for the City and 17.8418% for the Districts.

(2) Construction and Related Costs of Additions to Project Not Anticipated at Time of Third Agreement -

shall be shared in the ratio of City's additional storage achieved to Districts' additional storage achieved after deductions for original Don Pedro Reservoir and minimum power pool, which yields percentages of 51.7121% for the City and 48.2879% for the Districts. Any continuing costs to the Project which might result from the Districts' deficit operation of recreational facilities required to be constructed under terms of the Federal Power Commission license will be shared by the City and Districts in the ratio established under this section.

(3) Other Costs - shall be shared in the ratio of the estimated cost of building the Project without hydroelectric power facilities to building it with such facilities, yielding percentages of 62.0201% for the City and 37.9799% for the Districts; except that items

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applicable to separable costs listed in this article, section (a) above, shall be borne separately by the individual agencies.

(d) Sharing of Project Costs. The sharing of presently estimated Project costs under sections a, b, and c of this Article 10 is anticipated by the parties to be approximately as shown in Appendix A, incorporated herein by this reference.

ARTICLE 11. DISPOSITION OF CONTRIBUTED FUNDS

The Federal payments for the 340,000 acre-feet of flood control storage space in the New Don Pedro Reservoir, as provided for under Article 3b of the Federal Contract, shall be made to City. Any payments by the State or Federal Government for acquiring lands or interests in lands, or for the demolition, abandonment, relocation, or removal of buildings, and other structures, shall be made to Districts. Any payment by the State or Federal Government for recreation and fish and wildlife benefits shall be credited to the parties in the same percentages utilized for common construction costs under Article 10c2 hereof; provided, however, that the use of any money disbursed by the State of California to Districts pursuant to the portions of the Davis—Grunsky Act which provide for grants to public agencies shall be subject to the provisions of the grant contract to be executed between Districts and the State of California under that Act which regulates the use of the grant money. Any other Federal or State payments which may be made available for the New Don Pedro Project shall be allocated to Districts and City by supplemental agreement when and if they become available.

ARTICLE 12. LICENSE CONDITIONS

As a consequence of Districts' responsibilities as licensees for the New Don Pedro Project, as such responsibilities exist or may be changed pursuant to any further proceedings, City and Districts agree:

(a) To share as provided in Article 10c2 in the costs of such studies relating to the fishery of the Tuolumne River as may be required; in any

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proceedings resulting therefrom: and in the costs of any facilities or program instituted as a consequence of such fishery studies or proceedings.

(b) To share as provided in Article 10c 1, 10c2, or 10c3, as appropriate, other costs arising out of Districts' responsibilities as licensees of the New Don Pedro Project.

ARTICLE 13. BONDS AND INSURANCE

Districts agree that City will be named as an additional obligee, as its interests may appear, on all labor, material, and performance bonds obtained in construction of the subject Project, as an additional insured on liability policies in force during and after construction and as an additional insured as its interests may appear on any casualty policy covering the New Don Pedro Dam and its appurtenances.

ARTICLE 14. PROJECT DESIGN ENGINEERING

As soon as practicable, following the execution of this Agreement, the Districts shall direct Bechtel Corporation to proceed with project design engineering, and preparation of plans and specifications for (a) a single construction contract with unit prices, and (b) separate supply contracts for turbines and valves, generators and busses, transformers and circuit breakers, gantry crane and gate hoist, gates and penstock and liner, and allied work necessary for the calling for bids for the construction of the New Don Pedro Project. The estimated cost of this work by Bechtel Corporation is $500,000.00. The City shall pay to the Districts, 82.1582% of the cost of the work contemplated by this paragraph relating to the construction of those items specified in Paragraph I A, of Appendix hereto. Such payment shall be made on demand of the Districts. The Districts shall pay 100% of the cost of the work contemplated by this paragraph relating to those items specified in Paragraph I B of said Appendix.

ARTICLE 15. CONSTRUCTION CONTRACTS, BIDS

Upon completion of the work contemplated by Article 14 hereof,

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the Districts shall call for bids for the construction under a single construction contract with unit prices and separate supply contracts for the New Don Pedro Project.

ARTICLE 16. STATE HIGHWAY RELOCATION

The Districts shall enter into an agreement with the State of California, acting through the Division of Highways of the Department of Public Works, calling for a portion of the engineering and design work necessary for the State to proceed with the State highway relocations at a cost not to exceed $160,000.00 for the first year. The City shall pay 51.7121% of the cost thereof to the Districts at the time required by the Districts pursuant to said agreement,

ARTICLE 17. COUNTY HIGHWAY RELOCATION

The Districts shall take whatever action they may deem desirable in order to more accurately estimate the cost of relocating county highways, Provided the Districts have the prior written approval of the City for any expenditures in this regard, the City agrees to reimburse the Districts on demand 51.7121% of such expenditures.

ARTICLE 18. RECREATION PLAN

The Districts shall proceed with reasonable diligence to prepare the recreation plan required by the Federal Power Commission License and to prepare a feasibility report in support of an application for construction and facilities grants under the provisions of the Davis-Grunsky Act and to make an application for such grants. The City shall reimburse the Districts upon demand for the cost of such plan, feasibility report and application to the extent of 51.7121%, provided the cost thereof does not exceed $100,000.00,

ARTICLE 19. EVALUATION OF BIDS

Upon the receipt of bids for the construction of the New Don Pedro Project, each party shall make an estimate of the cost of the Project to it in accordance with the allocation of costs as provided herein.

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In the event that (a) the estimated costs of the New Don Pedro Project to the Turlock Irrigation District, based on all factors known at that time, exceeds $28,216,904.00, the Turlock Irrigation District, at its option, may declare that the cost of the project exceeds the benefits; (b) the estimated costs of the New Don Pedro Project to the Modesto Irrigation District, based on all factors known at that time, exceeds $15,881,658.00, the Modesto Irrigation District, at its option, may declare that the cost of the project exceeds the benefits; (c) the estimated costs of the New Don Pedro Project to the City, based on all factors known at that time, exceeds $48,423,538.00, the City, at its option, may declare that the cost of the project exceeds the benefits; and upon any such declaration the parties hereto agree that no party shall be bound by this agreement except as to the provisions of Articles 14 to 19 inclusive.

ARTICLE 20. RESERVATIONS

Except with respect to Articles 14 to 19 inclusive, this Agreement is subject to (a) the approval of the Federal Power Commission, (b) the approval of the California District Securities Commission, and (c) the Districts' ability with reasonable efforts to make satisfactory arrangements for necessary county highway abandonment and relocation.

IN WITNESS WHEREOF, the parties hereto have caused this Agreement to be executed by their respective officers thereunto duly authorized this _23ʳᵈ_.

day of _May_, 1966.

TURLOCK IRRIGATION DISTRICT

_____
President

_____
Secretary

APPROVED AS TO FORM:

_____
Chief Engineer

_____
Attorney

MODESTO IRRIGATION DISTRICT

_____
President

_____
Secretary

APPROVED AS TO FORM:

_____
Chief Engineer

_____
Attorney

CITY AND COUNTY OF SAN FRANCISCO

APPROVED AS TO FORM:

THOMAS M. O'CONNOR, City Attorney

By _____
Public Utilities Counsel

APPROVED _____
Accounts Bureau Director

_____
General Manager
of Public Utilities

Authorized by Resolution No. **359 66**
of the Board of Supervisors of the
City and County of San Francisco

Authorized by Resolution No. 66-0378
of the Public Utilities Commission
of the City and County of
San Francisco

Attest _____
Secretary and Assistant
General Manager, Administrative,
Public Utilities

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NEW DON PEDRO ESTIMATE

APPENDIX A

DISTRIBUTION OF COSTS

I. PER THIRD AGREEMENT

	TOTAL COSTS	CITY	MODESTO	TURLOCK
A. Construction Items Allocated by Third Agreement				
1. Reservoir	$ 1,420,000			
2. Dam	32,639,000			
3. Dikes	401,000			
4. Controlled Spillway	1,540,000			
5. Emergency Spillway	840,000			
6. Spillway Discharge Channel	117,000			
7. Structure Power and Lighting	162,000			
8. Diversions-Outlet Tunnel & Appurtenances	6,000,000			
9. Access Roads	780,000			
10. Visitors and Dam Headquarters	250,000			
11. Direct Costs for City and Districts	44,149,000			
12. Omissions and Contingencies	4,690,000			
13. Escalation	4,720,000			
14. Total	$ 53,559,000	$ 44,003,110	$ 3,013,926	$ 6,541,964
B. Construction Items for Districts Only - Power Facilities				
15. Power Plant Structures and Improvements	$ 2,100,000			
16. Power Tunnel, Penstock and Appurtenances	5,170,000			
17. Tailrace	41,000			
18. Turbines and Generators	4,549,000			
19. Accessory Electrical Equipment	1,133,000			
20. Miscellaneous Power Plant Equipment	616,000			
21. Switchyard Structures	160,000			
22. Switchyard Equipment	1,416,000			
23. Communications	80,000			
24. Direct Costs for Districts Only	15,265,000			
25. Omissions and Contingencies	1,270,000			
26. Escalation	1,560,000			
27. Total	$ 18,095,000		$ 5,707,163	$12,387,837

NEW DON PEDRO ESTIMATE (Cont'd.)

			DISTRIBUTION OF COSTS	
	TOTAL COSTS	CITY	MODESTO	TURLOCK
C. **Construction Items for City Only**				
28. Modification of Red Mountain Bar Siphon--- $	1,000,000			
29. Omissions and Contingencies------	100,000			
30. Escalation------	50,000			
31. Total------	1,150,000	$ 1,150,000		
32. Total Construction Cost of Dam, Reservoir and Power Facilities and Red Mountain Bar Modification $	72,804,000	$45,153,110	$ 8,721,089	$ 18,929,801
D. **Administrative Items Applicable to Construction Costs Allocated by Third Agreement**				
33. Administration, Legal, Taxes & General Expense	1,000,000			
34. Engineering & Management of Construction----				
35. On Specific Construction Costs------	5,370,000			
36. From Project Delay------	550,000			
37. Total------	6,920,000	4,291,791	828,940	1,799,269
38. Total Construction & Related Costs to City and Districts $	79,724,000			
E. **Other Districts' Costs**				
39. Reservoir Lands------ $	3,406,000			
40. Omissions, Contingencies, Engineering & Administration----	340,600			
41. Transmission Lines (Incl. O&C, Escal., Eng. Administration)------	4,337,000		1,181,678	2,564,922
42. Buildings & Grounds for Project Operation & Maintenance------	250,000		3,215,000	1,122,000
			78,850	171,150
43. Total Other Districts' Costs------ $	8,333,600		$ 4,475,528	$ 3,858,072
II. **ADDITIONS TO PROJECT COSTS NOT ANTICIPATED AT TIME OF THIRD AGREEMENT**				
44. Relocation of State and County Roads $	8,200,000			
45. Omissions, Contingencies, Eng. & Admin.	820,000			
46. Recreation------	1,250,000			
47. Omissions, Contingencies, Eng. & Admin.	100,000			
48. Total------ $	10,370,000	$ 5,362,545	$ 1,579,351	$ 3,428,104
49. Net Project Estimate------ $	98,427,600	$54,807,446	$15,604,908	$28,015,246

NEW DON PEDRO ESTIMATE (Cont'd.)

III. FINANCING COSTS

	TOTAL COSTS	DISTRIBUTION OF COSTS		
		CITY	MODESTO	TURLOCK
50. City's Interest During Construction (3%)	$ 2,958,500	$ 2,958,500		
51. Districts' Interest During Construction (3-3/4%)	4,100,000		$ 1,419,000	$ 2,681,000
52. Total Financing Cost	7,058,500	2,958,500	1,419,000	2,681,000
53. Gross Project Estimate	$ 105,486,100	57,765,946	17,023,908	30,696,246
54. Flood Control		- 5,464,000		
55. Davis-Grunsky		- 3,878,408	- 1,142,250	- 2,479,342
56. Net		$ 48,423,538	$ 15,881,658	$ 28,216,904

NOTES:

1. The ratio of 0.821582 for City participation is taken from the comparison of the 1959 Bechtel estimate of a 1,200,000 acre feet reservoir to a 2,030,000 acre feet reservoir as estimated on September 28, 1962 for the FPC hearing. ($35,853,000 ÷ $43,639,000 = 0.821582).

2. The ratio of 0.620201 for City participation in the administrative items applicable to construction costs allocated by Third Agreement is determined by comparison of City's participation in the construction of the dam, reservoir, power facilities and Red Mountain Bar Siphon modification to the Districts' participation in these costs. ($45,153,110 ÷ $72,804,000 = 0.620201).

3. The ratio of 0.517121 for City participation in Additions to Project Costs Not Anticipated At Time of Third Agreement is determined by comparison of City's additional storage achieved to Districts' additional storage achieved after deductions for original Don Pedro Reservoir, and minimum power pool. (740,000 ÷ 1,431,000 = 0.517121). (691,000 ÷ 1,431,000 = 0.482879).

4. The Legislature has authorized a Davis-Grunsky grant of up to $7,500,000 which will accrue as a contribution to the Project. This amount will be distributed to the City and Districts in proportion to the amounts of additional storage achieved. (See Note 3 for ratios.)

DANIEL B. STEINER
CONSULTING ENGINEER

MEMORANDUM

TO: Donn Furman

FROM: Daniel B. Steiner

SUBJECT: CCSF Exposure to SWRCB 35 Percent February-June Flow Requirement

DATE: March 15, 2013

I have reviewed the State Water Resources Control Board (SWRCB) Substitute Environmental Document (SED), December 2012, regarding potential changes to the Water Quality Control Plan for the San Francisco Bay-Sacramento/San Joaquin Delta Estuary. In broad terms, the SED identifies a preferred alternative that requires 35 percent of the unimpaired flow of the Tuolumne River be provided to the lower Tuolumne River during February through June. The purpose of this memorandum is to describe the potential effect of that requirement upon CCSF's water supply.

To illustrate the potential water supply effect of alternative flow requirements for the Tuolumne River I utilized a mathematical mass balance approach to evaluate the effect of assuming partial CCSF responsibility for an increase in lower Tuolumne River flow requirements. The analysis was performed for a recurrence of the 1987-1992 drought and provides insight as to the effect to yield that could occur during CCSF's design drought. The method of analysis results in showing that for each acre-foot of CCSF flow responsibility during the design drought, CCSF water deliveries will be reduced by approximately an equal amount.

The SED preferred alternative and method of implementation are sketchy, and at times flawed and non-sensible. Problems and ambiguities of the alternative concern the assumed point of "requirement" (at Modesto), methods of projecting operations (water diversion demands and reservoir operations) and the requirement itself which was illustrated as replacing regulatory requirements that currently exist with the preferred alternative. The alternative requirement may at times be less than existing requirements. Although the SED analysis results in the intuitive conclusion that more water to the river will cause less water diverted, the magnitude and sequencing of the impact is badly portrayed by the SED analysis. The SED does not address or analyze any impact that may occur to CCSF. To provide more meaningful results I have adapted the general objectives of the SED preferred alternative into modeling that is more consistent with the operations and hydrology of the Tuolumne River.

The limited period of analysis (1987-1992) and mass balance method requires very little information to compute and illustrate the potential water supply effect upon CCSF water deliveries. Table 1 illustrates the computations and results of assuming partial CCSF responsibility for the SED preferred alternative. The top half of Table 1 shows the water demand and delivery under a current CCSF water delivery demand and system setting. In this system setting the annual water delivery demand is 238 MGD and several components of the WSIP have been assumed to be operational. The existing setting also assumes the Modesto Irrigation District and Turlock Irrigation District (collectively referred to as the Districts) provide compliance to the current FERC flow requirements. With a CCSF delivery demand of 238 MGD during the design drought under this existing configuration, system-wide shortages would be reduced by 10 percent during Year 2. If runoff conditions were to continue as portrayed by design

drought hydrology, system-wide shortages would continue at 10 percent for the next 5 years, Year 2 through Year 6. "Existing System Delivery" identifies the projected annual delivery by year that would occur during the design drought after shortages have been applied.

Table 1. Effect of Proposed Incremental Water Releases on CCSF Water Delivery Shortages.

CCSF Water Deliveries and Shortages						
Projected Year	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Existing System Demand (MGD)	238	238	238	238	238	238
Existing System Shortage %	0	10	10	10	10	10
Existing System Delivery (MGD)	238	214	214	214	214	214
Existing System Delivery (Acre-feet/year)	266,600	239,700	239,700	239,700	239,700	239,700
Additional Reduction (Acre-feet)	111,700	111,700	111,700	111,700	111,700	111,700
Remaining Delivery (Acre-feet)	154,900	128,000	128,000	128,000	128,000	128,000
Remaining Delivery (MGD)	138	114	114	114	114	114
Remainding Delivery compared to Existing Demand (%)	58	48	48	48	48	48
Shortage after Additional Release (%)	42	52	52	52	52	52
System reaction to annual reductions in water supply assumes the 6 years of annual impact are averaged over the entire 6 year period (111,700 acre-feet/year), and that deliveries will be reduced each year by the average annual impact.						

The bottom half of Table 1 shows anticipated shortages that could be anticipated if partial CCSF responsibility is assumed for the incremental flows required by the SED preferred alternative. Assumptions for this setting include:
- The SED preferred alternative is assumed to be a flow requirement defined below La Grange Dam equal to the greater of existing FERC flow requirements or 35 percent of the Tuolumne River unimpaired flow during February through June.
- The total incremental required release (above existing FERC requirements) below La Grange Dam is approximately 216,000 acre-feet per year which is the average over the Year 1 (1986) through Year 6 (1992) period.
- The CCSF system is assumed to provide the Districts with approximately 52% of the incremental required release, 111,700 acre-feet per year.
- CCSF distributes the incremental shortages across the entire Year 1 through Year 6 period at a constant rate.

Based on these assumptions approximately 112,000 acre-feet per year would be provided to the Districts each year and be removed from the CCSF water supply. That reduction in supply would reduce the amount of water CCSF could delivery to its customers by an additional 42 percentage points. During Year 1 this means that water supply available for delivery would be 42 percent less than demand, rather than the no shortage currently projected under the existing flow requirements at La Grange. For Year 2 through Year 6, the water supply available for delivery would be 52 percent less than demand, rather than the 10 percent currently projected.

For reference purposes, the following additional tables are provided:
Table 2. 1987-1992 Time Series
- o   SED Preferred Alternative Requirement (Greater Existing FERC or 35% UF during Feb-Jun)
- o   Existing FERC Requirement
- o   Difference in Requirements
- o   Potential CCSF Responsibility for Additional Flow (51.7121%)

Table 2. 1987-1992 Time Series

SED Preferred Alternative Requirement (Greater Existing FERC or 35% UF during February-June) Acre-feet - Below La Grange Dam

WY	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
1987	24,397	17,851	18,447	18,447	23,730	32,908	67,096	72,195	24,498	3,074	3,074	2,975	308,693
1988	7,736	8,926	9,223	9,223	20,492	36,839	55,373	74,092	34,727	3,074	3,074	2,975	265,755
1989	7,736	8,926	9,223	9,223	22,300	97,441	107,603	111,662	72,877	3,074	3,074	2,975	456,115
1990	7,736	8,926	9,223	9,223	19,696	46,573	77,364	62,870	38,893	3,074	3,074	2,975	289,627
1991	7,736	8,926	9,223	9,223	11,115	58,131	64,081	117,219	104,680	3,074	3,074	2,975	399,459
1992	7,736	8,926	9,223	9,223	35,337	39,578	81,193	65,727	17,835	3,074	3,074	2,975	283,903
													333,925

Existing FERC Requirement Acre-feet - Below La Grange Dam

WY	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
1987	24,397	17,851	18,447	18,447	16,661	18,447	24,481	23,806	2,975	3,074	3,074	2,975	174,636
1988	7,736	8,926	9,223	9,223	8,331	9,223	14,649	14,589	2,975	3,074	3,074	2,975	94,000
1989	7,736	8,926	9,223	9,223	8,331	9,223	25,991	25,222	2,975	3,074	3,074	2,975	115,975
1990	7,736	8,926	9,223	9,223	8,331	9,223	19,362	19,008	2,975	3,074	3,074	2,975	103,131
1991	7,736	8,926	9,223	9,223	8,331	9,223	25,870	25,109	2,975	3,074	3,074	2,975	115,740
1992	7,736	8,926	9,223	9,223	8,331	9,223	19,995	19,601	2,975	3,074	3,074	2,975	104,357
													117,973

Difference in Requirements Acre-feet

WY	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
1987	0	0	0	0	7,069	14,462	42,615	48,388	21,523	0	0	0	134,057
1988	0	0	0	0	12,161	27,616	40,723	59,503	31,752	0	0	0	171,755
1989	0	0	0	0	13,969	88,218	81,612	86,439	69,901	0	0	0	340,140
1990	0	0	0	0	11,365	37,350	58,002	43,862	35,917	0	0	0	186,496
1991	0	0	0	0	2,785	48,908	38,211	92,110	101,705	0	0	0	283,719
1992	0	0	0	0	27,006	30,355	61,198	46,127	14,860	0	0	0	179,546
													215,952

Potential CCSF Responsibility for Additional Flow (51.7121%) Acre-feet

WY	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
1987	0	0	0	0	3,656	7,479	22,037	25,023	11,130	0	0	0	69,324
1988	0	0	0	0	6,289	14,281	21,059	30,770	16,419	0	0	0	88,818
1989	0	0	0	0	7,224	45,619	42,203	44,700	36,147	0	0	0	175,893
1990	0	0	0	0	5,877	19,315	29,994	22,682	18,574	0	0	0	96,441
1991	0	0	0	0	1,440	25,291	19,760	47,632	52,594	0	0	0	146,717
1992	0	0	0	0	13,966	15,697	31,647	23,853	7,684	0	0	0	92,847
													111,673

UNITED STATES OF AMERICA
BEFORE THE
FEDERAL ENERGY REGULATORY COMMISSION

| Turlock Irrigation District and | Project Nos. 2299-065 |
| Modesto Irrigation District | 2299-053 |

ANSWERING TESTIMONY OF
DAVID L. SUNDING ON BEHALF OF
SAN FRANCISCO PUBLIC UTILITIES COMMISSION

1 **Q.** **PLEASE STATE YOUR NAME AND BUSINESS ADDRESS.**

2 **A.** My name is David L. Sunding, Berkeley Economic Consulting, Inc., 2531 Ninth

3 Street, Berkeley, CA 94710.

4 **Q.** **WHAT IS YOUR OCCUPATION?**

5 **A.** I am a director of Berkeley Economic Consulting, Inc. (BEC), an independent

6 economic research firm. I am an economist specializing in natural resource and

7 environmental economics, including water resource economics.

8 **Q.** **ON WHOSE BEHALF DO YOU APPEAR IN THIS PROCEEDING?**

9 **A.** I am appearing on behalf of the San Francisco Public Utilities Commission

10 (SFPUC).

11 **Q.** **PLEASE SUMMARIZE YOUR BACKGROUND AND EXPERIENCE.**

12 **A.** I completed a Ph.D. in natural resource economics from the University of

13 California, Berkeley (UC Berkeley). I earned a bachelor's degree in economics

14 from Claremont McKenna College. My CV is attached hereto as Exhibit CSF-21. **I**

15 have over 20 years of experience as a water resource economist and have held

16 several prominent academic appointments. I currently hold the Thomas J. Graff

17 Chair in Natural Resource Economics and Policy at UC Berkeley and am

18 co-director of the Berkeley Water Center. I have served on panels of the National

19 Academy of Sciences and the U.S. EPA Science Advisory Board. Prior to joining

1   the Berkeley faculty, I taught at Boston College in the Department of Economics

2   and the School of Law. During the Clinton Administration, I was a senior

3   economist at the President's Council of Economic Advisors.

4   Q.   **WHAT IS THE PURPOSE OF YOUR TESTIMONY?**

5   A.   I have been asked to present my estimates of the economic impacts that would

6   result from water rationing in the SFPUC service area if the SFPUC Regional

7   Water System is required to provide flows from its water system to the Turlock

8   and Modesto Irrigation Districts (Districts) for release to the lower Tuolumne

9   River below LaGrange Dam, as recommended by National Marine Fisheries

10   Service (NMFS) and U.S. Fish and Wildlife Service (USFWS) in their direct

11   testimony submitted on September 14, 2009 (Exh. NMF-1), which USFWS

12   witness Michelle Workman supports in her direct testimony (Exh. No. FWS-2).[1]

13   Q.   **PLEASE DESCRIBE BRIEFLY HOW ECONOMISTS EVALUATE THE**

14   **ECONOMIC   IMPACTS   OF   WATER   RATIONING   ON   THE**

15   **RESIDENTIAL, COMMERCIAL, AND INDUSTRIAL SECTORS OF THE**

16   **BAY AREA ECONOMY.**

17   A.   Economists measure economic impacts in terms of changes to consumer and

18   producer surplus. Consumer surplus refers to the difference between what a

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[1] Exhibit No. NMF-1 is the interim protection measures newly recommended by NMFS and USFWS in their September 14, 2009 direct testimony, and it does not appear to be sponsored by any single NMFS or USFWS witness. As stated by NMFS witness Strange in Exhibit No. NMF-2, page 16 of 25, lines 7-8, different experts support the different elements of Exhibit No. NMF-1. I understand that six witnesses from NMFS (Steven Lindley (Exh. NMF-6), Erin Strange (Exh. NMF-2), Craig Anderson (Exh. NMF-4)), USFWS (Michelle Workman (Exh. FWS-2) (referring to identical Exhibit No. FWS-1), and the California Department of Fish and Game (CDFG) (Timothy Heyne (Exh. DFG-2), Andrew Gordus (Exh. DFG-4) (referring to identical Exhibit No. DFG-1)), all filed direct testimony stating that they support the Exhibit No. NMF-1 Interim Measure Elements.

1   consumer is willing to pay for a good or service and what a consumer actually

2   pays. Producer surplus is a similar measure; it is defined by the difference between

3   revenues and variable costs, and is a measure of economic profit. Producer surplus

4   reflects the benefit of an activity to business owners by measuring revenues in

5   excess of levels adequate to keep producing goods or services.

6   While consumer and producer surplus measures are preferred by economists

7   since they are grounded in modern concepts of welfare economics and public

8   finance, we are often asked to calculate changes in other measures such as

9   employment and sales. Economists typically estimate these impacts by using an

10   empirical relationship between variables of interest, referred to as elasticity.

11   Q.   **PLEASE DESCRIBE BRIEFLY THE PRIOR STUDIES THAT HAVE**

12   **BEEN CONDUCTED ON THE IMPORTANCE OF THE BAY AREA**

13   **REGIONAL WATER SYSTEM TO THE ECONOMY OF THE SFPUC**

14   **SERVICE AREA, INCLUDING ANY PRIOR STUDIES IN WHICH YOU**

15   **PARTICIPATED.**

16   A.   Several studies have been conducted to measure the impacts of water supply

17   shortages in the San Francisco Bay area over the past 15 years. Exhibit CSF-22

18   lists four of them, including one that I collaborated on in 2007 on behalf of

19   SFPUC and one that I directed in 2002 for the Bay Area Economic Forum. Dr.

20   William Wade conducted a drought impact study on behalf of the Bay Area Water

21   Supply and Conservation Agency (BAWSCA) in 2005. Just over 10 years earlier,

22   Dr. Philip McCleod conducted a study on behalf of SFPUC. All three studies

23   found that even a 10% water shortage results in substantial losses in industrial

1   output (sales or shipments). The most recent study found that a 10% shortage

2   would reduce industrial output by over $0.5 billion and create job losses of over

3   1,300. The previous study estimated that industrial output would fall by $2.5

4   billion. (Employment impacts were not addressed). Larger losses may be

5   explained in part by changes in industrial composition over time. Many water

6   "intensive" industries have left the region since the late 1990s thereby reducing

7   the impact of water shortages.

8   According to all three studies, economic losses increase relative to increased

9   water shortages. Doubling the water shortage from 10% to 20% roughly doubles

10   the industrial losses ($0.5 billion to $1.1 billion) according to the most recent

11   study and more than triples the industrial losses ($2.5 billion to $7.66 billion)

12   according to the 2005 study. The earlier study showed an even more dramatic

13   increase. Doubling the water shortage from 15% to 30% resulted in a five-fold

14   increase in industrial losses ($0.4 billion to $2.1 billion). The most recent study

15   found that a 30% water shortage would result in industrial losses totaling $3.6

16   billion with job losses exceeding 8,000.

17   I also conducted a study in 2002 with funding from the Bay Area Economic

18   Forum to calculate the economic impacts of a Hetch Hetchy system failure caused

19   by an earthquake or other catastrophic event. In such events, water supplies would

20   be unavailable or severely rationed for 10 to 30 days and possibly as long as 60

21   days. This study, which was published in *Water Resources Research*, concluded

22   that this type of supply interruption occurring along the San Andreas Fault would

1   result in economic losses in excess of $28.7 billion in the Bay Area. Commercial

2   and industrial losses alone would be at least $14.2 billion.

3   Q.   **WHAT IS THE IMPORTANCE TO THE BAY AREA ECONOMY OF THE**

4   **SFPUC REGIONAL WATER SYSTEM?**

5   The SFPUC Regional Water System is comprised of the SFPUC retail agency and

6   the member agencies of BAWSCA. The retail agencies serve residential,

7   commercial, industrial, and government customers across four counties –

8   San Francisco, Alameda, San Mateo, and Santa Clara counties.

9   Across the agencies receiving water from the Regional Water System,

10 residential demand represents 60% of FY 04-05 demand, industrial demand

11 represents 7%, commercial demand accounts for 19%, and government and other

12 sectors account for the remaining 14% of demand.

13   Six agencies—SFPUC retail, Alameda County Water District (Alameda CWD),

14 California Water Service Company (CWS),[2] Santa Clara, Sunnyvale, and

15 Hayward—account for about two-thirds of total water demand. Six agencies,

16 including SFPUC retail, Alameda CWD, Sunnyvale, Hayward, CWS - Mid

17 Peninsula, and CWS - Bear Gulch account for roughly two-thirds of residential

18 demand. Santa Clara, Alameda CWD, and Hayward account for nearly two-thirds

19 of industrial water demand.

20   The SFPUC provides retail water delivery service within the City and County of

21 San Francisco to over 147,800 residential accounts and 21,600 non-residential

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[2] CWS is broken down into its three jurisdictions in the area: CWS - Bear Gulch, CWS – Mid-Peninsula, and CWS – South San Francisco.

1   accounts and to 27 wholesale agencies. BAWSCA is composed of the 24 cities

2   and water districts and two private utilities, Stanford University and California

3   Water Service Company, that are wholesale customers of SFPUC. Member

4   agencies of BAWSCA service a population of nearly 1.7 million, with over

5   370,000 residential accounts, 5,500 industrial accounts, and 25,800 commercial

6   accounts. In FY 04-05, SFPUC water accounted for roughly 68% of total water

7   supply for BAWSCA members; the remaining 32% of water supply is from other

8   sources.

9   The area served by the SFPUC Regional Water System is one of the largest

10   centers of employment and economic activity in the United States. There are over

11   1.6 million jobs located in the service area. Firms located in the service area

12   produce over $280 billion in goods and services each year. Because of the Bay

13   Area's arid climate, this economic activity is dependent on the importation of

14   water from other areas.

15 Q. **HAVE YOU REVIEWED THE TESTIMONY OF DAN STEINER**

16   **REGARDING POTENTIAL LEVELS OF RATIONING FOR THE**

17   **REGIONAL WATER SYSTEM AND ELLEN LEVIN'S TESTIMONY ON**

18   **STRATEGIES FOR REDUCING THE IMPACTS OF RATIONING?**

19 A. Yes, I have.

20 Q   **WHAT STEPS DID YOU UNDERTAKE TO ANALYZE THE IMPACTS**

21   **OF THESE LEVELS OF RATIONING IN THE SAN FRANCISCO BAY**

22   **AREA?**

1   A   I developed an economic model of agency-level water allocation that reflects the

2   demand for water for various customer classes. The model incorporates all retail

3   agencies receiving water from the SFPUC Regional Water Supply System. The

4   technical report attached to this testimony as Exhibit CSF-24 describes the

5   specification of the model.

6   In developing the impact model, I estimated a detailed statistical demand

7   relationship for residential water use in the Regional Water System. The data used

8   in the estimation capture a number of important factors that influence demand,

9   including income, climate variables, residential density, water rates, and adoption

10   of the Best Management Practices described in Ms. Levin's direct testimony. As

11   she notes, retail agencies receiving water from SFPUC have made good progress

12   in encouraging efficient water use practices. Residential water use accounts for

13   over 60% of total water consumption in the SFPUC Regional Water System. The

14   econometric model I developed for this customer class greatly enhances my ability

15   to make accurate predictions about the economic ramifications of water supply

16   disruptions.

17   For each customer class in each agency, the economic impact model calculates

18   the rationing levels that minimize economic surplus losses while still achieving

19   necessary levels of conservation. Actual surplus losses may be larger than those

20   calculated here to the extent that agencies use other factors to determine mandated

21   levels of conservation for different groups of consumers. Even with this

22   conservative assumption in place, the economic losses resulting from the levels of

1   rationing described by Mr. Steiner and Ms. Levin are extraordinarily large and

2   would have a devastating effect on the economy of the Bay Area.

3 Q. **PLEASE SUMMARIZE YOUR CONCLUSIONS ON THE ECONOMIC**

4   **IMPACTS OF THE POTENTIAL LEVELS OF RATIONING IDENTIFIED**

5   **BY MR. STEINER AND HOW SUCH RATIONING MIGHT BE**

6   **IMPLEMENTED BETWEEN THE WHOLESALE AND RETAIL**

7   **CUSTOMERS AS DESCRIBED BY MS. LEVIN.**

8 A. I calculated economic impacts for several levels of rationing: 10%, 20%, 41%,

9   and 51%. While the first two scenarios do not represent the maximum potential

10   impacts of the proposed instream flow requirements, these lower rationing levels

11   will occur with much greater frequency than at present, and with much greater

12   frequency than the maximum rationing scenarios. The results of my analysis of

13   these four scenarios are presented in Exhibit CSF-23.

14   With respect to lost consumer and producer surplus, the potential rationing

15   losses will result in significant impacts, which I calculate at $471 million annually

16   in the 51% rationing scenario. Losses in the other scenarios are $324 million (41%

17   Rationing), $119 million (20% Rationing), and $53 million (10% Rationing).

18   Rationing in the range of 40% - 50% is extreme, and it is more reminiscent of

19   the effects of a major earthquake than the effects of typical environmental

20   regulation. To understand some of the practical difficulties associated with

21   conservation of this magnitude, consider that residential consumption accounts for

22   around 60% of all water use in the Regional Water System. The United Nations

23   recommends that a minimum level of water to maintain human survival with basic

1   levels of sanitation is 13.7 gallons of water per person per day (gcd). Multiplying

2   this basic human water requirement across the population served by the Regional

3   Water System (and accounting for the proportion of supply from non-SFPUC

4   sources), it follows that roughly 34 mgd is needed to meet this basic level. Thirty-

5   four mgd is close to 13% of the total water delivered by the SFPUC, meaning that

6   this quantity is absolutely off-limits to conservation, and conservation must come

7   from remaining uses.

8   More realistic levels of residential indoor uses can be determined by looking

9   across retail agencies in the Bay Area. A level of 50 gcd is below that of any retail

10   agency in the Regional Water System, is below the level currently attained in East

11   Palo Alto, a severely depressed city, and 13% below the current level of

12   residential consumption in the City of San Francisco, which has one of the lowest

13   levels of per capita water use of any major city in California. At a level of 50 gcd,

14   residential consumption across the Regional Water System would account for

15   nearly 125 mgd in total. In this instance, all required conservation would need to

16   be met by reductions in other demands such as outdoor use, commercial and

17   industrial uses. In addition, some agencies can turn to alternative supplies to

18   replace some portion of lost SFPUC deliveries as described in Exhibit CSF-24

19   Q.   **PLEASE DESCRIBE THE IMPACT OF THE POTENTIAL WATER**

20   **RATIONING LEVELS ON EMPLOYMENT AND SALES IN THE SAN**

21   **FRANCISCO BAY AREA.**

22   A.   The impact of the potential rationing levels on employment is severe. In the 51%

23   rationing scenario, I estimate that the Bay Area would lose more than 188,000 jobs

1   as industrial and commercial output is reduced to meet conservation requirements.

2   Such losses account for over one-tenth of all payroll in the SFPUC Regional Water

3   System service area. Job losses in the other scenarios are 139,146 (41%

4   Rationing), 6,562 (20% Rationing), and 3,922 (10% Rationing). Note that job

5   losses increase dramatically in the event of larger rationing as firms run out of

6   ways to reduce water consumption that do not require shutting down.

7   Lost sales of firms in the SFPUC Regional Water System area are in excess of

8    $49 billion annually in the event of 51% rationing. This figure corresponds to

9   roughly 20% of all economic activity in the region. Sales losses in the other

10   scenarios are $37 billion (41% Rationing), $3.1 billion (20% Rationing), and

11   $1.8 billion (10% Rationing).

12   **Q.   DOES THIS CONCLUDE YOUR TESTIMONY?**

13   **A.**   Yes, it does.

Economic Impacts of Potential Levels of Rationing for Regional Water System

Measure	10% Rationing	20% Rationing	41% Rationing	51% Rationing
Lost Surplus				
SFPUC Retail (thousands)	$0	$330	$27,530	$55,310
Wholesale (thousands)	$52,685	$118,972	$296,383	$415,257
Total	$52,685	$119,302	$323,913	$470,567
Lost Jobs	3,922	6,562	139,146	188,049
Lost Sales (millions)	$1,818	$3,144	$36,673	$49,148

Notes:

(1) Water is allocated by agency according to FY 2004-05 consumption, and is efficient among sectors.

(2) Guadalupe Valley and Stanford are excluded from welfare loss calculations due to lack of pricing data.

(3) Total Sales includes all sales, shipments, receipts, and revenues in the industrial and commercial NAICS codes for Alameda, San Francisco, San Mateo, and Santa Clara Counties.

(4) To reflect that SFPUC retail and wholesale agencies do not service the entire counties for which we have data, all of San Francisco and San Mateo County sales are included, while 50% of Alameda County and 80% of Santa Clara County sales are included. (See "Hetch Hetchy and the Bay Area Economy," Bay Area Economic Forum, October 2002.)

(5) Total Payroll includes all payroll in the industrial and commercial NAICS codes for Alameda, San Francisco, San Mateo, and Santa Clara Counties. Total jobs in the industrial and commercial NAICS codes for Alameda, San Francisco, San Mateo and Santa Clara Counties total 1,627,780.

(6) Weighted-average industrial and commercial output elasticities were calculated using MHB output elasticities and 2002 Economic Census data. The elasticities reported in the MHB study are for 0% to 15% and a 15% to 30% reductions in water supply.

Sources:

(1) BAWSCA Annual Survey, FY 2004-2005.

(2) SFPUC Consumption and Pricing Data <CP Active Accounts.xls>.

(3) 2002 Economic Census data

(4) Welfare Loss Models (Table 14)

(5) MHB Study and 2002 Economic Census data

(6) 2004 County Business Patterns data

(7) Welfare Loss Models

(8) MHB Study and 2004 County Business Patterns data

BEC Berkeley Economic Consulting

Technical Report Describing the Economic Analysis of Water Rationing on the SFPUC Regional Water System

David Sunding
Director, Berkeley Economic Consulting, Inc.
Professor, UC Berkeley

September 21, 2009

Model

This document describes the specification and calibration of the model used to calculate the economic impacts of water rationing in the SFPUC Regional Water System. The model is an agency-level optimization model that allocates water to minimize the economic surplus lost from required reductions in total water consumption.

Define the following variables for each water agency:

x_i: consumption of sector i

$S_i(x_i)$: surplus (welfare) of sector i

r: marginal water rate

Then we can write demand as marginal surplus, or

$$D_i(x_i) = \frac{dS_i(x_i)}{dx_i}: \text{ demand curve of sector } i$$

Define the total quantity of water consumed by each sector within the agency as

x_{i0}: base quantity consumed by sector i

x_0: base quantity supplied by the agency

Then it follows that the marker for water will clear (supply will equal demand) if the following relationship holds:

$$\sum_i D_i^{-1}(r) = x_0$$

Sectoral water demand is assumed to be linear, or

$$D_i(x_i) = a_i + b_i x_i$$

The parameters of the demand relationship are determined using base rates, quantities consumed, and price elasticities as follows:

ε_i: elasticity of demand of sector i

$$b_i = \frac{r}{\varepsilon_i x_{i0}}$$

$$a_i = r\left(1 - \frac{1}{\varepsilon_i}\right)$$

Given these specifications, the economically efficient allocation of water within an agency is determined as the solution to the following linear programming problem:

$$\max_{\{x_i\},\lambda} L = \sum_i S_i(x_i) + \lambda\left[x_0 - \sum_i x_i\right]$$

The solution to the model is determined by solving the following $i+1$ equations for the sectoral demands $\{x_i^*\}$ and the Lagrange multiplier (or shadow value) λ^*:

$$D_i(x_i) - \lambda = 0$$
$$x_0 - \sum_i x_i = 0$$

Given the specification of demand outlined above, the model is calibrated so that with baseline levels of supply, current demands are optimal. To model the loss-minimizing levels of rationing for each sector, the linear program is re-run given new values of x_0.

Economic surplus losses for each sector are calculated as follows:

2

$$\Delta S_i = S_i(x_i^*(x_1)) - S_i(x_i^\bullet(x_0)) ,$$

where

x_1 : post-regulation level of agency water supply

Job losses and sales losses are calculated using elasticities based on changes in industrial and commercial sector water consumption.

Data Sources

The BAWSCA Annual Survey contains data on water consumption by five different sectors: residential, industrial, commercial, government, and other. For the purposes of our model, we are assuming that the Government and Other sectors have perfectly inelastic demand. For the remaining three sectors (Residential, Commercial, and Industrial), we construct linear demand curves using price elasticities of demand and consumption and price data.

Residential elasticity of demand for each agency is calculated from a regression analysis described in the following section. Commercial and industrial sector elasticities are taken from the MHB study. Values used are -0.1206 for commercial and -0.1029 for industrial; these elasticities are assumed to be invariant among agencies. SFPUC data only separates out residential versus non-residential; for this case, all non-residential consumption is allocated to the commercial sector under the assumption that most of the non-residential activity in San Francisco is commercial instead of industrial.

Consumption data are taken from the BAWSCA Annual Survey for FY 2004-2005. Prices for each sector and agency are calculated at the average consumption amount using the residential retail rate structures in the annual survey.

The model calculates losses for four rationing scenarios using a base of 265 mgd: 10%, 20%, 41%, and 51%. Under 10 % rationing, SFPUC retail is constrained to 81 mgd and hence does not experience a shortage. Wholesale customers receive 64% of the available supplies, equivalent to a 17% reduction. Under the remaining rationing scenarios SFPUC retail is allocated 37.5% of available supplies and wholesale customers the remaining 62.5%. At 20% rationing, SFPUC experiences a water reduction of 1.85% and wholesale customers a reduction of 28.5%. SFPUC retail water is reduced 27.6% and wholesale is reduced 46.9% given 41% rationing. At 51%, SFPUC retail is reduced 39.9% and wholesale is reduced 55.9%.

3

Residential Demand Model

A price elasticity of demand for water was calculated using single-family residential price and consumption data from SFPUC and BAWSCA member agencies. Water consumption, marginal price, and customer data were taken from BAWSCA Annual Surveys (FY 1995-96 through FY 2004-05). Price and consumption data for FY 2002-03 were unavailable for BAWSCA member agencies. Additionally, the following BAWSCA agencies were not included in the regression analysis: Cordilleras, Guadalupe Valley Municipal Improvement District, Los Trancos, and Stanford University.[1] SFPUC data, received from the SFPUC,[2] only spanned FY 1999-00 through FY 2004-05.[3] In total, there are 249 observations spanning 28 water agencies (27 BAWSCA members and SFPUC). Each of the BAWSCA members with price data has nine years of data, and SFPUC has six.

Average yearly single-family household consumption for each water agency was calculated by dividing the total single-family residential consumption for the fiscal year by the number of single-family residential accounts for that fiscal year. A monthly average consumption was created by dividing the yearly average by twelve. The marginal price of water is equal to the marginal price charged by each agency to residential customers for a ccf of water at the calculated average monthly consumption for that fiscal year. While we would ideally like to have an actual marginal price of water, the lack of customer-level data forces us to use the above marginal price as a proxy.

Agency fixed effects terms are not used in the regression. Instead, climatic and other exogenous agency-specific factors are used as controls. The weather variables used in the regression are average maximum daily temperature during the summer months of July, August, and September; and total annual precipitation. (In general, there is little to no precipitation in the Bay Area during the summer.) Each water agency was matched to the geographically closest weather station reporting to the Western Regional Climate Center.[4] Some water agencies share the same weather data because there are only seven weather stations to the 28 water agencies.

Additional variables to control for differences in water consumption behavior include average single-family home lot size from DataQuick and average household income from Census data. Both these variables control for socioeconomic factors. We would expect water agencies with larger housing lots to consume more water because larger lots

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[1] No price data are available for Cordilleras, Stanford, and Guadalupe Valley. Los Trancos was merged into CWS – Bear Gulch in FY 2004-05. Cordilleras dropped out of BAWSCA after FY 2001-02.

[2] Excel file <CP Accounts.xls> received from SFPUC.

[3] The fiscal years of BAWSCA and SFPUC start on July 1st.

[4] Available at http://www.wrcc.dri.edu/summary/Climsmcca.html. The seven weather stations reporting to the WRCC are Half Moon Bay, Newark, Pacifica 4 SSE, Palo Alto, Redwood City, San Francisco WSO (SFO), and San Jose.

correlate with more outdoor water use (for lawns and landscapes, etc.). Wealthier households are also expected to use more water than poorer households.

Lot size data from DataQuick were for single family homes by ZIP code. An average agency lot size was calculated by intersecting ZIP code boundaries with BAWSCA and SFPUC agency boundaries using ArcView and taking an area- and population-density-weighted average of the ZIP codes that comprise each agency.

Similarly, median household income data by census tract were intersected with water agency boundaries, and an area- and population-density-weighted average of the census tracts median household incomes is used as the average household income for each water agency.

The percent of best management practices (BMPs) implemented in FY 2004-05, as reported in the BAWSCA Annual Survey report, is also included to control for variations in consumption behavior among the different agencies. SFPUC BMP implementation was derived from the 2005 San Francisco Urban Water Management Plan. (BMP implementation for prior years is not available, although the California Urban Water Conservation Council has data that could be potentially useful.) Note that this variable does not vary with time.

The basic linear regression equation used to calculate consumer elasticity of demand has the following form:

$$\ln(consumption) = \alpha + \beta_1 \cdot \ln(rate) + \beta_2 \cdot BMP + \beta_3 \cdot lotsize + \beta_4 \cdot hhinc$$
$$+ \beta_5 \cdot summertemp + \beta_6 \cdot precipitation + \beta_7 \cdot year + \varepsilon$$

The results of the regression are presented in the table below.

Estimation Results for Residential Water Demand Model

Dependent Variable: ln(water consumption)

	[I]		[II]		[III]		[IV]	
					With Rate-BMP and Rate-Income Interactions		With Rate-BMP, Rate-Income, and Rate-Lotsize Interactions	
	Base Specification		With Rate-BMP Interaction					
Variable	coeff.	|t-statistic|	coeff.	|t-statistic|	coeff.	|t-statistic|	coeff.	|t-statistic|
ln(rate per ccf at average use)	-0.1759	4.89	-0.5477	4.94	-1.1263	5.37	-0.9381	3.59
percent of BMPs implemented	-0.1845	2.45	-0.6988	4.08	-0.7524	4.55	-0.6018	3.11
average lot size (thousand sq. ft.)	0.0351	10.23	0.0361	10.11	0.0347	11.50	0.0548	5.97
"average median" household income (thousand dollars)	0.0053	8.82	0.0050	7.43	-0.0003	0.20	-0.0019	1.16
average daily maximum summer temperature (July, August, September)	0.0093	3.72	0.0120	4.88	0.0132	5.43	0.0146	5.70
annual precipitation (inches)	-0.0013	0.81	-0.0016	0.96	-0.0007	0.43	-0.0005	0.28
year	0.0041	0.90	0.0040	0.91	0.0036	0.84	0.0041	0.96
Rate-BMP Interaction			0.6067	3.76	0.6770	4.50	0.4627	2.26
Rate-Income Interaction					0.0062	3.66	0.0078	5.19
Rate-Lotsize Interaction							-0.0218	2.27
R-squared	0.78		0.80		0.81		0.81	

Notes:
Robust t-statistics shown.

Sources:
BAWSCA Annual Survey
SFPUC data (<CP Accounts.xls>)
DataQuick lot size data
Census data for household income
Weather data from WRCC

An R-squared value of 0.78 indicates that the model is a strong fit for the data. Roughly 78% of the variation in residential water consumption can be explained by the seven factors we have examined (marginal rate/price, BMP implementation, lot size, household income, summer temperature, annual precipitation, and year).

Controlling for weather and other agency-specific factors detailed below, we estimate a price elasticity of -0.176, which means that a 10% increase in the incremental price of water will cause single-family residential customers in the BAWSCA and SFPUC jurisdictions to reduce water consumption by 1.76 percent. This elasticity indicates that the price elasticity for water is relatively inelastic: customers do not respond to increases in water prices by proportionately decreasing water consumption. However, the coefficient on the term is statistically significant, indicating that there is *some* water consumption change due to changes in price.

As expected, the percentage of BMPs implemented significantly affects the amount of water consumption. However, the coefficient on this term is not very high, indicating that BMPs as a whole do not significantly influence residential water consumption. An increase of two BMPs (out of 15 total) in an agency can be expected to yield a 2.5% reduction in water consumption, a modest amount.

The average lot size coefficient is also as we would expect: agencies with larger lot sizes will tend to have consumers who consume more water. The coefficient, which is highly significant, indicates that an increase in lot size of 1,000 square feet results in

approximately a 3.5% increase in water consumption. Similarly, the hypothesis that water consumption increases as income increases is also borne out by the analysis: an increase in household income of $10,000 corresponds with a 5.3% increase in water consumption. Also as predicted, higher summer temperature is correlated with water consumption. An average increase of one degree Fahrenheit in the maximum temperature in summer months causes a 0.9% increase in water consumption.

The model indicates that annual precipitation and the year do not affect the amount of residential water consumption for the time period in question (1995-2005).

An additional specification of the regression model was run to test for the effects, if any, of demand hardening. Demand hardening refers to the phenomenon where the demand for water becomes relatively more inelastic as more of the easier or more attractive forms of water conservation have been implemented, rendering any current or future initiatives for water reduction much more expensive. Due to the Bay Area's drought history, it is widely believed that demand hardening has indeed occurred to mitigate the effects of each of the succeeding droughts.

To estimate the effects of demand hardening in our regression model, we interact the price term with the percent of BMPs implemented, allowing us to estimate a price elasticity that depends on the BMP term. Assuming the most economical BMPs are implemented first, as more BMPs are employed, demand is expected to harden because each additional BMP is more expensive to implement.

The regression specification including the demand hardening term is

$$\ln(consumption) = \alpha + \beta_1 \cdot \ln(rate) + \beta_2 \cdot BMP + \beta_3 \cdot lotsize + \beta_4 \cdot hhinc$$
$$+ \beta_5 \cdot summertemp + \beta_6 \cdot precipitation + \beta_7 \cdot year + \beta_8 \cdot (\ln(rate) * BMP) + \varepsilon$$

The estimation results indicate that demand hardening does in fact exist: as an agency implements more BMPs, the price elasticity becomes smaller (i.e. more inelastic). Customers are thus less likely to respond to price increases by decreasing water consumption as more BMPs are put in place.

Note that the coefficient of the first term ("ln(rate per ccf at average use)") no longer represents the elasticity of demand because price is interacted with BMP implementation. At the average BMP implementation and at the average price, the calculated elasticity is -0.236, which means that a 10% increase in the incremental price of water will cause single-family residential customers to reduce water consumption by 2.36 percent.[5]

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[5] Calculated as the mean BMP-price interaction value (.514) multiplied by the rate-bmp coefficient (.6067) plus the rate term (-.5477).

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We would expect some multicollinearity because the variables we have selected would be expected to be correlated to some degree. However, given that none of the variance inflation factors (VIFs) are over 10, multicollinearity does not appear to be a specification problem with our regression model.

The Breusch-Pagan heteroskedasticity test does not indicate any problems with heteroskedasticity. However, to be conservative, Huber-White robust standard errors are displayed in the table above.

The Ramsey specification error test was also run to detect omitted variables. With a p-value of 0.0025, this test indicates that the specification may have omitted variable biases.

Additionally, an alternative model was run with a price and income interaction term. The results show that this interaction term renders the income term insignificant, while making the price-income interaction term significant. Other coefficients do not change dramatically.

The price elasticity of demand for residential water calculated from our model fits very well with the price elasticities from previous studies, especially those that examined price elasticities in California. While estimates of the price elasticity for water tend to vary significantly, our estimate is near the inelastic side of the results.

Our calculated elasticity of -0.176 is within the range of calculated price elasticities of demand in the academic literature. For example, Schneider and Whitlatch estimated short-run residential price elasticity to be -0.119 and long-run elasticity to be -0.262.[6] Espey, Espey, and Shaw, in their meta-anaylsis, found an average price elasticity of -0.51, with a short-run median elasticity of -0.38.[7] Renwick and Green estimated a price elasticity of -0.16 for the eight California water agencies they studied (only SFPUC overlaps with our water agencies), a result very close to our own.[8]

Non-SFPUC Water Supplies

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[6] Schneider, M.L. and Whitlatch, E.E. "User Specific Water Demand Elasticities." Journal of Water Resources Planning and Management Vol 117 no 1, pp. 52-73, 1991.

[7] Espey, M., J. Espey, and W.D. Shaw, Price Elasticity of Residential Demand for Water: A Meta-Analysis. Water Resources Research, vol 33 no 6, pp. 1369-74, June 1997.

[8] Renwick, Mary E. and Richard D. Green, "Do Residential Water Demand Side Management Policies Measure Up? An Analysis of Eight California Water Agencies," Journal of Environmental Economics and Management, vol 40, pp.37-55, 2000.

One extension to the programming framework above is that some agencies have non-SFPUC supplies available that can be brought online or increased during a drought. This modification simply adds an agency-specific supply curve to the programming analysis, but the basic framework remains intact.

The agency supply curve is composed of a step function with two steps: the first step being the SFPUC supply and the second step representing the sum of all other water supplies. The SFPUC step has a height equal to the wholesale price of SFPUC water ($1.168 per ccf) and a length equal to the water supply available to the sector, agency, or region. The second step has a height equal to $1.25 (an arbitrary price that is slightly more than the SFPUC price) and a length equal the sum of the non-SFPUC water supplies.

Water supply capacity information for each agency was gathered from a variety of sources, including the BAWSCA Annual Survey and agency Urban Water Management Plans. In general, actually supply capacities are used when available, and when actual supply data are not available, consumption in FY 2004-2005 is used instead. Some of the assumptions regarding water supply capacities are listed below:

The following table describes the assumptions made regarding alternative supplies:

Assumptions for Water Supply Capacities

Supplies during a Normal Year:

1 Groundwater capacities are equal to the capacities listed in the Urban Water Management Plans for the agencies during normal years for Alameda CWD, Coastside CWD, Daly City, and Sunnyvale. Alameda CWD groundwater capacity is assumed to be equal to gw storage plus gw recharge minus gw system demands. No groundwater supply information exists for CWS - South SF, San Bruno, San Jose, and Santa Clara; these agencies have supply equal to FY 0405 consumption.

2 Alameda CWD SWP capacity, desalination capacity, and Semitropic banking withdrawals during a normal, non-drought year are from the UWMP. (Alameda CWD Urban Water Management Plan, Table 8-4)

3 Recycled water capacity is assumed to be equal to the actual recycled water consumption for FY 2004-05.

4 Surface water capacity is assumed to be equal to FY 2004-05 consumption.

5 Santa Clara Valley WD capacity is assumed to be equal to the actual SCVWD consumption for FY 2004-05.

6 SFPUC capacity is assumed to be equal to the actual SFPUC consumption for FY 2004-05.

Supplies during a Drought Scenario:

1 For those agencies with groundwater capacities in UWMPs, they are equal to capacity during a multiple year drought scenario. Otherwise, they are reduced by the percentage of total water reduction during a drought scenario. Alameda CWD groundwater capacity is assumed to be equal to max gw storage and min gw recharge less the multiple drought year groundwater system demands. (Table 3-1 and 8-4 of UWMP)

2 SWP water is equal to minimum capacity per Table 3-1 of the Alameda CWD UWMP.

3 Semitropic banking withdrawal is equal to the max available per Table 3-1 of the Alameda CWD UWMP. Desalination remains unchanged from a normal year.

4 Recycled water capacity is not reduced during a drought scenario.

5 Surface water capacity is assumed to be zero during a drought, except for Coastside CWD, where it does not change according to drought level.

6 SCVWD capacity is reduced by the percentage of total water reduction during a drought scenario.

7 SFPUC capacity is reduced by the percentage of total water reduction during a drought scenario.