Appendix L

City and County of San Francisco Analyses

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Acronyms and Abbreviations

AF	acre-feet
BARDP	Bay Area Regional Desalination Program
CCSF	City and County of San Francisco
CEQA	California Environmental Quality Act
DWR's	California Department of Water Resources'
FERC	Federal Energy Regulatory Commission
mgd	million gallons per day
MID	Modesto Irrigation District
OID	Oakdale Irrigation District
PEIR	Programmatic Environmental Impact Report
SED	substitute environmental document
SFPUC	San Francisco Public Utilities Commission
TID	Turlock Irrigation District
WSIP	Water System Improvement Program

L.1 Introduction

The San Francisco Public Utilities Commission (SFPUC) is a department of the City and County of San Francisco (CCSF) that provides retail drinking water and wastewater services to San Francisco, wholesale water to three Bay Area counties, and green hydroelectric and solar power to San Francisco's municipal departments. The Hetch Hetchy Watershed, in the Tuolumne River Watershed, provides approximately 85 percent of San Francisco's total water needs. The LSJR alternatives may affect the amount of surface water diversions to the SFPUC service area.

CCSF's water rights for the Hetch Hetchy water system on the Tuolumne River are junior to the most senior rights held by Turlock Irrigation District (TID) and Modesto Irrigation District (MID). Under the Raker Act, which authorized the construction of the Hetch Hetchy water system, CCSF must recognize the prior rights of TID and MID. Based on these prior rights and the Raker Act, CCSF cannot store water in Hetch Hetchy or directly divert water unless they first bypass minimum flows during spring and summer. Various agreements between CCSF and MID/TID, made in conjunction with the construction of New Don Pedro Reservoir, have reduced the effects of the storage and diversion constraints imposed on CCSF's reservoirs by the Raker Act by allowing CCSF to obtain storage credits in New Don Pedro Reservoir. These storage credits allow CCSF to store and directly divert water, within prescribed limits, when Raker Act constraints would not otherwise allow them to do so. There is some question, however, regarding how the latest of these agreements, (i.e., "Fourth Agreement"), could affect CCSF's water supply during periods of extended drought, especially when combined with the increased instream flow requirements under LSJR Alternatives 2, 3, and 4.

The purposes of this appendix are as follows.

1. To generally describe how CCSF's water supply could be affected by changed flow objectives.
2. To quantify the potential water supply effects on CCSF based on two different interpretations of how the Fourth Agreement could affect CCSF's responsibility to contribute to instream flows if new flow objectives are imposed as a condition of water quality certification associated with the Federal Energy Regulatory Commission (FERC) relicensing process for the New Don Pedro Project.
3. To describe the water transfer and other actions CCSF could take to meet water supply demand if water supplies are reduced.
4. To summarize the potential economic effects of water supply changes associated with a water transfer.

Although this appendix quantifies and describes how CCSF's water supply could be affected by changed flow objectives, the specific ultimate effect cannot be determined. The ultimate effect would likely be determined as it has in the past during times of water shortage--changes in overall water availability for the CCSF would most likely be resolved through agreements to purchase water. This appendix, therefore, includes analyses of the economic effects in the SFPUC service area that would result from the need for SFPUC to purchase water (i.e., water transfer) from willing sellers in the Central Valley. This appendix also summarizes information from other parts of this recirculated substitute environmental document (SED) that analyze actions CCSF may take to develop alternative water supplies: transfers, in-Delta diversions, and desalination. This appendix uses SFPUC and CCSF interchangeably as the public agency that provides potable water to the service area defined in Section L.3.1, *Service Area*.

L.2 General Background

Existing dams, water diversions, and downstream minimum flow agreements influence the hydrology of the Tuolumne River. New Don Pedro Dam, the major dam on the Tuolumne River, provides water to TID and MID. The Hetch Hetchy Dam and other dams constructed on tributaries in the Upper Tuolumne River Watershed provide hydropower and water supply for the CCSF).

CCSF operates several water supply and hydroelectric facilities in the upper reaches of the Tuolumne above New Don Pedro Dam. O'Shaughnessy Dam on the mainstem Tuolumne River impounds approximately 360 TAF to address CCSF's water needs and to provide instream flows in the Tuolumne River below O'Shaughnessy Dam. Two other storage facilities upstream of New Don Pedro Reservoir, Lake Eleanor and Cherry Lake, are also operated by CCSF for hydropower and water supply purposes. The combined capacity of these two reservoirs is about 300 TAF. Water from Lake Eleanor is diverted through the Lake Eleanor Diversion Tunnel and into Cherry Lake where it is released to supplement flows of the Upper Tuolumne River. The Hetch-Hetchy aqueduct conveys water from the Tuolumne River to the CCSF service area; the physical capacity of about 500 cubic feet per second (cfs) is limited by the Coastal Tunnel.

The current CCSF demand for water is about 290 TAF/y, or about 15 percent of the annual average unimpaired flow[1] of the Tuolumne River. The water rights and operating agreement for New Don Pedro Reservoir include seasonal storage in the CCSF upstream reservoirs and water banking (accounting) between TID, MID, and CCSF. CCSF has the right to store up to 740,000 AF/y in New Don Pedro Reservoir (CCSF, TID, and MID 1966)

Existing dams, water diversions, and downstream minimum flow agreements influence the hydrology of the Tuolumne River. Hetch Hetchy (360 TAF), Cherry Lake (270 TAF) and Lake Eleanor (27 TAF) in the Upper Tuolumne River Watershed provide hydropower and water supply for San Francisco and other Bay Area cities.

TID and MID have senior water rights on the Tuolumne River and control much of the river flow in most years. Under the Raker Act, which authorized the construction of the Hetch Hetchy system, the CCSF must recognize the prior rights of TID and MID to receive a certain amount of the daily natural flow of the Tuolumne River as measured at La Grange Dam when the water can be beneficially used by the districts. Under the Raker Act, CCSF must bypass 2,350 cfs, or the entire natural daily flow of the Tuolumne River whenever the flow is less than that amount. From April 15–June 13 (peak snowmelt) CCSF must bypass 4,066 cfs. (FERC 1996).

[1] *Unimpaired flow* represents the water production of a river basin, unaltered by upstream diversions, storage, or by export or import of water to or from other watersheds. It differs from natural flow because unimpaired flow is the flow that occurs at a specific location under the current configuration of channels, levees, floodplain, wetlands, deforestation and urbanization.

With the construction of New Don Pedro Reservoir, in which CCSF participated financially, TID, MID, and CCSF entered into a series of agreements establishing a water bank accounting system that provides CCSF with credit for water stored in the reservoir so that CCSF can store more water and make diversions when the water would otherwise be required to be delivered to MID and TID under the Raker Act. CCSF does not hold water rights to, or physically divert water from, New Don Pedro Reservoir.

The 1966 Fourth Agreement, between CCSF, TID, and MID, in part, sets forth the parties' responsibilities for water banking and operations involving New Don Pedro Reservoir, including sharing responsibility for additional instream flow requirements imposed as a result of FERC licensing. CCSF does not actually divert or store water in New Don Pedro Reservoir; instead it has a water bank account in the reservoir that provides flexibility in satisfying TID's and MID's Raker Act entitlements and its Fourth Agreement obligations. Under the Fourth Agreement, CCSF is allocated 570,000 AF of storage in Don Pedro Reservoir, with an additional 170,000 AF of storage when flood control is not required, to a maximum of 740,000 AF of storage space. Certain excess flows above the Raker Act requirements are credited to CCSF, which then "banks" the amount of water for later use. CCSF debits the water bank account when it diverts or stores water that would otherwise be within the districts' entitlements. A negative balance (CCSF bank depleted) would require prior agreement with the two irrigation districts. The Fourth Agreement also states that in the event any future changes to the New Don Pedro FERC water release conditions negatively impact the two irrigation districts, CCSF, MID, and TID would apportion the burden prorated at 51.7121 percent to CCSF and 48.2879 percent to MID and TID (CCSF, TID, and MID 1966).

Figure L.2-1 shows two examples of how water supplies are divided (on a daily basis) between TID and MID and CCSF under different hydrologic regimes. During a dry year in 1992, only 68 TAF (mostly in April) accrued for CCSF (68 TAF is equivalent to 1,143 cfs for 30 days). CCSF asked customers to conserve water and bought additional supplies from the California Department of Water Resources' (DWR's) emergency drought water bank due to the drought conditions that year. Rain and snow returned to the Sierra Nevada in 1993, allowing full water deliveries and replenishing surface storage in the Tuolumne River Watershed (including water banked by CCSF in New Don Pedro) and the Bay Area.

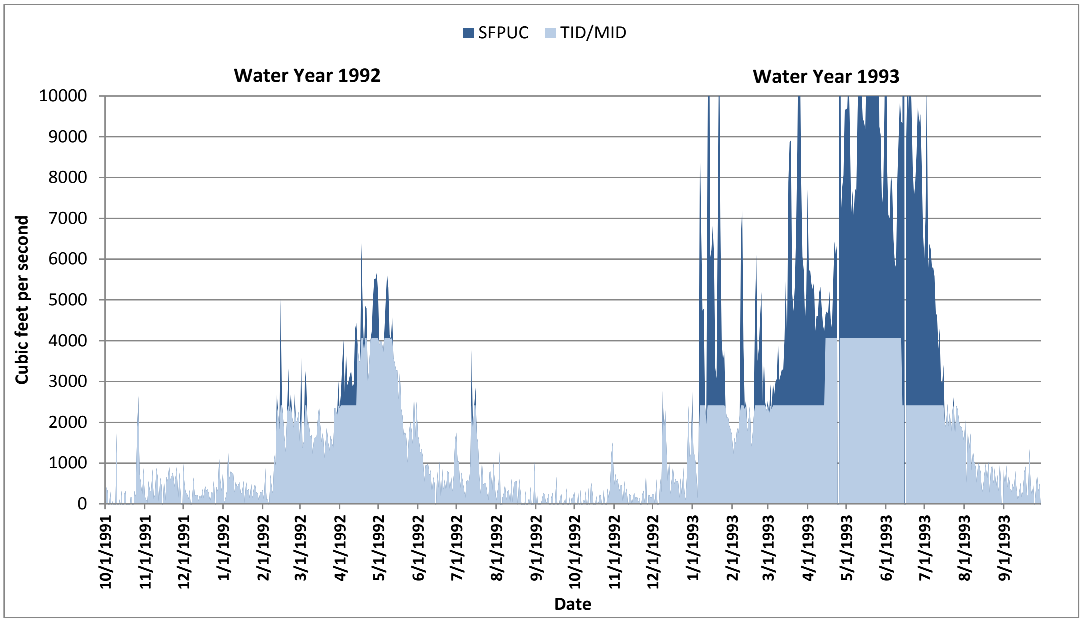

Figure L.2-1. Division of Water Supply between Turlock and Modesto Irrigation Districts (TID/MID) and the City and County of San Francisco (CCSF) for 1992 and 1993 (Source: California Department of Water Resources in Environmental Defense 2004)

The 1922-2003 average calculated volume of water potentially available to CCSF under the Raker Act was about 750 TAF/y, roughly the amount CCSF can bank in New Don Pedro Reservoir under the Fourth Agreement between CCSF and MID and TID, which represents about 40 percent of the Tuolumne River unimpaired flow at La Grange of 1,853 TAF/y for the 1922–2003 evaluation period. According to a SFPUC planning document, an average of 244 TAF/y is diverted from the Tuolumne River at Early Intake, located below Hetch Hetchy, Cherry, and Eleanor Reservoirs, based on data from 1989-2005, which represents 32.5 percent of the average annual unimpaired flow at that location (CCSF 2008). This CCSF diversion represents about 13 percent of the 1,853 TAF/y average annual unimpaired flow at La Grange.

L.2.1 CCSF Responsibility

CCSF may be one of the entities responsible for implementing an unimpaired flow requirement. The principal means by which CCSF would be responsible are as follows.

1. Responsibility is assigned specifically to CCSF in a proceeding amending the agency's water rights.
2. Responsibility is assigned to MID and TID in a proceeding amending the districts' water rights, and the SFPUC's water availability is determined by agreements with the irrigation districts.

The State Water Board may assign responsibility for meeting the flow objectives through a proceeding amending the agency's water rights to require compliance with the objectives. In a water right proceeding amending water users' rights, the State Water Board generally would assign responsibility for meeting the objectives in accordance with the rule of priority and other applicable law. At this time, it cannot be predicted how such responsibility would be allocated in a future proceeding among the water right holders on the Tuolumne River. Prior to assigning any responsibility, the State Water Board would comply with the California Environmental Quality Act (CEQA) on a project-level basis. Alternatively, or in addition, the CCSF may either continue any existing agreements, or enter into a new one, with the irrigation districts governing the responsibility for meeting instream flows required through the FERC relicensing process for New Don Pedro. The irrigation districts may be required to comply with the unimpaired flow requirements as a condition of the water quality certification under the FERC proceedings. Under an agreement such as the Fourth Agreement between CCSF and the irrigation districts, CCSF may contribute to minimum flow requirements imposed through the FERC process through an allocation of storage credits in New Don Pedro Reservoir or, under a different agreement with the irrigation districts, CCSF could pay the districts to release flows. The parties can negotiate amended or new agreements at any time, as they have done in the past (See the April 21, 1995 agreement between CCSF, TID, and MID [CCSF, TID, and MID 1995]).

L.3 Service Area and Ratepayer Background

L.3.1 Service Area

CCSF, through the SFPUC, owns and operates a regional water system that provides retail water directly to customers in San Francisco and wholesale water to 27 water agencies and water companies in three Bay Area counties, including those serving parts of Alameda, San Mateo, and Santa Clara Counties. The system also provides water to a small number of isolated retail and wholesale customers along the water system, including customers in Tuolumne County. In 2015, the SFPUC retail and wholesale service areas included service to about 2.6 million residents (SFPUC 2016).

The SFPUC water system has the capacity to deliver an annual average of about 265 million gallons per day (mgd) (296,800 acre-feet [AF]), of which about 85 percent is from the Tuolumne River Watershed through SFPUC's Hetch Hetchy Project, and about 15 percent is from the combined Alameda and Peninsula Watersheds (CCSF Planning Department 2008). During drought periods, the water provided by the Hetch Hetchy Project can amount to more than 93 percent of the total water delivered within SFPUC's retail and wholesale service areas (SFPUC 2011a).

In the 2010 baseline year established for this assessment, SFPUC water deliveries (excluding a small amount of groundwater deliveries) totaled about 226 mgd (253,100 AF), somewhat lower than average-year deliveries. The reduced demand in 2010 was due to several factors, including dry water conditions during the previous 2 years, resulting in SFPUC asking customers to reduce water consumption by 10 percent; a wet spring and cool summer during 2010, which slowed urban water demand throughout the state; and the effects of the economic recession (starting in 2008) that resulted in lower commercial and industrial water demands in subsequent years (SFPUC 2011a).

In 2010, SFPUC delivered about one-third of its regional water supply to its retail customers, primarily located in the city and county of San Francisco, with deliveries totaling about 76.5 mgd (85,690 AF) (Table L.3-1). About 55 percent of the demand for water in the retail service area was from residential customers, with commercial and industrial customers accounting for 32 percent of deliveries (Table L.3-2). Remaining demands (13 percent) were attributable to government and other water uses (e.g., system losses and meter under-registration losses).

Water deliveries in 2010 to SFPUC's wholesale customers in Alameda, San Mateo, and Santa Clara Counties totaled about 149.5 mgd (167,460 AF). These wholesale deliveries, which are annually made according to a contractual agreement, accounted for the remaining two-thirds of SFPUC's total water deliveries (Table L.3-1). In 2010, the wholesale customers, most of which are represented by the Bay Area Water Supply and Conservation Agency, consisted of 24 cities and water districts, plus Stanford University, one mutual water association, and one private utility. Within SFPUC's wholesale service area, about 50 percent of its total deliveries were made to customers in San Mateo County, 31 percent to customers in Santa Clara County, and 19 percent to customers in Alameda County (Table L.3-1).

The SFPUC regional water system met approximately 65 percent of the total demand for water of its wholesale customers in 2010 (Sunding 2014). As Table L.3-1 shows, individual water agencies rely on SFPUC supplies to varying extents. Based on fiscal year 2010–2011 water demands and deliveries, SFPUC provided at least 90 percent of the water used by 19 of the 27 wholesale agencies it served that year. An additional five agencies received at least half their water supply from SFPUC.

Water use by customer class also varies widely among the wholesale agencies, as shown in Table L.3-2. Across the entire wholesale service area, about 59 percent was delivered to residential customers, 21 percent to commercial and industrial customers, 11 percent to government and other users, and 9 percent to dedicated irrigation users.

Table L.3-1. SFPUC Water Deliveries to Retail and Wholesale Agencies and Reliance of Agencies on SFPUC Water, 2010

County/Agency	SFPUC Water Deliveries (mgd)	Percent of Total SFPUC Water Deliveries	Percent of Total Demand Met by SFPUC Regional Water System[a]
Retail Agency			
San Francisco City/County San Francisco Retail Area	76.50[b]	33.9	100.0
Wholesale Agencies			
Alameda County			
Alameda County Water District	10.81	4.8	18.3
City of Hayward	17.25	7.6	100.0
County subtotal	28.06	12.4	41.5
San Mateo County			
City of Brisbane/Guadalupe Valley Municipal Improvement District[c]	0.58	0.3	100.0
City of Burlingame	3.93	1.7	93.1
California Water Service Company[d]	32.57	14.4	95.1
Coastside County Water District	1.82	0.8	90.2
Cordilleras Mutual Water Association	0.01	0.0	100.0
City of Daly City	3.21	1.4	69.2
City of East Palo Alto	1.81	0.8	100.0
Estero Municipal Improvement District	4.90	2.2	100.0
Town of Hillsborough	2.97	1.3	100.0

County/Agency	SFPUC Water Deliveries (mgd)	Percent of Total SFPUC Water Deliveries	Percent of Total Demand Met by SFPUC Regional Water System[a]
City of Menlo Park	3.04	1.3	100.0
Mid-Peninsula Water District	2.87	1.3	100.0
City of Millbrae	2.24	1.0	99.1
North Coast County Water District	3.02	1.3	100.0
City of Redwood City	9.61	4.3	94.3
City of San Bruno	1.46	0.6	42.7
Westborough Water District	0.84	0.4	100.0
County subtotal	74.88	33.1	92.4
Santa Clara County			
City of Milpitas	6.28	2.8	61.0
City of Mountain View	8.95	4.0	82.8
City of Palo Alto	10.99	4.9	93.6
Purissima Hills Water District	1.75	0.8	100.0
City of San Jose (north)	4.13	1.8	90.8
City of Santa Clara	2.35	1.0	10.3
Stanford University	2.14	0.9	66.5
City of Sunnyvale	9.92	4.4	44.3
County subtotal	46.51	20.6	54.4
TOTAL RETAIL & WHOLESALE	225.95	100.0	73.6

Sources: SFPUC 2011a; Bay Area Water Supply and Conservation Agency 2012.

mgd = million gallons per day (1 mgd equals 1,120.147 AF of water).

[a] Based on water production and purchases during Fiscal Year 2010–2011.

[b] Includes water delivered to Lawrence Livermore Lab and the Groveland Community Services Districts. Excludes groundwater used for City of San Francisco irrigation uses and groundwater delivered to Castlewood and Sunol golf courses.

[c] The City of Brisbane and the Guadulupe Valley Municipal Improvement District represent two separate wholesale customers to SFPUC. However, their water demand data is reported together.

[d] CWS provides water to three separate service areas (Bear Gulch, Mid Peninsula, and South San Francisco).

Table L.3-2. Percentage Distribution of SFPUC Water Deliveries By Customer Class, 2010

County/Agency	Residential	Commercial & Industrial	Government & Other[a]	Dedicated Irrigation[b]
Retail Agency				
San Francisco City/County	55.2	32.1	12.7	NA
San Francisco Retail Area[c]				
Wholesale Agencies[d]				
Alameda County				
Alameda County Water District	61.0	14.9	14.5	9.6
City of Hayward	51.6	19.1	18.1	11.2
County subtotal	58.3	16.1	15.5	10.1
San Mateo County				
City of Brisbane/Guadalupe Valley Municipal Improvement District[c]	38.3	27.6	5.4	28.7
City of Burlingame	55.0	23.2	16.7	5.1
California Water Service Company[d]	67.5	22.2	10.3	0.0
Coastside County Water District	60.8	24.1	6.2	8.9
Cordilleras Mutual Water Association	100.0	0.0	0.0	0.0
City of Daly City	79.6	12.1	6.3	2.0
City of East Palo Alto	76.7	17.8	5.5	0.0
Estero Municipal Improvement District	61.4	11.0	4.1	23.5
Town of Hillsborough	94.7	0.2	3.7	1.4
City of Menlo Park	44.3	33.8	11.3	10.6
Mid-Peninsula Water District	60.7	14.8	24.5	0.0
City of Millbrae	66.4	16.1	10.1	7.4
North Coast County Water District	82.8	7.4	7.6	2.2
City of Redwood City	64.8	17.2	5.7	12.3
City of San Bruno	68.2	18.2	13.6	0.0
Westborough Water District	68.8	16.7	3.7	10.8
County subtotal	67.5	18.6	9.4	4.5
Santa Clara County				
City of Milpitas	43.0	24.5	13.6	18.9
City of Mountain View	53.2	18.8	4.2	23.8
City of Palo Alto	53.9	19.8	19.1	7.2
Purissima Hills Water District	93.6	0.0	5.8	0.6
City of San Jose (north)	22.9	43.2	4.5	29.4
City of Santa Clara	43.4	40.6	9.7	6.3
Stanford University	29.1	18.3	19.0	33.6
City of Sunnyvale	61.6	19.9	7.6	10.9

County/Agency	Residential	Commercial & Industrial	Government & Other[a]	Dedicated Irrigation[b]
County subtotal	49.6	26.5	10.4	13.5
TOTAL WHOLESALE	58.5	20.8	11.4	9.3

Sources: SFPUC 2011a; Bay Area Water Supply and Conservation Agency 2012.
NA = not available.

[a] Includes government uses, recycled water uses, unaccounted-for uses, meter under-registration loses, and other system losses.

[b] Includes dedicated irrigation uses for both private and government customers.

[c] Based on 2010 demands. Does not included city irrigation uses and golf course uses served by groundwater.

[d] Based on fiscal year 2010–2011 demands.

L.3.2 Ratepayers

SFPUC funds its water system through two separate budgets, its Hetch Hetchy Water and Power Budget and its Water Enterprise Budget. The Hetch Hetchy Water and Power Budget operates the collection and conveyance of approximately 85 percent of SFPUC's total water supply, employing a system of reservoirs, hydroelectric power plants, aqueducts, pipelines, and transmission lines that carry water and power to customers in San Francisco and to SFPUC's wholesale customers elsewhere in the Bay Area. The Water Enterprise is responsible for collecting, treating, and distributing SFPUC's water supply to its retail and wholesale customers, including operating and maintaining pipelines in San Francisco and the region, 27 pump stations, 28 dams and reservoirs, 9 water tanks, and 3 water treatment plants (SFPUC 2011b). An overview of recent budget expenditures under the Water Enterprise Budget and the water portion of the Hetch Hetchy Water and Power Budget are shown in Table L.3-3.

Table L.3-3. Overview of SFPUC Water Enterprise and Hetch Hetchy Water Budgets

Budget/Expenditure Category	Fiscal Year 2010–2011[a]	2011–2012[b]	2012–2013[c]	2013–2014[c]
Water Enterprise				
Operations and maintenance	149.1	178.5	173.4	176.8
Debt service	98.3	155.9	173.6	210.0
General reserve	16.5	1.3	2.4	5.4
Capital/revenue reserve	42.7	34.7	17.2	31.9
Programmatic projects	4.8	12.2	20.4	22.2
Water Enterprise subtotal	311.4	382.6	387.0	446.3
Hetch Hetchy Water				
Operations and maintenance	43.7	50.7	56.8	54.3
Reclassification of power only & joint operating costs[d]	(18.8)	(22.2)	(21.7)	(19.9)
Capital/revenue reserve	41.6	38.5	18.9	22.6
Programmatic project	0.0	0.2	3.6	2.5
Reclassification of power only & joint capital costs	(30.3)	(24.4)	(18.9)	(22.6)
Water Enterprise subtotal	36.2	42.8	38.7	36.9
TOTAL—BOTH BUDGETS	347.6	425.4	425.7	483.2

Source: SFPUC 2011b.

Note: Budget amounts shown in millions of dollars.

[a] Audited actual budget expenditures.

[b] Pre-audit actual budget expenditures.

[c] Adopted budget expenditures.

[d] Reflects expenditures reallocated to the Hetch Hetchy Power Budget for its share of costs shared with the Hetch Hetchy Water Budget.

SFPUC sets its retail water rates based on an independent rate study conducted at least once every 5 years. As shown by Table L.3-4, retail water rates consist of a monthly service charge based on meter size and a commodity charge based on usage volumes. Retail water rates through the 2013–2014 fiscal year were established by a 2009 rate study that examined the future revenue requirements and cost of service of the Water Enterprise. Annual rate increases are set to meet project costs and debt coverage requirements. Over the past 7 fiscal years, single-family retail water rates have increased from 6.5 percent to 15.0 percent per year (Table L.3-4). Annual non-residential rate increases have ranged from 6.0 percent to 15.8 percent.

SFPUC's water rates for its 27 wholesale customers are based on the Water Supply Agreement established in 2009 (CCSF 2009). Wholesale customers pay a proportionate share of regional water system operating expenses, debt service on bonds sold to finance regional system improvements, and other regional system improvements funded from current revenues, along with the repayment of previously constructed capital assets that were not otherwise fully depreciated (SFPUC 2011b). In general, costs are apportioned to wholesale customers based on proportionate water use, and rates are reset annually to cover costs as mandated by the Water Supply Agreement.

Wholesale water rates over the past 7 fiscal years are shown in Table L.3-4. The wholesale rate structure consists of a monthly service charge based on meter size and type, and a uniform volume charge. Monthly service charges to wholesale customers vary depending upon meter size and type. For example, during fiscal year 2013–2014, the monthly charge for a 5/8-inch disc/compound meter was $11.00, while charges for a 6-inch meter ranged from $476 for a disc/compound meter to $1,256.00 for a turbine meter. The volume charge currently stands at $2.45 per hundred cubic feet of water use, with annual rate changes varying from a decrease of 16.4 percent in fiscal year 2013-14 to an increase of 38.4 percent in fiscal year 2011-12 (Table L.3-4). The relatively large wholesale rate increase in fiscal year 2011–2012 was primarily due to the need to generate revenues to compensate for wholesale revenue underpayments during the previous 3 years resulting from decreased water purchases, and to continue paying for seismic upgrades to the Hetch Hetchy water pipeline system (Bay Area Water Supply and Conservation Agency 2011). (Note that the 2013–2014 rate decrease was due to a 1-year adjustment in the rate calculation, as explained in the footnote to Table L.3-4.) Based on SFPUC wholesale water costs, costs for other water supplies (if applicable), and other budgetary conditions faced by the 27 agencies that purchase water from SFPUC, retail water rates are then set for end-use customers (e.g., residential, commercial, and industrial) in cities and districts served by the agencies.

Table L.3-4. SFPUC Retail and Wholesale Water Rates, FY 2007/08– FY 2013/14

	Retail Water Rates									Wholesale Rates[c]	
		Single-Family			Multiple-Family			Non-Residential			
Fiscal Year	Service Charge Rate[a] ($)	Volume Charge ($/ccf) (0-3 ccf)	Volume Charge ($/ccf) (over 3 ccf)	Percent Increase	Volume Charge ($/ccf) (0-3 ccf)	Volume Charge ($/ccf) (over 3 ccf)	Percent Increase	Volume Charge ($/ccf)	Percent Increase	Volume Charge ($/ccf)	Percent Increase/ (Decrease)
2007–2008	4.60	2.08	2.50	15.0	2.47	2.47	15.0	2.52	15.2	1.30	6.6
2008–2009	4.70	2.28	2.89	15.0	2.87	2.87	15.0	2.92	12.7	1.43	10.0
2009–2010	5.40	2.61	3.48	15.0	2.87	3.82	10.5	3.35	14.8	1.65	15.4
2010–2011	6.20	3.09	4.12	8.2	3.28	4.37	6.6	3.89	15.8	1.90	15.2
2011–2012	7.00	3.50	4.60	12.5	3.70	4.90	12.5	4.52	15.5	2.63	38.4
2012–2013	7.90	3.90	5.20	12.5	4.20	5.50	12.8	5.10	12.8	2.93	11.4
2013–2014	8.40	4.20	5.50	6.5	4.50	5.90	7.0	5.40	6.0	2.45[b]	(16.4)[b]

Source: SFPUC 2013.
ccf = hundred cubic feet of water.

[a] Monthly service charge for 5/8-inch meter.

[b] The early payment by the wholesale customers of their liability of the pre-2009 Water Supply Agreement assets, and their projected higher water consumption for Fiscal Year 2013–2014, translated into a reduction of the wholesale water rate for that year.

[c] Note that wholesale service rate charges are not shown because these rates vary across meter size and type.

L.4 Water Bank Account Modeling

As described above, the Fourth Agreement between CCSF, TID, and MID currently governs the New Don Pedro Reservoir water bank account. Under certain conditions, excess flows exceeding TID's and MID's entitlements can be credited to CCSF. CCSF may have a credit balance up to 570,000 AF with an additional 170,000 AF of credit storage during times when encroachment into flood control space is permitted. Absent the prior consent of TID and MID, CCSF can never have a debit balance in the water bank account.

In addition, the Fourth Agreement allocates responsibility to meet instream flow requirements below New Don Pedro Reservoir that are imposed on TID and MID as licensees under the FERC hydropower license for the New Don Pedro Project. The irrigation districts and CCSF agreed to allocate such responsibility in Article 8 as follows:

(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 them of such burdens, City and Districts agree that there will be a re-allocation of storage credits so as to apportion such burdens on the following basis: 51.7121% to City and 48.2879% to Districts.

The parties can modify this responsibility through other agreements. For example, in 1995 CCSF and TID and MID entered into an agreement where CCSF agreed to pay the irrigation districts $3.5 million per year and the irrigation districts agreed to provide all of the water necessary to meet the FERC-license related minimum flow schedules set forth in a settlement agreement. (See the April 21, 1995 agreement between CCSF, TID, and MID [CCSF, TID, and MID 1995].) The agreement provided that once CCSF discontinued the payments, it would thereafter meet its obligations under Article 8 of the Fourth Agreement.

The LSJR flow objectives may be imposed on TID and MID as a condition of water quality certification associated with FERC relicensing for the New Don Pedro Project. It cannot be predicted whether and how CCSF and the irrigation districts would agree to apportion responsibility for meeting future flow requirements. In the past, the parties have agreed to either an allocation of storage credits or payments. This appendix, nonetheless, analyzes the potential water supply effects associated with the allocation of responsibility under paragraph (b) of Article 8 of the Fourth Agreement. Under Scenario 1, storage credits would be reallocated only if CCSF has a positive credit balance in the water bank account. Under Scenario 2, storage credits would be reallocated even if CCSF has a negative balance in the water bank account.

L.4.1 Bank Account Analysis Methods

A mass balance of the water bank in New Don Pedro Reservoir was performed to evaluate the effects of the LSJR alternatives. The daily bank account was computed using historical inputs for the baseline and adjusted releases for the LSJR alternatives. The time period modeled was from water year 1983–2002. The balance in the account, at time t, is defined as:

$$\mathbf{Vol}_{CCSF,t} = \mathbf{Vol}_{CCSF,t-1} + \mathbf{NDP\ Inflow}_{t-1} - \mathbf{Raker\ Act}_{t-1} - \mathbf{Evap}_{t-1} - \mathbf{Flood}_{t-1} - \mathbf{Increased\ FERC\ flows}_{t-1}$$

Where:

$\mathbf{Vol}_{CCSF,t}$ = Current balance of water in the CCSF's account ≤ 570 TAF plus ½ of permitted encroachment in the flood control space.

$\mathbf{Vol}_{CCSF,t-1}$ = Previous days balance in the CCSF's account.

NDP Inflow = Estimated inflow to New Don Pedro Reservoir, credits to the account (Column D) (Source: CCSF 2011a, 2011b).

Raker Act = Debits from the account, set forth in the Raker Act as:

4/15 - 6/14: 4066 cfs or natural flow at La Grange, whichever is less
6/15 – 4/14: 2416 cfs or natural flow at La Grange, whichever is less
(Source: CCSF 2011a, 2011b).

Evap = Evaporation and other losses are subtracted from the balance on a daily basis proportionate to the net credit balance in the water bank account (Source: CCSF 2011a, 2011b).

Flood = Flood releases are subtracted when required under the US Army Corps Flood Control requirements on the basis 50% Districts, 50% CCSF. Flood space was estimated using historic daily maximum storage (Source: CCSF 20011a, 2011b).

Increased FERC flows = Increased FERC releases are to be apportioned 51.71% to the City out of the City's credit. Under Scenario 1, 51.71% of the increased FERC flows are debited from the account only when the balance is positive. Under Scenario 2, 51.71% of the increased FERC releases are always subtracted from the account balance.

The daily bank account volume was calculated using historical data and compared with observed account balance provided by SFPUC. This account volume is considered the analysis baseline and represents historical conditions.

Baseline

The baseline credit balance was developed using historical inflows, Raker Act requirements, evaporation and flood control releases provided by SFPUC (Figure L.4-1) (CCSF 2011a, 2011b). During the drought of the late 1980s, the baseline is lower than historically reported because, during this time, the account dropped below zero and the City purchased water from the districts. The details of the purchase agreement between the City and the districts during this period are unknown, but the difference from baseline and the reported balance can be attributed to this purchase.

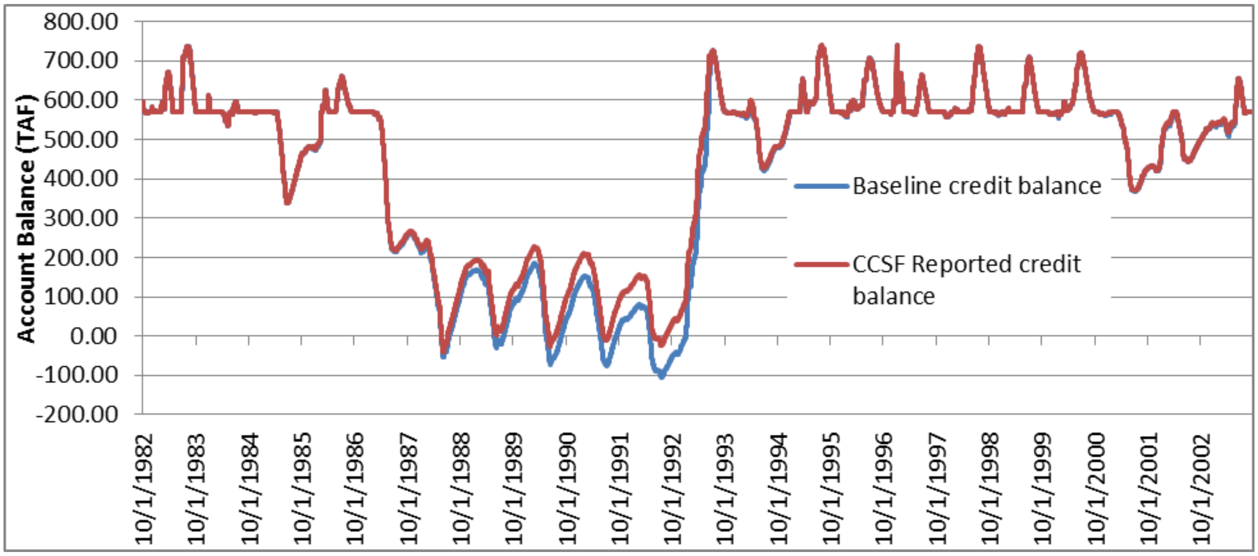

Figure L.4-1. Baseline Credit Balance and Historic Balance Showing Agreement

Under historic conditions the maximum amount of water needed to be purchased by the City to make it through the 6-year drought was about 105 TAF, or an average of 18 TAF per year for the 6-year period (1987–1992).

LSJR Alternatives

Three LSJR alternatives were analyzed—LSJR Alternative 2, 3, and 4 (20 percent, 40 percent, 60 percent unimpaired flow, respectively, between February and June).[2] The increased flow requirement for each alternative was estimated for each month by calculating the percentage of unimpaired flow. This method of determining the instream flow requirement at the compliance point near the confluence with the LSJR, which is different than the current FERC instream flow compliance location, which is at La Grange. To accurately compare the two instream flow requirements, the current FERC requirement(s) were adjusted by subtracting accretions and adding depletions for the reach between La Grange and the confluence. Each of the LSJR alternatives were analyzed under the two scenarios of the Fourth Agreement.

Assumptions

This analysis includes the following assumptions.

- Inflows to New Don Pedro Reservoir will remain as historical under each of the LSJR alternatives.
- Diversions through the Canyon Tunnel will remain as historical under each LSJR alternative.
- Accretions and depletions between La Grange and the confluence will remain constant from baseline for each LSJR alternative.

[2] A reference in this appendix to 20, 40, and 60 percent unimpaired flow is the same as LSJR Alternative 2, 3, and 4, respectively.

- Alternative flow requirements on the Lower Tuolumne do not affect evaporation rates in New Don Pedro Reservoir. In reality, evaporation is a function of surface area, which in turn is a function of storage. WSE model results do show changes in reservoir storage and, therefore, may change evaporation rates. This change in evaporation is assumed to be negligible. Flood control releases do not change from baseline for each LSJR alternative. Changes in reservoir storage may affect flood control storage volumes and releases. This may affect flood releases and, ultimately, bank account balances. This is assumed not to affect CCSF because water supply would be affected during times of drought and not during times of flood.

L.4.2 Water Bank Account Analysis Results

The LSJR alternatives were compared with baseline to determine how the changes in flow requirements would affect the water bank account balance in New Don Pedro Reservoir. The results showed that the only time the water bank account reached zero under all of the alternatives was during times of drought. The largest drought sequence in the study period was the 1987–1992 drought. This drought sequence is, therefore, the period compared to baseline in this section. Under the LSJR Alternative 4, the account reached zero in the early 2000s as well. In drought years, the account balance dropped below baseline, and during the 1980s drought, the credit balance was reduced below zero under all of the LSJR alternatives (Table L.4-1). Each LSJR alternative under each of the two scenarios created an annual average increase in shortage over the 6-year drought period from baseline (Table L.4-1 and Figures L.4-2 and L.4-3). The account reached zero more often under LSJR Alternative 4, such as in 1994 and 2001–2002, than it did under the other LSJR alternatives (Figure L.4-2).

Table L.4-1. Annual Supplement Needed to Maintain a Positive Balance in the New Don Pedro Reservoir CCSF Water Bank Account for Each Scenario (The drought 6-year average is for the years 1987–1992.)

		Scenario 1 Supplement Needed			Scenario 2 Supplement Needed		
Calendar Year	Baseline Supplement Needed (TAF)	LSJR Alt. 2 (20% UF) (TAF)	LSJR Alt. 3 (40% UF) (TAF)	LSJR Alt. 4 (60% UF) (TAF)	LSJR Alt. 2 (20% UF) (TAF)	LSJR Alt. 3 (40% UF) (TAF)	LSJR Alt. 4 (60% UF)(TAF)
1983	0	0	0	0	0	0	0
1984	0	0	0	0	0	0	0
1985	0	0	0	0	0	0	0
1986	0	0	0	0	0	0	0
1987	0	0	0	0	0	0	0
1988	54.6	70.5	147.5	209.3	73.6	185.1	311.8
1989	0.0	19.9	20.4	0.0	45.4	188.4	330.7
1990	20.2	58.6	68.0	46.5	73.7	142.2	213.9
1991	3.8	12.8	3.8	3.8	64.9	182.4	300.6
1992	29.6	29.6	29.6	29.6	58.5	125.5	198.2
1993	0	0	0	0	0	0	0
1994	0	0	0	0	0	0	61.3
1995	0	0	0	0	0	0	0
1996	0	0	0	0	0	0	0
1997	0	0	0	0	0	0	0
1998	0	0	0	0	0	0	0
1999	0	0	0	0	0	0	0
2000	0	0	0	0	0	0	0
2001	0	0	0	0	0	0	0
2002	0	0	0	11.4	0	0	57.7
2003	0	0	0	0	0	0	119.4
Drought Total	108.2	191.3	269.3	300.5	316.2	823.6	1593.7
6-yr Average	18.0	31.9	44.9	48.2	52.7	137.3	225.9
21-yr Average	5.2	9.1	12.8	14.3	15.1	39.2	75.9

UF = unimpaired flow
TAF = thousand acre-feet

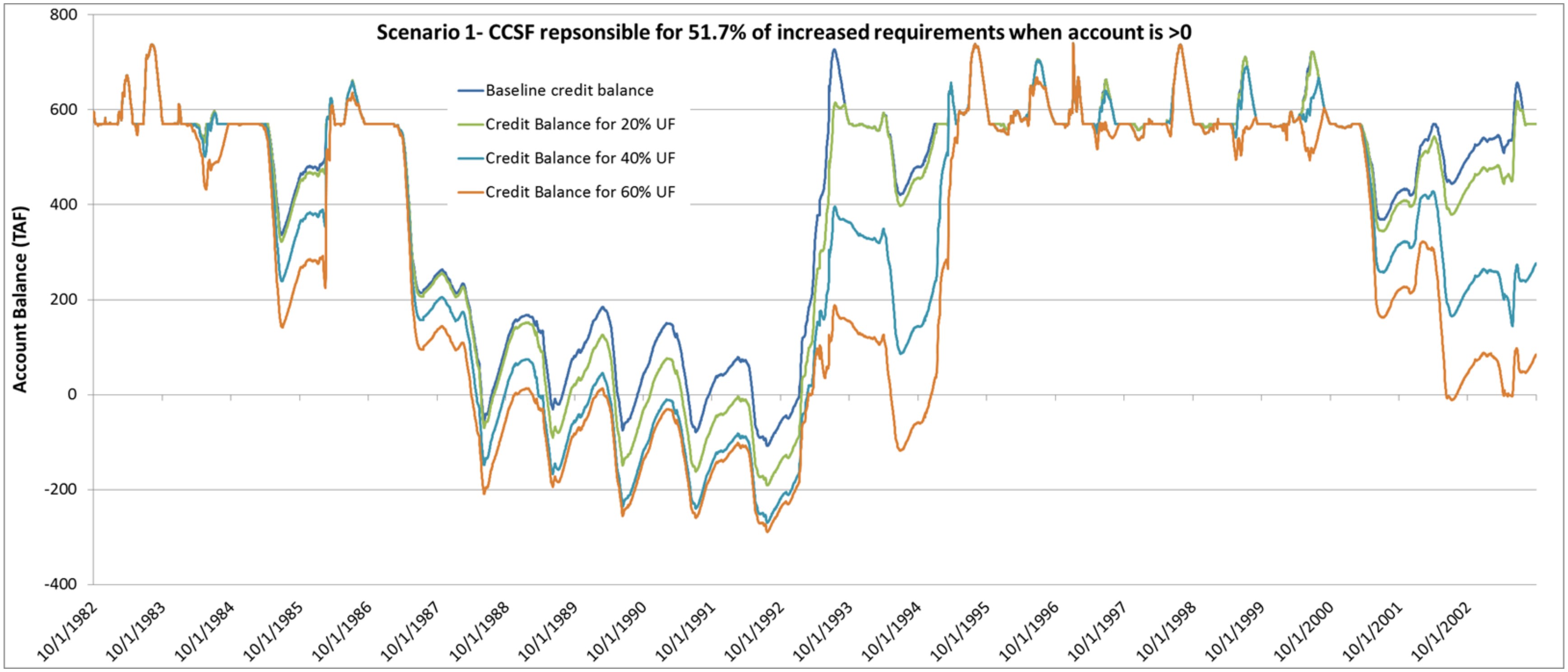

Figure L.4-2. CCSF's Water Bank Account Balance Assuming Scenario 1 (City is Responsible for 51.7% of Increased Flow Requirement Only When Balance is Positive.)

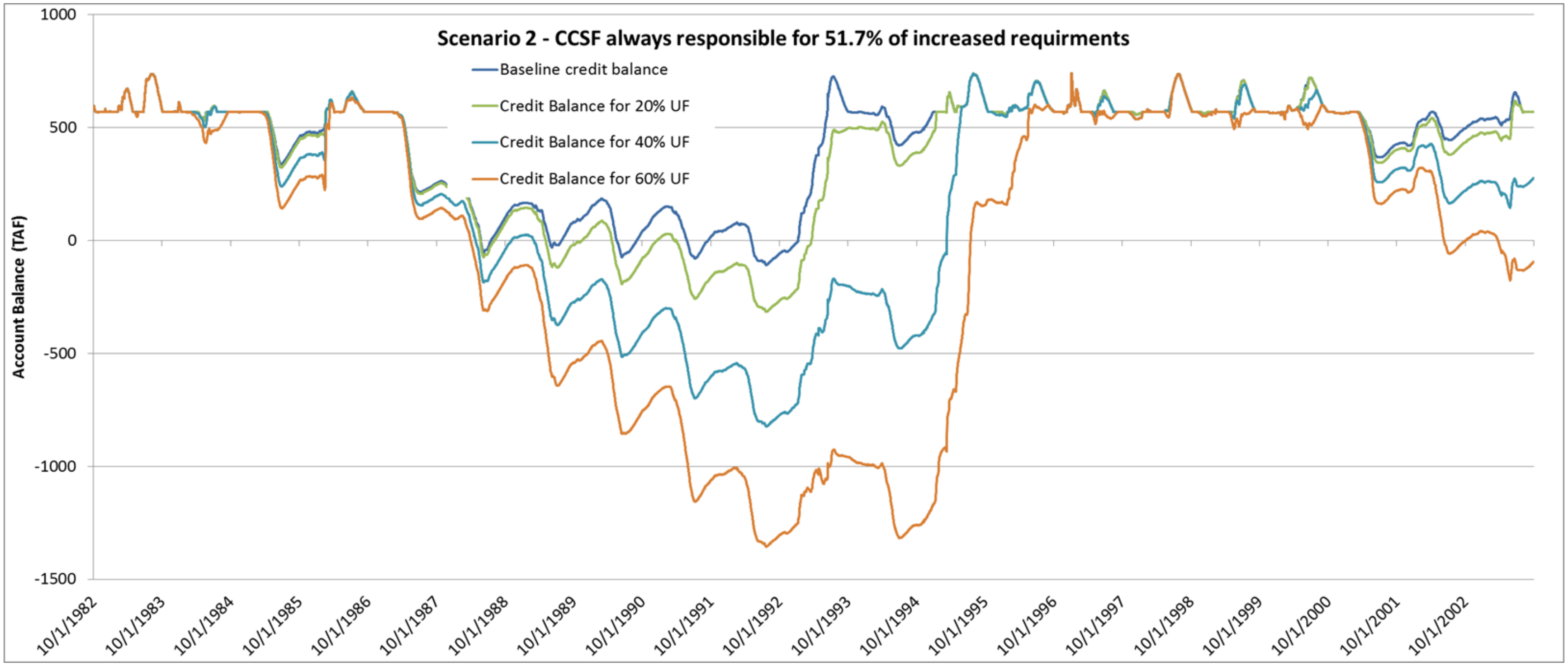

Figure L.4-3. CCSF's Water Bank Account Balance Assuming Scenario 2 **(City is Always Responsible for 51% of Increased Flow Requirement)**

The results show that increased instream flow requirements on the Lower Tuolumne River potentially required as a result of water quality certification associated with FERC relicensing would primarily affect SFPUC water supply during a drought. Reductions in the water bank account balance are replenished in average years; however, the results show that during multi-year droughts the balance is further diminished under the LSJR the alternatives.

SFPUC currently delivers an annual average of 238 mgd (SFPUC 2013). About 15 percent of the supply is from the Alameda and Peninsula Watersheds and 85 percent of the supply is from the Tuolumne River. However during drought periods, the Hetch Hetchy project can supply nearly 93 percent of the total supply delivered (SFPUC 2013). The SFPUC has undertaken a multi-year capital water supply improvement program, the Water System Improvement Program (WSIP), to upgrade its water supply systems; some of the projects within the WSIP are underway and some projects are nearing completion (SFPUC 2006) (see Chapter 16, *Evaluation of Other Indirect and Additional Actions*, and Section L.5, *Potential Actions to Meet Water Supply Demand*, for a description of several of these projects). These projects are meant to bolster the base supply to meet the service area's growing demands, as well as to provide reliability and supply during a drought (SFPUC 2006). Current supplies are adequate to meet current demand under annual average precipitation patterns. Increased future demands would be met through the WSIP. Under average annual precipitation patterns the bank account balance remains positive throughout the year; therefore, there is no effect to CCSF. During prolonged annual sequences of less than average precipitation, drought operations are invoked and LSJR alternatives could further reduce available supply.

Drought operations include a design maximum of 20 percent retail rationing per year, groundwater conjunctive use and agricultural water transfers. The 20 percent rationing is not uniform across all customers, some wholesale customers may receive up to 40 percent reductions (SFPUC 2013). It should be noted that these annual retail rationing considerations during drought operations were developed before Executive Order EO B-29-15, State of Emergency Due to Severe Drought Conditions, was implemented in May 2015, which directs urban water agencies to achieve mandatory water conservation goals; as a result, changes in the rationing design assumptions have likely changed since the SFPUC 2013 report was published. The Regional Groundwater Storage and Recovery project would yield over 60 TAF per drought cycle and is currently being constructed. Remaining design drought demand is met through transfers from irrigation districts. Historically, transfers have occurred from MID and TID to the SFPUC. However, in 2012, the MID Board of Directors rejected a proposal for long-term transfers to SFPUC. This rejection makes future temporary drought transfers uncertain. Negotiations are ongoing between neighboring Oakdale Irrigation District (OID) and the SFPUC. A transfer from OID would involve a wheeling deal with MID, but would not require any new infrastructure.

The decrease in water bank account balance below zero is considered bank account deficit, which can be interpreted as drought shortage from the Tuolumne River Watershed (Table L.4-1). The increase in deficit from baseline, in severe drought periods represented by the years 1987–1992, ranges from 14 to 30 TAF/y under Scenario 1 and from 35 to 208 TAF/y under Scenario 2 (Table L.4-2). This is the assumed water supply that would need to be replaced to meet the demand of the SFPUC service area. SFPUC has a variety of water supply options that may be employed to replace the drought supplies, which are discussed elsewhere in this document (Chapter 13, *Service Providers*, Chapter 16, *Evaluation of Other Indirect and Additional Actions,* and summarized in Section L.5, *Potential Actions to Meet Water Supply Demand*).

While the above results, and the annual average of 1987–1992 "severe drought year" increased deficits from baseline (i.e., additional supplemental water needed as a result of project alternatives), are expressed here and in the following Section L.6, *Regional Economic and Ratepayer Effects on Water Supply Changes*, and Chapter 20, *Economic Analyses*, as the annual average basis for severe drought years only, these deficits can also be expressed as a longer-term annual average, as shown in Table L.4-3.

Table L.4-2. Annual Average CCSF Water Bank Deficit for 6-Year Drought Period (1987–1992)

	Scenario 1		Scenario 2	
	Annual Average Deficit (TAF)	Increase from Baseline (TAF)	Annual Average Deficit (TAF)	Increase from Baseline (TAF)
Baseline Account Deficit	18		18	
Deficit for LSJR Alternative 2 (20% UF)	32	14	53	35
Deficit for LSJR Alternative 3 (40% UF)	45	27	137	119
Deficit for LSJR Alternative 4 (60% UF)	48	30	226	208

TAF = thousand acre-feet
UF = unimpaired flow

Table L.4-3. Annual Average CCSF Water Bank Deficit for 21-Year Period of Record (1983–2003)[a]

	Scenario 1		Scenario 2	
	Annual Average Deficit (TAF)	Increase from Baseline (TAF)	Annual Average Deficit (TAF)	Increase from Baseline (TAF)
Baseline Account Deficit	5		5	
Deficit for LSJR Alternative 2 (20% UF)	9	4	15	10
Deficit for LSJR Alternative 3 (40% UF)	13	8	39	34
Deficit for LSJR Alternative 4 (60% UF)	14	9	76	71

TAF = thousand acre-feet
UF = unimpaired flow
[a] This 21-year period of record corresponds to available data from CCSF Form 173 and 174 hydrologic operations data and reported Raker Act balances (CCSF 2011a, 2011b) that overlap with the WSE model period of record up to 2003.

L.5 Potential Actions to Meet Water Supply Demand

This section summarizes the actions SFPUC could take to meet water supply demand to make up any reductions in water supply resulting from the flow requirements. The extent to which CCSF's water supply diversions from the Tuolumne River Watershed would be reduced by the flow requirements is uncertain. It would depend on a number of factors, including the assignment of responsibility to the CCSF or the irrigation districts to meet the flow requirements through a proceeding amending water rights or FERC relicensing, the interpretation of the Fourth Agreement, whether CCSF pays the irrigation districts to release water to meet the flow requirement, and any future agreement between the irrigation districts and CCSF. It is reasonable to assume, however, that CCSF's water supply from the Tuolumne River could be reduced because (1) SFPUC would have less available water supply to divert under CCSF's water rights, or (2) more flows would be released to comply with the irrigation districts' FERC license, potentially leaving SFPUC with less water. With these caveats, the analysis in Section L.4, *Water Bank Account Modeling*, quantifies a potential reduction in the SFPUC water supply during a drought under each of the LSJR alternatives (Table L.4-2).

Because of these unknown factors, SFPUC's potential response(s) to meeting the unimpaired flow requirements of the LSJR alternatives are difficult to predict and could involve implementing multiple actions concurrently or consecutively. As a result, analyzing and disclosing the economic and environmental effects of such actions is complex, and impacts cannot be precisely determined. The following are potential actions SFPUC could take to replace reductions in water supply resulting under the LSJR alternatives.

- Water transfer
- In-Delta diversion(s)
- Water supply Desalination Project

The resource chapters of this recirculated SED disclose the possible environmental effects of water transfers, and Section L.6, *Regional Economic and Ratepayer Effects of Water Supply Changes*, discloses the economic effects of water transfers. The cost and environmental evaluation of constructing and operating an in-delta diversion or desalination plant are provided in Chapter 16, *Evaluation of Other Indirect and Additional Actions*. It is unlikely that either in-Delta diversion or desalination could replace all of the water supply no longer available for diversion under the LSJR alternatives, particularly LSJR Alternatives 3 and 4, given the amount of water that may be reduced in drought conditions under these two alternatives, and depending on the scenario applied (Table L.4-2). Because these actions include publicly-owned facilities and discretionary actions by a public agency (i.e., SFPUC), they would be subject to CEQA and would undergo the project-level CEQA review at the time they are proposed. Following is a summary of these actions.

L.5.1 Water Transfer

For the purposes of the economic analysis in Section L.6, *Regional Economic and Ratepayer Effects of Water Supply Changes,* it is assumed that SFPUC would enter into a water transfer agreement the irrigation districts and pay for the volume of water needed to meet its demand. A possible water transfer between SFPUC and irrigation districts relies on numerous unknown variables (e.g., willingness of irrigation districts to enter into a transfer agreement, the price of the water, and the volume of water needed). If a water transfer were to occur, the Bay Area would experience a regional economic effect because additional dollars would be spent in the SFPUC service provider region for some portion of their needed water supply. The plan area would experience a reduction in economic activity because the volume of water transferred to CCSF likely would no longer be used for farming in the plan area. This economic effect is described in the agricultural economic analysis in Appendix G, *Agricultural Economic Effects of the Lower San Joaquin River Flow Alternatives: Methodology and Modeling Results.* The analysis assumes that agricultural resources would not receive their total water supply to meet needed demand under each of the LSJR alternatives. Appendix G does not evaluate the impacts on other water supply uses, such as municipal uses, which are evaluated in Chapter 20, *Economic Analysis*. A water transfer, however, would also result in an offsetting (at least partially) positive economic benefit to the plan area because compensating income would come from the Bay Area to the plan area. The extent to which the compensating income from the water transfer would offset the negative economic effects associated with the reduction of water supply needed for farming is uncertain because the value of the water to be transferred is not known.

The SFPUC WSO report was developed in support of the SFPUC WSIP prepared by SFPUC to increase reliability of the regional water system that provides water to San Francisco and neighboring communities (SFPUC 2008a). In the 2008 WSIP Draft Programmatic Environmental Impact Report (PEIR), SFPUC included an proposed water transfer between SFPUC and MID and TID for 25 mgd during drought years (BAWSCA 2016). The final WSIP PEIR reduced the water transfer to 2 mgd during droughts and (SFPUC 2008b and BAWSCA 2016). While neither 25 mgd nor 2 mgd are not enough to potentially compensate for the potential need under the LSJR alternatives described in Section L4, *Water Bank Account Modeling*, this information is useful because it provides context for the potential to transfer water and the types of impacts associated with the transfer of water. It was described that construction and operation of new infrastructure would not be needed for the type of transfer (SFPUC 2008b). It is expected this type of transfer would transfer water that would otherwise be directly diverted or stored by the irrigation districts (SFPUC 2012a). Furthermore, and assumed that the irrigation districts would maintain the same level of canal diversions (SFPUC 2012a). Under the water transfer, as described in the WSIP PEIR, impacts would be less than significant to the following resources on the Tuolumne River: streamflow and reservoir water levels; geomorphology; surface water quality; surface water supplies; groundwater; fisheries; terrestrial biological resources; recreational and visual resources and energy resources. Impacts on terrestrial biological resources could be mitigated to a level of less than significance (SFPUC 2008b, SFPUC 2012a, and ESA+Orion Joint Venture 2012).

Similar to the water transfer described by the WSIP PEIR the type of water transfer that could occur under the LSJR alternatives likely would not require the construction or operation of new infrastructure, given that the Hetch Hetchy aqueduct can accommodate the delivery of water to the existing Tesla Portal treatment plant near the city of Tracy. It would also likely transfer water that would otherwise be directly diverted or stored by the irrigation districts. Nonetheless, because a water transfer would involve a discretionary action by a public agency (i.e., SFPUC, the irrigation districts, or the State Water Board), it would be subject to CEQA and would undergo the project-level CEQA review at the time it is proposed. A larger water transfer under the LSJR alternatives between SFPUC and the irrigation districts could result in indirect environmental impacts on several resources as a result of the potential reduced surface water supply in the Central Valley (i.e., surface water supply going to SFPUC would not go to Central Valley surface water users). As discussed in Chapter 9, *Groundwater Resources*, Chapter 11, *Agricultural Resources*, Chapter 13, *Service Providers*, and Chapter 14, *Energy and Greenhouse Gases*, and Chapter 16, *Evaluation of Other Indirect and Additional Actions*, reductions in surface water supply to various end users in the Central Valley could result in significant and unavoidable impacts, particularly under the higher unimpaired flow alternatives.

L.5.2 In-Delta Diversion

As described in SFPUC documents, specifically the WSO report (SFPUC 2007), SFPUC has several options for augmenting or increasing their water supply, including diverting water from the Sacramento-San Joaquin Delta. The SFPUC WSO report was developed in support of the SFPUC WSIP prepared by SFPUC to increase reliability of the regional water system that provides water to San

Francisco and neighboring communities (SFPUC 2008a). In the 2008 WSIP PEIR, SFPUC concluded that the in-Delta diversion option was infeasible, in part, because it would not achieve consistent year-round diversions due to uncertainties regarding the availability of water supplies and pumping capacities (SFPUC 2008a). Nonetheless, a discussion of this option has been included in light of the changing circumstances since 2008 (e.g., Pelagic Organism Decline, climate change, California WaterFix, and the State Water Board's Delta Flow Criteria Report [State Water Board 2010]). Thus, it is discussed as a possible option available to the SFPUC that may be explored in the future in light of the changing circumstances.

Constructing and operating an in-Delta diversion with a design capacity of 28,000 AF/y at the Tesla Portal near the City of Tracy is estimated to cost about $306.1 million for capital cost, $7.8 million for annual operation and maintenance costs, for $357.1 million in lifecycle costs (SFPUC 2007). This project would include a new Delta intake and pumping plant, a new pipeline, a new Delta Water Treatment Plant and a new blending facility at Tesla Portal. For a project of 28,000 AF/y, this results in approximately $255 per AF over the 50-year lifecycle period. The cost per AF of additional water from a delta diversion for a larger project could be less than $255 per AF because of the economies of scale (i.e., the larger infrastructure projects are, the less they typically cost per unit per year). These costs do not include the cost of purchasing the water from willing sellers to supply the diversion project. This, or other in-Delta diversions, may be able to divert water that was left in the Tuolumne River as a result of increased instream flows under LSJR Alternatives 2, 3, or 4. The water rights and contractual obligations of SFPUC and other water right holders would need to be determined. If purchased, the purchase cost would vary depending on market conditions, entities selling the water, and water-year conditions (i.e., drought), but could range from about $50–$600 per AF, which could result in costs of $1.4 million to $16.8 million per year (PPIC 2011; Maven 2015).

The construction and operation of an in-Delta diversion could result in potentially significant environmental impacts on various resources, as disclosed in Chapter 16, *Evaluation of Other Indirect and Additional Actions,* including: aesthetics, agriculture, air quality, biological resources, cultural resources, geology and soils, greenhouse gas emissions, hazards and hazardous materials, hydrology and water quality, land use and planning, noise, transportation and traffic, and utilities and service systems. The significance determination ultimately would depend on the location of the Delta intake and the route of the pipeline to deliver the water to the existing Tesla Portal, both of which are currently unknown. As disclosed in Chapter 16, the SFPUC identified a number of mitigation measures that could be applied to reduce potentially significant impacts to a less-than-significant level, including many related to air quality, biological resources, cultural resource, geology and soils, greenhouse gas emissions, hazards and hazardous materials, hydrology and water quality, noise, and transportation and traffic applied during construction and design of the facility, should it be constructed.

L.5.3 Water Supply Desalination Project

The WSO report (SFPUC 2007) addressed potential challenges or issues associated with constructing and operating a year-round desalination facility (capacity of 28,000 AF/y) near the existing Oceanside Water Pollution Control Plant in San Francisco. In the WSIP PEIR (SFPUC 2008b), the Oceanside site, along with two other alternative locations, was identified as a potential site for desalination in drought years as part of the Bay Area Regional Desalination Program. SFPUC included the Bay Area Regional Desalination Program (BARDP) in the WSIP PEIR analysis as part of a "variant" of the WSIP. A desalinization project would provide a reliable water supply regardless of the water year type or other surface water supplies used by SFPUC. A desalinization project would likely need to be larger than analyzed in the WSO report, or the BARDP feasibility studies, for LSJR Alternatives 3 and 4. Therefore, costs and environmental impacts associated with the Claude "Bud" Lewis Carlsbad Desalination Plant (Carlsbad Desalination Plant) in Carlsbad, California, which has a larger capacity, are summarized below.

Desalination projects currently under development or completed in the past 5 years in California have estimated costs between $1,000 and $3,000 per AF (WaterReuse 2012; SDCWA 2015). SFPUC estimated that the capital cost for a BARDP desalination facility that would use 28,000 AF/y of feedwater to produce approximately 22,175 AF/y of treated water, including the intake and pipeline for conveyance to the existing conveyance system, would be $168 million, or approximately $8.50 per gallon per day. This includes contingencies and planning, permitting, engineering, and administrative costs. The annual operating cost was estimated at approximately $10.5 million (MWH 2010). The BARDP would require the use of existing infrastructure, including the use of Mallard Slough Pump Station and associated water rights, conveyance to and from Los Vaqueros Reservoir, and Los Vaqueros Reservoir (for storage); the estimated total costs for using these facilities would translate into about $173 - $226 per AF of delivered water (CCWD 2014)

Poseidon Resources currently owns and operates the Carlsbad Desalination Plant, which has been operating since December 2015. However, the County of San Diego has the option to purchase the plant in 30 years. The County of San Diego has agreed to pay $2,131 to $2,367 per acre-foot of desalinated water, which includes the cost of conveying water to the San Diego County Water Authority's aqueduct (Carlsbad Desalination Project 2015).

As part of the WSIP PEIR, SFPUC prepared a conceptual-level, generalized impact analysis of the BARDP, which, at the time of the analysis, was based on limited, preliminary information regarding project design and operation, and site location. The construction and operation of BARDP could result in potentially significant environmental impacts on various resources, as disclosed in Chapter 16, *Evaluation of Other Indirect and Additional Actions.* Because of this limited project-specific information, it was generally determined that most of the potential impacts associated with construction and operation of a desalination plant and associated facilities would be potentially significant for the following resources: land use; visual quality; geology, soils, and seismicity; water quality and hydrology; air quality; biological resources; cultural resources; greenhouse gas emissions; hazards; noise and vibration; energy resources; traffic, transportation, and circulation; public services and utilities; recreational resources; and agricultural resources. This is similar to the resources affected by the construction and operation of the existing Carlsbad Desalination Project. While there are many geographic differences between San Francisco and Carlsbad that could influence the significance of an impact on an environmental resource, the analysis for the Carlsbad facility identified significant and unavoidable impacts only for the cumulative regional impact associated with air quality; all other impacts on resources were either mitigated to levels of less than significant (cultural, hazards and hazardous materials, land use and planning and transportation and circulation) or were less than significant (City of Carlsbad 2015).

L.6 Regional Economic and Ratepayer Effects of Water Supply Changes

Based on the assessment of SFPUC's water bank balance in New Don Pedro Reservoir over a 21-year historical sequence (Section L.4, *Water Bank Account Modeling*), the regional effects of the three LSJR alternatives on the four-county Bay Area regional economy (Alameda, San Francisco, San Mateo, Santa Clara Counties) and ratepayers were evaluated under the two scenarios. As discussed in Section L.4, the assessment shows that under both scenarios, the water bank account would reach zero during drought years, indicating that changes in flow objectives on the Lower Tuolumne River may affect the ability of SFPUC to supply water to its retail and wholesale customers under drought conditions.

L.6.1 Methodology

Water Replacement Costs Assumptions

For purposes of assessing water shortage impacts on the four-county Bay Area regional economy, it was assumed that the SFPUC would meet its water demands during drought periods by purchasing water from MID and TID. Other water supply options are summarized above in Section L.5, *Potential Actions to Meet Water Supply Demand*, and discussed in Chapter 16, *Evaluation of Other Indirect and Additional Actions*. While is likely that SFPUC would employ a suite of water supply actions to meet its water demands, the specific combination of actions at any given time cannot be predicted.

It is reasonable to assume that SFPUC would purchase and transfer additional water supplies from the Tuolumne River Watershed to its service area to offset water shortages during drought periods. Such purchases would be expected to result in substantially lower estimates of regional impacts than if SFPUC would cut back its water deliveries (i.e., impose shortages) to its retail and wholesale customers, particularly for impacts related to commercial and industrial water users. See Sunding 2014 for an assessment of impacts on SFPUC due to assumed imposition of water shortages, as opposed to the water replacement approach used in this analysis, within the Hetch Hetchy Regional Water System Service Area.

Under the assumption that SFPUC would purchase replacement water supplies from MID and TID, water costs to SFPUC were calculated based on the predicted annual average shortages under the LSJR alternatives during severe drought years (represented by 1987–1992), relative to baseline conditions. The estimated annual average costs to SFPUC to replace the reduced water supplies were then calculated based on the following assumptions.

- During drought periods, SFPUC would replace reductions in water supplies under the LSJR alternatives by purchasing water at $1,000 per AF; the $1,000 per AF assumes a cost higher than the $50–$600 per AF documented in PPIC, 2011 and Maven 2015.
- No other costs to SFPUC would be required to wheel, treat, or distribute the purchased water beyond existing costs for Hetch Hetchy water. (Note that if the transferred water comes from Cherry or Eleanor Reservoirs instead of passing through Hetch Hetchy Reservoir, the water would need to be filtered, potentially resulting in additional cost.)
- SFPUC operations and maintenance costs to produce water from the Hetch Hetchy water system do not vary based on the amount of water annually delivered by the system. As a result, SFPUC

water-production costs do not appreciably decline when less water is delivered during drought conditions. (System facilities still need to be operated and maintained regardless of the amount of water delivered through the system.) Because of this, 100 percent of the $1,000 per AF cost to replace reduced water supplies would be added to overall SFPUC costs to provide water from the Hetch Hetchy system.

Based on these assumptions, average annual water-shortage replacements costs for SFPUC are estimated in Table L.6-1a and L.6-1b. Annual severe drought-period costs for the LSJR alternatives are estimated to range from about $14 million to $30 million under Scenario 1, and from about $35 million to $208 million under Scenario 2.

Table L.6-1a. Estimated Annual SFPUC Replacement Water Purchase Costs under the LSJR Alternatives (Annual average within severe 6-year drought period represented by years 1987–1992)

	Scenario 1		Scenario 2	
Alternative	Required Water Transfer (TAF)	Estimated Purchase Cost	Required Water Transfer (TAF)	Estimated Purchase Cost
LSJR Alternative 2	14	$14,000,000	35	$35,000,000
LSJR Alternative 3	27	$27,000,000	119	$119,000,000
LSJR Alternative 4	30	$30,000,000	208	$208,000,000

TAF = thousand acre –feet

Long-term average costs depend on the return period of droughts of the magnitude and duration used in this analysis of SFPUC replacement water costs. The 6-year drought used in this analysis, 1987–1992, occurred within a 21-year analysis period, 1983–2003, that is hydrologically consistent with[3] the 94-year, 1922–2015, period of record analyzed in Chapter 21, *Drought Evaluation*. This 6-year drought is the driest 6-year period on record with regard to Tuolumne River flows, and has a return frequency of 1 in 94 years. Assuming a ”worst-case” return period of one severe 6-year drought every 21 years, the mean annual cost to purchase replacement water in drought years shown in Table L.6.1a would be spread over 21 years, instead of over only 6 drought years. The mean annual reduction in water supply compared to baseline would range from 4 to 9 TAF per year under scenario 1, to 10 to 71 TAF per year under scenario 2 (table L.6-1b). The distributed costs would be similarly reduced--longer-term annual average costs for the LSJR alternatives are estimated to range from about $4 million to $9 million under scenario 1 and from about $10 million to $71 million under scenario 2.

It should be noted, however, that the estimated costs to be incurred by SFPUC and its wholesale agencies due to a water supply reduction during a severe drought would not be expected to occur evenly over a defined period, either 6 years or 21 years, as suggested by the calculation of an average annual value, based either on the example 1987–1992 drought or on the available 21-year period of record used for assessing water bank deficits. Consequently, while the calculation of an

[3] Median, 75th, and 90th percentile exceedence unimpaired flows for the Tuolumne River at New Don Pedro Reservoir were 1665 TAF, 1094 TAF, and 820 TAF, respectively, for the WY 1922–2015 period of record, and 1626 TAF, 1033 TAF, and 834 TAF, respectively, for the WY 1983–2003 period of record (DWR 2007a, updated with DWR 2016 and CDEC records). The specific order of the 1987–1992 sequence of below-average flows resulted in the significance of that particular 6-year drought, while the overall probability distribution of annual unimpaired flow in any water year is similar for both periods of record compared (1983–2003 and 1922–2015).

average annual cost is useful for evaluating potential effects (both cost and regional economic effects) relative to ongoing budgetary conditions, the temporal accuracy of calculating an average annual cost is somewhat uncertain.

Table L.6-1b. Estimated Mean Annual SFPUC Replacement Water Purchase Costs under the LSJR Alternatives (Annual average over longer period of record represented by years 1983-2003).

	Scenario 1		Scenario 2	
Alternative	Required Water Transfer (TAF)	Estimated Purchase Cost	Required Water Transfer (TAF)	Estimated Purchase Cost
LSJR Alternative 2	4	$4,000,000	10	$10,000,000
LSJR Alternative 3	8	$8,000,000	34	$34,000,000
LSJR Alternative 4	9	$9,000,000	71	$71,000,000

TAF = thousand acre -feet

For the assessment of regional economic effects of the water supply impacts, the costs in Table L.6-1aL.5-1 were distributed to SFPUC water users by agency and user category as follows.

- Replacement water and related costs were distributed to water agencies in proportion to 2010 water deliveries, as reported in SFPUC's 2010 Urban Water Management Plan for CCSF, excluding SFPUC's retail groundwater customers. According to this distribution, 34 percent of the water would be delivered to the retail service area and 66 percent would be delivered to the wholesale service area (Table L.3-1). Within the wholesale service area, distributions to the 27 agencies receiving SFPUC water would be proportional to SFPUC water deliveries in 2010.

Replacement water costs were allocated among end-use water customer categories (i.e., residential, commercial and industrial, government and other, and dedicated irrigation uses) according to 2010 water deliveries, as shown in Table L.3-2. For the SFPUC retail service area, reported delivery allocations among user categories include 55.2 percent residential, 32.1 percent commercial and industrial, and 12.7 percent government and other. (For the SFPUC retail service area, dedicated city irrigation demands are met using groundwater supplies, which have been excluded from the assessment.) Across the wholesale service area, delivery allocations among user categories include 58.5 percent residential, 20.8 percent commercial and industrial, 11.4 percent government and other, and 9.3 percent dedicated irrigation uses.

Based on these methods, the costs of replacement water under each LSJR alternative were allocated to agencies and user categories, and were then compiled by county for each scenario.

Regional Impact Assessment

As discussed in Section L.4, *Water Bank Account Modeling*, implementation of the LSJR alternatives could result in water shortages in the SFPUC retail and wholesale service areas during drought periods. As discussed previously, it was assumed that SFPUC would purchase water to offset water shortages during the drought periods. It was also assumed that SFPUC would pass along the additional cost to its retail customers in the form of a temporary rate surcharge and to its wholesale customers in the form of higher wholesale water rates. In turn, wholesale customers would be expected to pass along their higher costs to their retail customers through a temporary rate surcharge. As higher water costs filter through the four-county Bay Area region, less discretionary income would be available to water customers to spend on goods and services, resulting in reductions in output (sales) and employment throughout the region. Under 2010 baseline conditions, industrial output within the Bay Area region totaled $645.3 billion, led by $278.1 billion in industrial output in Santa Clara County. This level of output supported almost 3.2 million jobs within the regional economy.

The regional economic effects of rate surcharges would largely be determined by the reactions of end-use customers to temporarily higher water rates, including the actions taken by residential customers, commercial and industrial customers, government water users, and dedicated irrigation water users. For example, faced with higher water costs during drought years, residential customers could decrease their water use in response to water price increases or they could decrease their spending on other goods and services to compensate for higher water utility bills. However, if rate increases are relatively small, households may not change their spending habits at all or may maintain current spending levels by reducing savings and/or investments by charging purchases using credit cards or by borrowing.

For commercial and industrial water customers, the situation is more complex. These water customers could react in several ways, including temporarily incurring reduced profits, purchasing less water and/or decreasing production levels, raising product/service prices, or changing their mix of production inputs to reduce non-water-related costs. In reality, businesses would likely take implement a combination of these actions, depending on the proportion of a business's overall costs that are attributable to water, the magnitude of rate increases, and a business's ability to raise prices in its individual market environment.

For institutional water users primarily composed of government agencies, the cause-and-effect response to water prices would not be the same as for households or commercial and industrial customers. While agencies could lay off staff or reduce spending on other operational inputs in response to temporarily higher water costs, the need for agencies to maintain staffing and service levels set through agency budgeting suggests that temporary economic effects of higher water costs would be limited. Additionally, government agencies are often reluctant to reduce payroll or staff levels, and may be more likely to run temporary budget deficits or to seek a temporary budget augmentation to offset cost increases.

The IMPLAN input-output economic model was used to analyze SFPUC water-replacement cost effects on the regional economy. The model was used to estimate the indirect and induced economic activity associated with direct changes in water costs to customers within SFPUC's retail and wholesale service areas. IMPLAN is the most widely used economic input-output model for assessing regional economic impacts of regulatory and policy actions. Using 2010 IMPLAN county-level data files, individual IMPLAN models were constructed for Alameda, San Francisco, San Mateo, and Santa Clara Counties, and water costs were input to the models, as discussed below, to generate estimates of direct, indirect, and induced effects on industrial output and employment. Refer to Appendix G, *Agricultural Economic Effects of the Lower San Joaquin River Flow Alternatives: Methodology and Modeling Results,* for additional details concerning the IMPLAN model. Due to the complexities of predicting how the various classes of water customers would react to temporarily higher water rates, and due to the limitations of the IMPLAN input-output modeling tool to assess cost-related impacts, several assumptions were made to simplify the modeling approach for assessing the regional economic effects of the LSJR alternatives, including the following.

- For the SFPUC retail service area and the 27 water agencies that purchase wholesale water from SPFUC, it is assumed that the increased water costs would be passed along to customers. As a result, no reductions in output values or employment levels would be expected for water agencies, although demand for water may fall while rate surcharges are in effect. This assumption appears reasonable both due to the temporary nature of water cost increases during drought years and due to the need for agencies to maintain operating capacity, even when water demand temporarily decreases.

- Households would react to temporarily higher water costs by reducing their discretionary spending on other goods and services within the four-county Bay Area region. Note that this assumption may result in overestimating regional economic impacts because households are likely to react to higher water costs by cutting water use, which would have limited effects on the regional economy, as well as by reducing spending on other goods and services, some of which would occur outside of the region.
- Due to the temporary nature of potential water cost increases during drought years, commercial and industrial users would react to higher water costs by absorbing reduced levels of profits rather than by cutting production or raising prices. With production (or unit sales) remaining stable, there would be no change in the demand for goods and services from a business's suppliers and no employee layoffs would occur. Similarly, with no increase in product prices, there would be no related change in costs to a business's customers. The effect, therefore, would be on the discretionary personal income of business owners and those who receive corporate profit distributions, such as shareholders, resulting in lowered consumer spending in the region. To the extent that business owners and shareholders reside in the four-county Bay Area region, the reduced spending would cause reduced economic activity in the region. It is unlikely, however, that all or most business owners and shareholders reside in the region. However, for the purposes of this assessment, all business owners and shareholders are assumed to reside within the region. Note that this assumption may lead to an overestimate of regional impacts, particularly because many corporate shareholders likely reside outside of the region.
- For government agencies, a temporary increase in water costs would represent an increase in operating costs. Government agencies were assumed to react by decreasing spending on labor and other goods and services required for agency operations. Note that this assumption may lead to an overestimate of regional impacts because some agencies may not respond by decreasing spending.
- For dedicated irrigation users, who include both public and private entities irrigating large or high water-use sites, a temporary increase in water costs would result in a decrease in discretionary spending by private water users (e.g., multi-family residential complexes, commercial and industrial landscaped areas) and a decrease in operational spending on goods and services by government water users.

Based on the assumptions discussed above, the following methods were used to model effects for the four major customer categories served by affected water agencies.

- For residential water users, increased water costs were treated as a decrease in discretionary income. The regional economic impacts of a change in water costs to households were modeled by importing an "institutional" spending pattern for households from the IMPLAN model's library, editing the spending pattern as needed (e.g., removing expenditures that would not likely change because of increased water spending), and inputting the decrease in discretionary income due to increased water costs under each LSJR alternative. Water costs were allocated across the nine IMPLAN household income categories based on the existing percentage distribution of household demand for IMPLAN commodity No. 3033 (which includes water, sewage treatment, and other utility services) in each county, as indicated by IMPLAN county-level data files.

- For commercial and industrial water customers, increased water costs were treated as a decrease in discretionary personal income for proprietors and corporate shareholders based on the assumption that these water users would absorb temporary reductions in profits rather than decrease production and/or increase prices to consumers. As a result, regional economic impacts were modeled as reductions in household income, using the same modeling methods employed for residential water users.
- For government agencies, increased water costs were treated as an increase in government agency operating costs, which would cause a reduction in spending on other operational inputs. The regional impacts of a change in water costs to government was modeled by importing "institutional" spending patterns for four government sectors from the model's library and inputting the increased water costs under each LSJR alternative. Water costs were allocated across the four government sectors (i.e., federal government non-defense, federal government defense, state and local government non-education, and state and local government education) based on the existing percentage distribution of demand by each government sector for IMPLAN commodity 3033 (water, sewage treatment, and other utility services) in each county, as indicated by IMPLAN county-level data files.
- Some water agencies have separate customer accounts for large- or high-water-use landscapes (e.g., parks, multi-family residential lawn areas, business landscaping). These accounts are often connected to dedicated irrigation water meters and may be enrolled in an agency's water conservation landscape program. As such, data on water used by these customers, which include both public and private users, is compiled separately from other residential, commercial and industrial, and government accounts. No information is readily available concerning the allocation of dedicated irrigation water use among these customer categories. As a result, for dedicated irrigation water users, it was assumed that half of the cost increases assigned to dedicated irrigation uses would be attributable to multi-family, commercial, and industrial users and half would be attributable to government users. Based on this assumption, half of the costs estimated for dedicated irrigation customers was assigned to residential, commercial, and industrial users, and half was assigned to government users, with regional impacts modeled as described above for each customer category.

Using these methods, water-replacement costs for each customer category were input to the county-level IMPLAN models, and the resulting estimates of direct, indirect, and induced effects on output and employment were compiled for each LSJR alternative by county.

Ratepayer Effects Assumptions

As discussed previously, under drought conditions, implementation of the LSJR alternatives is predicted to result in water supply reductions within the SFPUC retail service area and within the service areas of the 27 agencies in Alameda, San Mateo, and Santa Clara Counties that purchase wholesale water from SFPUC. Under the LSJR alternatives, SFPUC is assumed to meet its water demands during drought periods by buying water from MID and TID. SFPUC would then presumably pass along the additional cost to its retail customers in the form of a temporary rate surcharge and to its wholesale customer in the form of a higher wholesale water rate. In turn, wholesale agencies would presumably pass along their higher costs to their retail customers through a temporary rate surcharge based on water usage.

Effects of water purchases on SFPUC service area rates were evaluated based on the relative increase in overall SFPUC budget costs attributable to replacement water purchases under each alternative. Existing water rates that are annually established for both the retail and wholesale service areas reflect operating costs, debt service costs, capital costs, programmatic project costs, and reserve considerations. The ratepayer assessment used the total SFPUC Water Enterprise and Hetch Hetchy Water budgets for fiscal year 2013–2014 as baselines for the assessment. These budgets account for the cost of producing, conveying, filtering, treating, and distributing water within the SFPUC service areas, as well as to defray the costs of past, current, and future projects.

For purposes of evaluating ratepayer effects, increases in budgetary costs to SFPUC to replace water under drought conditions was assumed to result in proportional rate increases in SFPUC's retail and wholesale water rates, relative to the existing rates shown in Table L.3-4.

L.6.2 Regional Economic Effects of the LSJR Alternatives

Under Scenario 1 (the City is only responsible for 51.7 percent of the increased flow requirement when the New Don Pedro Reservoir bank account balance is positive), decreased spending on goods and services resulting from increased water costs for residential, commercial, industrial, and institutional water users would result in industrial output declining throughout the Bay Area region during severe drought periods. These reductions during severe drought years (e.g. 1987–1992) are estimated to range from $16.2 million under LSJR Alternative 2 to $35.3 million under LSJR Alternative 4 (Table L.6-2). While large, these reductions during drought periods would be relatively small in the context of the regional economy, ranging from 0.03 to 0.05 percent of total output.

Table L.6-2. Estimated Average Annual Water Supply Effects (Direct, Indirect, and Induced) during Severe Drought Years on Economic Output in the Bay Area Region Associated with the LSJR Alternatives 2, 3, and 4: Scenario 1[a]

		Change from Baseline by LSJR Alternative Under Scenario 1[a]		
Economic Effects (2010 Dollars)	2010 Baseline	LSJR Alternative 2	LSJR Alternative 3	LSJR Alternative 4
Alameda County				
Total County Output ($ Millions)	143,450.6	-2.8	-5.5	-6.2
% of Output	*100*	*-0.02*	*-0.04*	*-0.04*
San Francisco County				
Total County Output ($ Millions)	124,678.1	-5.6	-10.9	-12.2
% of Output	*100*	*-0.04*	*-0.09*	*-0.10*
San Mateo County				
Total County Output ($ Millions)	99,088.3	-4.4	-8.5	-9.5
% of Output	*100*	*-0.04*	*-0.09*	*-0.10*
Santa Clara County				
Total County Output ($ Millions)	278,082.8	-3.4	-6.6	-7.4
% of Output	*100*	*-0.01*	*-0.02*	*-0.03*
Bay Area Region				
Total Region Output ($ Millions)	645,299.8	-16.2	-31.4	-35.3
% of Output	*100*	*-0.03*	*-0.05*	*-0.05*

Source: 2010 IMPLAN county data files and IMPLAN model runs for LSJR alternatives.

[a] The City is only responsible for 51.7% of the increased flow requirement when the New Don Pedro Reservoir bank account balance is positive

The total regional effects of the LSJR alternatives on jobs under Scenario 1 are similar, in relative terms, to the effects on economic output. During drought periods, average annual jobs within the region are predicted to decrease by 117 (0.01 percent) under LSJR Alternative 2 compared to baseline (Table L.6-3). Under LSJR Alternatives 3 and 4, jobs are predicted to decrease by 226 (0.01 percent) and 254 (0.01 percent), respectively. Job losses under LSJR Alternative 4 are predicted to be largest in San Francisco County (84 jobs) and San Mateo County (71 jobs).

Table L.6-3. Estimated Average Annual Water Supply Effects (Direct, Indirect, and Induced) during Severe Drought Years on Jobs in the Bay Area Region Associated with LSJR Alternatives: Scenario 1[a]

		Change from Baseline by LSJR Alternative Under Scenario 1		
Economic Effects	2010 Baseline	LSJR Alternative 2	LSJR Alternative 3	LSJR Alternative 4
Alameda County				
Total County Jobs	872,636	-21	-41	-46
% of Jobs	100	<-0.01	<-0.01	-0.01
San Francisco County				
Total County Jobs	734,063	-39	-75	-84
% of Jobs	100	-0.01	-0.01	-0.01
San Mateo County				
Total County Jobs	464,194	-33	-64	-71
% of Jobs	100	-0.01	-0.01	-0.02
Santa Clara County				
Total County Jobs	1,112,308	-24	-47	-53
% of Jobs	100	<-0.01	<-0.01	<-0.01
Bay Area Region				
Total Region Jobs	3,183,201	-117	-226	-254
% of Jobs	100	<-0.01	<-0.01	<-0.01

Source: 2010 IMPLAN county data file, and IMPLAN model runs for LSJR alternatives.

[a] The City is only responsible for 51.7% of the increased flow requirement when the New Don Pedro Reservoir bank account balance is positive.

Under Scenario 2 (the City is always responsible for 51.7 percent of the increased flow requirement)) output and job losses during drought periods are predicted to be substantially higher than under Scenario 1 because replacement water needs and related costs to customers would be much larger. Annual output reductions are estimated to range from $40.5 million to $243.6 million under LSJR Alternatives 2, 3, and 4 (Table L.6-4). In the context of the overall Bay Area region economy, these reductions would represent less than 0.01 percent of total output. Similarly, job losses would be relatively small, ranging from an estimated 292 to 1,756 jobs, representing up to 0.06 percent of all regional jobs, across LSJR Alternatives 2, 3, and 4 (Table L.6-5).

Table L.6-4. Estimated Average Annual Water Supply Effects (Direct, Indirect, and Induced) during Severe Drought Years on Economic Output in the Bay Area Region Associated with the LSJR Alternatives 2, 3, and 4: Scenario 2[a]

Economic Effects (2010 Dollars)	2010 Baseline	Change from Baseline by LSJR Alternative Under Scenario 2[a]		
		LSJR Alternative 2	LSJR Alternative 3	LSJR Alternative 4
Alameda County				
Total County Output ($ Millions)	143,450.6	-7.1	-24.5	-43.0
% of Output	100	-0.05	-0.17	-0.30
San Francisco County				
Total County Output ($ Millions)	124,678.1	-14.0	-48.2	-84.2
% of Output	100	-0.11	-0.39	-0.68
San Mateo County				
Total County Output ($ Millions)	99,088.3	-10.9	-37.6	-65.5
% of Output	100	-0.11	-0.38	-0.66
Santa Clara County				
Total County Output ($ Millions)	278,082.8	-8.5	-29.2	-51.0
% of Output	100	-0.03	-0.11	-0.18
Bay Area Region				
Total Region Output ($ Millions)	645,299.8	-40.5	-139.5	-243.6
% of Output	100	-0.06	-0.22	-0.38

Source: 2010 IMPLAN county data files and IMPLAN model runs for LSJR alternatives.

[a] The City is always responsible for 51.7% of the increased flow requirement.

Table L.6-5. Estimated Average Annual Water Supply Effects (Direct, Indirect, and Induced) during Severe Drought Years on Jobs in the Bay Area Region Associated with LSJR Alternatives 2, 3, and 4: Scenario 2[a]

		Change from Baseline by LSJR Alternative Under Scenario 2[a]		
Economic Effects	2010 Baseline	LSJR Alternative 2	LSJR Alternative 3	LSJR Alternative 4
Alameda County				
Total County Jobs	872,636	-53	-181	-318
% of Jobs	100	-0.01	-0.02	-0.04
San Francisco County				
Total County Jobs	734,063	-97	-334	-583
% of Jobs	100	-0.01	-0.05	-0.08
San Mateo County				
Total County Jobs	464,194	-82	-282	-491
% of Jobs	100	-0.02	-0.06	-0.11
Santa Clara County				
Total County Jobs	1,112,308	-61	-209	-364
% of Jobs	100	-0.01	-0.02	-0.03
Bay Area Region				
Total Region Jobs	3,183,201	-292	-1,005	-1,756
% of Jobs	100	-0.01	-0.03	-0.06

Source: 2010 IMPLAN county data files and IMPLAN model runs for LSJR alternatives.

[a] The City is always responsible for 51.7% of the increased flow requirement.

L.6.3 Ratepayer Effects of the LSJR Alternatives

As discussed previously, the SFPUC Water Enterprise and Hetch Hetchy Water budgets account for the cost of producing, conveying, filtering, treating, and distributing water within the SFPUC service areas, as well as providing funds to defray the costs of past, current, and future projects. The adopted fiscal year 2013–2014 budgets totaled $483.2 million (Table L.3-3). Existing water rates for SFPUC's retail and wholesale customers, which are largely driven by these budget costs, are shown in Table L.3-4.

The budget effects of purchasing replacement water during severe drought periods (e.g., 1987–1992) under the LSJR alternatives are shown in Tables L.6-6 and L.6-7. Compared to adopted fiscal year 2013–2014 SFPUC budget costs of $483.2 million, water replacement costs under Scenario 1 (the City is only responsible for 51.7 percent of the increased flow requirement when the New Don Pedro Reservoir bank account balance is positive) would represent increases in overall costs ranging from 3 to 6 percent (Table L.6-6). These severe drought-period increases would presumably result in rate surcharges within the retail and wholesale service areas of about the same percentage relative to existing water rates. For example, the drought-period rate surcharge in the SFPUC retail service area could cause existing rates for a single-family residential customer to rise by about 3 percent under LSJR Alternative 2, and by about 6 percent under LSJR Alternatives 3 and 4. Existing rates charged by SFPUC to its wholesale customers could increase by similar percentages.

Table L.6-6. Estimated SFPUC Budget Effects of Purchasing Replacement Water Supplies during Severe Drought Periods Associated with LSJR Alternatives 2, 3, and 4: Scenario 1[a]

	Baseline[a]	LSJR Alternative 2	LSJR Alternative 3	LSJR Alternative 4
Average Annual Water Replacement Costs ($ Millions)	--	14	27	30
Water Budget with Replacement Costs ($ Millions)	483.2	497.2	510.2	513.2
Percentage Change in Water Budget Expenditures	--	2.9%	5.6%	6.2%

Scenario 1: The City is only responsible for 51.7% of the increased flow requirement when the New Don Pedro Reservoir bank account balance is positive

[a] Represents combined Adopted Water Enterprise and Hetch Hetchy Water budgets for fiscal year 2013–2014.

Table L.6-7. Estimated SFPUC Budget Effects of Purchasing Replacement Water Supplies during Severe Drought Periods Associated with LSJR Alternatives 2, 3, and 4: Scenario 2[a]

	Baseline[a]	LSJR Alternative 2	LSJR Alternative 3	LSJR Alternative 4
Average Annual Water Replacement Costs ($ Millions)	--	35	119	208
Water Budget with Replacement Costs ($ Millions)	483.2	518.2	602.2	691.2
Percentage Change in Water Budget Expenditures	--	7.2%	24.6%	43.1%

Scenario 2: The City is always responsible for 51.7% of the increased flow requirement

[a] Represents combined Adopted Water Enterprise and Hetch Hetchy Water budgets for fiscal year 2013–2014.

Under Scenario 2 (the City is always responsible for 51.7 percent of the increased flow requirement), estimated increases in SFPUC budget expenditures to purchase and transfer water to offset shortages during severe drought periods under the LSJR alternatives would be much higher than under Scenario 1, with increases ranging from about 7 to 43 percent (Table L.6-7). As a result, water rate increases during severe drought periods would be expected to be substantially higher than under Scenario 1. Under Scenario 2, the severe drought-period rate surcharge in the SFPUC retail service area could cause existing rates for a single-family residential customers to rise by about 7 percent under LSJR Alternative 2, by about 25 percent under LSJR Alternative 3, and by about 43 percent under LSJR Alternative 4. Existing rates charged by SFPUC to its wholesale customers could be expected to increase by similar percentages.

Using a longer-term period of record (1983–2003), the annual average water replacement costs (as derived in Table L.6.1b) are much less than the costs within the severe drought period (1987 to 1992) described above. Under Scenario 1, estimated longer-term increases in budget expenditures range from 0.8 to 1.9 percent (Table L.6-8). Under Scenario 2, estimated longer-term increases in budget expenditures range from 2.1 to 14.7 percent (Table L.6-9).

Table L.6-8. Estimated Longer-term SFPUC Budget Effects of Purchasing Replacement Water Supplies during Severe Drought Periods Associated with LSJR Alternatives 2, 3, and 4: Scenario 1[a]

	Baseline[a]	LSJR Alternative 2	LSJR Alternative 3	LSJR Alternative 4
Average Annual Water Replacement Costs ($ Millions)	--	4	8	9
Water Budget with Replacement Costs ($ Millions)	483.2	487.2	491.2	492.2
Percentage Change in Water Budget Expenditures	--	0.8%	1.7%	1.9%

Scenario 1: The City is only responsible for 51.7% of the increased flow requirement when the New Don Pedro Reservoir bank account balance is positive

[a] Represents combined Adopted Water Enterprise and Hetch Hetchy Water budgets for fiscal year 2013–2014.

Table L.6-9. Estimated Longer-term SFPUC Budget Effects of Purchasing Replacement Water Supplies during Severe Drought Periods Associated with LSJR Alternatives 2, 3, and 4: Scenario 2[a]

	Baseline[a]	LSJR Alternative 2	LSJR Alternative 3	LSJR Alternative 4
Average Annual Water Replacement Costs ($ Millions)	--	10	34	71
Water Budget with Replacement Costs ($ Millions)	483.2	493.2	517.2	554.2
Percentage Change in Water Budget Expenditures	--	2.1%	7.0%	14.7%

Scenario 2: The City is always responsible for 51.7% of the increased flow requirement

[a] Represents combined Adopted Water Enterprise and Hetch Hetchy Water budgets for fiscal year 2013–2014.

For the 27 individual water agencies that purchase wholesale water from SFPUC, the actual drought surcharges levied on their retail water customers (e.g., residential, commercial and industrial) would be expected to vary depending on the percentage of each district's overall water demand met by purchases from SFPUC. As shown in Table L-3-1, 19 of the water agencies served by SFPUC purchased at least 90 percent of their total water supply from SFPUC in 2010. Within the service areas of those agencies (e.g., the Cities of Hayward, East Palo Alto, Menlo Park), percentage increases in drought-period rates would likely be similar to increases in wholesale water rates under the LSJR alternatives. For water agencies that rely less on SFPUC water deliveries (e.g., the Cities of Santa Clara, Sunnyvale, and San Bruno), the rate surcharges attributable to the LSJR alternatives would presumably be lower. Additionally, rate increases for customer classifications within each agency would vary based on the rate-setting policies of each agency.

L.6.4 Sensitivity Analysis

The results described above are based on an assumed cost of $1000 per AF of water for purchases from irrigation districts (i.e., MID and TID). This assumed price is key to the analysis, and was derived based on a review of recent water purchases, involving both MID and TID, as well as by other agricultural districts in California. Although this assumption is considered reasonable for the analysis, a case also can be made for assuming either a higher or lower average cost per AF, given the many site- and time-specific factors that affect water transaction prices.

One important factor is that water transfers in California, particularly agricultural-to-urban water district transfers, are often constrained by the availability of facilities to transport water between areas. A second important factor is that some irrigation districts prohibit, restrict or, at a minimum, discourage water transfers from districts (or individual farmers) to urban water districts (Aredas 2015). These factors, however, are not considered limiting for assessing water purchases (under certain conditions) by CCSF from MID or TID; consequently, the assumed water transfers appear reasonably feasible, although highly dependent on the amount of water to be transferred and other considerations.

As presented in Table L.4-2, the amount of water to be transferred varies under the LSJR alternatives and implementation scenarios. As shown, the two implementation scenarios would have a substantially different effect on the need for water. Under Scenario 1 (the City is only responsible for 51.7 percent of the increased flow requirement when the New Don Pedro Reservoir bank account balance is positive), the estimated amount of water needed by CCSF ranges from 14 TAF to 30 TAF annually during severe drought periods. Under Scenario 2 (the City is always responsible for 51.7 percent of the increased flow requirement), the amount of water needed ranges from 35 TAF to 208 TAF. Because these amounts are based on average annual conditions over a 6-year severe drought period similar to 1987–1992, the availability of water for purchase from sources other than MID and TID should be assumed to be limited, thereby putting upward pressure on the price of water.

In its 2012 report to the SFPUC Commission, the SFPUC staff estimated that 2 million gallons of water per day (see Table 1 of that report)[4] would be purchased from MID/TID at a cost of $700 per AF (in 2018 dollars) (SFPUC 2012b). Obtaining these water supplies from MID/TID for the 2011–2012 water year was considered "water supply projects in planning and environmental review." Based on supply and demand conditions during extended drought periods, it can reasonably be assumed that the cost of water would likely be higher during the later years of this period.

A limited review of relevant information concerning the cost of water in recent water purchase transactions suggests that a reasonable cost range for agricultural-to-urban water transfers is $500 to $2000 per AF, depending importantly on underlying supply and demand conditions (Carr pers. comm.). Although many factors influence the relationship between the price of water per AF and the extent of associated regional economic effects, assuming that this relationship is linear provides an order-of-magnitude approximation of potential effects of assuming different average water prices.

Approximate impacts on total economic output and employment in the four-county Bay Area region (San Francisco, Alameda, San Mateo, and Santa Clara Counties) using water transfer prices of $500, $1000, and $2000 per AF are shown in Tables L.6-8 and L.6-9 under Scenarios 1 and 2 for the LSJR alternatives. "Severe drought periods" refer to the 1987–1992 drought used as a basis for calculated deficits (see Sections L.4 and L.5).

[4] This amount of water is equivalent to 6 AF/y.

Table L.6-8. Estimated Average Annual Water Supply Effects on Economic Output during Severe Drought Periods in the Four-County Bay Area Region under LSJR Alternatives 2, 3, and 4 for Different Water Transfer Prices

Scenario	Water Transfer Price ($/AF)	Total Region Output ($ Millions)[c]			
		2010 Baseline	Change from Baseline under LSJR Alternative		
			LSJR Alternative 2	LSJR Alternative 3	LSJR Alternative 4
Scenario 1[a]	500	645,300	-8.1	-15.7	-17.7
	1000	645,300	-16.2	-31.4	-35.3
	2000	645,300	-32.4	-62.8	-70.6
Scenario 2[b]	500	645,300	-20.3	-69.8	-121.8
	1000	645,300	-40.5	-139.5	-243.6
	2000	645,300	-81	-279	-487.2

Source: 2010 IMPLAN county data files and IMPLAN model runs for LSJR alternatives; Appendix L, Table L.6-2 and L.6-4.

$/AF = dollars per acre-foot

[a] Scenario 1 is defined in Appendix L as: storage credits would be reallocated only if CCSF has a positive credit balance in the water bank account.

[b] Scenario 2 is defined in Appendix L as: storage credits would be reallocated even if CCSF has a negative balance in the water bank account.

[c] Region consists of the four Bay Area counties: San Francisco, Alameda, San Mateo, and Santa Clara.

Table L.6-9. Estimated Average Annual Water Supply Effects on Employment in the Four-County Bay Area Region during Severe Drought Periods under LSJR Alternatives 2, 3, and 4 Assuming Different Water Transfer Prices

Scenario	Water Transfer Price ($/AF)	Total Region Employment (# of Jobs)[c]			
		2010 Baseline	Change from Baseline under LSJR Alternative		
			LSJR Alternative 2	LSJR Alternative 3	LSJR Alternative 4
Scenario 1[a]	500	3,183,201	-58.5	-113	-127
	1000	3,183,201	-117	-226	-254
	2000	3,183,201	-234	-452	-508
Scenario 2[b]	500	3,183,201	-146	-502.5	-878
	1000	3,183,201	-292	-1005	-1756
	2000	3,183,201	-584	-2010	-3512

Source: 2010 IMPLAN county data files (baseline conditions) and IMPLAN model runs for LSJR alternatives; Appendix L, Table L.6-3 and L.6-5.

$/AF = dollars per acre-foot.

[a] Scenario 1 is defined as: storage credits would be reallocated only if CCSF has a positive credit balance in the water bank account.

[b] Scenario 2 is defined as: storage credits would be reallocated even if CCSF has a negative balance in the water bank account.

[c] Region consists of the four Bay Area counties: San Francisco, Alameda, San Mateo, and Santa Clara.

In summary, the results presented in Tables L.6-2 through L.6-5 are considered reasonable estimates of regional economic impacts based on an assumed average cost of $1000 per AF. The amount of economic output lost associated with an assumed average price of water ranging from $500 to $2,000/AF could range from $8.1 to $70.6 million annually under Scenario 1, and $20.3 to $487.2 million annually under Scenario 2. The number of jobs lost associated with an assumed average price of water ranging from $500 to $2,000/AF could range from 59 to 508 annually under Scenario 1, and 146 to 3,512 annually under Scenario 2.

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