Feasibility and Implementation Risk Tab

Attachment 1: WSIP Feasibility Study for Sites Reservoir

Attach feasibility studies or documentation that demonstrates the proposed project's engineering, environmental, economic, and financial feasibility as described in TR section 3.5. See also regulations section 6003(a)(1)(O).

WSIP Application Instructions, March 2017

Response

This attachment contains the feasibility study for Sites Project specific to the WSIP application in compliance with the *Technical Reference* (TR) Section 3.5 and regulations section 6003(a)(1)(O).

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Tables

Acronyms and Abbreviations

AACE	Association for the Advancement of Cost Engineering
AB	Assembly Bill
CVP	Central Valley Project
CWC	California Water Commission
DEC	Design, estimate, and constructability
DSR	Debt Service Reserve
DSRF	debt service reserve fund
DWR	California Department of Water Resources
EIR	Environmental Impact Report
EIS	Environmental Impact Statement
IDC	interest during construction
JPA	Joint Power Authority
M&I	Municipal and Industrial
NED	National Economic Development
NODOS	North-of-the-Delta Offstream Storage
NOI	Net Operating Income
O&M	operations and maintenance
P3s	public-private partnerships
Reclamation	U.S. Bureau of Reclamation
SRF	State Revolving Loan Fund
SWP	State Water Project
SWRCB	State Water Resources Control Board
TAF	thousand acre-feet
TAF/yr	thousand acre-feet per year
USBR	U.S. Bureau of Reclamation
WSIP	Water Storage Investment Program

Introduction

This WSIP Feasibility Study responds to the specific requirements of WSIP. Extensive studies have been prepared by the U.S. Bureau of Reclamation (Reclamation) and the California Department of Water Resources (DWR). Key publications by these agencies include the following:

- *Draft North-of-the-Delta Offstream Storage (NODOS) Investigation Feasibility Report*, Reclamation, 2017.

    https://www.sitesproject.org/information/FeasibilityReport

- *North-of-the-Delta Offstream Storage Investigation Highlights*, DWR, 2014.

    http://www.water.ca.gov/storage/docs/Highlights/NODOS%20Highlights%20Booklet%2028May14.pdf

This WSIP Feasibility Study addresses all requirements of Section 3.5 of the TR (California Water Commission [CWC], 2017); however, there are some fundamental differences between this attachment and the U.S. Bureau of Reclamation (Reclamation) Feasibility Report. The most significant is a different climate change assumption for the evaluation of economic feasibility. The Reclamation Feasibility Report uses current conditions while this application evaluates 2030 and 2070 under changed climate conditions.

WSIP Feasibility Requirements

The WSIP application for Sites Reservoir includes the following information, consistent with Section 3.5 of the *Technical Reference* (CWC, 2017).

Project Objectives

The project objectives, including all public and non-public benefits the proposed project is designed to provide, are as follows:

- Improve water supply and water supply reliability
- Provide Incremental Level 4 water supply
- Improve the survival of anadromous fish and other aquatic species
- Improve Delta environmental and export water quality

The secondary objectives are:

- Provide sustainable hydropower generation
- Provide opportunities for recreation
- Provide flood-damage reduction

Project Description

A description of the proposed project, including facilities, operations, and relationships with existing facilities and operations is provided in Sites_A3 Project Description under the ELIGIBILITY AND GENERAL PROJECT INFORMATION TAB. A detailed operations plan is provided in Sites_A2 Operations under the BENEFIT CALCULATION, MONETIZATION, AND RESILIENCY TAB.

Project Costs

The Basis of Estimate Report is in Sites_A8 Estimate under the BENEFIT CALCULATION, MONETIZATION, AND RESILIENCY TAB. It documents all project costs, including construction costs, interest during construction, replacement costs, operations and maintenance costs consistent with the operations plan, and costs of mitigation for adverse environmental consequences identified in the draft environmental documentation.

Project Benefits

Sites_A5 Documentation under the BENEFIT CALCULATION, MONETIZATION, AND RESILIENCY TAB describes and quantifies all project benefits, consistent with the operations plan. Public benefits and non-public benefits are quantified using physical metrics and, where possible, monetized. Proposed project benefits are displayed as expected average annual values for each year of the planning horizon is in Sites_A6 Annual Benefits Table under the BENEFIT CALCULATION, MONETIZATION, AND RESILIENCY TAB. The benefits analysis addresses specific water year types (such as dry and critical).

Cost Allocation

A benefits-based cost allocation is provided in Sites_A10 Allocation under the BENEFIT CALCULATION, MONETIZATION, AND RESILIENCY TAB.

Technical Feasibility

The Modeling Summary and Operations Plan (Sites_A1 Modeling under the BENEFIT CALCULATION, MONETIZATION, AND RESILIENCY TAB and Sites_A2 Operations under the BENEFIT CALCULATION, MONETIZATION, AND RESILIENCY TAB) demonstrates that the project is technically feasible consistent with the operations plan, including a description of data and analytical methods, the hydrologic period, development conditions, and hydrologic time step. A water balance analysis showing, for the with- and without-project condition, all flows and water supplies relevant to the benefits analysis is provided in Appendix 1 at the end of this attachment.

The ability of the project to achieve the level of benefits identified in this application depends on collaborative operation of Sites Reservoir with the Central Valley Project (CVP) and State Water Project (SWP). The Authority is coordinating an Operations Working Group with participation from Reclamation and DWR to develop Principles of Agreement to coordinate the operations in a way that will deliver the expected benefits. The Authority has coordinated with the California State Water Resources Control Board (SWRCB) staff with regard to water rights and is developing a strategy to secure the water rights required for project implementation.

The engineering design for most facilities has been developed to support a Class 3 (a higher level than is required in the WSIP Technical Reference) estimate (Association for the Advancement of Cost Engineering [AACE] International) of the construction costs; however, some facilities are currently developed to a Class 4 (less rigorous) level. Design, estimate, and constructability (DEC) reviews were performed by Reclamation in July 2007 and May 2014. A special assessment was performed in March 2017.

Sites Reservoir is constructible and can be operated and maintained. The construction would be similar to that of existing CVP and SWP facilities. Construction would result in changes in operations for the CVP and SWP systems. Considerable effort would be needed to cooperatively operate Sites Reservoir with the existing CVP and SWP facilities in a manner that would fully realize the benefits.

Environmental Feasibility

The environmental effects of the project are evaluated in Reclamation and Authority, Sites Project Draft Environmental Impact Report (EIR)/Environmental Impact Statement (EIS) (2017). Constructing Sites Project would affect environmental resources in the Primary, Secondary, and Extended Study Areas. Beneficial effects correspond to the following resource areas: water management, agricultural resources, fisheries and aquatic resources, socioeconomics, power and energy, and recreation. Some adverse effects would be temporary, construction-related effects that would be reduced to less-than-significant levels through mitigation. Other adverse effects would be significant, including the effects on aquatic, botanical, terrestrial, wetlands, cultural/tribal, paleontological, land use, and air quality in Alternative D (the Authority's proposed project). The proposed mitigation is identified in the Mitigation Monitoring Plan (Appendix A1 in the Draft EIR/EIS). The URL for the Draft EIR/EIS is https://www.sitesproject.org/information/DraftEIR-EIS.

Economic Feasibility

The expected benefits of the project exceed the expected costs, considering all benefits and costs related to or caused by the project. This analysis is presented in the Physical Monetized Benefits attachment, Sites_A3 Physical Monetized under the BENEFIT CALCULATION, MONETIZATION, AND RESILIENCY TAB.

Financial Feasibility

Pursuant to WSIP Regulation 6003(a)(1)(O) and the Water Storage Investment Program (WSIP) Technical Reference Document (Technical Reference) (California Water Commission, November 2016), the purpose of the Funding Strategy is to demonstrate that the Sites Reservoir project will be able to obtain sufficient funding from public (including the requested WSIP funds) and private sources to cover the construction and operation and maintenance costs of the project over the planning horizon. This section outlines a funding strategy based on the assumption that long-term, tax-exempt bond financing will be utilized to fund the Municipal and Industrial (M&I) and Agricultural Water Supply portions of the project costs.

As described in other sections of this application, the requested WSIP funding in conjunction with separately requested Federal funding will support the provision of significant public benefits that would not otherwise be financeable through conventional means. In addition, the WSIP and Federal funding will help to offset interest carrying costs during the project's construction phase, thus significantly lowering overall development costs and delivering multiple public and water supply benefits to the citizens of California.

Project Costs

As detailed in Section A10 (Allocation of Total Costs) and shown below in Table A1-1, the total development costs for the project are estimated at $5,176 million, including both construction costs and interest during construction (IDC). Assuming Federal funding of $730 million in combination with the requested $1,662 million in funding from WSIP for the public benefits portions of the project, the remaining portion of the project's costs would be approximately $2,784 million, including $509 million for hydropower. The total amount of project's cost attributed to M&I and Agricultural water supply would be $2,276 million. This is the portion of the project for which the Sites Joint Power Authority (JPA) would need to seek financing, either from conventional sources such as tax-exempt revenue bonds, or through alternative project delivery approaches.

Table A1-1. Sites Reservoir Capital Development Sources and Uses (2015$; $Millions)

Sources	Uses (Costs)		*Sources of Funding*					
			Federal Non-Reimbursable		WSIP		Other Public & Private	
Water Supply	$2,276	44%	$0	0%	$0	0%	$2,276	100%
Hydropower	$509	10%	$0	0%	$0	0%	$509	100%
Public Benefits	$2,392	46%	$730	31%	$1,662	69%	$0	0%
Total Project Costs	**$5,176**	**100%**	**$730**	**14%**	**$1,662**	**32%**	**$2,784**	**54%**

Current Investors and Committed Funding Sources

Current investors for the project include the JPA investors listed below in Table A1-2. In addition to directly funding the preparation of early feasibility analysis, preparation of funding applications and other activities during the first phase of project development, these investors are providing the necessary commitments for purchasing water resources from the project to ensure a stable long-term revenue stream to support the repayment of debt for the construction of the project as well as the long-term payment of water conveyance and operations and maintenance costs.

Although the below listed agencies have invested in the development of the WSIP application, they are not currently under a formal agreement to fund design, construction, or ongoing operations and maintenance (O&M). The initial distribution of investors displayed in Table A1-2 is not final, and water could be allocated differently between these investors or new investors could be added prior to construction. Even if these agencies became the investors responsible for M&I and agricultural water supply, it is unlikely that they would be the sole water users.

Table A1-2. Current JPA Investors by Type and Class

Agency	Class 1 (TAF/yr)	Class 2 (Waiting List) (TAF/yr)	Grand Total
American Canyon, City of	2,000.0	2,000.0	4,000.0
Antelope Valley-East Kern Water Agency	1,427.0	573.0	2,000.0
California Water Service		35,000.0	35,000.0
Carter MWC		1,000.0	1,000.0
Castaic Lake Water Agency	3,567.0	1,433.0	5,000.0
Coachella Valley Water District	18,906.0	7,594.0	26,500.0
Colusa County	10,000.0		10,000.0
Colusa County Water District	32,111.0		32,111.0
Desert Water Agency	4,637.0	1,863.0	6,500.0
Garden Highway MWC		4,000.0	4,000.0
Glenn-Colusa Irrigation District	20,000.0		20,000.0
Metropolitan Water District of S. CA		50,000.0	50,000.0
Orland-Artois Water District	20,000.0		20,000.0
Pacific Resources MWC		20,000.0	20,000.0
Reclamation District 108	20,000.0		20,000.0
San Bernardino Valley Municipal Water District	21,403.0	8,597.0	30,000.0
San Gorgonio Pass Water Agency	9,988.0	4,012.0	14,000.0
Santa Clara Valley Water District	17,123.0	6,877.0	24,000.0
TC6: 4M Water District	500.0		500.0
TC6: Cortina Water District	300.0		300.0
TC6: Davis Water District	2,000.0		2,000.0
TC6: Dunnigan Water District	5,000.0		5,000.0
TC6: LaGrande Water District	1,000.0		1,000.0
TC6: Proberta Water District	3,000.0		3,000.0
Western Canal Water District	3,500.0		3,500.0
Westside Water District	25,000.0		25,000.0
Wheeler Ridge-Maricopa Water Storage District	14,269.0	5,731.0	20,000.0
Zone 7 Water Agency	14,269.0	5,731.0	20,000.0
Grand Total	**250,000.0**	**154,411.0**	**404,411.0**

Key:
TAF/yr = thousand acre-feet per year
— = not applicable

Funding Strategy

Traditional capital financing strategies for major water infrastructure projects like the Sites Reservoir typically include both short- and long-term debt, such as revenue bonds, general obligation bonds, and state revolving loan funds. After an extensive review of the available options, and given the relatively large size of the proposed project, the funding strategy that appears most viable would rely on:

1. a combination of public grant funding (Federal and WSIP) for the project's public benefit purposes;
2. short-term debt during the design and construction phase; and
3. long-term tax exempt revenue bond debt, to be repaid over the course of 40 years from M&I and agricultural water supply revenues.

The funding structure for each project component is discussed below.

Public Benefits

As described in detail in Sites_A10 Allocation under the BENEFIT CALCULATION, MONETIZATION, AND RESILIENCY TAB, federal funding in combination with WSIP would fund the project's public benefit purposes (e.g., ecosystem improvements). This funding would also result in significant overall capital cost saving for the project as a result of reduced interest costs during the construction phase of the project. Federal non-reimbursable construction funding of up to $730 million would be provided as funding for Anadromous Fish ($488 million), Incremental Level 4 Refuge ($201 million) and Flood Reduction ($41 million) purposes. The federal government would also provide $1.3 million per year as its 50 percent cost share of the Incremental Level 4 Refuge's allocated $2.6 million annual O&M cost (see Table A10-1).

If granted, the $1,662 million in WSIP funding would provide sufficient matching funds to fully cover the capital cost for all the project's public benefit categories. WSIP would provide 100 percent funding for the capital cost assignments for Oroville Coldwater Pool, Yolo Bypass and recreation. The WSIP funding would also provide the necessary 56 percent remaining capital needed by the other public benefit purposes receiving federal funding (i.e., Incremental Level 4 Refuge, Anadromous Fish and Flood Reduction).

WSIP funding is not available to pay for the future O&M costs assigned to the public benefit purposes. Although these annual O&M costs are relatively minor compared to the public benefits' capital costs, future funding will needed to cover their respective assigned O&M costs. Except for Incremental Level 4 Refuge which could receive a 50% O&M cost-share contribution, it is expected that non-federal partners (e.g. California Fish and Game) and/or the JPA would be responsible for repaying the majority of the public benefits' estimated future O&M costs of $12.2 million per year.

It is expected that some O&M funding may be obtained for recreation from user fees. Preliminary analysis suggests that $1.1 million in fee revenues could potentially be obtained from reservoir visitors. In addition, flood protection beneficiaries could perhaps be willing to contribute some minor share towards the public benefit purpose's future annual O&M expenses.

In addition to its planned water supply deliveries for agricultural and M&I users, Sites Reservoir will collect limited quantities of "recaptured" water that will be assigned for JPA use. The quantity of future recaptured water is expected to average approximately 11 TAF per year. The JPA plans to sell the recaptured water predominantly to south-of-the-Delta water contractors and use the sale revenues to pay the public benefits' cost share of the project's annual O&M expenses. At a $700 to $800 per acre foot water price, the JPA would be able to contribute $7.7 million to $8.8 million annually.

The JPA also proposes to use its hydropower operation's net revenues as another supplemental funding source for the public benefit purpose's O&M costs. In accordance with the JPA's general "beneficiary pays' approach, to the extent possible revenue sharing would be made between purposes based on their corresponding water allocation. As a result, water supply beneficiaries would also receive a commensurate share of the hydropower operation's net benefits as that for the public benefit purposes.

However, in absence of securing any other public agency funding support for the project's ecosystem benefit purposes, future O&M funding shortfall could occur. In which case, any such shortfall would mostly likely be re-assigned to the project's water supply users. Based on an average total water supply deliveries of 275 TAF, a potential $1 million shortfall would correspond to approximately an additional $3.65 per acre foot cost surcharge to the JPA water contractors.

Hydropower Benefits

As discussed in the Cost Allocation analysis (Sites_A10 Allocation under the BENEFIT CALCULATION, MONETIZATION, AND RESILIENCY TAB), the capital costs for the project's Hydropower facilities would be $509 million. This portion of the project would be financed during phases 1 through 3 through short-term debt in the form of loans from commercial banks or other financial institutions.

As with the project's water supply purpose described below, the primary long-term financing for hydropower would be obtained from revenue bonds to be repaid from energy purchasing agreement and sales to utilities. The hydropower revenues would be expected to include compensation for the facility's ancillary and system-wide capacity benefits. Preliminary analysis suggests there is both ample demand for this type of energy resource, and strong financial capacity among relevant California energy utilities to ensure long-term demand for the project's hydropower energy resources.

Sites Reservoir water contractors would also be a potential funding source for the project's hydropower operations. The water contractors provide an additional guarantee of potential O&M funding in the unlikely event of a funding shortfall in any given year since if necessary, the required revenues could be obtained through increased operating cost surcharges. Depending on their future O&M funding sources, there may or may not also be some opportunities for cost recapture from increased operating cost surcharges to some of the project's public benefit purposes.

Water Supply Benefits

A total of $2,276 million in development costs are attributed to water supply. These costs would be funded through short-term debt from commercial banks or other financial institutions during Phase 1 through 3 of the project. After which long-term, tax-exempt revenue bonds would be used for the project's expected 40 year repayment phase. Under this structure, payment of principal and interest on the bonds would be secured by a pledge of gross revenues derived from payment obligations under water supply contracts with JPA participating contractors.

Water Supply for State Water Contractors

As currently planned approximately 44 percent of the water supply quantities from the Sites Reservoir will likely be delivered to California SWP contractors. Based on preliminary discussions with DWR staff, there may be future partnership or cooperative agreements opportunities with DWR to assist the JPA with both future administration and management of the water supply payments but also participate with underwriting and financing assistance for a major portion of the project's water supply capital cost.

DWR could most readily provide this assistance through its SWP program. The SWP has existing legal authority, regulatory mechanisms, contractual agreements and administrative capacity to partner with the JPA's future water supply program. Furthermore DWR's technical expertise and longstanding working relationships with the state water contractors would be major assets for both funding and managing the project's future water supply program.

The JPA and DWR could coordinate future billing, payment and operations through a series of operational and trust agreements. SWP contractors and DWR have several options for reaching agreement that ensure: (1) JPA participating contractors receive their Sites Reservoir entitled deliveries independently from other SWP deliveries; and (2) DWR collects the contractors' payments.

Currently, it is envisioned that new I(h)4(a) agreements would likely be the preferred regulatory approach for establishing the necessary new SWP-contractors agreements. This authorizing regulation allows separate new "side agreements" mutually agreed upon between the SWP and individual water contractors in support of the development of new capital facilities.

Alternatively, amendments or Yuba Accord approaches could be used to develop the necessary agreements and arrangements. However, these approaches will likely involve more extensive and time-consuming negotiation and approvals.

There are numerous potential major benefits for future partnership arrangements between the JPA, DWR and participating SWP contractors. By partnering with the SWP, the JPA and its participating SWP contractors would be able to take advantage of highly favorable administrative and financing mechanisms that allow for the SWP to collect contractor payments, qualify and secure bond financing, and subsequently manage the debt administration and repayment through State Water Project backed bond financing.

Capital funds raised on behalf of the SWP contractors through SWP bond financing would likely be obtained at lower overall interest rates and have more favorable financing terms than capital funding raised by non-SWP contractors.

Water Supply for Other Water Agencies (Non-SWP Contractors)

It is currently expected that other JPA water contractors would be ineligible to participate under the SWP partnership program. As currently planned, these contactors would account for approximately 56 percent of total water supply deliveries and would have to obtain revenue bond financing through other means, including but not limited to traditional municipal bond markets and private placements.

The feasibility of financing all or part of the Sites Reservoir project with revenue bonds was evaluated by Citigroup Municipal Securities in March, 2014 at the request of the Glenn-Colusa irrigation district. The Citigroup analysis found that financing up to $4.2B in total development costs would be feasible through a series of revenue bonds issued with a coupon rate of 5 percent. This analysis has not been subsequently updated, but for the purposes of this application it provides important and external verification that both SWP and non-SWP contractors would be able to access adequate sources of debt financing to underwrite the capital costs to develop Sites Reservoir's future water storage and supply facilities.

For the purposes of the debt repayment capacity analysis which follows below, it is assumed that the interest rate, debt service reserve and other terms reflect a generalized and blended bond financing approach taking into account both SWP and non-SWP financing. Note that this analysis also includes the annual O&M costs that would also have to be paid by the water contractors.

Capacity for Repayment of Debt Plus Operations and Maintenance

Table A1-3 below provides a simplified presentation of one bond repayment scenario. This funding scenario is based on the revenue bond assumptions listed below, and incorporates water supply revenues estimated from other sections of this application.

As shown below in Table A1-3, the anticipated annual water supply revenues would be more than sufficient to cover both the repayment of a 40-year bond of $2,276 million and the future ongoing O&M costs. A full operating pro forma for the water supply portion of the project is included as an attachment to this section.

Project financing, bond amortization and interest cost assumptions are as follows:

1. Coupon interest rate assumed to be 3%, as adjusted to reflect 2015 terms.
2. No interest is paid on bonds during the construction phase.
3. Each bond series is assumed to be issued with a 5 percent debt service reserve fund ("DSRF").
4. The project bonds are scheduled to amortize over the course of 40 years.
5. Bonds would be issued either by municipal utilities, or under a partnership agreement with a State of California agency.

Table A1-3 shows a "static" or average year pro-forma for the Sites Reservoir's water supply operations. Under this simplified pro-forma, the JPA's annual revenue requirements are met by an estimated average water supply price of $422 per acre foot over a 40 year repayment period. The analysis assumes a real (i.e., without inflation) interest repayment rate of 3 percent and is also based on averaged total water supply quantities of 274 TAF per year.

Table A1-3. Annual Bond Repayment and O&M, 40-year Term (2015$; $Millions)

	2030-2069		2070-2122		2030-2122	
Annual Water Supply Expenses	Total Cost $M	$/AF	Total Cost $M	$/AF	Total Cost $M	$/AF
Annual Bond Repayment	$98.4	$374	$0	$0	$42.3	$154
Annual O&M	$12.6	$48	$12.6	$44	$12.6	$46
Total Annual Debt and O&M	**$111.1**	**$422**	**$12.6**	**$44**	**$55.0**	**$200**
JPA Gross Operating Income						
M&I	$77.1	$693	$8.8	$75	$38.2	$333
Agricultural	$33.9	$224	$3.9	$23	$16.8	$105
Water Supply Annual Income	$111.1	***$422***	$12.6	***$44***	$55.0	***$200***
Net Operating Revenue	$0		$0		$0	

Table A1-4 shows the public benefits cash flow on an annual basis over the full study period. This analysis assumes $750 per acre foot for recaptured water supply sales and $1.1 million in recreation fee revenues. These revenues would not fully cover the total WSIP public benefits O&M ($12.2 million per year) and would be expected to result in a $2.8 million per year revenue shortfall. However, it is possible the State government may assist with the public benefits' O&M costs. Alternatively, the State could potentially reduce its water deliveries (particularly in wetter years) to sell some of its water allocation to generate revenues to cover any remaining or accumulated O&M funding shortfalls.

Table A1-4. Sites Reservoir Public Benefits Cash Flow (2015$; $Millions, TAF)

Factor	Total Period 2030-2122 (93 Yrs)						
	2030	2031	...	...	2122	Total	Average
Recaptured Water Supply	11	11	...	...	11	***1,023***	***11***
Recaptured Water Supply Sales	$8	$8	...	...	$8	*$767*	*$8*
Recreation Fees	$1.1	$1.1	...	...	$1.1	*$103*	*$1*
Subtotal Authority Admin Operations	**$9**	**$9**	...	...	**$9**	***$870***	***$9***
WSIP Public Benefits O&M	($12)	($12)	...	...	($12)	*($1,127)*	*($12)*
Subtotal Authority Admin Operations	**($2.8)**	**($2.8)**	...	...	**($2.8)**	***($257)***	***($2.8)***

Assumptions:

Water Supply Prices	2030-2122
Recaptured Sales Price $/Acre Foot	**$750**

Table A1-5 shows the pro forma on an annual basis over the full study period. This more detailed pro forma includes the projected future annual water supply quantities (which are expected to increase between 2030 and 2070). The base water supply cost has also been adjusted to factor in both: (1) an additional 5 percent cost surcharge for a debt service reserve fund; and (2) a 3 percent net operating income surcharge to provide the additional JPA revenues to ensure that project is net revenue positive (when the debt service reserve fund is included) during its early operating years.

As shown in Table A1-5, at a water supply cost of $456 per acre foot, the project's water supply program would be expected to operate in 2030 with a net operating income deficit of $4.0 million. However, if the $5.7 million debt service reserve contribution is included, the overall net operating income for the JPA's water supply program would be positive at $1.6 million. As future water supply quantities increase, the JPA's water supply program's net operating income would improve to near break-even by 2040 (and would also make its full $5.7 million debt service reserve contribution).

In subsequent years, the JPA water supply program would operate with an increasing net operating income (NOI) surplus. By 2069 its NOI surplus would total $10.3 million per year. Over the 40 year repayment period, the JPA water supply program would be expected to result in a of $125 million cumulative NOI surplus. Although perhaps unlikely, in the absence of any required reserve draw downs, the JPA water supply program would also accumulate debt service reserve funds of $240 million. If unused, both these cumulative funds could be used to pre-pay the remaining principal prior the end of the 40 year repayment period. The size of these cumulative reserves indicates the extent of the financial buffer that the debt reserve fund would provide during the project's repayment period.

Table A1-5 also shows that from 2070 onwards, the annual water supply cost would decrease to only $44 per acre foot in order to cover the JPA water supply program's assigned O&M costs.

Table A1-5. Sites Reservoir Water Supply Financial Pro Forma (2015$; $Millions; TAF)

Factor	Capital Repayment Period 2030-2069 (40 Yrs)																	Post Repayment Period 2070-2122 (53 Yrs)						Total Period 2030-2122 (93 Yrs)	
	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	...	...	2069	*Total*	*Average*	2070	...	...	2122	*Total*	*Average*	Total	Average
Supply (TAF/Year) - Long Term Average Deliveries for Average Water Year Type																										
M&I Water Supply	106	106	107	107	107	107	108	108	108	109	109	109	109	...	...	117	*4,455*	*111*	117	...	...	117	*6,195*	*117*	***10,649***	***115***
Ag Water Supply	137	138	138	139	140	141	141	142	143	144	145	145	146	...	...	167	*6,071*	*152*	167	...	...	167	*8,873*	*167*	***14,944***	***161***
Water Supply Total	243	244	245	246	247	248	249	250	251	252	253	254	255	...	...	283	*10,525*	*263*	284	...	...	284	*15,067*	*284*	***25,593***	***275***
Gross Revenues ($M)																										
M&I Supply	$80	$80	$80	$80	$80	$81	$81	$81	$81	$81	$82	$82	$82	...	...	$87	*$3,339*	*$83*	$9	...	...	$9	*$465*	*$9*	***$3,804***	***$41***
Ag Supply	$33	$33	$34	$34	$34	$34	$34	$34	$35	$35	$35	$35	$35	...	...	$40	*$1,471*	*$37*	$4	...	...	$4	*$205*	*$4*	***$1,676***	***$18***
Total Water Supply Revenues	**$113**	**$113**	**$113**	**$114**	**$114**	**$115**	**$115**	**$115**	**$116**	**$116**	**$117**	**$117**	**$117**	...	...	**$128**	***$4,809***	***$120***	**$13**	...	...	**$13**	***$670***	***$13***	***$5,479***	***$59***
Operating Expenses (Before Debt)																										
O&M	($13)	($13)	($13)	($13)	($13)	($13)	($13)	($13)	($13)	($13)	($13)	($13)	($13)	...	...	($13)	*($506)*	*($13)*	($13)	...	...	($13)	*($670)*	*($13)*	*($1,176)*	*($13)*
Debt Repayment																										
Principal	($30)	($31)	($32)	($33)	($34)	($35)	($36)	($37)	($38)	($39)	($41)	($42)	($43)	...	...	($96)	*($2,275)*	*($57)*		...	...					
Interest	($68)	($67)	($66)	($65)	($64)	($63)	($62)	($61)	($60)	($59)	($58)	($57)	($55)	...	...	($3)	*($1,662)*	*($42)*		...	...					
Annual Fixed Debt Payment	($98)	($98)	($98)	($98)	($98)	($98)	($98)	($98)	($98)	($98)	($98)	($98)	($98)	...	...	($98)	*($3,938)*	*($98)*	$0	...	...	$0	*$0*	*$0*	*($3,938)*	*($42)*
Debt Service Reserve (DSR)	($6)	($6)	($6)	($6)	($6)	($6)	($6)	($6)	($6)	($6)	($6)	($6)	($6)	...	...	($6)	*($240)*	*($6)*		...	...		*$0*	*$0*	*($240)*	*($3)*
Total	**($104)**	**($104)**	**($104)**	**($104)**	**($104)**	**($104)**	**($104)**	**($104)**	**($104)**	**($104)**	**($104)**	**($104)**	**($104)**	...	...	**($105)**	***($4,178)***	***($104)***	**$0**	...	...	**$0**	***$0***	***$0***	***($4,178)***	***($45)***
Cumulative Balances																										
Principle Balance	$2,275	$2,245	$2,214	$2,182	$2,149	$2,115	$2,080	$2,044	$2,007	$1,969	$1,930	$1,889	$1,847	...	...	$96	*$0*	*$1,385*	$0	...	...					
Debt Service Reserve Balance	$0	$6	$11	$17	$23	$28	$34	$40	$46	$51	$57	$63	$69			$234	$240	*$6*	$0							
Net Operating Income																										
NOI Water Supply (w/o DSR)	$1.6	$2.0	$2.4	$2.8	$3.2	$3.5	$3.9	$4.3	$4.7	$5.1	$5.5	$5.9	$6.2	...	...	$16.7	*$366*	*$9.1*	$3.9	...	...	$3.9	*$205.0*	*$4*	*$571*	*$6.1*
Total Net Operating Income (w/ DSR)	**($4.0)**	**($3.7)**	**($3.3)**	**($2.9)**	**($2.6)**	**($2.2)**	**($1.8)**	**($1.5)**	**($1.1)**	**($0.7)**	**($0.4)**	**$0.0**	**$0.4**	...	...	**$10.3**	***$125.4***	***$3.1***	**$3.9**	...	...	**$3.9**	***$205.0***	***$4***	***$330***	***$3.6***

Assumptions:

Water Supply Prices	2030-2069			2070+
	Before Adjust	Adjustments NOI (a)	DSR (b)	
M&I $/Acre Foot	$693	$714	$749	$75
AG $/Acre Foot	$224	$231	$242	$23
Supply $/AF	**$422**	**$435**	**$456**	**$44**

Interest Rate (Real - w/o Inflation)	3.0%
(a) Adjust for Net Operating Income (NOI)	3.0%
(b) Adjust for Debt Service Reserve (DSR)	5.0%

Alternative Delivery Financing

Give the large size of the Sites Reservoir Project and the strong existing appetite in the financial markets for stable, long-term investments in major infrastructure assets, there are several "alternative delivery" financing approaches that would also likely prove feasible for this project. These include primarily various forms of public-private partnerships ("P3s"). As defined by the Water Research Foundation, these typically "involve a contractual arrangement whereby the resources, risks and rewards of both the public agency and private entity are combined to provide greater efficiency, better access to capital, and improved compliance with government regulations".[1] Under Assembly Bill (AB) 2551 adopted in August 2016, California has relatively broad authorizing legislation allowing alternative delivery methods for water storage projects. Additional details on alternative delivery are provided below as Appendix 1 to this Section.

Conclusion

In accordance with the WSIP Technical Guidance, the analysis period for the Site Reservoir project was 93 years from its start of operations in 2030 through to the end of the study period in 2122. Over the course of this period the project will deliver significant new public benefits, clean hydroelectric energy and major new water deliveries for California's M&I and agricultural water users. The above analysis provides a conservative approach to financing the construction costs for the project over the course of 40-years, assuming relatively low-risk financing approaches that are commonly utilized by water contractors and authorities across the United States, and for which there is currently considered to be ample demand from investors.

Although this low-risk approach would be feasible, there are also other potential approaches that could be leveraged over the long-run to deliver water supply resources at rates lower than those assumed for the purposes of this financing strategy. The full range of options has not been explored here, but will be analyzed in greater detail in the future as public funding commitments for the project, including WSIP, are confirmed.

Constructability

At the current feasibility level of design for the Sites Reservoir Project, detailed construction plans and specifications are not yet available. However, the concepts for all of the major facilities comprising the project are at a level that supports developing a Class 4 cost estimate and a preliminary implementation schedule for construction. The constructability review for the current level of design is a high level review that focuses on identifying design concept and construction schedule issues that could introduce significant cost estimating and planning risk.

The constructability review findings include the following:

1. The conceptual designs represent proven technology. Rapidly evolving, new concepts have not been adopted, although these concepts may allow for improved designs and cost savings based on further evaluation in future design phases for the project.

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[1] Sources: "New and Emerging Capital Providers for Infrastructure Funding," Water Research Foundation", 2016 (http://www.waterrf.org/resources/pages/PublicWebTools-detail.aspx?ItemID=34); and "Alternative Water Project Delivery Models", University of North Carolina Environmental Finance Center, 2017 (https://efc.sog.unc.edu/project/alternative-water-project-delivery-models).

2. Construction easements (permanent and temporary) have been evaluated in sufficient detail to determine that real estate costs are reasonable.
3. Environmental mitigation costs have been evaluated based on current understanding of project permitting needs (based on site environmental assessments) and in preliminary consultation with the various state and federal agencies.
4. A preliminary assessment of the potential for encountering hazardous material was performed; including the presence of abandoned gas well, septic systems, underground tanks, and the like.
5. For major facilities, cost estimates were based on preliminary quantity estimates, equipment and manpower estimates to complete tasks, manufacturer's quotes, and AECOM experience on recent similar projects.
6. The construction schedule is based on manpower and equipment needed to complete construction, and reflects the interdependency of construction tasks between facilities that control the start or finish of construction activities.
7. An adequate labor pool exists in the region to complete the project.
8. Appropriate allowances have been included for mobilization and demobilization, construction contingency, and non-contract (owner) costs.
9. Packaging of contracts can facilitate competition and avoid potential for equipment and material shortages.
10. Traffic handling and detours during construction has been considered.
11. Temporary diversion of water during the winter has been considered.

Appendix 1: Financial Feasibility - Research Foundation Definitions of Water Infrastructure Financing Types [2]

Traditional Financing

Revenue Bonds

Revenue bonds are fixed income, debt obligations issued by local governments or other public agencies where the principal and interest on the bonds are secured by the specific revenues named in the bond documents. Revenue bonds typically include a rate covenant by which the user agrees to set rates sufficient to meet all operating costs and some multiple of debt service, and may include a flow of funds requirement and a cash reserve fund requirement, among others.

General Obligation Bond. General Obligation bonds are debt obligations issued by a government entity that are secured by the entities full faith and credit and pledge of tax revenues. This is the strongest pledge the government can provide and is usually regarded by investors and rating agencies as the strongest form of bond security. General Obligation bond issuances often require a bond referendum and public vote.

State Revolving Fund Loan

The State Revolving Loan Fund (SRF) program provides low-interest loans for water and sanitation infrastructure to municipalities, water/sewer authorities, and utility districts. Each state's SRF programs

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2 From *New and Emerging Capital Providers for Infrastructure Funding,* Water Research Foundation, 2016.

receive its initial capital from federal grants and state contributions, and then "revolves" through the repayment of principal and the payment of interest on outstanding loans. There are two SRF programs, the Clean Water State Revolving Fund created under the Clean Water Act, and the Drinking Water State Revolving Fund created under the Safe Drinking Water Act. Each state administers their own SRF programs and program eligibility, requirements, and benefits differ from state to state.

Alternative Delivery: Public Private Partnerships

"Public-private partnerships ("P3s") are a contractual arrangement whereby the resources, risks and rewards of both the public agency and private company are combined to provide greater efficiency, better access to capital, and improved compliance with government regulations. The public's interests are generally assured through provisions in the contracts that provide on-going monitoring and oversight of the operation of a service or development of a facility. The key distinctions of P3s from other forms of alternative project delivery are (1) the extended duration of the partnership, and (2) the nature of the financing and the sources of revenues. In a P3, the duration of the partnership is a long-term one, lasting 10 to 20 years or more. While private financing is not a pre-requisite for an alternative delivery project, it is commonly accepted that private financing is a key distinguishing feature of a P3 arrangement.

In general, there are at least two types of P3 models; (1) demand risk model, and (2) availability payment model. The demand risk model represents the case where P3 financing is secured with the future revenue streams from user charges, and where the private concessionaire takes on the overall financial risks associated with potential fluctuations in future user demand. This model is typically used where there are sufficient revenue streams from user charges to fund the capital investment. Under the availability payment model, the private concessionaire provides the P3 financing, but it is secured with annual payment commitments from the public sector over the concession term. Table A1-6 shows the major investors in North American water infrastructure with their global ranking.

Table A1-6. Top 10 Global Investors in Water Infrastructure, North America

2016 Global Rank	Company	Country	Funding ($M)
2	Brookfield Asset Management	Canada	$31,985
3	Global Infrastructure Partners	United States	$20,780
4	Borealis Infrastructure	Canada	$19,246
7	ArcLight Capital Partners	United States	$10,675
11	Kohlberg Kravis Roberts	United States	$5,913
12	Energy Capital Partners	United States	$5,882
13	Stonepeak Infrastructure Partners	United States	$5,275
14	JP Morgan Investment Management	United States	$5,171
17	EnerVest	United States	$4,400
20	First Reserve	United States	$3,769

Source: PEI, The Infrastructure Investor 50, 2016 (http://www.infrastructureinvestor.com/uploadedFiles/Infrastructure_Investor/Non-Pagebuilder/Aliased/News_And_Analysis/2016/November/Magazine/II77_II50_Nov16.pdf)

Appendix 2: Water Balance of CalSim II Simulation Results for Current Conditions, WSIP 2030, and WSIP 2070

The following section contains tables that portray the water balance results for the following CalSim II simulations:

1. Current Conditions With Project vs. Current Conditions Without Project
2. WSIP 2030 With Project vs. WSIP 2030 Without Project
3. WSIP 2070 With Project vs WSIP 2070 Without Project

As defined in Section 4.3.1 of the WSIP Technical Reference Document, a water balance is an accounting of all the flows of water into and out of an account for a defined period. An account can represent a location or geographic boundary, such as a reservoir, watershed, or region. The following accounts are included in this report:

1. Sites Reservoir
2. Colusa Basin
3. Sacramento Valley
4. Sacramento-San Joaquin Delta

The Sacramento-San Joaquin Delta account consists of the region upstream of Delta outflow and downstream of inflows at Freeport and Vernalis. The Sacramento Valley account includes the region upstream of Freeport and downstream of inflows at Shasta Lake and Trinity Lake, not including the Colusa Basin. The Colusa Basin account consists of the entire Colusa Basin region, not including Sites Reservoir. The Sites Reservoir account provides a water balance for the reservoir itself.

The following tables include inputs, outputs, and changes in reservoir storage for each account. The parameters are presented as water-year (October through September) annual averages based on the full simulation period (82 years; 1922–2003). The mass balance is computed as the total volume of inputs subtracted by the total volume of outputs and the total volume of change in storage. A mass balance value of zero indicates that all water entering the account is equal to all water leaving the account and accumulating in storage. Moreover, a mass balance of zero confirms that there are no net gains or losses within the account that are unaccounted for. As shown in this report, all the CalSim II models achieve mass balance values of zero for each of the four accounts defined above.

Sites Reservoir Mass Balance *(All values are in TAF)*	Annual Average for Full Simulation Period		
	Current Conditions With Project	Current Conditions Without Project	Difference
Sites Reservoir Mass Balance **Inputs**			
Diversion to Sites Reservoir at Red Bluff (TCC)	277	0	277
Diversion to Sites Reservoir at Hamilton City (GCC)	105	0	105
Diversion to Sites Reservoir at Delevan Pipeline	133	0	133
Total Inputs to Sites Reservoir	**514**	**0**	**514**
Outputs			
Release from Sites Reservoir to TCC, GCC, and Colusa Basin Drain	233	0	233
Release from Sites Reservoir to Delevan Pipeline	234	0	234
Sites Reservoir Evaporation & Losses	44	0	44
Total Outputs from Sites Reservoir	**510**	**0**	**510**
Change in Storage			
Sites Reservoir	4	0	4
Mass Balance	0	0	0

*Change in Storage is End of Period Volume minus Beginning of Period Volume divided by number of years in the period.

*Annual Averages for October through September.

Colusa Basin Mass Balance *(All values are in TAF)*	Annual Average for Full Simulation Period		
	Current Conditions With Project	Current Conditions Without Project	Difference
Colusa Basin Mass Balance **Inputs**			
Diversion at Red Bluff (TCC & Corning Canal)	428	188	240
Diversion at Hamilton City (GCC)	890	861	29
Release from Sites Reservoir to TCC, GCC, and Coluse Basin Drain	233	0	233
Other Diversions from Sacramento River	507	505	1
Stony Creek and other tributary Inflows	928	928	0
Return Flows	332	332	0
Total Inputs to Colusa Basin	**3,318**	**2,814**	**503**
Outputs			
Diversion to Corning Canal	23	20	3
Diversion to Orland Unit Agriculture	102	103	0
Diversion to TCCA Agriculture	246	173	73
Diversion from TCC to Sites Reservoir	277	0	277
Diversion to GCID Agriculture	763	759	4
Diversion from GCC to Sites Reservoir	105	0	105
Diversion to Refuges	100	97	3
Diversion to Other Colusa Basin Agriculture (Right Bank)	507	505	1
Stony Creek Outflow to Sacramento River	235	237	-2
Colusa Basin Drain Outflow to Sacramento River	447	427	20
Knights Landing Ridge Cut Outflow	342	320	22
Losses from Canals (TCC, CC, GCC, CBD)	147	149	-2
Stony Creek Reservoirs Evaporation & Losses	24	24	0
Total Outputs from Colusa Basin	**3,317**	**2,814**	**503**
Change in Storage			
Stony Creek Reservoirs	1	1	0
Mass Balance	**0**	**0**	**0**

*The Colusa Basin mass balance includes parameters within the Colusa Basin, not including Sites Reservoir, Funks Reservoir, and the Sacramento Valley outside of the Colusa Basin. The Delevan Pipeline is not included in this table because it serves as an input and output for the Sites Reservoir Mass Balance and Sacramento Valley Mass Balance reports.
*Other Diversion from Sacramento River include diversions to Colusa Basin, West Bank, and WBA8S
*Stony Creek and other tributary inflows include inflows to East Park Reservoir, Stony Gorge Reservoir, Black Butte Lake and DSA 12 Accretion
*Return flows include those from WBA8NN, WBA7N, WBA7S, WBA8S, WBA8NS, Delevan and Colusa Refuges
*Diversion to TCCA Agriculture includes diversions to WBA4, WBA7N, and WBA7S.
*Diversion to GCID Agriculture includes diversions to WBA8NN and WBA8NS.
*Diversion to Refuges includes diversions from the Sacramento Valley and the Colusa Basin Drain.
*Stony Creek Reservoirs includes East Park Reservoir, Stony Gorge Reservoir, and Black Butte Lake.
*Change in Storage is End of Period Volume minus Beginning of Period Volume divided by number of years in the period
*Annual Averages for October through September.

Sacramento Valley Mass Balance	Annual Average for Full Simulation Period		
(All values are in TAF)	Current Conditions With Project	Current Conditions Without Project	Difference
Sacramento Valley Mass Balance **Inputs**			
Inflow to Shasta Lake and Whiskeytown Reservoir	5,998	5,998	0
Flow through Clear Creek Tunnel	550	542	7
Tributary Inflows upstream of Red Bluff	1,434	1,434	0
Tributary Inflows between Red Bluff and Hamilton City	803	803	0
Stony Creek Inflow	235	237	-2
Big Chico Creek Inflow	97	97	0
Accretions in Upper Sacramento River	1,395	1,395	0
Sites Reservoir Release to river through Delevan Pipeline	234	0	234
Inflow from Colusa Basin Drain	447	427	20
Feather River Inflow to Lake Oroville	3,967	3,967	0
Yuba River and Bear River Inflow to Feather River	2,167	2,167	0
Kelly Ridge and Butte Creek Inflow to Feather River	419	419	0
Accretions in Feather River	460	460	0
American River Inflow to Folsom Lake	2,734	2,734	0
Other American River Inflows	674	674	0
Accretions in Lower Sacramento River	595	595	0
Inflow from Knights Landing Ridge Cut	342	320	22
Groundwater Pumping	1,204	1,204	-1
Return Flows	1,502	1,494	8
Total Inputs to Sacramento Valley	**25,256**	**24,968**	**289**
Outputs			
Diversion to Sutter Refuge	13	11	2
Diversion at Red Bluff (TCC & CC)	428	188	240
Diversion at Hamilton City (GCC)	890	861	29
Diversion to Sites Reservoir through Delevan Pipeline	133	0	133
Diversion to Other Colusa Basin Agriculture (Right Bank)	507	505	1
Diversion to Other Sacramento River Agriculture and M&I	2,875	2,875	0
Diversion to Feather River Agriculture and M&I	2,245	2,226	19
Diversion to Yuba River Agriculture and M&I	63	65	-1
Reservoir Evaporation & Losses	231	227	4
Stream-Groundwater Interaction	139	145	-6
Yolo Bypass	2,129	2,158	-29
Sacramento River below Freeport	15,605	15,709	-104
Total Outputs from Sacramento Valley	**25,257**	**24,970**	**288**
Change in Storage			
Shasta Lake	5	4	1
Lake Oroville	-8	-7	-1
Folsom Lake	1	0	0
Other Reservoirs	1	1	0
Total Change in Reservoir Storage in Sacramento Valley	**-1**	**-2**	**1**
Mass Balance	**0**	**0**	**0**

*The Sacramento Valley Mass Balance includes parameters upstream of Freeport to Shasta Lake and Trinity Lake inflow, not including the Colusa Basin. See "Colusa Basin Mass Balance" for additional detail.
*Other Inflows upstream of Red Bluff include Cow Creek, Cottonwood Creek, Battle Creek, and Payne Creek.
*Inflows between Red Bluff and Hamilton City include Elder Creek, Thomes Creek, Antelope Creek, Mills Creek, Deer Creek, and Red Bank Creek.
*Other American River Inflows include inflows to the Sacramento River and from Lake Natoma.
*Diversion to Other Sacramento River Agriculture and M&I include diversions to West Sacramento Diversion for Davis Municipal Project, EBMUD & CCWD Freeport Regional Water Project, North Fork Dam, DSA12, DSA15, DSA59, DSA70, WBA4, and WBA5.
*Diversion to Feather River Agriculture and M&I includes diversions to Gray Lodge Refuge, Butte Sink Duck Clubs, Western Canal & Joint WD Rice Straw Decomp, DSA69, and diversion to Sites Reservoir at Joint Canal near Thermalito.
*Diversion to Yuba River Agriculture and M&I include transfers for Lower Yuba River Accord and SCWA excess flows.
*Change in Storage is End of Period Volume minus Beginning of Period Volume divided by number of years in the period.
*Other Reservoirs include Whiskeytown Lake, Kesiwck Reservoir, Thermalito Complex, and Lake Natoma.
*Annual Averages for October through September.

Sacramento - San Joaquin Delta Mass Balance (All values are in TAF)	Annual Average for Full Simulation Period		
	Current Conditions With Project	Current Conditions Without Project	Difference
Sacramento - San Joaquin Delta Mass Balance **Inputs**			
Sacramento River below Freeport	15,605	15,709	-104
Yolo Bypass	2,129	2,158	-29
San Joaquin River below Vernalis	3,134	3,137	-3
Eastside Streams and other inflows	831	831	0
Total Inputs to Sacramento - San Joaquin Delta	**21,699**	**21,836**	**-136**
Outputs			
Diversion to North Bay Aquaduct	85	85	1
Export at Banks Pumping Plant	2,812	2,708	104
Export at Jones Pumping Plant	2,267	2,233	34
Export to Contra Costa WD/Los Vaqueros Reservoir	168	168	0
Other Delta Diversions	60	59	1
Net Delta Island Consumptive Use	883	883	0
Delta Outflow	15,425	15,700	-276
Total Outputs from Sacramento - San Joaquin Delta	**21,699**	**21,836**	**-136**
Mass Balance	0	0	0

*The Delta Mass Balance includes parameters upstream of Delta Outflow, not including the Sacramento Valley. It is bounded by inflow at Freeport and Vernalis. See "Sacramento Valley Mass Balance" for additional detail.

*Eastside Streams and other inflows includes Marsh Creek, Mokelumne, & Calaveras, Cosumnes River.

*Export to Contra Costa WD/Los Vaqueros Reservoir includes exports to CCWD Old River, Victoria Canal, & Rock Slough Intakes.

*Other Delta Diversions include diversions to Stockton DWSP/COSMA, the City of Antioch (pre-1914 water rights), and Vallejo.

*Net Delta Island Consumptive Use includes diversions and island seepage and drainage.

*Annual Averages for October through September.

Sites Reservoir Mass Balance *(All values are in TAF)*	Annual Average for Full Simulation Period		
	WSIP 2030 With Project	WSIP 2030 Without Project	Difference
Sites Reservoir Mass Balance **Inputs**			
Diversion to Sites Reservoir at Red Bluff (TCC)	299	0	299
Diversion to Sites Reservoir at Hamilton City (GCC)	105	0	105
Diversion to Sites Reservoir at Delevan Pipeline	148	0	148
Total Inputs to Sites Reservoir	**552**	**0**	**552**
Outputs			
Release from Sites Reservoir to TCC, GCC, and Colusa Basin Drain	262	0	262
Release from Sites Reservoir to Delevan Pipeline	242	0	242
Sites Reservoir Evaporation & Losses	44	0	44
Total Outputs from Sites Reservoir	**549**	**0**	**549**
Change in Storage			
Sites Reservoir	3	0	3
Mass Balance	**0**	**0**	**0**

*Change in Storage is End of Period Volume minus Beginning of Period Volume divided by number of years in the period.

*Annual Averages for October through September.

Colusa Basin Mass Balance *(All values are in TAF)*	Annual Average for Full Simulation Period		
	WSIP 2030 With Project	WSIP 2030 Without Project	Difference
Colusa Basin Mass Balance **Inputs**			
Diversion at Red Bluff (TCC & Corning Canal)	416	146	271
Diversion at Hamilton City (GCC)	886	868	18
Release from Sites Reservoir to TCC, GCC, and Coluse Basin Drain	262	0	262
Other Diversions from Sacramento River	510	509	1
Stony Creek and other tributary Inflows	941	941	0
Return Flows	332	332	0
Total Inputs to Colusa Basin	**3,349**	**2,796**	**552**
Outputs			
Diversion to Corning Canal	19	16	3
Diversion to Orland Unit Agriculture	102	103	0
Diversion to TCCA Agriculture	235	136	100
Diversion from TCC to Sites Reservoir	299	0	299
Diversion to GCID Agriculture	763	758	5
Diversion from GCC to Sites Reservoir	105	0	105
Diversion to Refuges	102	99	4
Diversion to Other Colusa Basin Agriculture (Right Bank)	510	509	1
Stony Creek Outflow to Sacramento River	250	252	-2
Colusa Basin Drain Outflow to Sacramento River	445	422	23
Knights Landing Ridge Cut Outflow	348	329	19
Losses from Canals (TCC, CC, GCC, CBD)	145	149	-4
Stony Creek Reservoirs Evaporation & Losses	24	24	0
Total Outputs from Colusa Basin	**3,348**	**2,795**	**552**
Change in Storage			
Stony Creek Reservoirs	1	1	0
Mass Balance	**0**	**0**	**0**

*The Colusa Basin mass balance includes parameters within the Colusa Basin, not including Sites Reservoir, Funks Reservoir, and the Sacramento Valley outside of the Colusa Basin. The Delevan Pipeline is not included in this table because it serves as an input and output for the Sites Reservoir Mass Balance and Sacramento Valley Mass Balance reports.
*Other Diversion from Sacramento River include diversions to Colusa Basin, West Bank, and WBA8S
*Stony Creek and other tributary inflows include inflows to East Park Reservoir, Stony Gorge Reservoir, Black Butte Lake and DSA 12 Accretion
*Return flows include those from WBA8NN, WBA7N, WBA7S, WBA8S, WBA8NS, Delevan and Colusa Refuges
*Diversion to TCCA Agriculture includes diversions to WBA4, WBA7N, and WBA7S.
*Diversion to GCID Agriculture includes diversions to WBA8NN and WBA8NS.
*Diversion to Refuges includes diversions from the Sacramento Valley and the Colusa Basin Drain.
*Stony Creek Reservoirs includes East Park Reservoir, Stony Gorge Reservoir, and Black Butte Lake.
*Change in Storage is End of Period Volume minus Beginning of Period Volume divided by number of years in the period
*Annual Averages for October through September.

Sacramento Valley Mass Balance *(All values are in TAF)*	Annual Average for Full Simulation Period WSIP 2030 With Project	 WSIP 2030 Without Project	 Difference
Sacramento Valley Mass Balance			
Inputs			
Inflow to Shasta Lake and Whiskeytown Reservoir	6,209	6,209	0
Flow through Clear Creek Tunnel	540	534	5
Tributary Inflows upstream of Red Bluff	1,484	1,484	0
Tributary Inflows between Red Bluff and Hamilton City	840	840	0
Stony Creek Inflow	250	252	-2
Big Chico Creek Inflow	101	101	0
Accretions in Upper Sacramento River	1,395	1,395	0
Sites Reservoir Release to river through Delevan Pipeline	242	0	242
Inflow from Colusa Basin Drain	445	422	23
Feather River Inflow to Lake Oroville	4,115	4,115	0
Yuba River and Bear River Inflow to Feather River	2,199	2,199	0
Kelly Ridge and Butte Creek Inflow to Feather River	433	433	0
Accretions in Feather River	460	460	0
American River Inflow to Folsom Lake	2,784	2,784	0
Other American River Inflows	674	674	0
Accretions in Lower Sacramento River	595	595	0
Inflow from Knights Landing Ridge Cut	348	329	19
Groundwater Pumping	1,220	1,221	-1
Return Flows	1,490	1,486	4
Total Inputs to Sacramento Valley	**25,823**	**25,533**	**291**
Outputs			
Diversion to Sutter Refuge	13	10	3
Diversion at Red Bluff (TCC & CC)	416	146	271
Diversion at Hamilton City (GCC)	886	868	18
Diversion to Sites Reservoir through Delevan Pipeline	148	0	148
Diversion to Other Colusa Basin Agriculture (Right Bank)	510	509	1
Diversion to Other Sacramento River Agriculture and M&I	2,872	2,872	0
Diversion to Feather River Agriculture and M&I	2,221	2,211	10
Diversion to Yuba River Agriculture and M&I	60	62	-1
Reservoir Evaporation & Losses	224	221	3
Stream-Groundwater Interaction	140	148	-8
Yolo Bypass	2,742	2,827	-85
Sacramento River below Freeport	15,595	15,666	-71
Total Outputs from Sacramento Valley	**25,829**	**25,540**	**289**
Change in Storage			
Shasta Lake	3	3	1
Lake Oroville	-9	-10	1
Folsom Lake	-1	-1	0
Other Reservoirs	1	1	0
Total Change in Reservoir Storage in Sacramento Valley	**-6**	**-7**	**1**
Mass Balance	**0**	**0**	**0**

*The Sacramento Valley Mass Balance includes parameters upstream of Freeport to Shasta Lake and Trinity Lake inflow, not including the Colusa Basin. See "Colusa Basin Mass Balance" for additional detail.
*Other Inflows upstream of Red Bluff include Cow Creek, Cottonwood Creek, Battle Creek, and Payne Creek.
*Inflows between Red Bluff and Hamilton City include Elder Creek, Thomes Creek, Antelope Creek, Mills Creek, Deer Creek, and Red Bank Creek.
*Other American River Inflows include inflows to the Sacramento River and from Lake Natoma.
*Diversion to Other Sacramento River Agriculture and M&I include diversions to West Sacramento Diversion for Davis Municipal Project, EBMUD & CCWD Freeport Regional Water Project, North Fork Dam, DSA12, DSA15, DSA59, DSA70, WBA4, and WBA5.
*Diversion to Feather River Agriculture and M&I includes diversions to Gray Lodge Refuge, Butte Sink Duck Clubs, Western Canal & Joint WD Rice Straw Decomp, DSA69, and diversion to Sites Reservoir at Joint Canal near Thermalito.
*Diversion to Yuba River Agriculture and M&I include transfers for Lower Yuba River Accord and SCWA excess flows.
*Change in Storage is End of Period Volume minus Beginning of Period Volume divided by number of years in the period.
*Other Reservoirs include Whiskeytown Lake, Kesiwck Reservoir, Thermalito Complex, and Lake Natoma.
*Annual Averages for October through September.

Sacramento - San Joaquin Delta Mass Balance *(All values are in TAF)*	Annual Average for Full Simulation Period		
	WSIP 2030 With Project	WSIP 2030 Without Project	Difference
Sacramento - San Joaquin Delta Mass Balance **Inputs**			
Sacramento River below Freeport	15,595	15,666	-71
Yolo Bypass	2,742	2,827	-85
San Joaquin River below Vernalis	3,349	3,352	-3
Eastside Streams and other inflows	886	886	0
Total Inputs to Sacramento - San Joaquin Delta	**22,573**	**22,731**	**-159**
Outputs			
Diversion to North Bay Aquaduct	86	85	1
Export at Banks Pumping Plant	2,755	2,637	118
Export at Jones Pumping Plant	2,136	2,106	30
Export to Contra Costa WD/Los Vaqueros Reservoir	168	168	0
Other Delta Diversions	60	60	0
Net Delta Island Consumptive Use	875	875	0
Delta Outflow	16,492	16,801	-309
Total Outputs from Sacramento - San Joaquin Delta	**22,573**	**22,731**	**-159**
Mass Balance	0	0	0

*The Delta Mass Balance includes parameters upstream of Delta Outflow, not including the Sacramento Valley. It is bounded by inflow at Freeport and Vernalis. See "Sacramento Valley Mass Balance" for additional detail.
*Eastside Streams and other inflows includes Marsh Creek, Mokelumne, & Calaveras, Cosumnes River.
*Export to Contra Costa WD/Los Vaqueros Reservoir includes exports to CCWD Old River, Victoria Canal, & Rock Slough Intakes.
*Other Delta Diversions include diversions to Stockton DWSP/COSMA, the City of Antioch (pre-1914 water rights), and Vallejo.
*Net Delta Island Consumptive Use includes diversions and island seepage and drainage.
*Annual Averages for October through September.

Sites Reservoir Mass Balance *(All values are in TAF)*	Annual Average for Full Simulation Period		
	WSIP 2070 With Project	WSIP 2070 Without Project	Difference
Sites Reservoir Mass Balance **Inputs**			
Diversion to Sites Reservoir at Red Bluff (TCC)	306	0	306
Diversion to Sites Reservoir at Hamilton City (GCC)	118	0	118
Diversion to Sites Reservoir at Delevan Pipeline	164	0	164
Total Inputs to Sites Reservoir	**588**	**0**	**588**
Outputs			
Release from Sites Reservoir to TCC, GCC, and Colusa Basin Drain	272	0	272
Release from Sites Reservoir to Delevan Pipeline	268	0	268
Sites Reservoir Evaporation & Losses	45	0	45
Total Outputs from Sites Reservoir	**585**	**0**	**585**
Change in Storage			
Sites Reservoir	3	0	3
Mass Balance	**0**	**0**	**0**

*Change in Storage is End of Period Volume minus Beginning of Period Volume divided by number of years in the period.

*Annual Averages for October through September.

Colusa Basin Mass Balance *(All values are in TAF)*	Annual Average for Full Simulation Period		
	WSIP 2070 With Project	WSIP 2070 Without Project	Difference
Colusa Basin Mass Balance **Inputs**			
Diversion at Red Bluff (TCC & Corning Canal)	388	95	293
Diversion at Hamilton City (GCC)	894	867	27
Release from Sites Reservoir to TCC, GCC, and Coluse Basin Drain	272	0	272
Other Diversions from Sacramento River	509	507	2
Stony Creek and other tributary Inflows	972	972	0
Return Flows	332	332	0
Total Inputs to Colusa Basin	**3,368**	**2,773**	**594**
Outputs			
Diversion to Corning Canal	14	10	4
Diversion to Orland Unit Agriculture	102	103	-1
Diversion to TCCA Agriculture	212	86	126
Diversion from TCC to Sites Reservoir	306	0	306
Diversion to GCID Agriculture	757	757	0
Diversion from GCC to Sites Reservoir	118	0	118
Diversion to Refuges	102	99	4
Diversion to Other Colusa Basin Agriculture (Right Bank)	509	507	2
Stony Creek Outflow to Sacramento River	283	288	-5
Colusa Basin Drain Outflow to Sacramento River	449	427	21
Knights Landing Ridge Cut Outflow	346	324	23
Losses from Canals (TCC, CC, GCC, CBD)	143	147	-4
Stony Creek Reservoirs Evaporation & Losses	24	25	0
Total Outputs from Colusa Basin	**3,367**	**2,773**	**594**
Change in Storage			
Stony Creek Reservoirs	1	1	0
Mass Balance	**0**	**0**	**0**

*The Colusa Basin mass balance includes parameters within the Colusa Basin, not including Sites Reservoir, Funks Reservoir, and the Sacramento Valley outside of the Colusa Basin. The Delevan Pipeline is not included in this table because it serves as an input and output for the Sites Reservoir Mass Balance and Sacramento Valley Mass Balance reports.
*Other Diversion from Sacramento River include diversions to Colusa Basin, West Bank, and WBA8S
*Stony Creek and other tributary inflows include inflows to East Park Reservoir, Stony Gorge Reservoir, Black Butte Lake and DSA 12 Accretion
*Return flows include those from WBA8NN, WBA7N, WBA7S, WBA8S, WBA8NS, Delevan and Colusa Refuges
*Diversion to TCCA Agriculture includes diversions to WBA4, WBA7N, and WBA7S.
*Diversion to GCID Agriculture includes diversions to WBA8NN and WBA8NS.
*Diversion to Refuges includes diversions from the Sacramento Valley and the Colusa Basin Drain.
*Stony Creek Reservoirs includes East Park Reservoir, Stony Gorge Reservoir, and Black Butte Lake.
*Change in Storage is End of Period Volume minus Beginning of Period Volume divided by number of years in the period
*Annual Averages for October through September.

Sacramento Valley Mass Balance	Annual Average for Full Simulation Period		
(All values are in TAF)	**WSIP 2070 With Project**	**WSIP 2070 Without Project**	**Difference**
Sacramento Valley Mass Balance			
Inputs			
Inflow to Shasta Lake and Whiskeytown Reservoir	6,254	6,254	0
Flow through Clear Creek Tunnel	552	546	6
Tributary Inflows upstream of Red Bluff	1,521	1,521	0
Tributary Inflows between Red Bluff and Hamilton City	877	877	0
Stony Creek Inflow	283	288	-5
Big Chico Creek Inflow	106	106	0
Accretions in Upper Sacramento River	1,395	1,395	0
Sites Reservoir Release to river through Delevan Pipeline	268	0	268
Inflow from Colusa Basin Drain	449	427	21
Feather River Inflow to Lake Oroville	4,228	4,228	0
Yuba River and Bear River Inflow to Feather River	2,255	2,255	0
Kelly Ridge and Butte Creek Inflow to Feather River	447	447	0
Accretions in Feather River	460	460	0
American River Inflow to Folsom Lake	2,809	2,809	0
Other American River Inflows	674	674	0
Accretions in Lower Sacramento River	595	595	0
Inflow from Knights Landing Ridge Cut	346	324	23
Groundwater Pumping	1,279	1,286	-7
Return Flows	1,486	1,472	14
Total Inputs to Sacramento Valley	**26,282**	**25,962**	**320**
Outputs			
Diversion to Sutter Refuge	13	10	3
Diversion at Red Bluff (TCC & CC)	388	95	293
Diversion at Hamilton City (GCC)	894	867	27
Diversion to Sites Reservoir through Delevan Pipeline	164	0	164
Diversion to Other Colusa Basin Agriculture (Right Bank)	509	507	2
Diversion to Other Sacramento River Agriculture and M&I	2,869	2,869	0
Diversion to Feather River Agriculture and M&I	2,217	2,186	31
Diversion to Yuba River Agriculture and M&I	57	58	-1
Reservoir Evaporation & Losses	212	208	4
Stream-Groundwater Interaction	174	183	-10
Yolo Bypass	3,308	3,424	-117
Sacramento River below Freeport	15,486	15,565	-79
Total Outputs from Sacramento Valley	**26,291**	**25,972**	**318**
Change in Storage			
Shasta Lake	2	1	1
Lake Oroville	-11	-11	1
Folsom Lake	-1	-1	0
Other Reservoirs	1	1	0
Total Change in Reservoir Storage in Sacramento Valley	**-9**	**-11**	**2**
Mass Balance	**0**	**0**	**0**

*The Delta Mass Balance includes parameters upstream of Delta Outflow, not including the Sacramento Valley. It is bounded by inflow at Freeport and Vernalis. See "Sacramento Valley Mass Balance" for additional detail.
*Other Inflows upstream of Red Bluff include Cow Creek, Cottonwood Creek, Battle Creek, and Payne Creek.
*Inflows between Red Bluff and Hamilton City include Elder Creek, Thomes Creek, Antelope Creek, Mills Creek, Deer Creek, and Red Bank Creek.
*Other American River Inflows include inflows to the Sacramento River and from Lake Natoma.
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*Diversion to Feather River Agriculture and M&I includes diversions to Gray Lodge Refuge, Butte Sink Duck Clubs, Western Canal & Joint WD Rice Straw Decomp, DSA69, and diversion to Sites Reservoir at Joint Canal near Thermalito.
*Diversion to Yuba River Agriculture and M&I include transfers for Lower Yuba River Accord and SCWA excess flows.
*Change in Storage is End of Period Volume minus Beginning of Period Volume divided by number of years in the period.
*Other Reservoirs include Whiskeytown Lake, Kesiwck Reservoir, Thermalito Complex, and Lake Natoma.
*Annual Averages for October through September.

Sacramento - San Joaquin Delta Mass Balance (All values are in TAF)	Annual Average for Full Simulation Period		
	WSIP 2070 With Project	WSIP 2070 Without Project	Difference
Sacramento - San Joaquin Delta Mass Balance **Inputs**			
Sacramento River below Freeport	15,486	15,565	-79
Yolo Bypass	3,308	3,424	-117
San Joaquin River below Vernalis	3,493	3,497	-4
Eastside Streams and other inflows	895	895	0
Total Inputs to Sacramento - San Joaquin Delta	**23,182**	**23,381**	**-199**
Outputs			
Diversion to North Bay Aquaduct	85	84	1
Export at Banks Pumping Plant	2,579	2,446	133
Export at Jones Pumping Plant	1,858	1,824	34
Export to Contra Costa WD/Los Vaqueros Reservoir	169	169	0
Other Delta Diversions	60	60	0
Net Delta Island Consumptive Use	865	864	1
Delta Outflow	17,566	17,934	-368
Total Outputs from Sacramento - San Joaquin Delta	**23,182**	**23,381**	**-199**
Mass Balance	0	0	0

*The Delta Mass Balance includes parameters upstream of Delta Outflow, not including the Sacramento Valley. See "Sacramento Valley Mass Balance" for additional detail.
*Eastside Streams and other inflows includes Marsh Creek, Mokelumne, & Calaveras, Cosumnes River.
*Export to Contra Costa WD/Los Vaqueros Reservoir includes exports to CCWD Old River, Victoria Canal, & Rock Slough Intakes.
*Other Delta Diversions include diversions to Stockton DWSP/COSMA, the City of Antioch (pre-1914 water rights), and Vallejo.
*Net Delta Island Consumptive Use includes diversions and island seepage and drainage.
*Annual Averages for October through September.