Appendix D

Evaluation of LSJR Alternative 1 and SDWQ Alternative 1 (No Project Alternative)

Appendix D

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D.1 Introduction

California Code of Regulations (Cal. Code Regs.) requires that the potential impacts of not approving a proposed project be evaluated under a no project alternative. "The purpose of describing and analyzing a no project alternative is to allow decision makers to compare the impacts of approving the proposed project with the impacts of not approving the proposed project." (14 Cal. Code Regs., § 15126.6(e)(1)). When the project is the revision of an existing regulatory plan, such as the 2006 Bay-Delta Plan, the no project alternative will be the continuation of the existing plan into the future. (14 Cal. Code Regs., § 15126.6(e)(3)(A)). Thus, projects initiated under the existing plan would continue while the new plan is being developed. The no project analysis must discuss the existing conditions, "as well as what would be reasonably expected to occur in the foreseeable future if the project were not approved, based on current plans and consistent with available infrastructure and community services." (14 Cal. Code Regs., § 15126.6(e)(2)).

For the purposes of this analysis, Lower San Joaquin River (LSJR) Alternative 1 and southern Delta water quality (SDWQ) Alternative 1 (referred to as the No Project Alternative in this appendix and in Chapter 15, *LSJR Alternative 1 and SDWQ Alternative 1 [No Project Alternative]*) is the continuation of the State Water Resources Control Board's (State Water Board's) 2006 Bay-Delta Plan as implemented through Water Rights Decision 1641 (D-1641). The 2006 Bay-Delta Plan includes San Joaquin River (SJR) at Vernalis flow objectives (SJR flow objectives) and southern Delta salinity objectives (including the salinity objective on the SJR at Vernalis). The No Project Alternative also includes flows required to comply with the 2009 National Marine Fisheries Services biological opinion Stanislaus River reasonable and prudent alternative, including Action 3.1.3 (NMFS BO), which increased the Stanislaus River flow requirements. The No Project Alternative does not include continuation of flows under the Vernalis Adaptive Management Program (VAMP), which was implemented as the Vernalis flow objective from 2000 to 2011 and is no longer in effect.

This analysis assumes that to implement the 2006 Bay-Delta Plan flow and salinity objectives, water would be released by the U.S. Bureau of Reclamation (USBR) from New Melones Reservoir to increase Stanislaus River flow and achieve full compliance with D-1641. There are potentially other ways that compliance with the objectives could be achieved, but it is speculative to identify which other measures, or combination of measures, would be used. The analytical approach selected evaluates increased releases from New Melones Reservoir to meet the objectives because such releases would generally achieve the existing Vernalis flow objectives and southern Delta salinity objectives while affording a full evaluation of potential water supply impacts. This appendix describes the assumptions in the Department of Water Resources' (DWR) and USBR's CALSIM Water Resources Simulation Model (CALSIM)[1] baseline and estimates the changes in flows needed to fully comply the 2006 Bay-Delta Plan as implemented through D-1641.

[1] The CALSIM model was used as the baseline for impact determinations in Chapters 5–14 of this substitute environmental document (SED).

D.2 Description of the No Project Alternative

The No Project Alternative assumes continued implementation of, and full compliance with, the Vernalis flow and southern Delta salinity objectives in the 2006 Bay-Delta Plan as implemented through D-1641. No Project Alternative conditions differ from baseline conditions because the Vernalis flow objectives were not fully implemented in the baseline. In D-1641, the State Water Board approved conducting the VAMP experiment proposed in the San Joaquin River Agreement (SJRA) in lieu of meeting the April–May pulse flow objective at Vernalis required as part of the Vernalis flow objectives in the 2006 Bay-Delta Plan. The VAMP flows, which are generally lower than the flows in the 2006 Bay-Delta Plan, are included in the baseline. The VAMP experiment concluded in December 2011, and VAMP flows are included in the baseline. During VAMP, a portion of the flows needed to comply with VAMP came from all three eastside tributaries of the SJR—the Stanislaus, Tuolumne, and Merced Rivers—even though the 2006 Bay-Delta Plan and D-1641 do not contain numeric or narrative flow objectives specifically for those rivers. The No Project Alternative, however, does not include VAMP flows because that experimental flow regime concluded in 2011. The No Project Alternative and the baseline both include NMFS BO flow requirements on the Stanislaus River.

The SJR flow objectives were first established at Vernalis in the 1995 Bay-Delta Plan to protect fish and wildlife beneficial uses and are now contained in the 2006 Bay-Delta Plan. These objectives include the minimum monthly flow rates for fish and wildlife beneficial uses during specific times of the year as presented in Table 3 of the 2006 Bay-Delta Plan and D-1641. In D-1641, the State Water Board assigned compliance with these minimum flows on the SJR at Vernalis to USBR. The No Project Alternative assumes the flows would continue to be the responsibility of USBR. Without VAMP in effect, the flows would likely be achieved by a combination of releases from New Melones Reservoir, water purchases and transfers among different water users (which cannot be fully quantified or predicted), and other upstream SJR actions (e.g., SJR Restoration Program flows).

The No Project Alternative also assumes continuation of, and full compliance with, the southern Delta salinity objectives for agricultural beneficial uses that are identified in Table 2 of the 2006 Bay-Delta Plan and implemented through D-1641. Under D-1641, compliance with the numeric salinity objectives on the SJR at Vernalis (station C-10) is the obligation of USBR. Compliance with the numeric salinity objectives at the three interior southern Delta compliance stations, the SJR at Brandt Bridge (station C-6), Old River near Middle River (station C-8), and Old River at Tracy Road Bridge (station P-12), are the combined obligation of USBR and DWR.

D.3 Evaluating the No Project Alternative

D.3.1 Modeling

For water-related projects in California, it is standard practice to evaluate the difference between baseline conditions and the alternatives using a sequence of historical hydrology (often monthly) that includes the effects from seasonal and year-to-year variations in rainfall, runoff, and reservoir operations. It is important to evaluate changes that would result from revised reservoir operations using a full range of runoff conditions. Baseline conditions for water resources (runoff, reservoir storage, river flows, salinity, and temperature) can best be described using the most recent 10–25 years of historical measurements. However, because every year's hydrology is different, and new facilities may be added or operating rules may change (i.e., VAMP, Old River at Middle River [OMR] limits), a long-term planning model comparison approach is often used to evaluate the differences between a baseline case and a project (alternative) case.

The planning model, CALSIM, was used to simulate baseline hydrologic conditions. USBR developed the CALSIM SJR module to simulate monthly flows, reservoir storages, water supply deliveries, and salinity (EC[2]) in the SJR Basin. It is used as part of the CALSIM planning model for the Central Valley Project (CVP) and State Water Project (SWP) and calculates reservoir operations and Delta operations for a specified set of water resources facilities (i.e., reservoirs and diversions), level of development (i.e., demands), and regulatory requirements using the historical sequence of hydrologic conditions for 1922–2003.

The State Water Board's Water Supply Effects (WSE) model was used to simulate modified hydrologic conditions under the LSJR and SDWQ alternatives. It is a monthly water balance spreadsheet model that calculates the increased river flows, reductions in water supply diversions, and changes in reservoir operations that would occur in each of the three eastside tributaries based upon user-defined inputs, output from CALSIM (i.e., baseline), and flood-storage rules. The WSE model allows the release flow targets for each tributary for February–June to be a specified fraction of the monthly unimpaired runoff. The model maximizes diversions and maintains baseline reservoir storage levels to minimize effects on both coldwater pool and water supply diversions by adjusting annual diversion targets based on storage at the end of January each year.

The CALSIM and WSE models are discussed in more detail in Appendix F.1, *Hydrologic and Water Quality Modeling*, and Appendix F.2, *Evaluation of Historical Flow and Salinity Measurements in the Lower San Joaquin River and Southern Delta.*

D.3.2 Assumptions

CALSIM provides a reasonably accurate representation of the recent historical hydrology and recent operations (Appendix F.1, *Hydrologic and Water Quality Modeling*). The CALSIM case (i.e., assumptions and results) selected to represent baseline for Chapters 5–14 of this SED included

[2] EC is electrical conductivity. Measuring EC assesses salinity, which is the concentration of dissolved salts (often expressed in parts per thousand or parts per million). Because salinity refers to salt concentration in the water, whereas EC values are the result of one measurement technique to assess salinity, both "EC" and the more general term "salinity" are used in this chapter. EC is generally expressed in deciSiemens per meter (dS/m) in this document. However, this appendix uses microSiemens per centimeter (µS/cm). The conversion is 1 dS/m = 1000 µS/cm.

assumptions about the appropriate rules to apply for reservoir operations on the three eastside tributaries. It also included assumptions about implementation of the Vernalis flow objectives, the Vernalis salinity objectives at the SJR at Vernalis, and the southern Delta salinity objectives at the three interior southern Delta compliance stations.

The selected CALSIM case (2009 *SWP Water Supply Delivery Reliability Existing Conditions Study*) included the NMFS BO for the Stanislaus flows (as defined in Chapter 2, *Water Resources*, and Chapter 5, *Water Supply, Surface Hydrology, and Water Quality)*, the VAMP-modified Vernalis flow objectives, and the Vernalis salinity objectives[3]. The CALSIM model results were not always able to fully meet these flow and southern Delta salinity objectives because the CALSIM calculations include an annual allocation of New Melones Reservoir water for these objectives that is reduced in low runoff or low storage years.

The monthly sequence of reservoir storage, water supply diversions, river flows, and Vernalis salinity for the No Project Alternative could differ from the recent historical measurements and from the CALSIM-modeled baseline because of different assumptions used to calculate the baseline and the No Project Alternative.

The No Project Alternative would be slightly different than the recently observed historical flow and salinity conditions. The reasons for this are identified below.

1. The Vernalis flow objectives for a 30-day period April–May were "modified" to be more adaptive (conditioned on observed flow) during the 12-year VAMP (2000–2011); VAMP has ended, and the original D-1641 flow objectives that are dependent only on the SJR water year type and Delta outflow are assumed for the No Project Alternative.
2. The Vernalis flow objectives for February–June, which are dependent on the SJR water year type and the daily location of the 2-parts per thousand (ppt) salinity (i.e., Delta outflow), were not always fully implemented during the 1996–2011 period.
3. The required flows on the Stanislaus River have been recently revised by the NMFS BO for the CVP and SWP Operational Criteria and Plan (OCAP), requiring generally higher fish flows for Chinook salmon and Central Valley steelhead. These higher flows are included in the No Project Alternative.
4. The full CVP contract deliveries for the New Melones Reservoir (755 thousand acre-feet per year [TAF/y]) have recently been required by a federal court judgment; USBR has usually delivered the 600 TAF/y contract with Oakdale Irrigation District (OID) and South San Joaquin Irrigation District (SSJID) but has rarely delivered much of the 155 TAF/y contract with Stockton East Water District (SEWD) and Central San Joaquin Water Conservation District (CSJWCD). The No Action Alternative assumes the full 755 TAF/y deliveries.

The No Project Alternative would be different than the selected CALSIM baseline case for the following reasons.

1. The CALSIM model assumed a 50 microsiemens per centimeter (μS/cm) buffer at Vernalis in months when salinity control releases from New Melones Reservoir were necessary to meet the Vernalis EC objectives; this resulted in slightly higher Stanislaus River flows than necessary in

[3] Includes the flows needed from the Stanislaus River to meet the existing salinity objectives identified in the 2006 Bay Delta Plan for SJR at Vernalis and the three interior southern Delta compliance locations.

some months in the baseline. These additional flows are not assumed for the No Project Alternative.

2. The No Project Alternative would meet the southern Delta salinity objectives by requiring additional New Melones reservoir releases. An assumed EC increment from Vernalis to Tracy Boulevard reduced by higher Vernalis flow (i.e., EC increment [µS/cm] = 300,000 / Vernalis flow [cubic feet per second (cfs)]) was calculated for each month to estimate the maximum allowed Vernalis EC and the corresponding additional flow releases from New Melones to meet the EC objectives at Tracy Boulevard. This assumption resulted in much higher flows in some years.
3. The CALSIM baseline did not include the full Stanislaus River water supply demands.
4. The CALSIM baseline allowed water to be purchased from the Tuolumne and Merced Rivers to satisfy VAMP flow objectives. The No Project Alternative would not include the purchased water for the purposes of satisfying Vernalis flow objectives, so flows on the Merced and Tuolumne Rivers would be reduced in April and May of some years. The No Project Alternative would satisfy the D-1641 flows with releases from New Melones Reservoir alone.

The assumptions made for the No Project Alternative include reasonably foreseeable and feasible future actions and therefore provide a sufficient degree of analysis to evaluate the environmental effects being considered (State CEQA Guidelines, § 15204(a).). The CALSIM baseline for the No Project Alternative is the same baseline used for impact analysis in Chapters 5–14 of this SED.

D.3.3 Estimating Flows for the No Project Alternative

This section describes the methods used to estimate the additional flows needed to comply with the No Project Alternative—continuation of the 2006 Bay-Delta Plan objectives as implemented through D-1641—and compares the additional flows against the CALSIM baseline results for 1922–2003. This analysis assumes that additional Vernalis flows would come entirely from the Stanislaus River. The additional flows from additional New Melones Reservoir releases would cause reduced Stanislaus River water supply deliveries (increased deficits). In addition, the No Project Alternative assumed full Stanislaus River contract deliveries by USBR (755 TAF/y). The additional New Melones Reservoir releases were calculated for each required change in the CALSIM baseline results.

Stanislaus River Flow Requirements

The State Water Board's WSE model, which was used to evaluate all of the alternatives, was adjusted to check the Stanislaus River flows at Goodwin Dam required by the NMFS BO. The NMFS BO requires specified daily flows be released from New Melones at certain times of the year dictated by the lifecycle of steelhead and Chinook species. The pattern of daily flows depends on runoff and reservoir storage conditions each year. Specifically, pulse flows are required during the fall for adult attraction and during the spring for outmigration cues and juvenile outmigration. Flows generally range from approximately 200 to 1,500 cubic feet per second (cfs) in the fall and approximately 200 to 5,000 cfs in the spring. In October 2011, Federal Judge Wanger ordered NMFS to reevaluate the BO flow requirements on the Stanislaus River but allowed the originally specified requirements to remain in effect in the interim. Given the uncertainty regarding resulting future modifications to these flow requirements, the existing requirements are reasonably expected to occur in the foreseeable future and thus are included in the No Project Alternative.

The CALSIM baseline included these NMFS BO flows, which are five different monthly flow schedules based on the New Melones Reservoir Index (NMI) value. The NMI is calculated as the end of February storage plus the (forecasted) Stanislaus River runoff volume for March–September. The annual water supplies, flows, and salinity control releases are allocated based on the NMI value each year. Table D-1 gives the monthly fish flow schedule for various NMI values. The NMI index values for each flow schedule were selected iteratively (during model assessment) to have each flow schedule in about 20 percent of the years. The CALSIM model results for the Stanislaus River flows at Goodwin Dam generally satisfied NMFS BO requirements. However, CALSIM did not fully meet the NMFS BO in all years because the CALSIM model sometimes "ran out" of allocated water in January and February and also reduced the pulse flows in March and in May of a few years. Therefore, an average increase in annual flows was needed to fully satisfy NMFS BO flows. The average increase was about 7 TAF/y, with a maximum of 30 TAF/y and more than 20 TAF/y required in 10 percent of the years. Many of these releases could likely have been made without reducing deliveries (reduced spills when the reservoir was at flood-control limits). The WSE model was used to determine the effects of fully meeting the NMFS BO flows with additional releases, in combination with additional releases for the Vernalis flow objectives and southern Delta salinity objectives, on New Melones Reservoir storage and water supply deliveries (see Section D.3.4).

Table D-1. Stanislaus River Monthly Flows (cfs) at Goodwin Dam Required for NMFS BO (based on New Melones Index [NMI])

WY Type	NMI Value (TAF)	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Annual (TAF)
C	<1725	583	200	200	220	214	200	459	399	150	150	150	150	185
D	<2178	567	200	200	226	221	200	765	630	200	200	200	200	234
BN	<2387	773	200	200	233	235	200	1,551	1,240	363	250	250	250	347
AN	<2762	795	200	200	240	235	1,518	1,398	1,552	938	299	299	299	484
W	>2762	840	299	299	369	364	1,645	1,630	1,955	1,098	428	399	399	590

cfs = cubic feet per second
NMFS BO = 2009 National Marine Fisheries Service Biological Opinion
WY = water year
TAF = thousand acre-feet
C = Critical
D = Dry
BN = Below Normal
AN = Above Normal
W = Wet

Vernalis Flow Objectives

The Vernalis flow objectives[4] were compared to the CALSIM baseline Vernalis flows. The flow objectives at Vernalis are higher when the X2 location[5] is downstream of Chipps Island (i.e., higher outflow). Table D-2 shows the monthly flow objectives for the two cases: X2 upstream or X2 downstream of Chipps Island (75 kilometers [km]). Because the 30-day pulse flow spans April and May, the required flows in these 2 months were calculated as the average of the baseflow and the pulse flow. There were several years when the CALSIM model flows did not meet the Vernalis flow objectives because the CALSIM model assumed VAMP pulse flows were required and because CALSIM only allocated a maximum volume of New Melones Reservoir releases for meeting the February–June Vernalis baseflow. This comparison indicated that an average of 34 TAF/y of additional flow would be required to satisfy the NMFS BO and the Vernalis flow requirements, with a maximum of 408 TAF/y required in 1993 (wet year for SJR runoff but low New Melones Reservoir index). More than 20 TAF of additional water was needed in about half of the years. More than 85 TAF was needed in about 10 percent of the years. Therefore, full compliance with the Vernalis flow objectives and with the NMFS BO would likely have a substantial effect on reduced water supply deliveries from New Melones Reservoir because of the additional water needed to satisfy the No Project Alternative.

Table D-2. D-1641 Vernalis Monthly Flows Objectives (cfs) for X2 Upstream or Downstream of Chipps Island (km 75) Based on SJR 60-20-20 Water-Year Type

D-1641 with X2 >75 km	Feb	Mar	Apr	May	Jun
C	710	710	2,265	2,265	710
D	1,420	1,420	3,430	3,430	1,420
BN	1,420	1,420	3,730	3,730	1,420
AN	2,130	2,130	4,995	4,995	2,130
W	2,130	2,130	5,795	5,795	2,130
D-1641 with X2 <75 km	Feb	Mar	Apr	May	Jun
C	1,140	1,140	2,340	2,340	1,140
D	2,280	2,280	3,580	3,580	2,280
BN	2,280	2,280	3,880	3,880	2,280
AN	3,420	3,420	5,220	5,220	3,420
W	3,420	3,420	6,020	6,020	3,420

km = kilometers
cfs = cubic feet per second
C = Critical
D = Dry
BN = Below Normal
AN = Above Normal
W = Wet

[4] Vernalis flow objectives specified for February–June are based on the SJR 60-20-20 water year index and the end-of month X2 values (i.e., Delta outflow).

[5] The X2 standard, introduced in the 1995 Bay-Delta Plan, refers to the position at which 2 parts per thousand (ppt) salinity occurs in the Delta estuary and is designed to improve shallow-water fish habitat in the spring of each year and can limit export pumping (see Chapter 5, *Water Supply, Surface Hydrology, and Water Quality*, for additional information regarding X2).

Southern Delta Salinity Objectives

The No Project Alternative would include full compliance with the southern Delta salinity objectives. This includes compliance at SJR at Vernalis and the three interior southern Delta compliance locations. The CALSIM baseline meets the Vernalis salinity objectives but may not have enough of an EC buffer (i.e., Vernalis salinity objective minus Vernalis salinity) to meet the southern Delta EC objectives. The CALSIM model results include an EC buffer of 50 µS/cm when salinity control is necessary, so the modeled baseline Vernalis EC was always less than 650 µS/cm April–August and was always less than 950 µS/cm September–March. The Vernalis salinity objectives were always met in the CALSIM model baseline results.[6] The CALSIM model assumed the EC buffer resulted in Stanislaus River flows that were slightly more than necessary in several months.

The historical EC measurements have generally been highest at the Old River at Tracy Boulevard station, as described in Appendix F.2, *Evaluation of Historical Flow and Salinity Measurements of the Lower San Joaquin River and Southern Delta*. Therefore, the Tracy Boulevard station was selected to determine compliance with the southern Delta salinity objectives. The Vernalis EC required to meet the Old River at Tracy Boulevard salinity objectives was calculated based on the observed EC increments between Vernalis and Tracy Boulevard that were dependent on Vernalis flow. Based on historical EC data, the EC increment at Tracy Boulevard was estimated as:

EC Increment (µS/cm) = 300,000 / Vernalis flow (cfs) *(Eqn. D-1)*

For example, the EC increment from Vernalis to Tracy Boulevard would be 300 µS/cm when the Vernalis flow was 1,000 cfs, 150 µS/cm when the Vernalis flow was 2,000 cfs, and 100 µS/cm when the Vernalis flow was 3,000 cfs. The measured EC increments at Brandt Bridge and in OMR were generally much less (about 33 percent of the Tracy Boulevard EC increment).

To achieve full compliance with the salinity objectives at Tracy Boulevard, the Vernalis EC must be reduced to the EC objective minus the EC increment. For example, if the Vernalis flow was 4,000 cfs in April, the assumed EC increment from Vernalis to Tracy Boulevard would be 75 µS/cm and the Vernalis EC would need to be less than 625 µS/cm in order to also meet the EC objective of 700 µS/cm at Tracy Boulevard. The Vernalis EC can be reduced, if necessary, by increasing the Vernalis flow with additional New Melones Reservoir releases. If the Stanislaus EC was 0 µS/cm, the Vernalis EC would change as the inverse of the Vernalis flow change (ratio). But because the Stanislaus River EC is about 100 µS/cm, the Vernalis EC will decrease at a slightly slower rate as Stanislaus River water is added.

*Vernalis EC Reduction = (Vernalis EC – Stanislaus EC) * Added Q/ (Vernalis Q + Added Q) (Eqn. D-2)*

The added Stanislaus flow needed to reduce the Vernalis EC to satisfy the Tracy Boulevard EC objective was calculated (e.g., rearranged equation) as:

Added flow (cfs) = Vernalis Flow x EC Reduction/ (Vernalis EC – Stanislaus EC – EC Reduction) (Eqn. D-3)

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[6] In August of 1992, New Melones Reservoir ran out of water in the model and, therefore, did not meet the Vernalis EC objective for this one month.

For example, if the Vernalis flow was 4,000 cfs in April and the baseline Vernalis EC was 650 µS/cm, the EC increment to Tracy Boulevard would be 75 µS/cm, and the needed EC reductions would be 25 µS/cm. This would require about 190 cfs of Stanislaus River water. The Vernalis EC would be reduced by about 4 percent by adding about 5 percent more water.

Estimates of Additional New Melones Reservoir Releases

The CALSIM baseline flows and EC values at Vernalis were compared to determine the volume of additional Stanislaus water needed to fully comply with the No Project Alternative. An average of 91 TAF/y of additional New Melones Reservoir releases would be required, with a maximum of 420 TAF/y. More than 80 TAF/y would be required in about half of the years, and more than 195 TAF/y would be required in 10 percent of the years. Most of this additional water was required in the summer months of June–August with the Vernalis salinity objective of 700 µS/cm. The WSE model was used to evaluate the consequences of meeting the No Project Alternative on the New Melones Reservoir storage and Stanislaus River water supply deliveries (see Section D.3.4).

Table D-3 summarizes the annual CALSIM baseline New Melones Reservoir releases (TAF) and the additional releases from New Melones Reservoir that would be required under the No Project Alternative. These additional flows were estimated cumulatively for each month, and additional releases were not needed for each of these No Project requirements in each year. The first column gives the baseline New Melones annual water year releases, which ranged from 229 to 2,569 TAF, with an average release volume of 609 TAF. The second column gives the annual VAMP releases (in April and May) on the Tuolumne and Merced Rivers that were assumed in the CALSIM model. These VAMP releases ranged from 0 to 87 TAF, with an average of 30 TAF. The majority of these VAMP purchases were on the Merced River, so Merced River flows would be reduced in some years under the No Project Alternative. Under the No Project Alternative, it is assumed that these VAMP flows would shift to the Stanislaus River and thus could further reduce the New Melones Reservoir storage and Stanislaus River water supply diversions. The third column gives the additional water needed to satisfy the NMFS BO. Because these monthly NMFS BO flows were included in the CALSIM baseline, additional water was estimated to be needed in only a few years. The required releases ranged from 0 to 87 TAF, with an average of 36 TAF. The fourth column gives the additional flow needed to fully satisfy the Vernalis flow objectives. There would be a considerable amount of water needed in a few years when the SJR water year index was wet; the required releases ranged from a minimum of 3 to a maximum of 408 TAF with an average of 64 TAF. The final column gives the additional releases needed to also reduce the Vernalis EC so that the Tracy Boulevard EC objectives would be satisfied in every month. Because the EC increment was conservatively estimated, the total additional releases from New Melones Reservoir to meet the No Project Alternative conditions would range from 3 to 420 TAF, with an average of 121 TAF. About half of the total additional water was required to meet the Tracy Boulevard EC objectives.

Table D-3. Estimated Annual Adjustments in CALSIM Baseline New Melones Reservoir Releases (TAF = thousand acre-feet) Required for No Project Alternative to Meet NMFS BO Flows, Vernalis Flows, and Southern Delta Salinity Objectives (i.e., Tracy EC Objective) without VAMP Flows on Tuolumne and Merced Rivers

Year	New Melones Baseline Releases	Tuolumne and Merced VAMP	Stanislaus NMFS BO Flows	Vernalis Flow Objectives	Tracy EC Objectives
1922	460	0	3	3	3
1923	622	25	35	35	52
1924	539	15	16	16	130
1925	387	34	34	34	119
1926	409	40	41	41	135
1927	469	25	25	115	151
1928	422	74	75	75	153
1929	447	31	32	32	138
1930	357	47	47	47	163
1931	305	0	5	68	192
1932	400	22	33	223	262
1933	325	25	30	48	156
1934	310	25	31	64	196
1935	408	54	60	147	185
1936	354	24	29	63	85
1937	414	0	0	3	20
1938	832	0	22	22	22
1939	613	77	78	78	150
1940	619	15	25	25	65
1941	725	0	25	25	25
1942	749	0	22	22	22
1943	988	1	17	17	17
1944	668	77	78	78	136
1945	642	60	70	70	72
1946	726	73	83	83	118
1947	481	22	23	51	130
1948	473	47	47	90	150
1949	415	22	23	117	217
1950	446	25	25	43	118
1951	626	41	41	41	88
1952	696	0	21	21	21
1953	905	65	74	74	109
1954	524	25	26	26	127
1955	462	1	2	31	130
1956	711	49	59	59	59
1957	611	63	63	207	259
1958	658	0	24	24	24

Year	New Melones Baseline Releases	Tuolumne and Merced VAMP	Stanislaus NMFS BO Flows	Vernalis Flow Objectives	Tracy EC Objectives
1959	635	77	78	78	152
1960	465	40	41	41	164
1961	362	0	0	71	197
1962	308	34	46	81	165
1963	504	77	81	108	145
1964	383	35	36	61	166
1965	534	37	46	101	125
1966	483	60	60	78	159
1967	670	0	18	18	18
1968	593	77	78	78	179
1969	883	0	3	3	3
1970	1,307	77	86	86	128
1971	721	77	87	87	141
1972	513	11	11	71	165
1973	524	31	31	50	73
1974	693	47	56	56	56
1975	792	77	87	87	87
1976	487	26	27	27	130
1977	356	25	26	43	187
1978	314	0	9	53	62
1979	547	25	25	33	58
1980	769	12	22	22	22
1981	588	53	54	54	141
1982	1,094	0	20	20	20
1983	2,569	0	19	19	19
1984	1,555	52	55	55	66
1985	597	47	47	47	120
1986	692	0	21	21	22
1987	693	31	32	32	131
1988	350	13	13	27	174
1989	334	0	5	85	216
1990	308	0	4	64	205
1991	300	0	3	80	217
1992	229	0	9	128	283
1993	343	0	17	408	420
1994	285	13	17	35	177
1995	520	0	30	69	79
1996	667	7	29	29	38
1997	1,648	77	87	87	115
1998	938	0	22	22	22
1999	1,124	73	75	88	107

Year	New Melones Baseline Releases	Tuolumne and Merced VAMP	Stanislaus NMFS BO Flows	Vernalis Flow Objectives	Tracy EC Objectives
2000	703	77	87	87	122
2001	400	14	14	43	132
2002	464	34	34	92	177
2003	485	2	2	90	150
Minimum	229	0	0	3	3
Average	609	30	36	64	121
Maximum	2569	77	87	408	420

NMFS BO = National Marine Fisheries Services biological opinion Stanislaus River reasonably prudent alternative, including Action 3.1.3
VAMP = Vernalis Adaptive Management Program

If the Stanislaus River water supply diversions were reduced to make the required Stanislaus flows continue the 2006 Bay-Delta Plan as implemented through D-1641, the baseline diversions of 577 TAF/y would be potentially reduced to an average of 456 TAF/y. This would be a substantial reduction in the Stanislaus River deliveries that would be similar to the reductions needed for LSJR Alternative 4 (60% unimpaired flow) (which also resulted in an average delivery of 456 TAF/y). Although some of the additional flows might come from baseline flood-control releases in years with relatively high storage, most of the additional flows would require reduced deliveries.

Figure D-1 shows the comparison of the D-1641 Vernalis flow objectives with the CALSIM representation of baseline monthly SJR flows at Vernalis for water years 1985–2003 (recent historical period). The Vernalis flow objectives depend on the SJR water year index (60-20-20). This graph indicates that while most of the February–June baseflows were satisfied, some of the pulse flows in April and May were not satisfied in the baseline CALSIM results. Additional New Melones Reservoir releases would be required to fully satisfy the Vernalis flow objectives in several of the years.

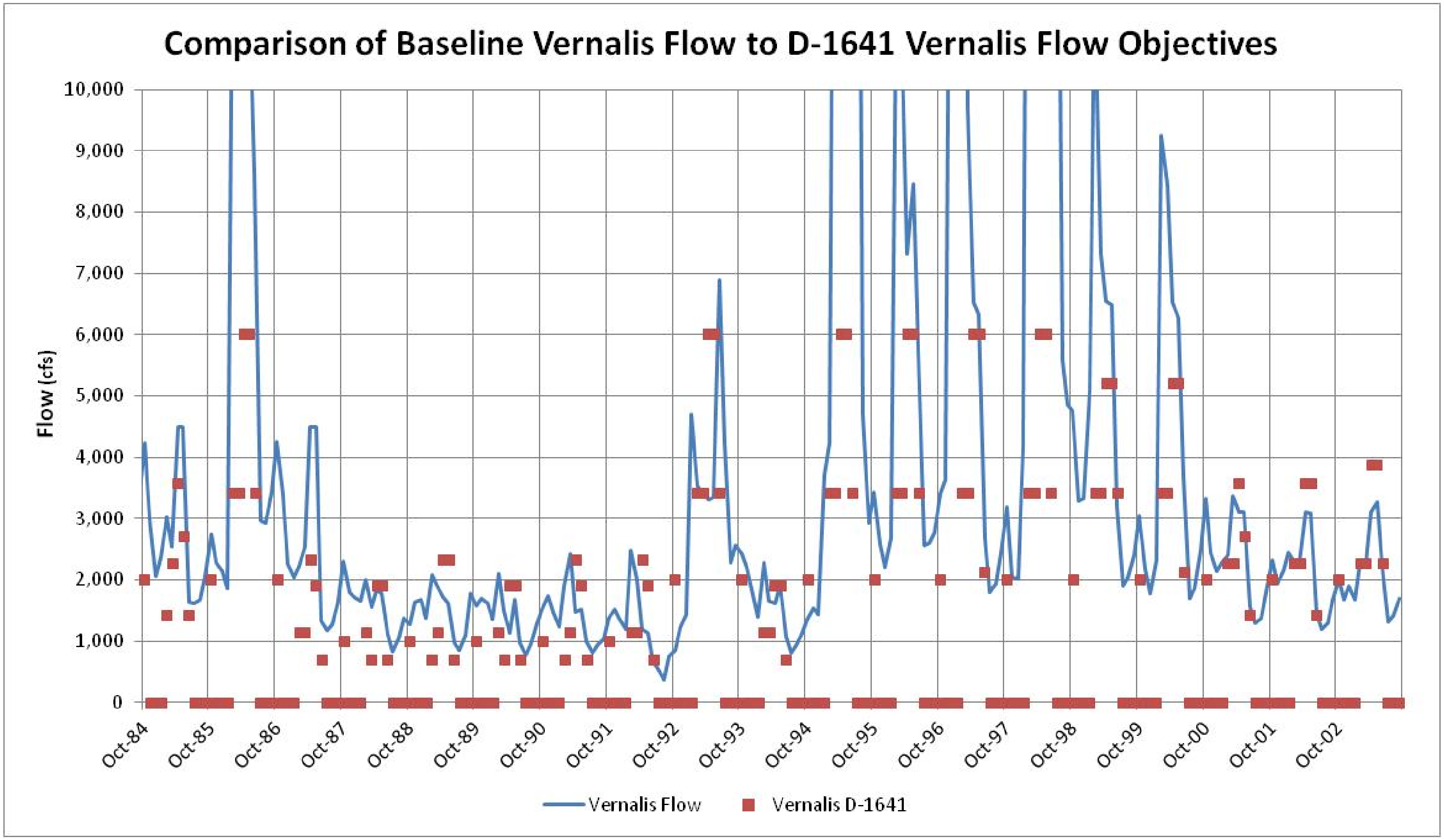

Figure D-1. Comparison of CALSIM Model Baseline Monthly Flows with D-1641 Vernalis Flow Objectives for Water Years 1984–2003

Figure D-2 shows the comparison of the CALSIM baseline flows on the Stanislaus River at Goodwin with the NMFS BO monthly flow requirements calculated from the NMI index that depends on end-of-February storage and the March–September runoff. Because the CALSIM model included the NMFS BO flows, these requirements were generally satisfied.

Figure D-3 shows the CALSIM-simulated baseline New Melones Reservoir storage compared with the monthly unimpaired Stanislaus River runoff and the NMFS BO flow requirements for water years 1985–2003. The CALSIM-simulated annual water supply deliveries are also shown. Because the New Melones Reservoir storage is a major term in the NMI (in addition to the runoff), higher Stanislaus River flows are required when the reservoir is nearly full, regardless of the runoff. A considerable amount of additional New Melones Reservoir releases would be required for full compliance with the Vernalis flow objectives and with the southern Delta salinity objectives. This would require substantial reductions in the water supply deliveries from New Melones Reservoir.

There is a difficulty in modeling the water year class with the NMI. Because the NMI is dependent on the end-of-January reservoir storage, this can result in a different sequence of year classes with different specified fish flows. The LSJR alternatives do not use any annual index (i.e., they are established by month-by-month percent of unimpaired flow). The water needed to satisfy the NMFS BO could, therefore, be more than simulated by the model.

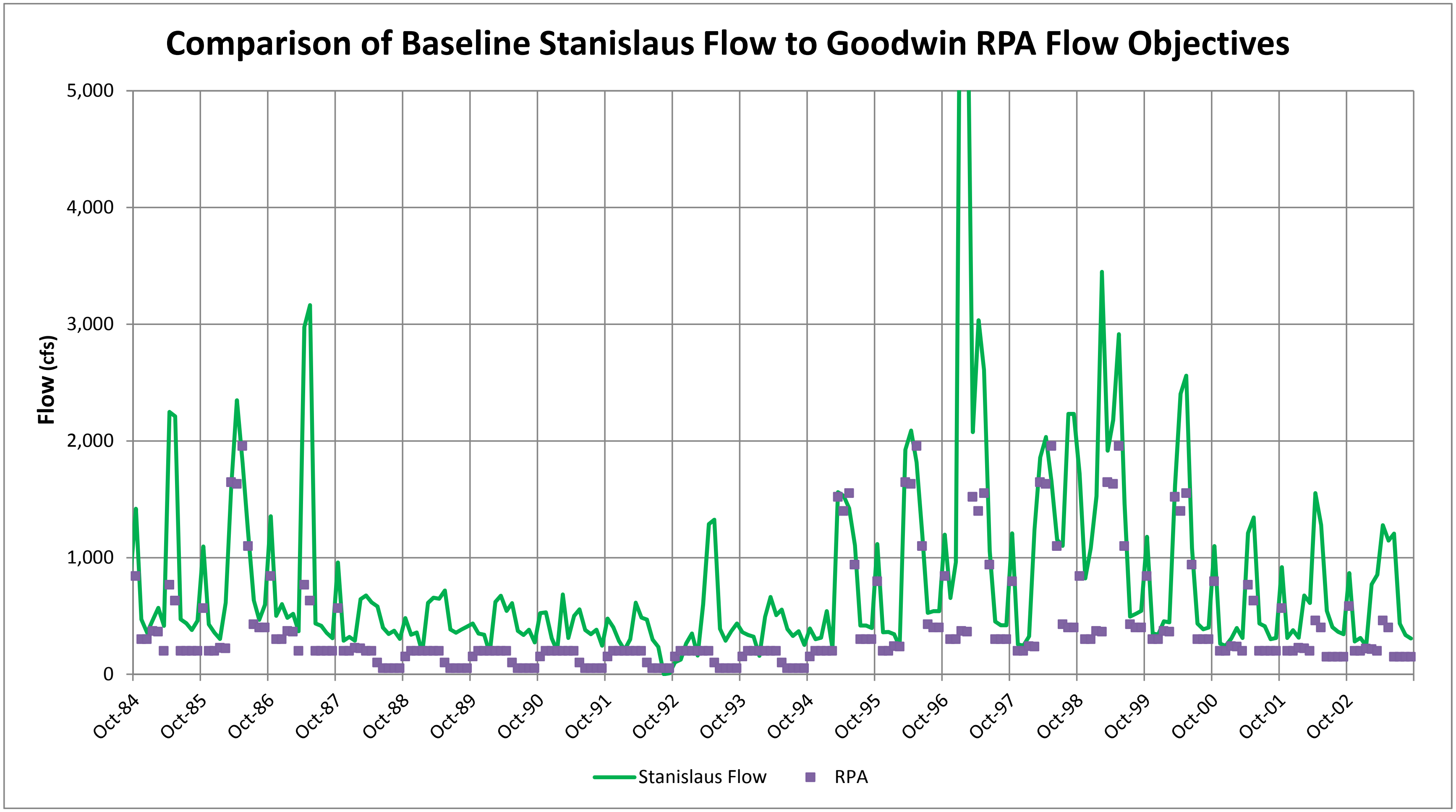

Figure D-2. Comparison of CALSIM Model Baseline Monthly Flows with RPA (NMFS BO) Stanislaus River Flow Requirements at Goodwin for Water Years 1995–2003 (cfs = cubic feet per second)

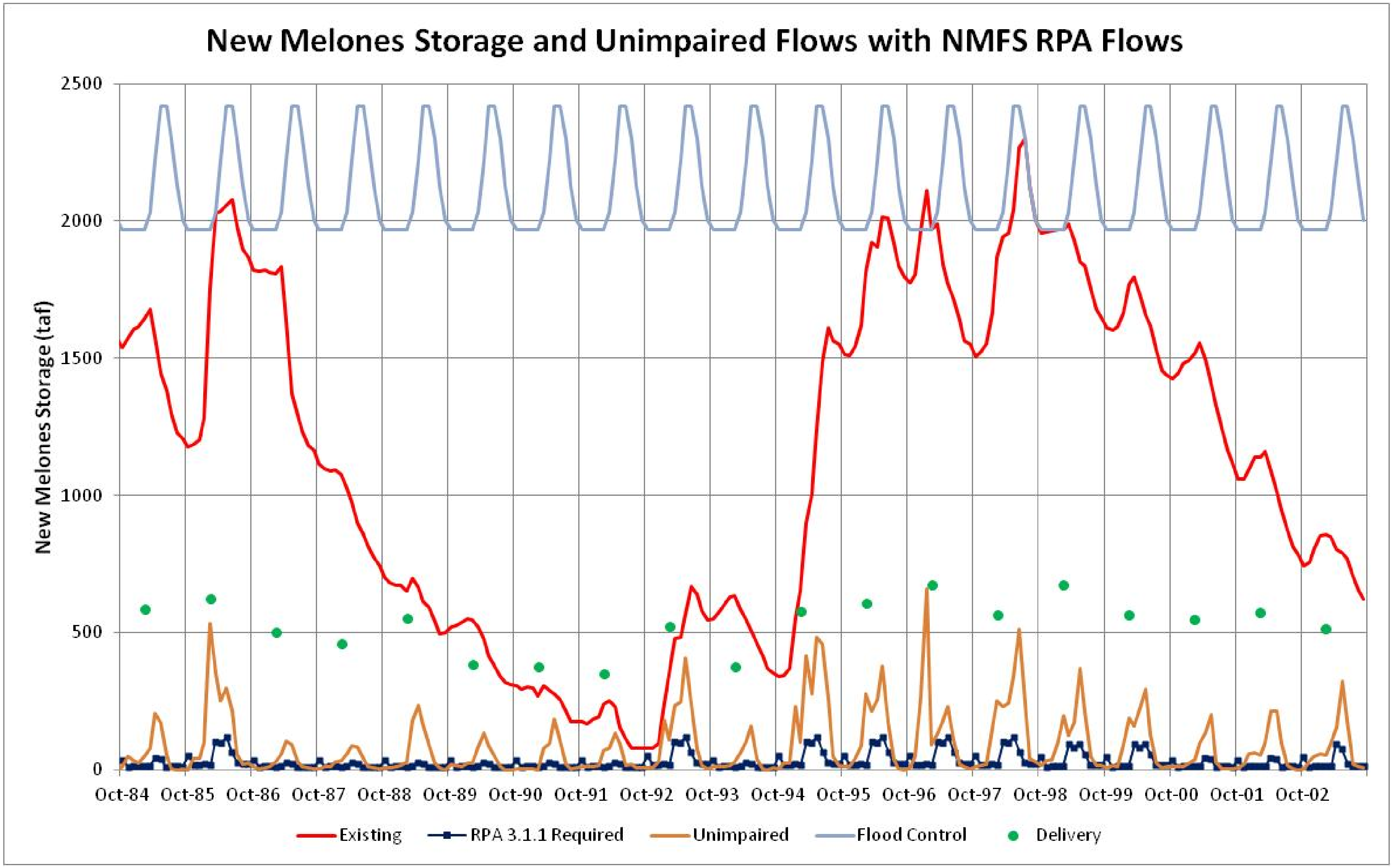

Figure D-3. Comparison of CALSIM Model Baseline Monthly New Melones Reservoir Storage and Annual Water Supply Delivery with Unimpaired Stanislaus Flows and RPA 3.1.1 Required (NMFS BO) Stanislaus River Flow Requirements for Water Years 1995–2003 (taf = thousand acre-feet)

D.3.4 WSE Model Results for No Project Alternatives

The WSE model was used to estimate the adjustments in the Stanislaus River flows that would be needed to shift the VAMP flows to the Stanislaus, fully meet the NMFS BO Stanislaus flows, divert the full water supply demands of 755 TAF/y at Goodwin Dam (when possible), meet the D-1641 Vernalis flow objectives, and meet the southern Delta salinity objectives (as measured at Tracy Boulevard). The CALSIM model VAMP flow contributions from the Merced and Tuolumne Rivers were reduced, and the releases were moved to the Stanislaus River to represent full implementation by USBR using New Melones flows. The CALSIM model did not include full Stanislaus River water supply contracts. The CALSIM model used the NMI to reduce the deliveries when the combination of New Melones Reservoir storage and projected runoff was reduced, while the WSE model used a different storage-delivery balancing curve to reduce water supply diversions when the end-of-January New Melones Reservoir storage is reduced. This storage-delivery balancing curve was adjusted in the WSE model for the No Project Alternative because of the large increases in the New Melones Reservoir releases required for full water supply deliveries and full compliance with the D-1641 flow and southern Delta salinity objectives.

Figure D-4a shows the cumulative distribution of the February–June release flow volume for the Stanislaus River. The flows were increased substantially (by more than 75 TAF, which is equivalent to an average February–June flow of 250 cfs) in about half of the years. Figure D-4b shows the corresponding reductions in annual water supply deliveries that were necessary. The water supply diversions were reduced below the baseline diversions in about 50 percent of the years. Many years would have deliveries of less than half of the maximum demand (755 TAF/y).

Figure D-5 shows the comparison of the baseline and No Project Alternative February–June flow volumes (TAF) for the Stanislaus, Tuolumne, and Merced Rivers. A volume of 150 TAF is equivalent to an average flow of 500 cfs. The Stanislaus River flow volumes were increased substantially in many of the years (Table D-3).

The water supply deliveries for the Tuolumne and Merced Rivers would generally be very similar to baseline. However, the VAMP flows assumed in the CALSIM baseline from the Tuolumne and Merced Rivers would be shifted to the Stanislaus River (Table D-3). The reductions would be very small on the Tuolumne River and would be moderate on the Merced River in lower flow years (Table D-3 and Figure D-5).

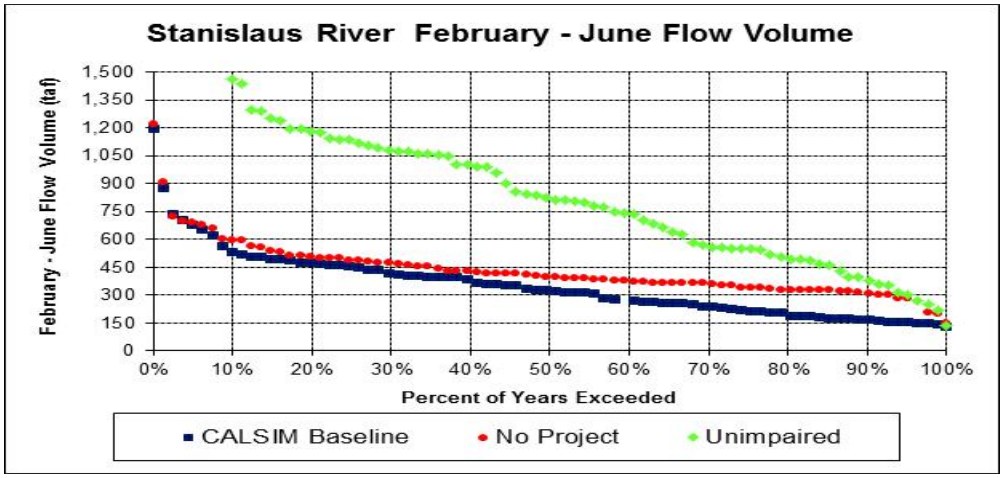

Figure D-4a. Comparison of WSE Annual Results for No Project Alternative Stanislaus River February–June flow volume (taf = thousand acre feet) with CALSIM Baseline and LSJR Alternatives

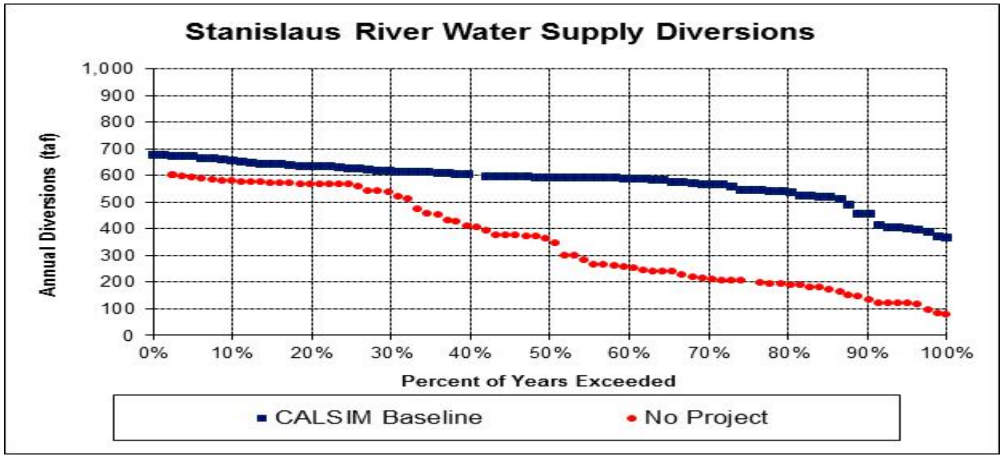

Figure D-4b. Comparison of WSE Annual Results for No Project Alternative Stanislaus River Water Supply Diversions (taf = thousand acre-feet) with CALSIM Baseline and LSJR Alternatives

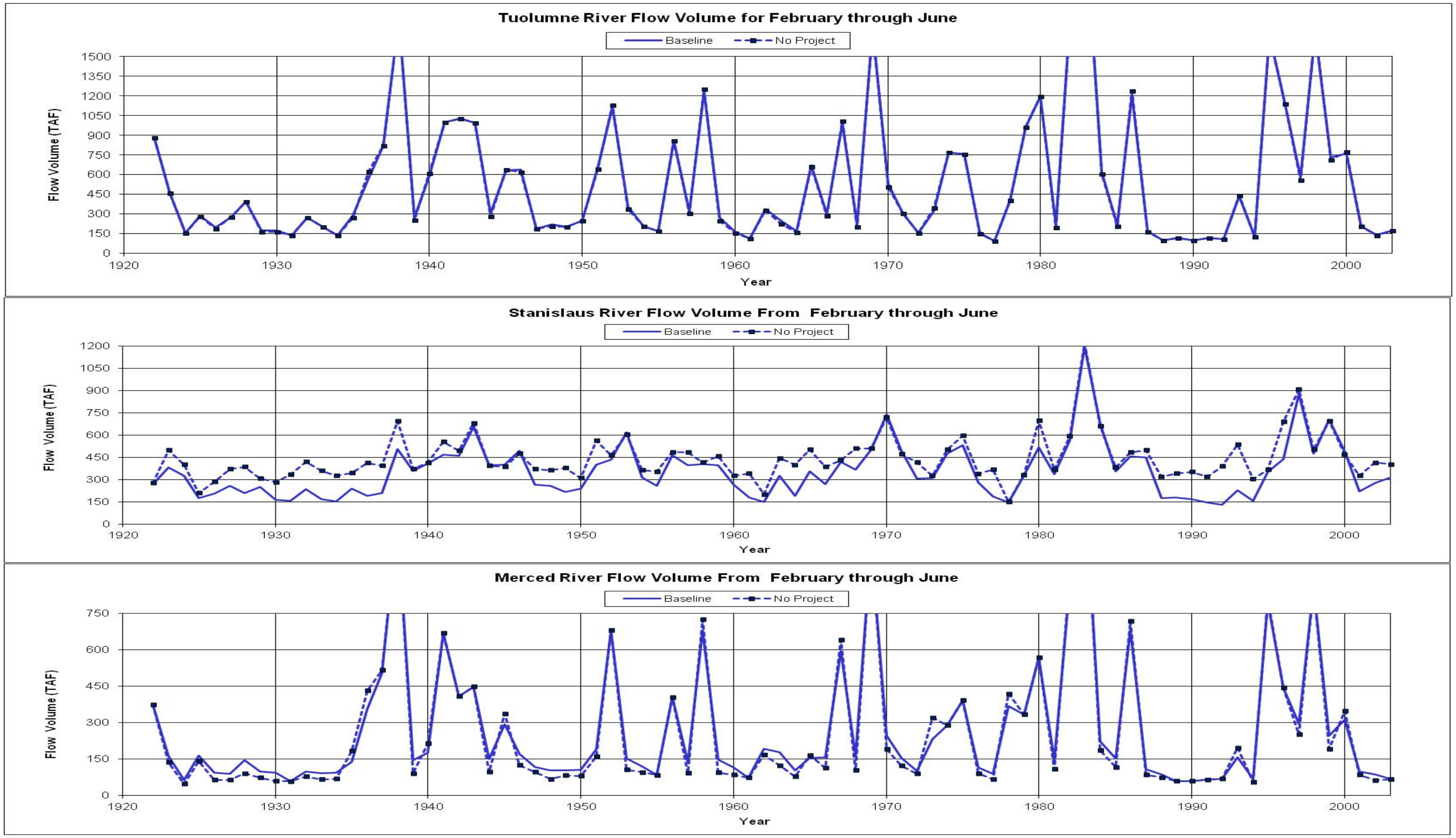

Figure D-5. Comparison of Baseline and No Project Alternative February–June Flow Volume (TAF = thousand acre-feet) for the Stanislaus, Tuolumne, and Merced Rivers from 1922–2003 Near their Confluences with the San Joaquin River