United States Department of the Interior

BUREAU OF RECLAMATION
Central Valley Operations Office
3310 El Camino Avenue, Suite 300
Sacramento, California 95821

FEB 28 2018

151422-WCR2006SA00268

IN REPLY
REFER TO:

CVO-100
PRJ-23.00

VIA ELECTRONIC MAIL AND U.S. MAIL

Ms. Maria Rea
Assistant Regional Administrator
California Central Valley Area Office
650 Capital Mall, Suite 5-100
Sacramento, CA 95814

Subject: Response to February 2018 Central Valley Project (CVP) Reservoir Operations Forecasts

Thank you for your response (Enclosure 1) to our transmittal (Enclosure 2) of the February forecast pursuant to the Reasonable and Prudent Alternative I.2.3 of the National Marine Fisheries Service (NMFS) Biological Opinion. We appreciate the opportunity to work with you as outlined on page 5 of your response to establish initial contract volumes for the 2018 contract year for municipal and industrial (M&I) water service contractors in the Trinity, Shasta, Sacramento River, American River, and Delta Divisions of the CVP, as well as a volume of water for March 2018 to meet minimal irrigation needs of the agricultural water service contractors in those areas. Our water service contract year begins on March 1, thus we request expedited review and response to this correspondence.

Given the current issues surrounding Shasta Lake cold water pool management as outlined in your response, the Bureau of Reclamation (Reclamation) proposes to establish an initial M&I allocation for contractors in the aforementioned areas that is in accordance with our current CVP M&I Water Shortage Policy Guidelines and Procedures, which were made effective February 1, 2017 (Enclosure 3). With the current lack of allocation to agricultural water service contractors, the guidelines and procedures would provide for an M&I allocation equivalent to the greater of 50 percent of historic use or public health and safety needs.

In addition, Reclamation is proposing that north-of-Delta agricultural water service contractors be allowed to divert up to 175 cubic feet per second (cfs) on a daily basis during the month of March to meet minimal needs during this initial part of the season, recognizing that an initial allocation for the contract year has not yet been made. Based on a review of past water use, as well as discussions with the water users, we believe this amount may provide for at least some of the early season needs of those contractors.

To put these proposed water supplies into context, at this time our calculations show that a 50 percent allocation to the M&I contractors of the American River Division this year equates to a

total contract year supply of approximately 23,000 acre-feet. On average over the past four years, approximately 1,800 acre-feet was utilized during the month of March. Similarly, a 50 percent allocation to the M&I contractors of the Trinity/Shasta/Sacramento River Divisions is estimated at a total contract year supply of approximately 11,000 acre-feet. Typical March deliveries are generally less than 1,000 acre-feet. For the Delta Division contractor (Contra Costa Water District), 50 percent would equate to a contract year supply of approximately 85,000 acre-feet. The district currently estimates it would utilize approximately 1,800 acre-feet in the month of March (including use of the recently approved modification to the no-fill/no-diversion period during this time). If the north-of-Delta agricultural water service contractors were to divert the full 175 cfs on a daily basis as proposed above, this would equate to just under 11,000 acre-feet during that month.

This proposal should result in a total contract year M&I allocation of approximately 119,000 acre-feet, of which we anticipate there would be less than 4,600 acre-feet delivered in the month of March. In addition, we would expect up to 11,000 acre-feet of north-of-Delta agricultural deliveries, which would result in a total March delivery for all of these contractors of less than 15,600 acre-feet.

It is important to note that any water not delivered under the contracts as outlined above does not necessarily represent a direct increase to water supply in Shasta Lake. The operations of the CVP and State Water Project are integrated by the "Agreement Between the United States of America and The State of California for Coordinated Operation of the Central Valley Project and the State Water Project (SWP)", more commonly referred to as the Coordinated Operations Agreement (COA). Under COA, deliveries to the CVP contractors in the Sacramento Valley and Delta are accounted for as "Sacramento Valley in basin uses." The responsibility for meeting these uses is shared according to formulas found within Article 6 of COA, thus to the extent that any reductions in these uses were to alter the operation of upstream reservoirs (Shasta, Folsom, Oroville) and/or Delta exports, there would be a distribution of those effects among those facilities/operations depending on real-time operating conditions and hydrology.

Reclamation does not believe that the limited amounts of water in March as outlined above would foreclose future measures for the fishery protection under the Endangered Species Act. Given current projections, as well as potential distribution of effects under COA above, there is a high degree of uncertainty that Shasta Lake storage overall would be improved absent the deliveries. If some component of the water that would be delivered under these contracts were assumed to be retained in storage in Shasta through the end of September, there is further uncertainty in the degree to which that results in an increase in colder water strata in the reservoir. When combining these uncertainties and given the modeling and temperature information included in our original transmittal, it is unlikely that the potential March delivery volume identified above would have a substantive effect on projecting the ability to meet a daily average Balls Ferry temperature of 56 degrees.

It is worth keeping the volumes identified above (particularly in March) in perspective when considering the degree of uncertainty in current runoff forecasts. For instance, the difference between the 50 and 90 percent exceedance forecasts produced in February by the California Department of Water Resources (DWR) for the anticipated accretions and depletions in the Sacramento Valley is over 1,190,000 acre-feet for the water year, and 490,000 acre-feet in March

alone. The difference between DWR's 50 and 90 percent February exceedance forecasts for the anticipated water year inflow to Shasta Lake is 600,000 acre-feet; with a difference of 280,000 acre-feet in the April through July timeframe alone. The proposed initial M&I allocations across the entire contract year are well within the level of uncertainty, and the anticipated March deliveries are miniscule in comparison. The anticipated March deliveries under the proposal would represent approximately 3 percent of the uncertainty in Sacramento Valley accretions and depletions between the 90 percent and 50 percent exceedance forecasts. It is also worth noting that the anticipated March deliveries outlined above represent only about 3 percent of the entire Sacramento Valley accretion volume anticipated in March under the 90 percent exceedance forecast, and approximately 1.5 percent of the total accretion of 1 million acre-feet in the 50 percent forecast.

Based on the above analysis, it is Reclamation's position that the M&I allocations and agricultural diversions identified above should be provided for at this time. This proposed operation is also consistent with the following direction in Section 4001(a) of the Water Infrastructure Improvements for the Nation Act, which requires the Secretaries of Interior and Commerce to "provide the maximum quantity of water supplies practicable to CVP agricultural, municipal and industrial contractors, water service or repayment contractors, water rights settlement contractors, exchange contractors, refuge contractors, and SWP contractors, by approving, in accordance with applicable Federal and State laws (including regulations), operations or temporary projects to provide additional water supplies as quickly as possible, based on available information."

In addition to our request for your review of the above information, we would like to follow up on a few items from your response to the February forecast. In particular, your response notes that the Keswick release and temperature results of Reclamation's HEC-5Q modeling were processed using the NMFS River Assessment for Forecasting Temperature (RAFT) model using a different set of meteorological conditions. Reclamation does not believe that this is an appropriate use of the models to determine projected downstream temperatures and associated mortality estimates, given that simulated temperature operations in the HEC-5Q model would be adjusted to address different meteorological conditions. Because a different set of meteorological conditions was used with a particular output from the HEC-5Q model than the one used to operate the model, the results presented by NMFS are likely invalid. In addition, to the extent that the results from the HEC-5Q model were directly used to model mortality in the mid-summer months, Reclamation reiterates a point that we've previously made regarding individual temperature spikes which we view as a result of the assumptions made for temperature control device (TCD) operations in the model. If these temperature spikes were experienced in real-time operations, they would generally be addressed through real-time TCD blending operations. For this reason, Reclamation believes that direct use of the HEC-5Q results for the purposes of prediction of mid-season temperature-related mortality may not produce valid results without additional processing to address temperature spikes. We look forward to continuing to work with you into the future on collective improvements to modeling methods used to predict temperature management and outcomes.

Your response contains a draft proposed Keswick release schedule on page 5, to be used as guidance for future water release decisions. Reclamation notes that on February 15, 2018, we provided an additional February forecast projection that utilized this draft proposed release

schedule to simulate system operation (Enclosure 4). As outlined in our transmittal of that information, the draft proposed release schedule would result in an infeasible operation for the CVP system, due to the requirements that schedule would place on Folsom Reservoir among other issues. For this reason we reiterate the need to continue to discuss a feasible operation for the complete CVP-SWP system due to the integrated nature of the system. We believe that the projected operation provided in our original February forecasts represents an approach that is more likely to result in a functional system based on the February DWR forecasts. Pursuant to Action I.2.3.B(2) of the NMFS Biological Opinion, enclosed (Enclosure 5) are the projected operations for the 50, 70, and 90 percent exceedance forecasts using the February DWR runoff projections. We will update those operational projections once we receive the March forecasts from DWR, and will continue to work with you on these approaches moving forward.

We look forward to your response regarding the proposed M&I allocations and March agricultural deliveries outlined in this letter. Please contact me at 916-979-2197 should you have questions or need additional information.

Sincerely,

Jeff Rieker
Operations Manager

Enclosures – 5

Enclosure 1

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
West Coast Region
650 Capitol Mall, Suite 5-100
Sacramento, California 95814-4700

February 16, 2018

Refer to NMFS No: WCR-2018-8920

Mr. Jeff Rieker
Operations Manager, Central Valley Project
U.S. Bureau of Reclamation
3310 El Camino Avenue, Suite 300
Sacramento, California 95821

Re: Transmittal of February Reservoir Operations Forecast Per RPA 1.2.3

Dear Mr. Rieker:

Thank you for the opportunity to review the U.S. Bureau of Reclamation's (Reclamation) February forecast and water supply allocations for water year 2018. Your February 14, 2018, letter included the results of the 90 and 50 percent exceedance Central Valley Project (CVP) reservoir operations forecasts, water temperature modeling, and this year's initial water supply allocations. For purposes of compliance with NMFS' June 4, 2009, conference and biological opinion on the long-term operation of the CVP and State Water Project (SWP, CVP/SWP operations Opinion) reasonable and prudent alternative (RPA) Action I.2.3, described in NOAA's National Marine Fisheries Service's (NMFS) April 7, 2011, amendment of the 2009 RPA[1], NMFS' concurrence is required prior to the initial water supply allocation of the year. The objective is to use a conservative forecast as early as possible to protect the cold water pool in Shasta Reservoir so that suitable spawning and egg/alevin incubation habitat can be maintained in the Sacramento River during the summer and fall season for federally listed endangered Sacramento River winter-run Chinook salmon (*Oncorhynchus tshawytscha*), and threatened Central Valley spring-run Chinook salmon (*O. tshawytscha*).

Returning adult winter-run in 2017 were born in 2014, when high water temperatures in the Sacramento River at the end of the summer and into the fall contributed to very low survival (~5%) of juveniles past Red Bluff Diversion Dam. As a result, total winter-run escapement in 2017 was just 1,155, which was the second lowest escapement over the past 20 years. Of those, more than 70% of the adults that returned in 2017 were of hatchery origin, due to triple the usual Livingston Stone National Fish Hatchery winter-run juvenile production contributing to that year class. As you know, water year 2017 was one of the wettest water years on record for the CVP, and Reclamation successfully implemented an operational study pursuant to the draft proposed

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[1] http://www.westcoast.fisheries.noaa.gov/publications/Central_Valley/Water%20Operations/Operations,%20Criteria%20and%20Plan/040711_ocap_opinion_2011_amendments.pdf

Shasta RPA amendment[2] that provided 53°F daily average temperature (DAT) at the Clear Creek California Data Exchange Center gaging station. As a result of the favorable water year 2017 hydrology, a relatively large cold water pool in Shasta Reservoir, and Reclamation's operations of Shasta Reservoir, the estimated egg-to-fry survival for winter-run juveniles was an above-average 44% (average is 23%). In addition, the end-of-September Shasta storage was an above normal 3.37 million acre-feet, indicating a good start to providing the necessary cold water habitat for winter-run in water year 2018. However, conditions in water year 2018 have become significantly drier, beginning in December 2017. In addition, winter-run Chinook salmon in brood year 2018 will be returning adults from winter-run born in 2015, when high water temperatures in the Sacramento River contributed to very low survival (~5%) of juveniles past Red Bluff Diversion Dam. In anticipation of poor in-river conditions, Livingston Stone National Fish Hatchery doubled its production of hatchery winter-run in 2015, and in February 2016, released ~400,000 juvenile winter-run into the Sacramento River in Redding. As a result of these circumstances affecting the brood year 2015 cohort, NMFS expects another low escapement of winter-run in 2018, with a high proportion of hatchery-origin fish. Because most winter-run return as three-year-olds, there are just three main year classes that support the population, and two have been severely depressed in abundance due to drought impacts in 2014 and 2015. The augmented hatchery releases for brood years 2014 and 2015 have provided the intended buffer to abundance, but those cohorts now have a hatchery influence far above the <15% hatchery fraction deemed best for conservation of the wild stock. Because the adults returning in brood year 2018 are from one of the two severely drought-impacted cohorts, it is very important to operate Shasta Reservoir conservatively this year to ensure that we are able to manage releases from the reservoir's cold water pool to provide and maintain adequate water temperatures in-river throughout key early life stages for winter-run Chinook salmon.

The February 2018 CVP reservoir operations forecast is based on estimated runoff within the Sacramento River basin as of February 1, 2018. The estimated annual inflow into Shasta Reservoir is 3.69 million acre-feet (MAF) in the 90 percent exceedance forecast. The projected storage in Shasta Reservoir is forecast to be at 3.80 MAF at the end of April 2018 and 2.19 MAF at the end of September in the 90 percent exceedance forecast, and the projected storage in Shasta Reservoir is forecast to be at 4.22 MAF at the end of April 2018 and 2.69 MAF at the end of September in the 50 percent exceedance forecast. The following table provides Reclamation's initial water supply allocations based on the 90 percent exceedance forecast:

February 90% Exceedance Municipal & Industrial (M&I) Water Service Contracts and Agricultural Water Service Contracts				
	North of Delta M&I	North of Delta Agricultural	South of Delta M&I	South of Delta Agricultural
Allocation	75%	50%	70%	20%

NMFS has reviewed Reclamation's February 2018 CVP reservoir operations 90 percent and 50 percent exceedance forecasts (Enclosure 1), and the corresponding water temperature model runs

[2] http://www.westcoast.fisheries.noaa.gov/publications/Central_Valley/Water%20Operations/nmfs_s_draft_proposed_2017_rpa_amendment_-_january_19__2017.pdf

(Enclosure 3). In addition, the NMFS-Southwest Fisheries Science Center (SWFSC) utilized the Keswick release and temperature data from the February CVP reservoir operations 90 percent and 50 percent exceedance forecasts as input into its River Assessment for Forecasting Temperature (RAFT) and temperature-dependent mortality model (Enclosure 3).

Based on the HEC5Q model runs, Reclamation projects the capability to meet a 56°F DAT at the Balls Ferry compliance point throughout the season. However, based on past analysis, there is an elevated degree of uncertainty in the September and October timeframe. Therefore, Reclamation utilized a relationship developed between the Shasta Reservoir volume less than 56°F at the end of September, and the projected water temperature at Balls Ferry (Figure 5 of Enclosure 2). Based on this relationship, results indicate that in September and October, Reclamation will not be able to meet a water temperature of 56°F DAT at Balls Ferry for 3 of the 4 forecasted scenarios (page 1 of Enclosure 2). In addition, despite including conservative forecasts of a 90% exceedance hydrologic forecast and 10% exceedance meteorological conditions, the meteorological data set did not include the most recent decade, of which northern California experienced some of the hottest days, weeks, months, and seasons on record. The NMFS-SWFSC utilized the Keswick release and temperature data from the February CVP reservoir operations 90 percent and 50 percent exceedance forecasts as input into its RAFT model while using meteorological conditions from 1990-2017. While the data set is not as broad as what Reclamation used in the historical record, it does capture the extreme air temperatures that northern California experienced over the last several years. Based on the RAFT model and data set used, the model outputs indicate that 56°F DAT at the Balls Ferry temperature compliance point will not be met, with exceedances throughout mid-June through mid-September in all 4 scenarios, and at times reaching 58°F. The following table provides the results from the temperature-dependent mortality model (details in enclosure 3).

February 2018 Hydrological Exceedance Forecast	**Meteorological Exceedance Forecast**	**Percent Temperature-Dependent Egg Mortality**		
		Mean	**Median**	**95% Confidence Interval**
50%	10%	43.07%	45.61%	1.08 – 74.77%
50%	50%	23.37%	18.82%	1.06 – 66.79%
90%	10%	40.06%	42.01%	0.23-73.77%
90%	50%	26.61%	22.54%	0.93-67.20%

Reclamation indicated that its approach to CVP water supply allocation determinations for south-of-Delta agricultural, and municipal and industrial, contracts this year relies heavily on the current relatively full Federal share of San Luis Reservoir. This is evidenced by the low export rates from the CVP throughout the summer months in both the 50% and 90% exceedance forecasts. NMFS agrees with that part of the assessment, and therefore, concurs with Reclamation's initial south-of-Delta allocations.

Past forecasts and temperature model runs have indicated that any inaccuracies in those model results typically result in less cold water volume in Shasta Reservoir, and/or warmer water temperatures either throughout or near the end of the temperature management season. Because of the dry hydrology, the 90% exceedance forecast, and the considerable uncertainties associated

with Reclamation's HEC5Q model (which are acknowledged in Reclamation's transmittal materials, and the RAFT model results), do not demonstrate an ability to meet 56°F DAT at Balls Ferry, NMFS cannot concur at this time on the proposed North of Delta allocations or forecasted operations. Therefore, at this time, RPA Action I.2.3.B (February Forecast, Based on 90 Percent Hydrology, Shows that Only Balls Ferry Compliance or 2.2 MAF EOS, but Not Both, Is Achievable) should be implemented. Specifically, RPA Action I.2.3.B requires Reclamation to implement the following actions:

"1) On or before February 15, Reclamation shall reduce Keswick releases to 3,250 cfs, unless NMFS concurs on an alternative release schedule. This reduction shall be maintained until a flow schedule is developed per procedures below.

2) In coordination with NMFS, by March 1, Reclamation shall develop an initial monthly Keswick release schedule, based on varying hydrology of 50 percent, 70 percent, and 90 percent (similar in format to the fall and winter action implementation procedures – see table above). These schedules shall be used as guidance for monthly updates and consultations.

3) Based on this guidance, Reclamation shall consult with NMFS monthly on Keswick releases. Reclamation shall submit a projected forecast, including monthly average release schedules and temperature compliance point to NMFS every month, within 7 business days of receiving the DWR runoff projections for that month. Within 3 business days of receiving this information from Reclamation, NMFS will review the draft schedule for consistency with the criteria below and provide written recommendations to Reclamation.

4) The initial monthly Keswick release schedule, and subsequent monthly updates, shall be developed based on the following criteria and including the following actions:

   a) Maintain minimum monthly average flows necessary to meet nondiscretionary delivery obligations and legal requirements.
   b) Provide for flow-related biological needs of spring life stages of all species covered by this Opinion in the Sacramento River and Delta, to the greatest extent possible.
   c) If operational changes are necessary to meet Delta outflow, X2, or other legal requirements during this time, then:

      - CVP/SWP Delta combined exports shall be curtailed to 2,000 cfs if necessary to meet legal requirements while maintaining a 3,250 cfs Keswick Dam release (or other planned release based on biological needs of species); and
      - if it is necessary to curtail combined exports to values more restrictive than 2000 cfs in order to meet Delta outflow, X2, or other legal requirements, then Reclamation and DWR shall, as an overall strategy, first, increase releases from Oroville or Folsom Dam; and
      - in general, Reclamation shall increase releases from Keswick Dam as a last resort.
      - Based on improvements in updated monthly hydrology, this restriction may be relaxed, with NMFS' concurrence."

NMFS looks forward to receiving and reviewing the updated hydrology in March, updated forecast and associated Keswick release schedule at that time. If Reclamation needs to make future water decisions in the interim, those decisions should be guided by the following Keswick release schedule for dry water year types, based on the draft proposed Shasta RPA amendment[3]:

Water Year Type	**Monthly Keswick release schedule (cfs)**						
	Apr	May	Jun	Jul	Aug	Sep	Oct
Dry	6,000	8,000	10,000	10,000	10,000	7,500	6,000

We appreciate Reclamation's indication in your letter that you will consult with NMFS on any changes to the current Keswick release of 3,250 cfs as a conservative approach, given the hydrology. We would like to continue to work with you over the coming weeks to iterate on what Keswick releases/operations might improve Shasta storage, providing for integrated operations at Folsom, Trinity, and Oroville Reservoirs, and the Delta, and therefore allow for allocation decisions to be made North of the Delta, when the March forecast is available.

Your letter notes that the north of Delta allocations are in conformance with Section 4005(e) of P.L. 114-322, the Water Infrastructure Improvements for the Nation (WIIN) Act. Section 4005(e)(2) directs the Secretary of the Interior to make every reasonable effort to allocate water to CVP agricultural water service contractors within the Sacramento River Watershed according for irrigation purposes according to the schedule provided, but Section 4005(e)(3) states that "[N]othing in paragraph (2) shall adversely affect any protections for the environment, including…any obligation of the Secretary of the Interior and the Secretary of Commerce under the smelt biological opinion, the salmonid biological opinion, or any other applicable biological opinion; including the Shasta Dam cold water pool requirements as set forth in the salmonid biological opinion…". Because the 90% exceedance forecast does not show that minimum temperature requirements will be met (i.e., 56°F DAT at Balls Ferry), NMFS concludes that providing allocations to all North of Delta contracts, other than required to meet health and safety or other recent drought-related or shortage policy appropriate levels of M&I water service contracts in the American and Sacramento River basin, is not supported by the analysis provided, and doing so according to the forecast provided would adversely affect the cold water pool and ability to meet requirements under the CVP/SWP operations Opinion. We are willing to work with you to confer on appropriate M&I water service contract levels next week, as necessary. In addition, while we cannot concur on the North of Delta agricultural water service contract allocations at this time, we understand and agree to work with you in your efforts to provide minimal needs to those contractors during the month of March, while we are discussing the system as a whole and updating the forecast.

In addition to our concerns about temperature, we reviewed the forecasted Keswick release schedules for the potential for winter-run Chinook salmon redd dewatering prior to complete fry emergence in the fall, and also fall-run Chinook salmon redd dewatering in the late fall and into the winter. Whatever Keswick release schedules are agreed to pursuant to the RPA, NMFS will work with Reclamation to minimize the potential for winter-run Chinook salmon redd

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3 http://www.westcoast.fisheries.noaa.gov/publications/Central_Valley/Water%20Operations/nmfs_s_draft_proposed_2017_rpa_amendment_-_january_19__2017.pdf

dewatering until complete emergence, and also to stabilize flows for fall-run Chinook salmon spawning and egg incubation.

NMFS and Reclamation are currently facing a very different set of conditions than those experience throughout the 2012-2016 drought, and also the wet water year in 2017, with consideration of a decent volume of water in Shasta Reservoir, coupled with the forecasted water year having a reasonable likelihood of a dry classification. As a result, there is significant uncertainty regarding the ability to meet temperatures sufficiently cold enough to ensure the protection of winter-run throughout the 2018 temperature management season. With this uncertainty in mind, and in consideration of the current reinitiation of consultation on CVP/SWP operations[4] NMFS reminds Reclamation of the requirements of section 7(d) of the Endangered Species Act to "not make any irreversible or irretrievable commitment of resources with respect to the agency action which has the effect of foreclosing the formulation or implementation of any reasonable and prudent alternative measures which would not violate subsection (a)(2)."

As a reminder, RPA Action I.2.3.B(4)(a) requires Reclamation to "Maintain minimum monthly average flows necessary to meet nondiscretionary delivery obligations and legal requirements." However, NMFS' CVP/SWP operations Opinion and incidental take statement[5] explicitly states that "In the event that Reclamation determines that delivery of quantities of water to any contractor is nondiscretionary for purposes of the ESA, any incidental take due to delivery of water to that contractor would not be exempted from the ESA section 9 take prohibition in this Opinion."

In summary, based on Reclamation's February forecast and temperature modeling, supplemented by the NMFS-SWFSC's RAFT model results:

- The Balls Ferry temperature compliance point will not be met, and therefore, RPA Action I.2.3.B should be implemented this year;
- NMFS concurs with Reclamation's south-of-Delta initial allocations, and we cannot concur with any North of Delta allocations at this time;
- If Reclamation needs to make future water decisions in the interim, those decisions should be guided by Keswick release schedule for dry water year types provided above and in the draft proposed Shasta RPA amendment;
- NMFS will continue to work with Reclamation to provide operational and temperature scenarios that have a higher likelihood of meeting the requirements of RPA Action I.2.3; and
- NMFS will work with Reclamation to adjust the Keswick release schedules in order to minimize the potential for winter-run and fall-run Chinook salmon redd dewatering.

Reclamation is currently reducing Keswick releases to reach a minimum of 3,250 cfs, which is the expected monthly average Keswick release schedule in both the 50% and 90% exceedance

[4] Reclamation's August 2, 2016, request for reinitiation of section 7 consultation can be found at http://www.westcoast.fisheries.noaa.gov/publications/Central_Valley/Water%20Operations/bureau_of_reclamation_s_request_to_reinitiate_the_2009_cvpswp_operations_consultation_-_august_2__2016.pdf

[5] Section 11.1.1, page 729 in the CVP/SWP operations Opinion (http://www.westcoast.fisheries.noaa.gov/publications/Central_Valley/Water%20Operations/Operations,%20Criteria%20and%20Plan/nmfs_biological_and_conference_opinion_on_the_long-term_operations_of_the_cvp_and_swp.pdf)

forecasts. Should Reclamation need to change the release schedule between now and the end of March, NMFS expects close coordination between our agencies to ensure that the habitat needs (*i.e.*, cold water, stable flows) of winter-run Chinook salmon continue to be met. In addition, NMFS requests to work with Reclamation on real-time management during the temperature management season.

Thank you for the recent discussions with your staff in meeting the requirements in RPA Action I.2.3. As you know, on January 19, 2017[6], NMFS issued to Reclamation a draft proposed 2017 RPA amendment, focused on Shasta RPA Action Suite I.2. As part of the amendment process, Reclamation agreed[7] to implement an operational study for Shasta Reservoir temperature management in water year 2017. I look forward to further communication between our agencies as we work on the annual Temperature Management Plan pursuant to RPA Action I.2.4 and consideration of another operational study in 2018 pursuant to the draft proposed 2017 Shasta RPA amendment.

NMFS also looks forward to continued coordination with Reclamation and stakeholders to discuss the Reinitiation of Consultation and further development and implementation of the science plan. We expect this dialogue with stakeholders will provide helpful context to supplement our ongoing conversations about how to manage Shasta resources for water supply and species over the long-term. If you have any questions regarding this letter, please feel free to contact me, or have your staff contact Mr. Garwin Yip at (916) 930-3611, or via e-mail at Garwin.yip@noaa.gov.

Sincerely,

Maria C. Rea
Assistant Regional Administrator

Enclosures:

1. 90 and 50 percent exceedance forecasts (2 pages)
2. Preliminary temperature analysis based on four scenarios cross-factoring 90 and 50 percent exceedance hydrology with 10 and 50 percent exceedance meteorology (8 pages)
3. RAFT and temperature-dependent mortality model results for the 4 forecast and meteorology scenarios (6 pages)

[6] http://www.westcoast.fisheries.noaa.gov/publications/Central_Valley/Water%20Operations/nmfs_s_draft_proposed_2017_rpa_amendment_-_january_19__2017.pdf

[7] http://www.westcoast.fisheries.noaa.gov/publications/Central_Valley/Water%20Operations/reclamation_s_response_to_nmfs_s_draft_proposed_2017_rpa_amendment_-_january_25__2017.pdf

cc: California Central Valley Office
Division Chron File: 151422SWR2006SA00268

Electronic copy only:

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Mr. Jim Smith, Project Leader, Red Bluff Fish and Wildlife Office, U.S. Fish and Wildlife Service, 10950 Tyler Road, Red Bluff, California 96080
Mr. Chuck Bonham, Director, California Department of Fish and Wildlife, 1416 Ninth Street, Sacramento, California 95814
Ms. Karla Nemeth, Director, California Department of Water Resources, 1416 Ninth Street, Sacramento, California 95814
Ms. Cindy Messer, Chief Deputy Director, California Department of Water Resources, 1416 Ninth Street, Sacramento, California 95814
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Mr. David Murillo, Regional Director, Mid-Pacific Region, Bureau of Reclamation, 2800 Cottage Way, Sacramento, California 95825
Mr. Dave Mooney, Area Manager, Bay-Delta Office, Bureau of Reclamation, 801 I Street, Suite 140, Sacramento, California 95814
Ms. Eileen Sobeck, Executive Director, State Water Resources Control Board, 1001 I St, Sacramento, California 95814

ENCLOSURE 1

Estimated CVP Operations Feb 90% Exceedance

Storages

Federal End of the Month Storage/Elevation (TAF/Feet)

		Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan
Trinity	**1776**	**1800**	**1842**	**1841**	**1676**	**1508**	**1353**	**1228**	**1114**	**1084**	**1066**	**1076**	**1108**
	Elev.	2327	2330	2330	2317	2304	2291	2279	2267	2264	2262	2263	2267
Whiskeytown	**205**	**206**	**206**	**238**	**238**	**238**	**238**	**238**	**230**	**206**	**206**	**206**	**206**
	Elev.	1199	1199	1209	1209	1209	1209	1209	1207	1199	1199	1199	1199
Shasta	**3349**	**3441**	**3812**	**3803**	**3712**	**3383**	**2891**	**2470**	**2192**	**2067**	**2062**	**2188**	**2385**
	Elev.	1026	1041	1040	1037	1024	1003	983	968	961	961	968	978
Folsom	**582**	**571**	**624**	**617**	**590**	**425**	**337**	**305**	**280**	**253**	**231**	**221**	**271**
	Elev.	425	431	430	427	407	393	388	383	378	374	372	382
New Melones	**1981**	**1940**	**1972**	**1901**	**1847**	**1793**	**1716**	**1658**	**1619**	**1589**	**1605**	**1622**	**1637**
	Elev.	1047	1050	1043	1038	1033	1025	1020	1016	1012	1014	1016	1017
San Luis	**973**	**920**	**942**	**899**	**824**	**560**	**273**	**99**	**164**	**284**	**322**	**370**	**542**
	Elev.	519	529	519	503	463	415	370	367	372	381	402	428
Total		8877	9397	9298	8887	7907	6808	5999	5598	5483	5492	5683	6149

State End of the Month Reservoir Storage (TAF)

Oroville	**1408**	**1510**	**1747**	**1748**	**1647**	**1456**	**1236**	**1078**	**1048**	**969**	**864**	**819**	**894**
	Elev.	732	758	758	747	725	698	676	671	659	642	634	647
San Luis	**763**	**805**	**910**	**827**	**717**	**548**	**375**	**210**	**121**	**36**	**60**	**168**	**218**
Total San Luis (TAF)	**1736**	**1725**	**1852**	**1726**	**1541**	**1108**	**649**	**308**	**286**	**320**	**383**	**538**	**760**

Monthly River Releases (TAF/cfs)

Trinity	TAF	17	18	36	92	47	28	53	52	23	18	18	18
	cfs	**300**	**300**	**600**	**1,498**	**783**	**450**	**857**	**870**	**373**	**300**	**300**	**300**
Clear Creek	TAF	11	12	13	13	17	9	9	9	12	12	12	12
	cfs	**200**	**200**	**218**	**216**	**288**	**150**	**150**	**150**	**200**	**200**	**200**	**200**
Sacramento	TAF	194	200	446	523	654	768	615	476	369	268	204	200
	cfs	**3500**	**3250**	**7500**	**8500**	**11000**	**12500**	**10000**	**8000**	**6000**	**4500**	**3320**	**3250**
American	TAF	139	126	159	155	224	137	84	76	62	62	62	61
	cfs	**2500**	**2053**	**2672**	**2514**	**3769**	**2227**	**1368**	**1269**	**1013**	**1045**	**1010**	**1000**
Stanislaus	TAF	59	12	91	76	22	15	15	15	49	12	12	14
	cfs	**1070**	**200**	**1537**	**1242**	**363**	**250**	**250**	**250**	**797**	**200**	**200**	**226**
Feather	TAF	97	80	101	49	54	92	92	71	61	57	58	58
	cfs	**1750**	**1300**	**1700**	**800**	**900**	**1500**	**1500**	**1200**	**1000**	**950**	**950**	**950**

Trinity Diversions (TAF)

	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan
Carr PP	20	23	53	112	135	130	71	62	16	21	12	3
Spring Crk. PP	**20**	**30**	**23**	**105**	**120**	**120**	**60**	**60**	**30**	**15**	**12**	**10**

Delta Summary (TAF)

		Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan
Tracy		135	136	24	25	25	40	100	250	249	95	84	210
USBR Banks		0	0	0	0	0	9	9	9	0	0	0	0
Contra Costa		14.0	12.7	12.7	12.7	9.8	11.1	12.7	14.0	16.8	18.4	18.3	14.0
Total USBR		149	149	37	37	35	60	122	273	266	113	102	224
State Export		161	205	18	18	20	25	20	60	66	160	217	210
Total Export		310	354	54	56	55	85	142	333	332	273	319	434
COA Balance		6	0	5	-10	9	23	19	65	22	22	22	22
Old/Middle River Std.													
Old/Middle R. calc.		-3,840	-4,301	-152	-279	-901	-1,302	-2,047	-4,530	-3,956	-3,570	-4,038	-5,463
Computed DOI		11436	11403	10405	7597	7598	4994	3497	3009	4002	4505	4506	5677
Excess Outflow		36	0	0	0	0	0	0	0	0	0	0	1171
% Export/Inflow		33%	33%	6%	7%	6%	11%	21%	47%	47%	44%	51%	58%
% Export/Inflow std.		45%	35%	35%	35%	35%	65%	65%	65%	65%	65%	65%	65%

Hydrology

	Trinity		Shasta		Folsom	New Melones	
Water Year Inflow (TAF)	474		3,447		1,562	776	
Year to Date + Forecasted % of mean	39%		62%		57%	73%	

CVP actual operations do not follow any forecasted operation or outlook; actual operations are based on real-time conditions.
CVP operational forecasts or outlooks represent general system-wide dynamics and do not necessarily address specific watershed/tributary details.
CVP releases or export values represent monthly averages.
CVP Operations are updated monthly as new hydrology information is made available December through May.

2/13/2018

ENCLOSURE 1

Estimated CVP Operations Feb 50% Exceedance

Storages

Federal End of the Month Storage/Elevation (TAF/Feet)

		Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan
Trinity	**1776**	**1805**	**1901**	**1994**	**1912**	**1849**	**1742**	**1605**	**1477**	**1439**	**1426**	**1456**	**1521**
	Elev.	2327	2334	2341	2335	2330	2322	2312	2301	2298	2297	2300	2305
Whiskeytown	**205**	**206**	**206**	**238**	**238**	**238**	**238**	**238**	**230**	**206**	**206**	**206**	**206**
	Elev.	1199	1199	1209	1209	1209	1209	1209	1207	1199	1199	1199	1199
Shasta	**3349**	**3445**	**3985**	**4222**	**4160**	**3849**	**3325**	**2953**	**2694**	**2630**	**2619**	**2764**	**3170**
	Elev.	1026	1047	1056	1053	1042	1022	1006	994	991	990	997	1015
Folsom	**582**	**579**	**669**	**754**	**855**	**727**	**522**	**408**	**353**	**306**	**277**	**266**	**310**
	Elev.	426	436	445	455	442	419	404	396	388	383	381	389
New Melones	**1981**	**1952**	**1922**	**1864**	**1819**	**1768**	**1703**	**1643**	**1602**	**1562**	**1583**	**1610**	**1644**
	Elev.	1048	1045	1040	1035	1031	1024	1018	1014	1010	1012	1015	1018
San Luis	**966**	**966**	**966**	**881**	**740**	**427**	**181**	**39**	**68**	**178**	**363**	**568**	**704**
	Elev.	525	540	524	499	455	407	359	371	393	430	461	477
Total		8954	9648	9953	9725	8858	7711	6886	6424	6320	6474	6870	7554

State End of the Month Reservoir Storage (TAF)

Oroville	**1408**	**1677**	**2053**	**2125**	**2008**	**1784**	**1535**	**1386**	**1300**	**1206**	**1139**	**1201**	**1378**
	Elev.	750	788	794	783	761	734	717	706	694	685	693	716
San Luis	**763**	**838**	**1019**	**910**	**761**	**598**	**395**	**197**	**246**	**290**	**421**	**513**	**552**
Total San Luis (TAF)	**1729**	**1804**	**1985**	**1791**	**1501**	**1025**	**576**	**235**	**315**	**468**	**783**	**1082**	**1255**

Monthly River Releases (TAF/cfs)

Trinity	TAF	17	18	32	180	47	28	53	52	23	18	18	18
	cfs	**300**	**300**	**540**	**2,924**	**783**	**450**	**857**	**870**	**373**	**300**	**300**	**300**
Clear Creek	TAF	11	12	13	13	17	9	9	9	12	12	12	15
	cfs	**200**	**200**	**218**	**216**	**288**	**150**	**150**	**150**	**200**	**200**	**200**	**240**
Sacramento	TAF	205	200	297	492	625	799	615	506	338	327	246	200
	cfs	**3700**	**3250**	**5000**	**8000**	**10500**	**13000**	**10000**	**8500**	**5500**	**5500**	**4000**	**3250**
American	TAF	194	154	149	108	228	272	178	119	123	119	123	108
	cfs	**3500**	**2500**	**2500**	**1750**	**3839**	**4432**	**2891**	**2000**	**2000**	**2000**	**2000**	**1750**
Stanislaus	TAF	59	93	83	96	56	18	18	18	49	12	12	14
	cfs	**1070**	**1521**	**1400**	**1555**	**940**	**300**	**300**	**300**	**797**	**200**	**200**	**232**
Feather	TAF	97	80	119	92	119	187	156	143	123	104	61	108
	cfs	**1750**	**1300**	**2000**	**1500**	**2000**	**3050**	**2540**	**2400**	**2000**	**1750**	**1000**	**1750**

Trinity Diversions (TAF)

	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan
Carr PP	22	35	36	24	71	84	85	76	26	25	9	0
Spring Crk. PP	**35**	**60**	**15**	**25**	**60**	**75**	**75**	**75**	**40**	**20**	**12**	**20**

Delta Summary (TAF)

		Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan
Tracy		143	112	48	49	128	250	270	261	270	260	260	200
USBR Banks		0	0	0	0	0	26	26	26	0	0	0	0
Contra Costa		14.0	12.7	12.7	12.7	9.8	11.1	12.7	14.0	16.8	18.4	18.3	14.0
Total USBR		157	125	60	62	138	287	309	301	287	278	278	214
State Export		200	300	42	43	102	76	65	269	262	325	260	200
Total Export		357	425	102	105	240	363	374	570	549	603	538	414
COA Balance		0	0	0	0	0	0	0	138	138	138	138	138
Old/Middle River Std.													
Old/Middle R. calc.		-3,244	-3,490	71	281	-2,711	-4,527	-4,726	-7,386	-6,535	-7,652	-6,577	-4,903
Computed DOI		18677	22563	12372	10867	7598	6507	4002	3009	4246	4572	8329	14966
Excess Outflow		7276	11159	1109	3091	0	0	0	0	244	67	3823	10460
% Export/Inflow		25%	23%	10%	11%	27%	35%	43%	62%	59%	64%	50%	31%
% Export/Inflow std.		45%	35%	35%	35%	35%	65%	65%	65%	65%	65%	65%	65%

Hydrology

	Trinity		Shasta		Folsom		New Melones	
Water Year Inflow (TAF)	754		3,937		1,944		887	
Year to Date + Forecasted % of mean	62%		71%		71%		84%	

CVP actual operations do not follow any forecasted operation or outlook; actual operations are based on real-time conditions.
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CVP releases or export values represent monthly averages.
CVP Operations are updated monthly as new hydrology information is made available December through May.

2/13/2018

February 13, 2018

Upper Sacramento River – February 2018 Preliminary Temperature Analysis

Summary of Temperature Results by Month (Monthly Average Temperature °F)

Initial Compliance Location (°F DAT)	APR	MAY	JUN	JUL	AUG	SEP*	OCT*
February 90%-Exceedance Outlook – 10% Historical Meteorology							
Keswick Dam KWK	52.5	52.8	53.4	53.9	53.9	NA	NA
Sac. R. abv Clear Creek CCR	52.4	52.9	53.5	54.1	54.0	NA	NA
Balls Ferry BSF	54.1	55.2	55.3	55.4	55.3	57.3	57.3
February 90%-Exceedance Outlook – 50% Historical Meteorology							
Keswick Dam KWK	52.2	52.3	52.7	53.5	53.5	NA	NA
Sac. R. abv Clear Creek CCR	52.2	52.7	53.2	54.0	53.9	NA	NA
Balls Ferry BSF	53.9	55.6	55.5	55.9	55.7	56.6	56.6
February 50%-Exceedance Outlook – 10% Historical Meteorology							
Keswick Dam KWK	52.9	53.0	53.1	53.9	54.3	NA	NA
Sac. R. abv Clear Creek CCR	52.7	53.1	53.3	54.0	54.4	NA	NA
Balls Ferry BSF	54.8	55.5	55.1	55.3	55.7	56.3	56.3
February 50%-Exceedance Outlook – 50% Historical Meteorology							
Keswick Dam KWK	52.5	51.6	52.3	53.2	53.7	NA	NA
Sac. R. abv Clear Creek CCR	52.5	52.1	52.8	53.7	54.1	NA	NA
Balls Ferry BSF	54.5	55.3	55.3	55.5	55.9	55.8	55.8

* The HEC5Q model output is displayed above for the months April through August. Based on past analysis, the temperature model does not perform well in late September and October. One factor is that the modeled release temperatures are cooler than has historically been achieved when all release is through the side gates (lowest gates), especially when there's a large temperature gradient between the pressure relief gates (PRG) and the side gates. For the months of September and October estimated temperatures

are provided based on the Fall Temperature Index (graphic below). This relationship is an end of September Lake Shasta Volume less than 56°F and likely downstream temperature performance at Balls Ferry for the early fall months.

Temperature Model Inputs, Assumptions, Limitations and Uncertainty:

1. The latest available profiles for Shasta, Trinity, and Whiskeytown were taken on February 6, February 1, and January 30, respectively. Model results are sensitive to initial reservoir temperature conditions and the model performs best under highly stratified conditions. The February 2018 temperature profile does not yet exhibit conditions for ideal model computations (still nearly isothermal conditions). The model performs well after the reservoir stratifies, typically in late spring. The concern this year is assuming lower than actual inflow temperatures due to low snow/higher than normal air temperature conditions and not capturing the stratification with sufficient detail to project.
2. Guidance on forecasted flows from the creeks (e.g., Cow, Cottonwood, Battle, etc.) between Keswick Dam and Bend Bridge are not available beyond 5 days. Creek flows developed from the historical record that most closely reflects current conditions were used for all model runs. The resulting greater than normal creek flows cause additional warming in the upper Sacramento River during spring.
3. Operation is based on the February 2017 Operation Outlooks (monthly flows, reservoir release, and end-of-month reservoir storage) for the 90%- and 50%-exceedances. Trinity Lake inflows are updated with the CNRFC 90% runoff exceedance for both the 90% and 50% runoff exceedance studies.
4. Although mean daily flows and releases are temperature model inputs, they are based on the mean monthly values from the operation outlooks. Mean daily flow patterns are user defined and are generalized representations. It is important to note that these outlooks do not suggest a certain actual future outcome, but rather the statistical likelihood of an event occurring, including, but not limited to, projected storage and releases. Thus, the outlooks do not provide exact end of month storages or flow rates but general projections that will likely fall within the range of uncertainty based on the different hydrologic runoff conditions between the 90% and 50% runoff exceedance hydrology.
5. Cottonwood Creek flows, Keswick to Bend Bridge local flows, and ACID diversions are mean daily synthesized flows based on the available historical record for a 1922-2002 study period. Inflows were adjusted to a 75% historical exceedance for both the 90% and 50% runoff exceedance studies.
6. Meteorological inputs represent historical (1920 – 2005) monthly mean equilibrium temperature exceedance at 10% and 50% patterned after like months on a 6-hour timestep.
7. Meteorology, as well as the flow volume and pattern, significantly influences reservoir inflow temperatures and downstream tributary temperatures; and consequently, the development of the cold-water pool during winter and early spring.
8. Modified model coefficients more closely represent actual Keswick Dam temperatures. As a result, temperature predictions downstream of Keswick Dam are likely to be warmer than actual. Model re-calibrations efforts are underway.

Model Run Date February 13, 2018

Temperature Analysis Results:

Modeling runs explore Sacramento River compliance performance above Clear Creek confluence and Balls Ferry locations by varying hydrology and meteorology. The temperature results for the Sacramento River between Keswick Dam and Balls Ferry are shown in Figures 1 through 3. The relationship between end-of-September lake volume below 56°F and a Balls Ferry compliance through fall is based on the Figure 5.

Model Run	End of September Cold Water Pool <56°F (TAF)	First Side Gate	Full Side Gates
90% Hydro, 10% Met	386	8/19	9/15
90% Hydro, 50% Met	529	8/29	10/4
50% Hydro, 10% Met	602	9/5	9/24
50% Hydro, 50% Met	707	9/17	10/14

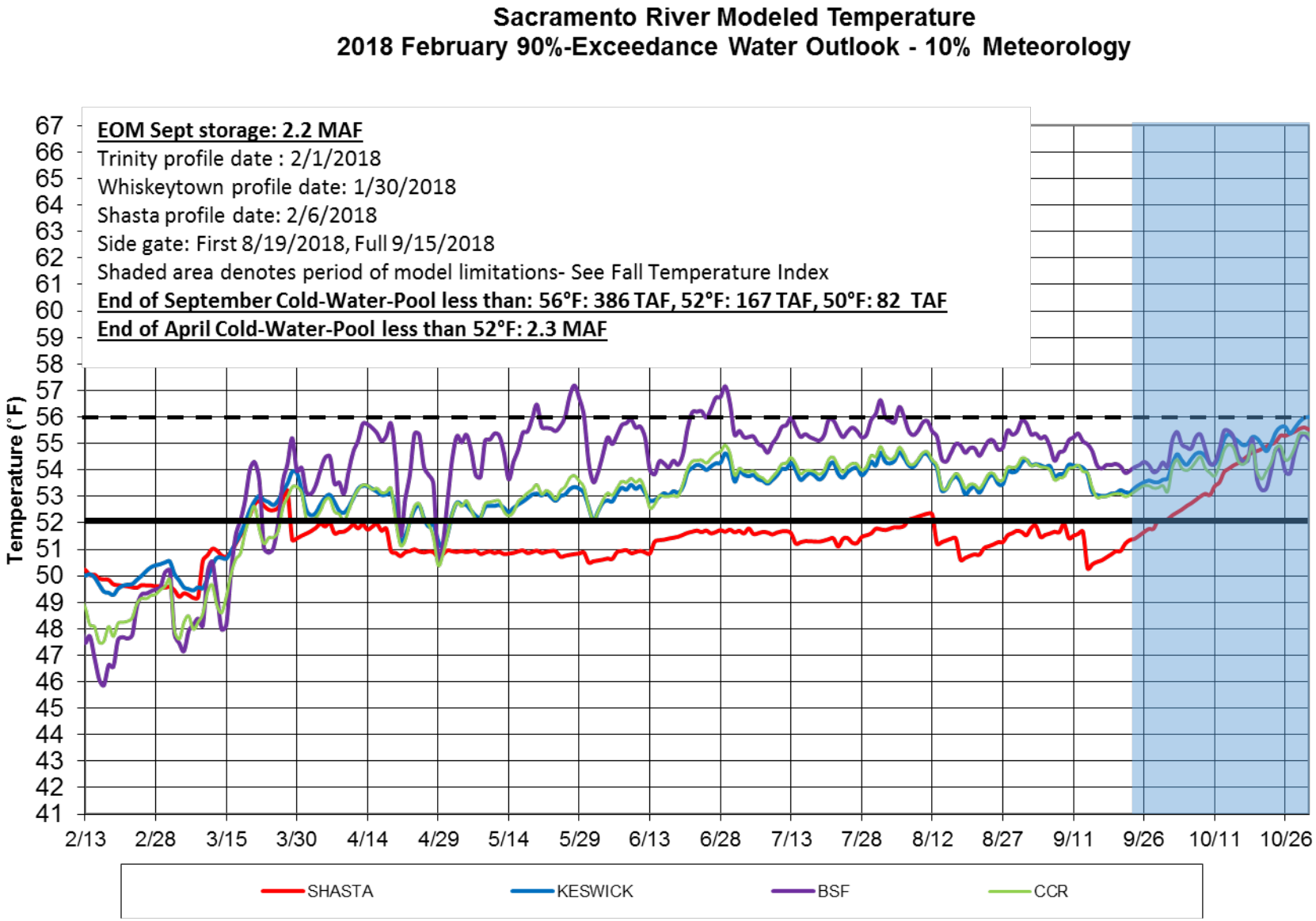
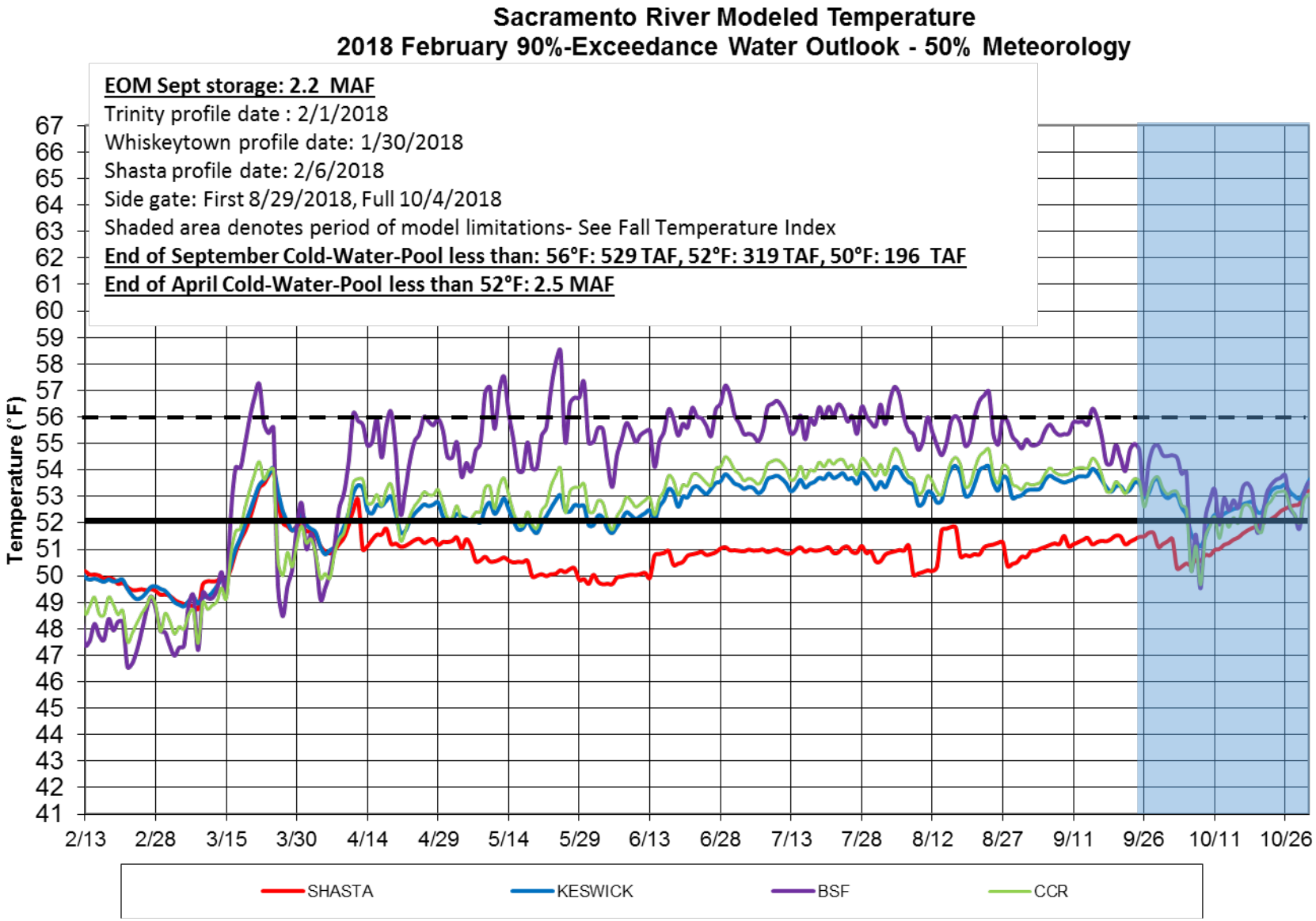

Sacramento River Modeled Temperature
2018 February 90%-Exceedance Water Outlook - 10% Meteorology
EOM Sept storage: 2.2 MAF
Trinity profile date : 2/1/2018
Whiskeytown profile date: 1/30/2018
Shasta profile date: 2/6/2018
Side gate: First 8/19/2018, Full 9/15/2018
Shaded area denotes period of model limitations- See Fall Temperature Index
End of September Cold-Water-Pool less than: 56°F: 386 TAF, 52°F: 167 TAF, 50°F: 82 TAF
End of April Cold-Water-Pool less than 52°F: 2.3 MAF
Temperature (°F)
67
66
65
64
63
62
61
60
59
58
57
56
55
54
53
52
51
50
49
48
47
46
45
44
43
42
41
2/13
2/28
3/15
3/30
4/14
4/29
5/14
5/29
6/13
6/28
7/13
7/28
8/12
8/27
9/11
9/26
10/11
10/26
SHASTA
KESWICK
BSF
CCR

Figure 1


Sacramento River Modeled Temperature
2018 February 90%-Exceedance Water Outlook - 50% Meteorology
EOM Sept storage: 2.2 MAF
Trinity profile date : 2/1/2018
Whiskeytown profile date: 1/30/2018
Shasta profile date: 2/6/2018
Side gate: First 8/29/2018, Full 10/4/2018
Shaded area denotes period of model limitations- See Fall Temperature Index
End of September Cold-Water-Pool less than: 56°F: 529 TAF, 52°F: 319 TAF, 50°F: 196 TAF
End of April Cold-Water-Pool less than 52°F: 2.5 MAF
Temperature (°F)
67
66
65
64
63
62
61
60
59
58
57
56
55
54
53
52
51
50
49
48
47
46
45
44
43
42
41
2/13
2/28
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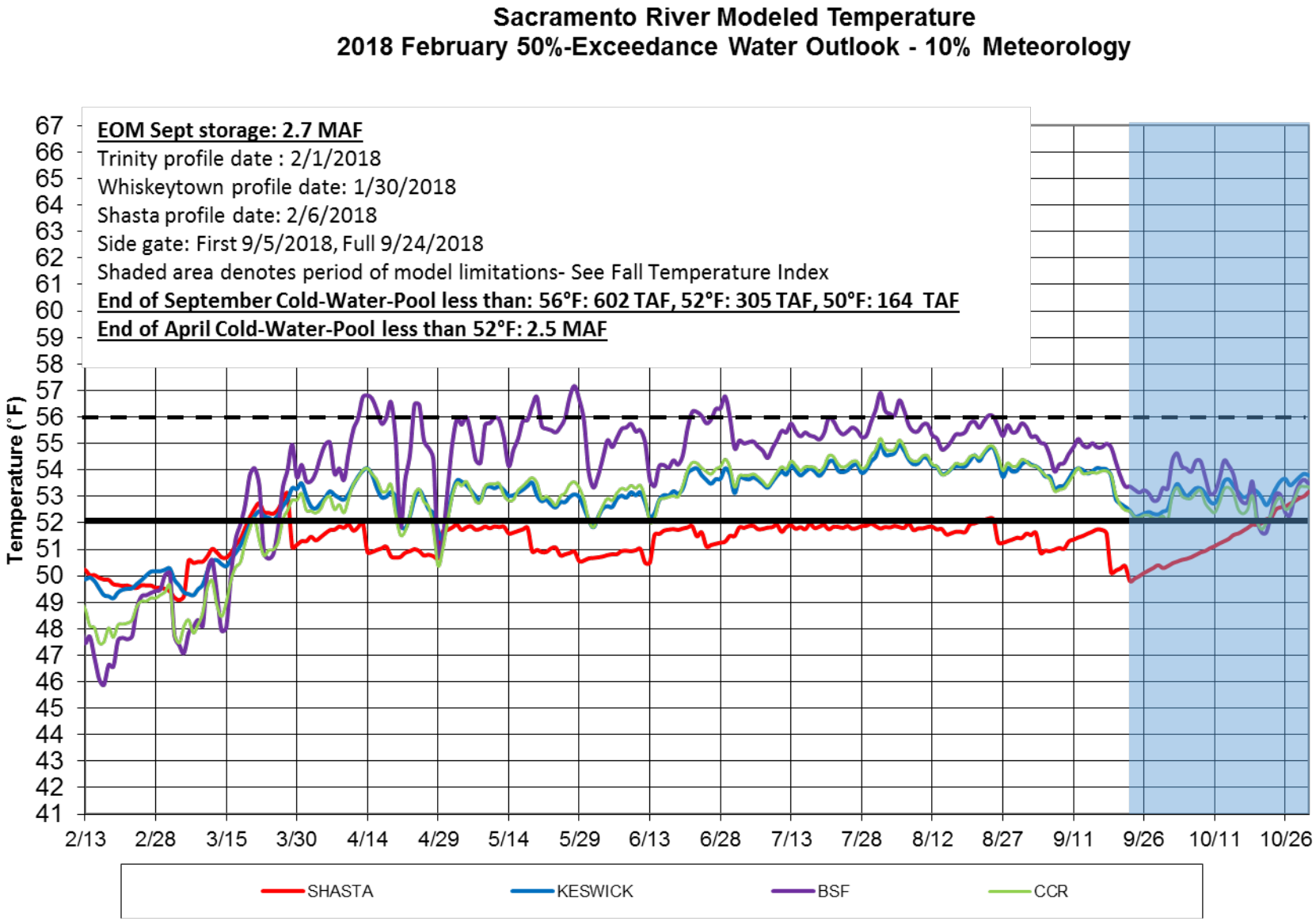
3/30
4/14
4/29
5/14
5/29
6/13
6/28
7/13
7/28
8/12
8/27
9/11
9/26
10/11
10/26
SHASTA
KESWICK
BSF
CCR

Figure 2


Sacramento River Modeled Temperature
2018 February 50%-Exceedance Water Outlook - 10% Meteorology
EOM Sept storage: 2.7 MAF
Trinity profile date : 2/1/2018
Whiskeytown profile date: 1/30/2018
Shasta profile date: 2/6/2018
Side gate: First 9/5/2018, Full 9/24/2018
Shaded area denotes period of model limitations- See Fall Temperature Index
End of September Cold-Water-Pool less than: 56°F: 602 TAF, 52°F: 305 TAF, 50°F: 164 TAF
End of April Cold-Water-Pool less than 52°F: 2.5 MAF
Temperature (°F)
67
66
65
64
63
62
61
60
59
58
57
56
55
54
53
52
51
50
49
48
47
46
45
44
43
42
41
2/13
2/28
3/15
3/30
4/14
4/29
5/14
5/29
6/13
6/28
7/13
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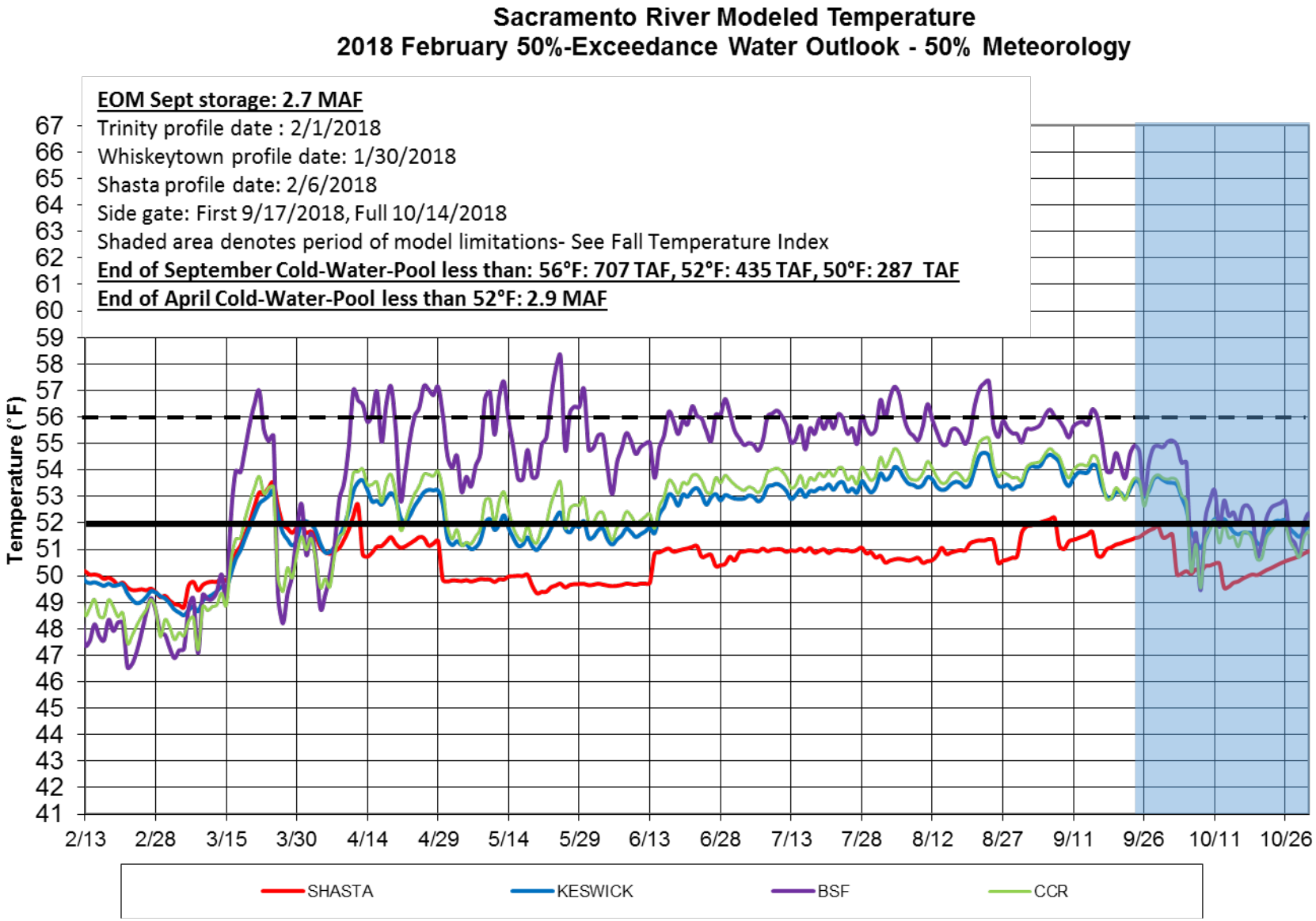
8/12
8/27
9/11
9/26
10/11
10/26
SHASTA
KESWICK
BSF
CCR

Figure 3


Sacramento River Modeled Temperature
2018 February 50%-Exceedance Water Outlook - 50% Meteorology
EOM Sept storage: 2.7 MAF
Trinity profile date : 2/1/2018
Whiskeytown profile date: 1/30/2018
Shasta profile date: 2/6/2018
Side gate: First 9/17/2018, Full 10/14/2018
Shaded area denotes period of model limitations- See Fall Temperature Index
End of September Cold-Water-Pool less than: 56°F: 707 TAF, 52°F: 435 TAF, 50°F: 287 TAF
End of April Cold-Water-Pool less than 52°F: 2.9 MAF
Temperature (°F)
67
66
65
64
63
62
61
60
59
58
57
56
55
54
53
52
51
50
49
48
47
46
45
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43
42
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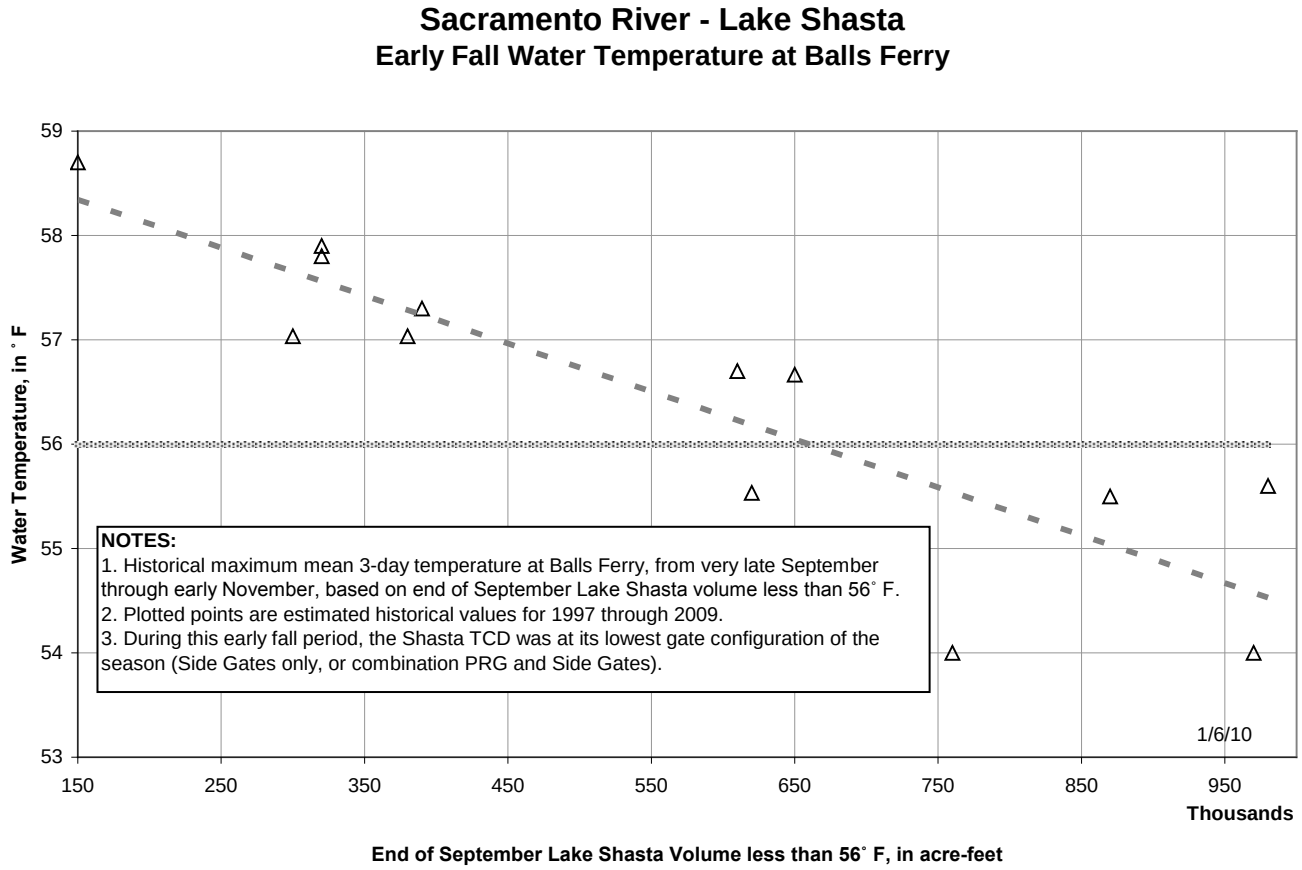
4/14
4/29
5/14
5/29
6/13
6/28
7/13
7/28
8/12
8/27
9/11
9/26
10/11
10/26
SHASTA
KESWICK
BSF
CCR

Figure 4

Figure 5 Model Performance and Fall Temperature Index:

1. Based on past analyses, the temperature model does not perform well in late September and October. One factor is that the modeled release temperatures are cooler than has historically been achieved when all release is through the side gates (lowest gates), especially when there's a large temperature gradient between the pressure relief gates (PRG) and the side gates.
2. Based on historical records, the end-of-September Lake Shasta volume below 56˚F is a good indicator of fall water temperature in the river reach to Balls Ferry.
3. For river temperatures not to exceed 56 ˚F downstream to Balls Ferry, the end-of-September lake volume less than 56˚F should be greater than about 600 TAF, see chart below:



Summary Document for Shasta/Keswick Operational Scenarios
Prepared by the Southwest Fisheries Science Center on Feb 14th, 2018

Below are results comparing four USBR scenarios ran February 12th 2017. Scenarios differ by hydrology (Input 50 or 90 percent exceedance) and air temperature (10 or 50 exceedance of L3MTO). Inputs from scenarios are used to generate daily average Sacramento River water temperatures using the RAFT model and associated temperature-dependent egg mortality and survival estimates using the NMFS temperature mortality model (Martin et al. 2017) for the 2018 temperature management season.

Further details of modeling methods are at: http://oceanview.pfeg.noaa.gov/CVTEMP/

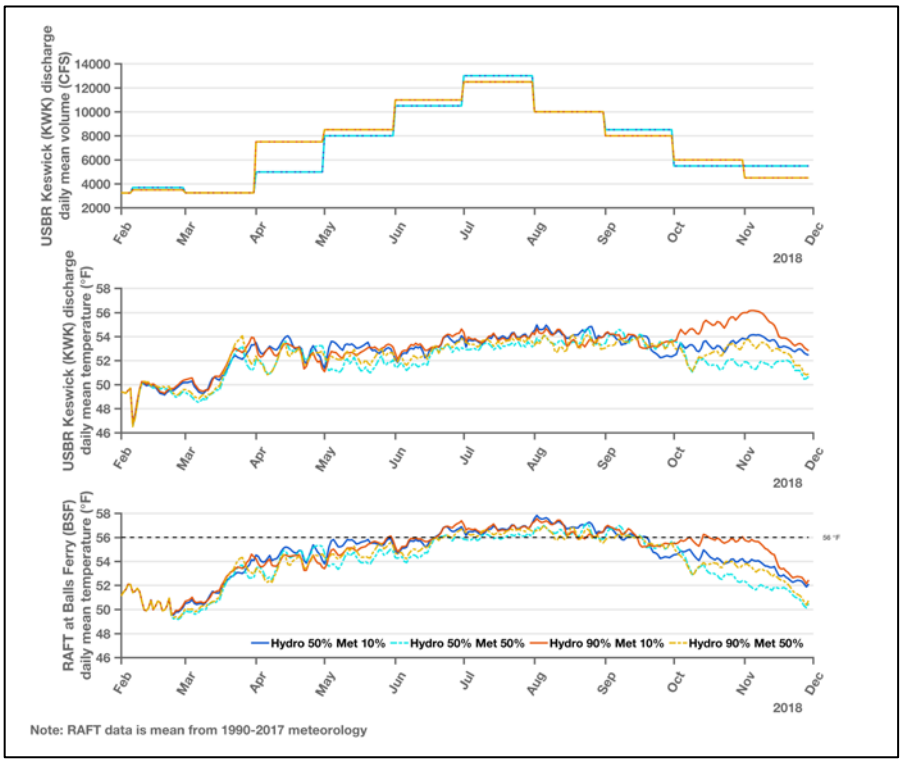


Figure 1: Summary plots showing differences in Keswick discharge volume and temperature, and Balls Ferry RAFT predicted temperature for four scenarios assessed.

Table 1: Estimated temperature-dependent egg mortality under different scenarios assuming a 2012-2017 spatial and temporal redd distribution.

Scenario	Mean (%)	Median (%)	Lower (%)	Upper (%)
Feb_14_2018_INPUT_50_OUTPUT_50_10L3MTO	43.07	45.61	1.08	74.77
Feb_14_2018_INPUT_50_OUTPUT_50_50L3MTO	23.37	18.82	1.06	66.79
Feb_14_2018_INPUT_90_OUTPUT_90_10L3MTO	40.06	42.01	0.23	73.77
Feb_14_2018_INPUT_90_OUTPUT_90_50L3MTO	26.61	22.54	0.93	67.20

Summary Document for Shasta/Keswick Operational Scenarios
Prepared by the Southwest Fisheries Science Center on Feb 14th, 2018

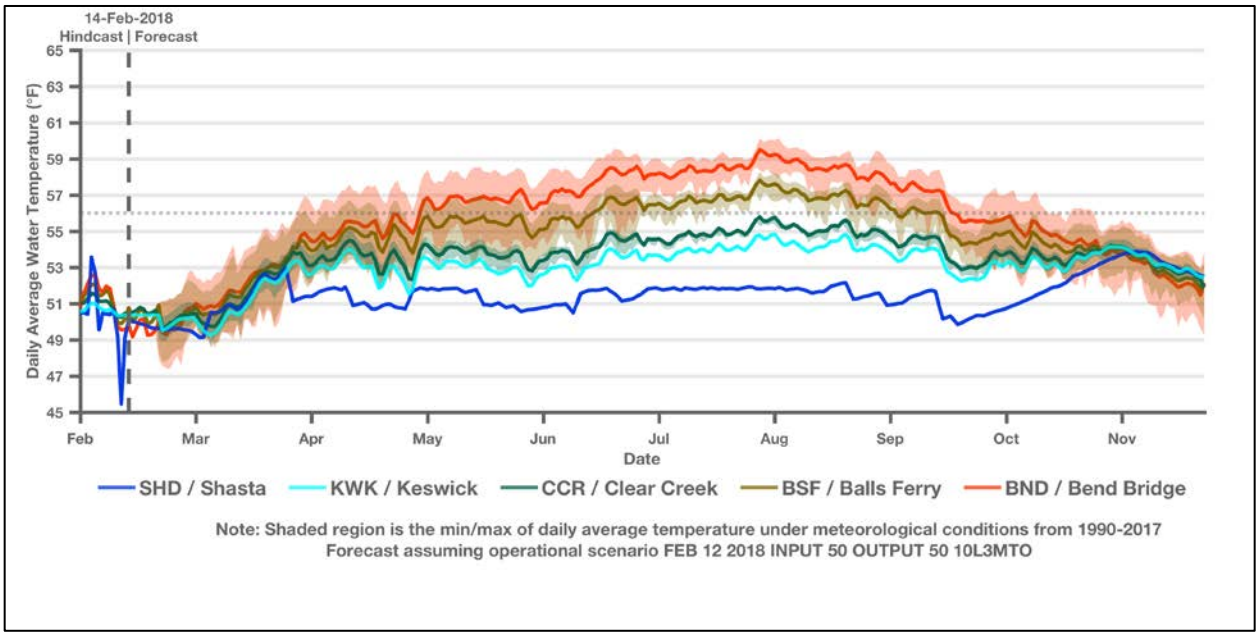


Figure 2: Estimated daily average water temperature produced by scenario input (Shasta and Keswick) and the RAFT model (Clear Creek, Balls Ferry, and Bend Bridge) under the Feb 12th 2018 Input_50_10_L3MTO scenario.

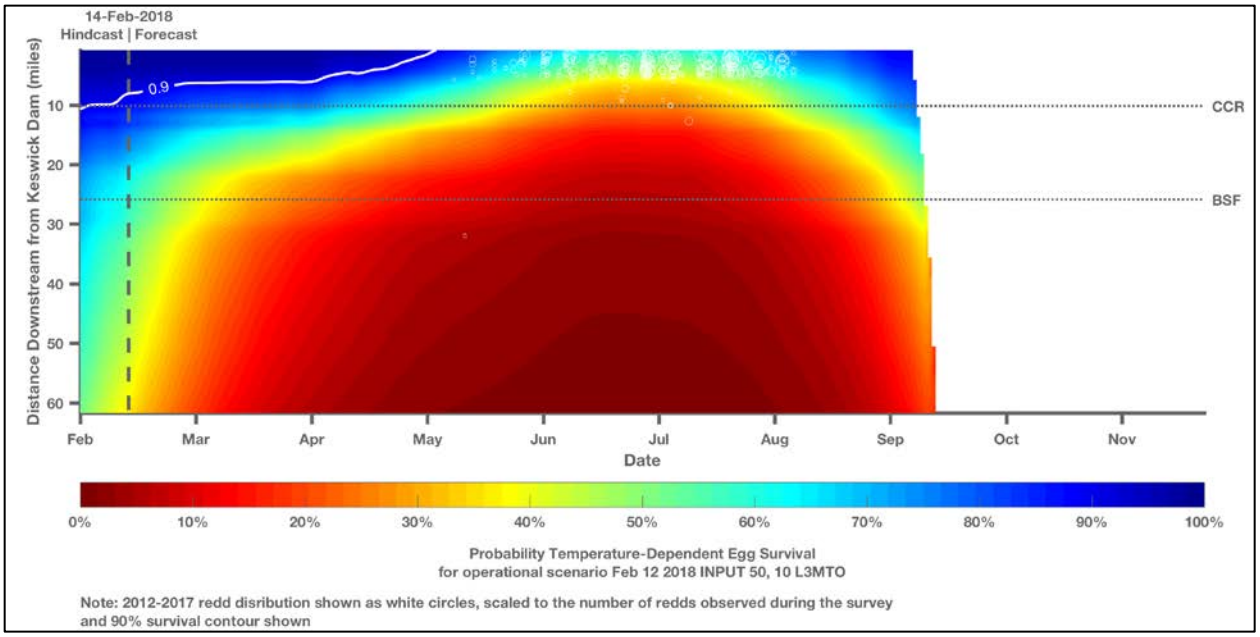


Figure 3: Estimated temperature-dependent egg survival produced by the NMFS temperature mortality model under the Feb 12th 2018 Input_50_10_L3MTO scenario.

Summary Document for Shasta/Keswick Operational Scenarios
Prepared by the Southwest Fisheries Science Center on Feb 14th, 2018

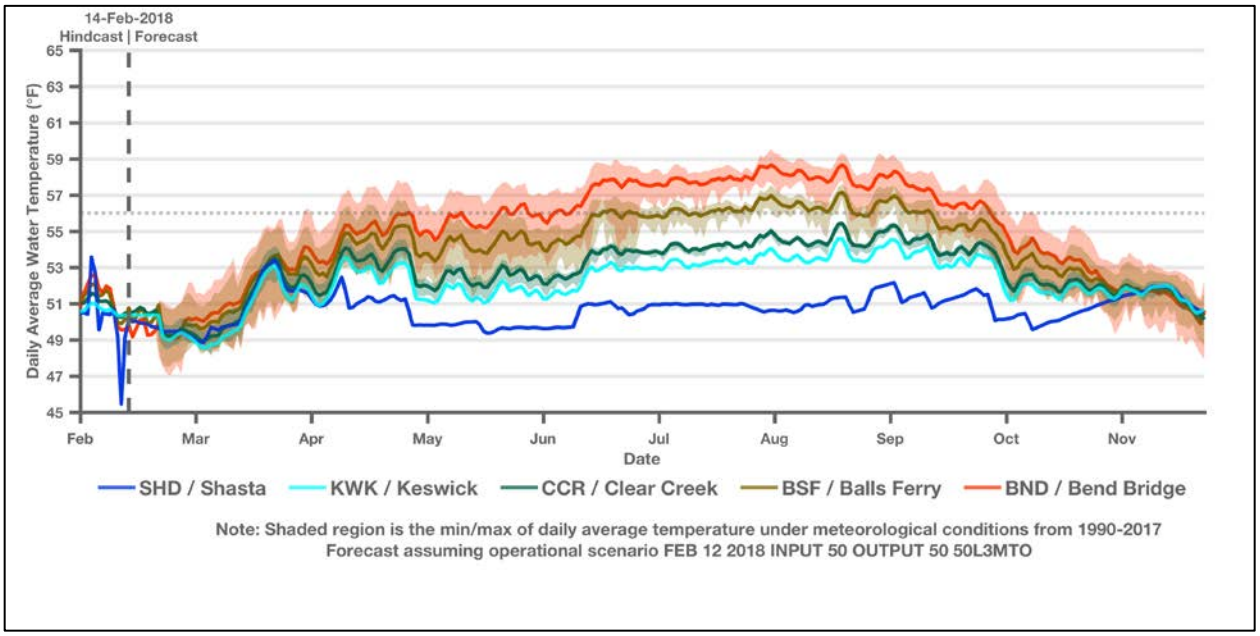


Figure 4: Estimated daily average water temperature produced by scenario input (Shasta and Keswick) and the RAFT model (Clear Creek, Balls Ferry, and Bend Bridge) under the Feb 12th 2018 Input_50_50_L3MTO scenario.

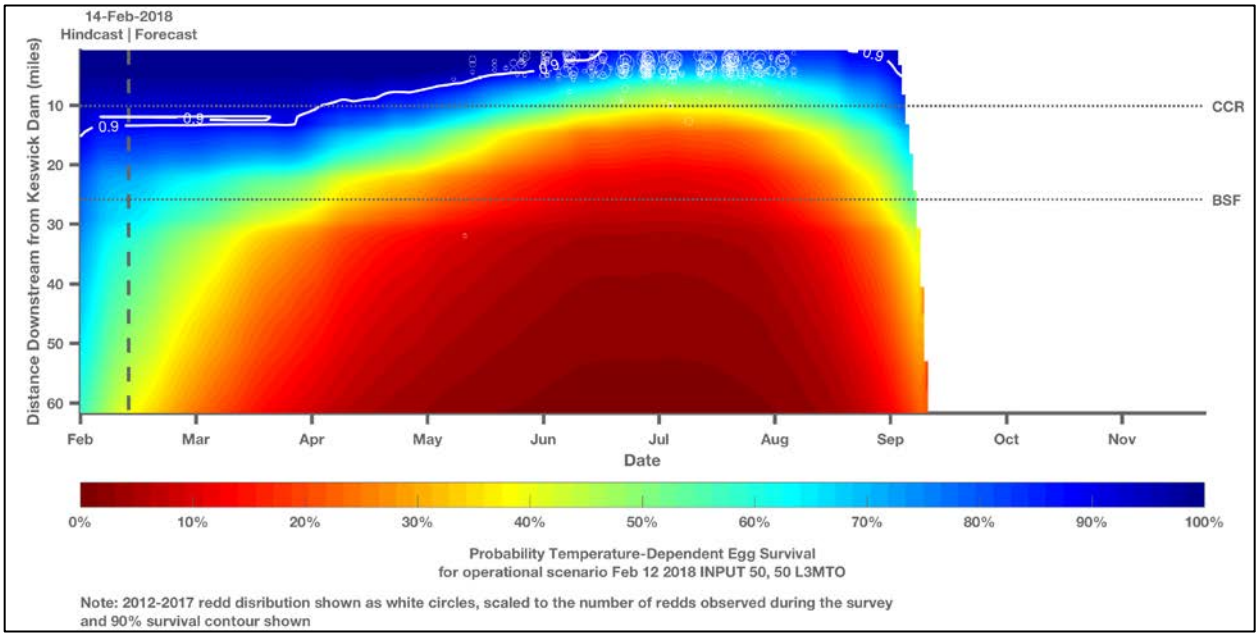


Figure 5: Estimated temperature-dependent egg survival produced by the NMFS temperature mortality model under the Feb 12th 2018 Input_50_50_L3MTO scenario.

Summary Document for Shasta/Keswick Operational Scenarios
Prepared by the Southwest Fisheries Science Center on Feb 14th, 2018

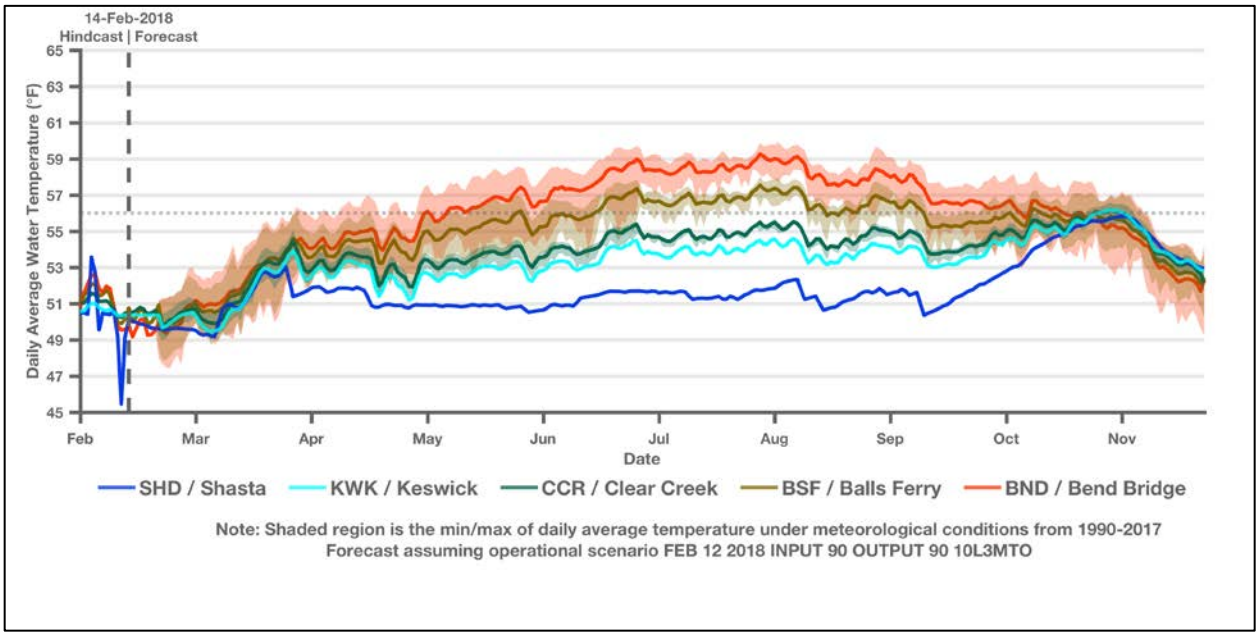


Figure 6: Estimated daily average water temperature produced by scenario input (Shasta and Keswick) and the RAFT model (Clear Creek, Balls Ferry, and Bend Bridge) under the Feb 12th 2018 Input_90_10_L3MTO scenario.

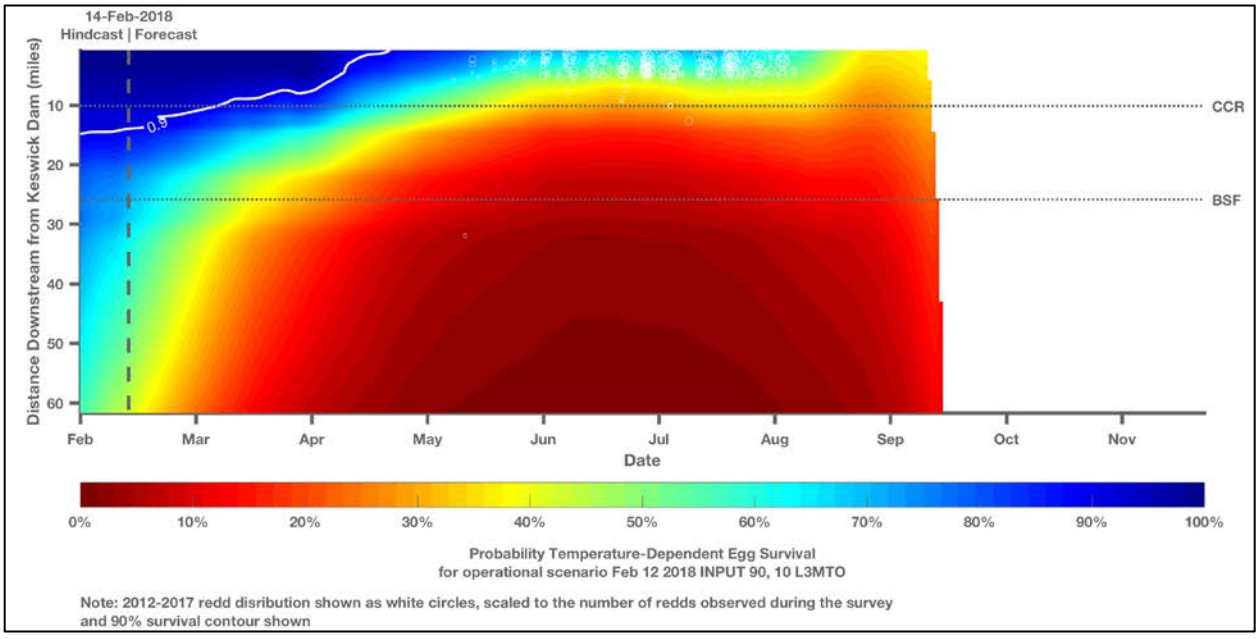


Figure 7: Estimated temperature-dependent egg survival produced by the NMFS temperature mortality model under the Feb 12th 2018 Input_90_10_L3MTO scenario.

Summary Document for Shasta/Keswick Operational Scenarios
Prepared by the Southwest Fisheries Science Center on Feb 14th, 2018

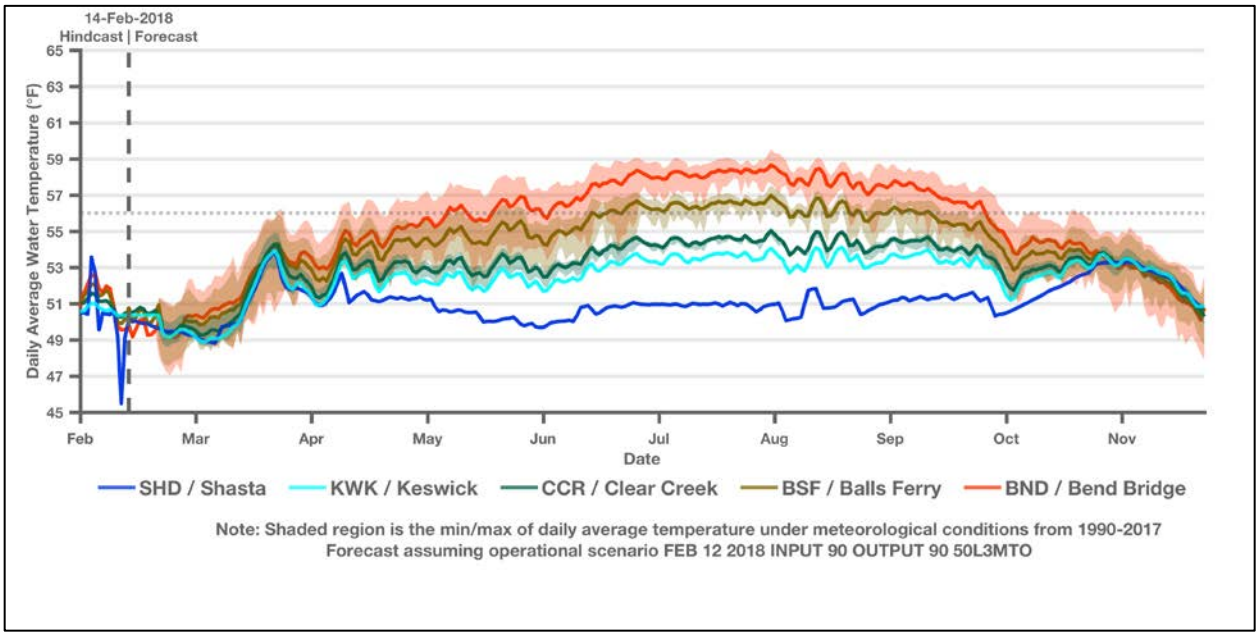


Figure 8: Estimated daily average water temperature produced by scenario input (Shasta and Keswick) and the RAFT model (Clear Creek, Balls Ferry, and Bend Bridge) under the Feb 12th 2018 Input_90_50_L3MTO scenario.

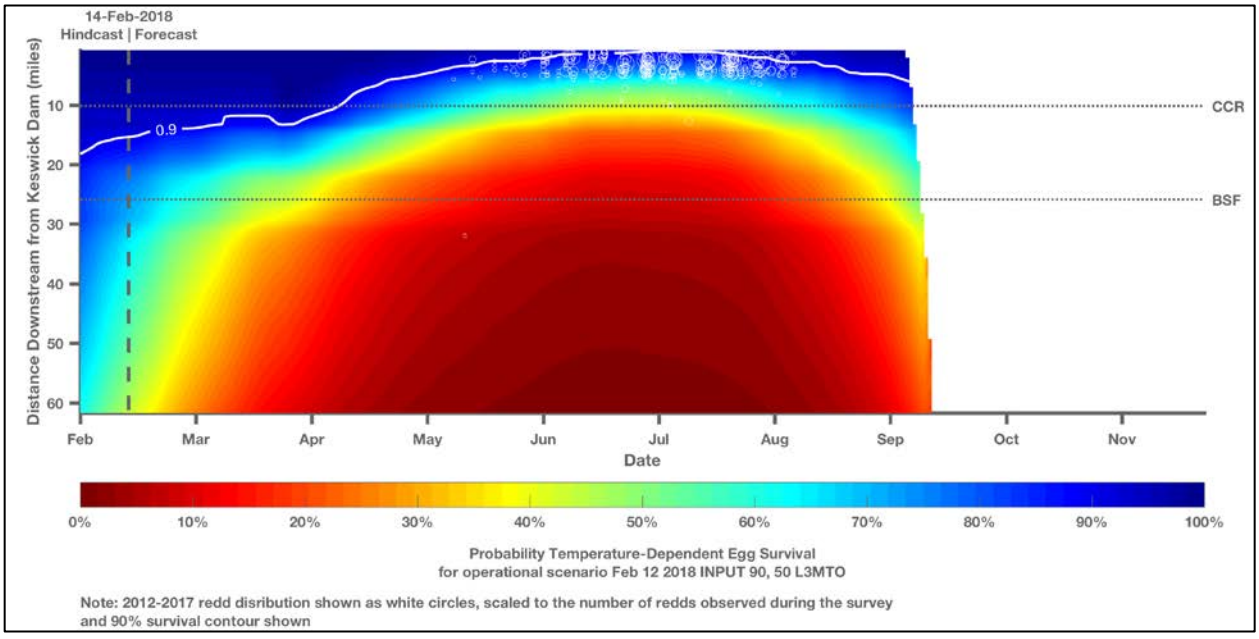


Figure 9: Estimated temperature-dependent egg survival produced by the NMFS temperature mortality model under the Feb 12th 2018 Input_90_50_L3MTO scenario.

Reference:

Martin, B. T., Pike, A., John, S. N., Hamda, N., Roberts, J., Lindley, S. T. and Danner, E. M. (2017), Phenomenological vs. biophysical models of thermal stress in aquatic eggs. Ecology Letters 20: 50–59. doi:10.1111/ele.12705

Enclosure 2

United States Department of the Interior

BUREAU OF RECLAMATION
Central Valley Operations Office
3310 El Camino Avenue, Suite 300
Sacramento, California 95821

IN REPLY
REFER TO:

FEB 14 2018

CVO-100
PRJ-23.00

VIA ELECTRONIC MAIL AND U.S. MAIL

Ms. Maria Rea
Assistant Regional Administrator
California Central Valley Area Office
650 Capital Mall, Suite 5-100
Sacramento, Ca 95814

Subject: Transmittal of February 2018 Central Valley Project (CVP) Reservoir Operations Forecasts

Dear Ms. Rea:

As required by the 2009 National Marine Fisheries Service (NMFS) Biological Opinion Reasonable and Prudent Alternatives (RPA) Action I.2.3, please find enclosed a set of CVP operational outlooks and a set of Sacramento River temperature model results for projected operations over the coming spring and summer. It is important to note that these operational outlooks and temperature models do not suggest a certain actual future outcome, but rather the statistical likelihood of an event occurring, including, but not limited to, projected storage and releases as well as temperature performance. Thus, the outlooks do not provide exact end of month storages, flow rates, or projected water temperatures, but general projections that will likely fall within the range of uncertainty based on the different hydrologic runoff conditions between the 90% and 50% hydrology.

The operational outlooks are based on February 1, 2018, hydrologic conditions and a forecast of reservoir inflows assuming both a 90% exceedance hydrology, and a 50% exceedance hydrology. The 90% exceedance hydrology is currently a "Dry" year type under the Sacramento Valley Index. The estimated annual inflow to Shasta Lake is 3.59 million acre-feet (MAF) and the projected end of September storage is 2.2 MAF.

The Sacramento River temperature model runs were completed using the HEC-5Q modeling software, and are also based on February 1 hydrology and a Shasta Lake profile from February 6, 2018. Because this is an early season profile, there is a high degree of uncertainty in the cold water pool volume calculated by the model. Higher confidence will come with the end of April Shasta Lake profile. Based on the model runs, we are currently projecting the capability to meet a 56 degree daily average temperature (DAT) at the Balls Ferry compliance point throughout the season. However, based on past analysis, there is an elevated degree of uncertainty in the September and October timeframe. One factor is that the modeled release temperatures are

cooler than has historically been achieved when all release is through the side gates (lowest gates), especially when there exists a large temperature gradient between the pressure relief gates and the side gates. For this reason, estimated temperatures for September and October in the first table of the attachment are based on a Fall Temperature Index (chart shown in the attachment), illustrating historical performance and indicating some uncertainty in late-season accomplishment of Balls Ferry temperature management at 56 degrees DAT.

The overall projected system operations and hydrologic conditions and the full Federal share of San Luis Reservoir south of the Delta gives us confidence that, even with a conservative assumption of pumping from the delta, we are able to support the following initial Central Valley Project allocations:

February 90% Exceedance Municipal & Industrial Water Service Contracts - Agricultural Water Service Contracts				
	North of Delta M&I	North of Delta Agricultural[1]	South of Delta M&I	South of Delta Agricultural
Allocation	75%	50%	70%	20%

As outlined above, based on the temperature modeling runs illustrating 56 degree performance at Balls Ferry and a 2.2 MAF end of September storage, we believe these conditions are consistent with RPA I.2.3.A, and we request your concurrence with our proposed operations, planning efforts, and allocations. With the uncertainty in September and October temperature performance, we recognize that the possibility exists that we may enter into a condition necessitating the activities under Action I.2.3.B, particularly if the hydrology remains dry in the coming months. Given that potential, please note that the following actions and activities are underway or projected:

- Keswick releases are currently being ramped down to 3,250 cfs; those reductions began on February 12 and due to the required ramping rates, will reach that rate by February 19.
- We believe the attached monthly Keswick release projections can be used during the next one to two months as we further evaluate conditions in coordination with your agency.
    - Though our projection illustrates a 3,250 cfs release projection in March, the ability to hold those releases is dependent on forecasted accretions and creek flows. We plan to further work with NMFS prior to March 1 to develop an understanding of an initial Keswick monthly release schedule. Should changed conditions result in a need to alter releases to meet downstream diversion requirements or Delta outflow, X2, or other legal requirements, Bureau of Reclamation will also consult with NMFS on these real-time changes.

[1] The north of Delta allocations illustrated above are in conformance with Section 4005(e) of P.L. 114-322, the Water Infrastructure Improvements for the Nation Act (WIIN), as well as Reclamation's M&I shortage policy.

- We plan to continue to consult with you monthly or more often as appropriate on the overall outlooks based on updated forecasts.

As noted above, we will be updating the projections of water supply availability and temperature management operations through the coming months as new water supply forecasts become available. We look forward to our continued close coordination as we develop our final Sacramento River temperature management plan for 2018. If you have any questions, please contact Elizabeth Kiteck at 916-979-2197 or Randi Field at 916-979-2066.

Sincerely,

Jeff Rieker
Operations Manager

Enc.

Estimated CVP Operations Feb 90% Exceedance

Storages

Federal End of the Month Storage/Elevation (TAF/Feet)

		Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan
Trinity	**1776**	**1800**	**1842**	**1841**	**1676**	**1508**	**1353**	**1228**	**1114**	**1084**	**1066**	**1076**	**1108**
	Elev.	2327	2330	2330	2317	2304	2291	2279	2267	2264	2262	2263	2267
Whiskeytown	**205**	**206**	**206**	**238**	**238**	**238**	**238**	**238**	**230**	**206**	**206**	**206**	**206**
	Elev.	1199	1199	1209	1209	1209	1209	1209	1207	1199	1199	1199	1199
Shasta	**3349**	**3441**	**3812**	**3803**	**3712**	**3383**	**2891**	**2470**	**2192**	**2067**	**2062**	**2188**	**2385**
	Elev.	1026	1041	1040	1037	1024	1003	983	968	961	961	968	978
Folsom	**582**	**571**	**624**	**617**	**590**	**425**	**337**	**305**	**280**	**253**	**231**	**221**	**271**
	Elev.	425	431	430	427	407	393	388	383	378	374	372	382
New Melones	**1981**	**1940**	**1972**	**1901**	**1847**	**1793**	**1716**	**1658**	**1619**	**1589**	**1605**	**1622**	**1637**
	Elev.	1047	1050	1043	1038	1033	1025	1020	1016	1012	1014	1016	1017
San Luis	**973**	**920**	**942**	**899**	**824**	**560**	**273**	**99**	**164**	**284**	**322**	**370**	**542**
	Elev.	519	529	519	503	463	415	370	367	372	381	402	428
Total		8877	9397	9298	8887	7907	6808	5999	5598	5483	5492	5683	6149

State End of the Month Reservoir Storage (TAF)

Oroville	**1408**	**1510**	**1747**	**1748**	**1647**	**1456**	**1236**	**1078**	**1048**	**969**	**864**	**819**	**894**
	Elev.	732	758	758	747	725	698	676	671	659	642	634	647
San Luis	**763**	**805**	**910**	**827**	**717**	**548**	**375**	**210**	**121**	**36**	**60**	**168**	**218**
Total San Luis (TAF)	**1736**	**1725**	**1852**	**1726**	**1541**	**1108**	**649**	**308**	**286**	**320**	**383**	**538**	**760**

Monthly River Releases (TAF/cfs)

Trinity	TAF	17	18	36	92	47	28	53	52	23	18	18	18
	cfs	**300**	**300**	**600**	**1,498**	**783**	**450**	**857**	**870**	**373**	**300**	**300**	**300**
Clear Creek	TAF	11	12	13	13	17	9	9	9	12	12	12	12
	cfs	**200**	**200**	**218**	**216**	**288**	**150**	**150**	**150**	**200**	**200**	**200**	**200**
Sacramento	TAF	194	200	446	523	654	768	615	476	369	268	204	200
	cfs	**3500**	**3250**	**7500**	**8500**	**11000**	**12500**	**10000**	**8000**	**6000**	**4500**	**3320**	**3250**
American	TAF	139	126	159	155	224	137	84	76	62	62	62	61
	cfs	**2500**	**2053**	**2672**	**2514**	**3769**	**2227**	**1368**	**1269**	**1013**	**1045**	**1010**	**1000**
Stanislaus	TAF	59	12	91	76	22	15	15	15	49	12	12	14
	cfs	**1070**	**200**	**1537**	**1242**	**363**	**250**	**250**	**250**	**797**	**200**	**200**	**226**
Feather	TAF	97	80	101	49	54	92	92	71	61	57	58	58
	cfs	**1750**	**1300**	**1700**	**800**	**900**	**1500**	**1500**	**1200**	**1000**	**950**	**950**	**950**

Trinity Diversions (TAF)

	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan
Carr PP	20	23	53	112	135	130	71	62	16	21	12	3
Spring Crk. PP	**20**	**30**	**23**	**105**	**120**	**120**	**60**	**60**	**30**	**15**	**12**	**10**

Delta Summary (TAF)

		Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan
Tracy		135	136	24	25	25	40	100	250	249	95	84	210
USBR Banks		0	0	0	0	0	9	9	9	0	0	0	0
Contra Costa		14.0	12.7	12.7	12.7	9.8	11.1	12.7	14.0	16.8	18.4	18.3	14.0
Total USBR		149	149	37	37	35	60	122	273	266	113	102	224
State Export		161	205	18	18	20	25	20	60	66	160	217	210
Total Export		310	354	54	56	55	85	142	333	332	273	319	434
COA Balance		6	0	5	-10	9	23	19	65	22	22	22	22
Old/Middle River Std.													
Old/Middle R. calc.		-3,840	-4,301	-152	-279	-901	-1,302	-2,047	-4,530	-3,956	-3,570	-4,038	-5,463
Computed DOI		11436	11403	10405	7597	7598	4994	3497	3009	4002	4505	4506	5677
Excess Outflow		36	0	0	0	0	0	0	0	0	0	0	1171
% Export/Inflow		33%	33%	6%	7%	6%	11%	21%	47%	47%	44%	51%	58%
% Export/Inflow std.		45%	35%	35%	35%	35%	65%	65%	65%	65%	65%	65%	65%

Hydrology

	Trinity		Shasta		Folsom	New Melones	
Water Year Inflow (TAF)	474		3,447		1,562	776	
Year to Date + Forecasted % of mean	39%		62%		57%	73%	

CVP actual operations do not follow any forecasted operation or outlook; actual operations are based on real-time conditions.
CVP operational forecasts or outlooks represent general system-wide dynamics and do not necessarily address specific watershed/tributary details.
CVP releases or export values represent monthly averages.
CVP Operations are updated monthly as new hydrology information is made available December through May.

2/13/2018

Estimated CVP Operations Feb 50% Exceedance

Storages

Federal End of the Month Storage/Elevation (TAF/Feet)

		Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan
Trinity	**1776**	**1805**	**1901**	**1994**	**1912**	**1849**	**1742**	**1605**	**1477**	**1439**	**1426**	**1456**	**1521**
	Elev.	2327	2334	2341	2335	2330	2322	2312	2301	2298	2297	2300	2305
Whiskeytown	**205**	**206**	**206**	**238**	**238**	**238**	**238**	**238**	**230**	**206**	**206**	**206**	**206**
	Elev.	1199	1199	1209	1209	1209	1209	1209	1207	1199	1199	1199	1199
Shasta	**3349**	**3445**	**3985**	**4222**	**4160**	**3849**	**3325**	**2953**	**2694**	**2630**	**2619**	**2764**	**3170**
	Elev.	1026	1047	1056	1053	1042	1022	1006	994	991	990	997	1015
Folsom	**582**	**579**	**669**	**754**	**855**	**727**	**522**	**408**	**353**	**306**	**277**	**266**	**310**
	Elev.	426	436	445	455	442	419	404	396	388	383	381	389
New Melones	**1981**	**1952**	**1922**	**1864**	**1819**	**1768**	**1703**	**1643**	**1602**	**1562**	**1583**	**1610**	**1644**
	Elev.	1048	1045	1040	1035	1031	1024	1018	1014	1010	1012	1015	1018
San Luis	**966**	**966**	**966**	**881**	**740**	**427**	**181**	**39**	**68**	**178**	**363**	**568**	**704**
	Elev.	525	540	524	499	455	407	359	371	393	430	461	477
Total		8954	9648	9953	9725	8858	7711	6886	6424	6320	6474	6870	7554

State End of the Month Reservoir Storage (TAF)

Oroville	**1408**	**1677**	**2053**	**2125**	**2008**	**1784**	**1535**	**1386**	**1300**	**1206**	**1139**	**1201**	**1378**
	Elev.	750	788	794	783	761	734	717	706	694	685	693	716
San Luis	**763**	**838**	**1019**	**910**	**761**	**598**	**395**	**197**	**246**	**290**	**421**	**513**	**552**
Total San Luis (TAF)	**1729**	**1804**	**1985**	**1791**	**1501**	**1025**	**576**	**235**	**315**	**468**	**783**	**1082**	**1255**

Monthly River Releases (TAF/cfs)

Trinity	TAF	17	18	32	180	47	28	53	52	23	18	18	18
	cfs	**300**	**300**	**540**	**2,924**	**783**	**450**	**857**	**870**	**373**	**300**	**300**	**300**
Clear Creek	TAF	11	12	13	13	17	9	9	9	12	12	12	15
	cfs	**200**	**200**	**218**	**216**	**288**	**150**	**150**	**150**	**200**	**200**	**200**	**240**
Sacramento	TAF	205	200	297	492	625	799	615	506	338	327	246	200
	cfs	**3700**	**3250**	**5000**	**8000**	**10500**	**13000**	**10000**	**8500**	**5500**	**5500**	**4000**	**3250**
American	TAF	194	154	149	108	228	272	178	119	123	119	123	108
	cfs	**3500**	**2500**	**2500**	**1750**	**3839**	**4432**	**2891**	**2000**	**2000**	**2000**	**2000**	**1750**
Stanislaus	TAF	59	93	83	96	56	18	18	18	49	12	12	14
	cfs	**1070**	**1521**	**1400**	**1555**	**940**	**300**	**300**	**300**	**797**	**200**	**200**	**232**
Feather	TAF	97	80	119	92	119	187	156	143	123	104	61	108
	cfs	**1750**	**1300**	**2000**	**1500**	**2000**	**3050**	**2540**	**2400**	**2000**	**1750**	**1000**	**1750**

Trinity Diversions (TAF)

	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan
Carr PP	22	35	36	24	71	84	85	76	26	25	9	0
Spring Crk. PP	**35**	**60**	**15**	**25**	**60**	**75**	**75**	**75**	**40**	**20**	**12**	**20**

Delta Summary (TAF)

		Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan
Tracy		143	112	48	49	128	250	270	261	270	260	260	200
USBR Banks		0	0	0	0	0	26	26	26	0	0	0	0
Contra Costa		14.0	12.7	12.7	12.7	9.8	11.1	12.7	14.0	16.8	18.4	18.3	14.0
Total USBR		157	125	60	62	138	287	309	301	287	278	278	214
State Export		200	300	42	43	102	76	65	269	262	325	260	200
Total Export		357	425	102	105	240	363	374	570	549	603	538	414
COA Balance		0	0	0	0	0	0	0	138	138	138	138	138
Old/Middle River Std.													
Old/Middle R. calc.		-3,244	-3,490	71	281	-2,711	-4,527	-4,726	-7,386	-6,535	-7,652	-6,577	-4,903
Computed DOI		18677	22563	12372	10867	7598	6507	4002	3009	4246	4572	8329	14966
Excess Outflow		7276	11159	1109	3091	0	0	0	0	244	67	3823	10460
% Export/Inflow		25%	23%	10%	11%	27%	35%	43%	62%	59%	64%	50%	31%
% Export/Inflow std.		45%	35%	35%	35%	35%	65%	65%	65%	65%	65%	65%	65%

Hydrology

	Trinity		Shasta		Folsom		New Melones	
Water Year Inflow (TAF)	754		3,937		1,944		887	
Year to Date + Forecasted % of mean	62%		71%		71%		84%	

CVP actual operations do not follow any forecasted operation or outlook; actual operations are based on real-time conditions.
CVP operational forecasts or outlooks represent general system-wide dynamics and do not necessarily address specific watershed/tributary details.
CVP releases or export values represent monthly averages.
CVP Operations are updated monthly as new hydrology information is made available December through May.

2/13/2018

February 13, 2018

Upper Sacramento River – February 2018 Preliminary Temperature Analysis

Summary of Temperature Results by Month (Monthly Average Temperature °F)

Initial Compliance Location (°F DAT)	APR	MAY	JUN	JUL	AUG	SEP*	OCT*
February 90%-Exceedance Outlook – 10% Historical Meteorology							
Keswick Dam KWK	52.5	52.8	53.4	53.9	53.9	NA	NA
Sac. R. abv Clear Creek CCR	52.4	52.9	53.5	54.1	54.0	NA	NA
Balls Ferry BSF	54.1	55.2	55.3	55.4	55.3	57.3	57.3
February 90%-Exceedance Outlook – 50% Historical Meteorology							
Keswick Dam KWK	52.2	52.3	52.7	53.5	53.5	NA	NA
Sac. R. abv Clear Creek CCR	52.2	52.7	53.2	54.0	53.9	NA	NA
Balls Ferry BSF	53.9	55.6	55.5	55.9	55.7	56.6	56.6
February 50%-Exceedance Outlook – 10% Historical Meteorology							
Keswick Dam KWK	52.9	53.0	53.1	53.9	54.3	NA	NA
Sac. R. abv Clear Creek CCR	52.7	53.1	53.3	54.0	54.4	NA	NA
Balls Ferry BSF	54.8	55.5	55.1	55.3	55.7	56.3	56.3
February 50%-Exceedance Outlook – 50% Historical Meteorology							
Keswick Dam KWK	52.5	51.6	52.3	53.2	53.7	NA	NA
Sac. R. abv Clear Creek CCR	52.5	52.1	52.8	53.7	54.1	NA	NA
Balls Ferry BSF	54.5	55.3	55.3	55.5	55.9	55.8	55.8

* The HEC5Q model output is displayed above for the months April through August. Based on past analysis, the temperature model does not perform well in late September and October. One factor is that the modeled release temperatures are cooler than has historically been achieved when all release is through the side gates (lowest gates), especially when there's a large temperature gradient between the pressure relief gates (PRG) and the side gates. For the months of September and October estimated temperatures

are provided based on the Fall Temperature Index (graphic below). This relationship is an end of September Lake Shasta Volume less than 56°F and likely downstream temperature performance at Balls Ferry for the early fall months.

Temperature Model Inputs, Assumptions, Limitations and Uncertainty:

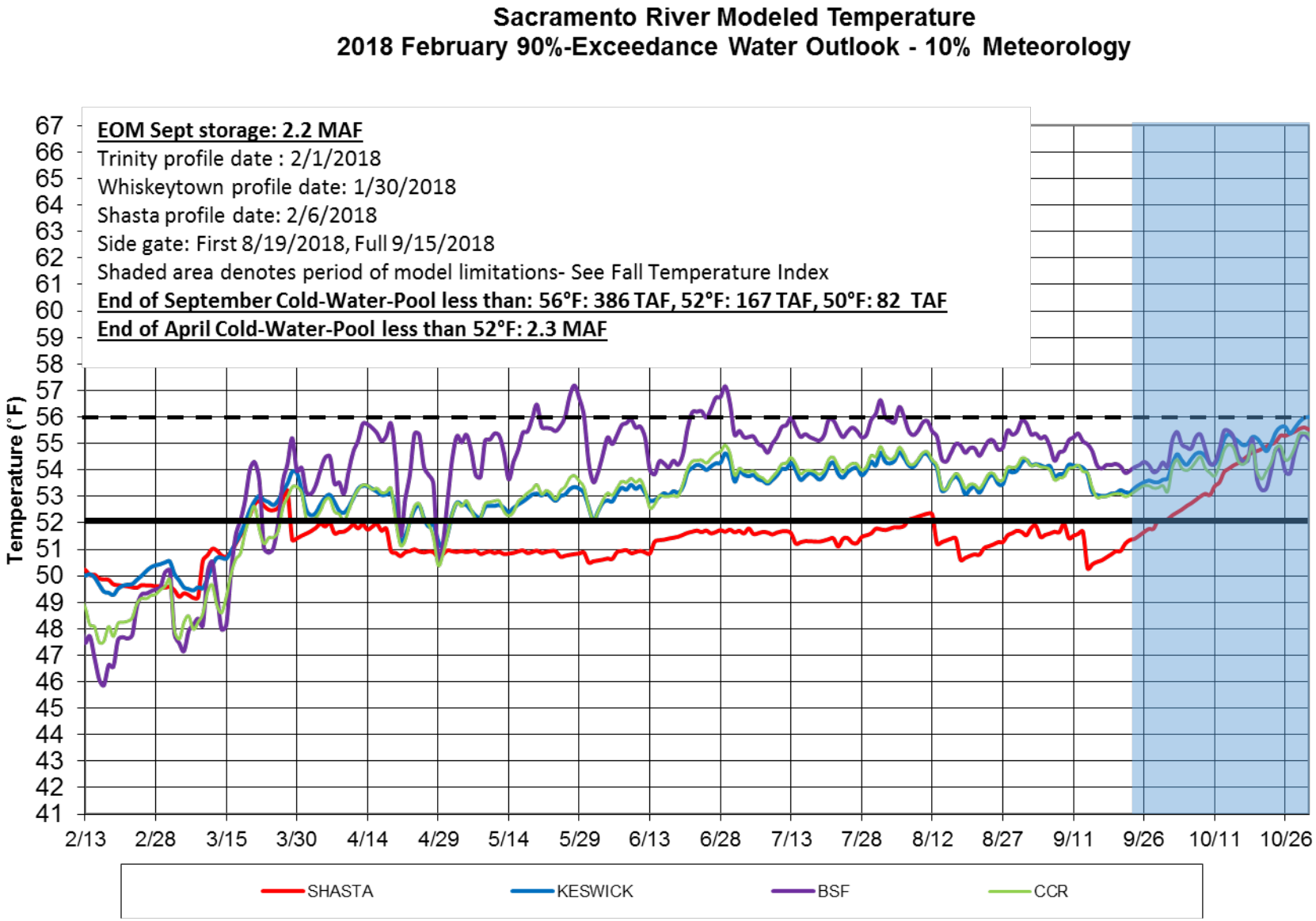
1. The latest available profiles for Shasta, Trinity, and Whiskeytown were taken on February 6, February 1, and January 30, respectively. Model results are sensitive to initial reservoir temperature conditions and the model performs best under highly stratified conditions. The February 2018 temperature profile does not yet exhibit conditions for ideal model computations (still nearly isothermal conditions). The model performs well after the reservoir stratifies, typically in late spring. The concern this year is assuming lower than actual inflow temperatures due to low snow/higher than normal air temperature conditions and not capturing the stratification with sufficient detail to project.
2. Guidance on forecasted flows from the creeks (e.g., Cow, Cottonwood, Battle, etc.) between Keswick Dam and Bend Bridge are not available beyond 5 days. Creek flows developed from the historical record that most closely reflects current conditions were used for all model runs. The resulting greater than normal creek flows cause additional warming in the upper Sacramento River during spring.
3. Operation is based on the February 2017 Operation Outlooks (monthly flows, reservoir release, and end-of-month reservoir storage) for the 90%- and 50%-exceedances. Trinity Lake inflows are updated with the CNRFC 90% runoff exceedance for both the 90% and 50% runoff exceedance studies.
4. Although mean daily flows and releases are temperature model inputs, they are based on the mean monthly values from the operation outlooks. Mean daily flow patterns are user defined and are generalized representations. It is important to note that these outlooks do not suggest a certain actual future outcome, but rather the statistical likelihood of an event occurring, including, but not limited to, projected storage and releases. Thus, the outlooks do not provide exact end of month storages or flow rates but general projections that will likely fall within the range of uncertainty based on the different hydrologic runoff conditions between the 90% and 50% runoff exceedance hydrology.
5. Cottonwood Creek flows, Keswick to Bend Bridge local flows, and ACID diversions are mean daily synthesized flows based on the available historical record for a 1922-2002 study period. Inflows were adjusted to a 75% historical exceedance for both the 90% and 50% runoff exceedance studies.
6. Meteorological inputs represent historical (1920 – 2005) monthly mean equilibrium temperature exceedance at 10% and 50% patterned after like months on a 6-hour timestep.
7. Meteorology, as well as the flow volume and pattern, significantly influences reservoir inflow temperatures and downstream tributary temperatures; and consequently, the development of the cold-water pool during winter and early spring.
8. Modified model coefficients more closely represent actual Keswick Dam temperatures. As a result, temperature predictions downstream of Keswick Dam are likely to be warmer than actual. Model re-calibrations efforts are underway.

Model Run Date February 13, 2018

Temperature Analysis Results:

Modeling runs explore Sacramento River compliance performance above Clear Creek confluence and Balls Ferry locations by varying hydrology and meteorology. The temperature results for the Sacramento River between Keswick Dam and Balls Ferry are shown in Figures 1 through 3. The relationship between end-of-September lake volume below 56°F and a Balls Ferry compliance through fall is based on the Figure 5.

Model Run	End of September Cold Water Pool <56°F (TAF)	First Side Gate	Full Side Gates
90% Hydro, 10% Met	386	8/19	9/15
90% Hydro, 50% Met	529	8/29	10/4
50% Hydro, 10% Met	602	9/5	9/24
50% Hydro, 50% Met	707	9/17	10/14


Sacramento River Modeled Temperature
2018 February 90%-Exceedance Water Outlook - 10% Meteorology
EOM Sept storage: 2.2 MAF
Trinity profile date : 2/1/2018
Whiskeytown profile date: 1/30/2018
Shasta profile date: 2/6/2018
Side gate: First 8/19/2018, Full 9/15/2018
Shaded area denotes period of model limitations- See Fall Temperature Index
End of September Cold-Water-Pool less than: 56°F: 386 TAF, 52°F: 167 TAF, 50°F: 82 TAF
End of April Cold-Water-Pool less than 52°F: 2.3 MAF
Temperature (°F)
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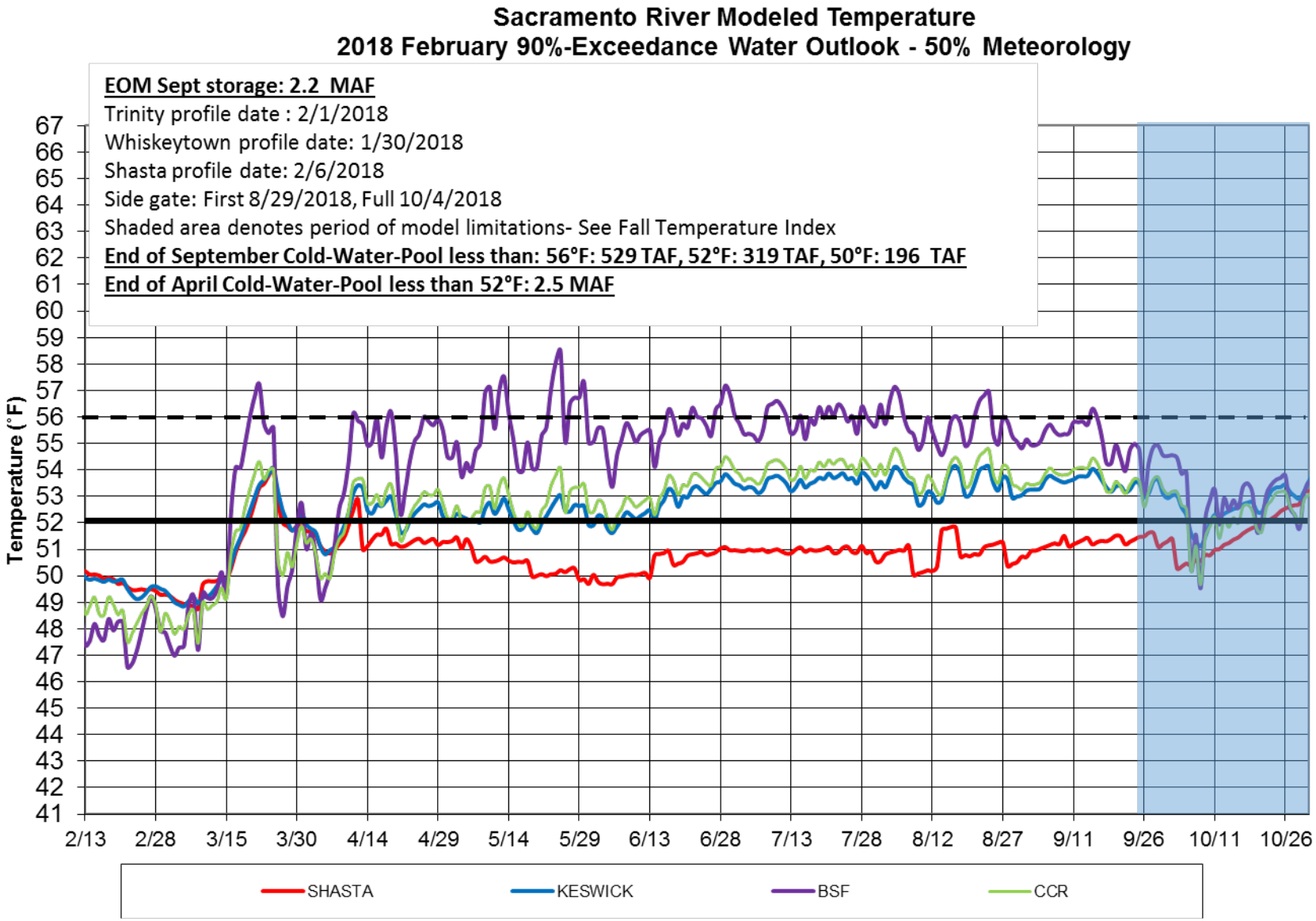
SHASTA
KESWICK
BSF
CCR

Figure 1


Sacramento River Modeled Temperature
2018 February 90%-Exceedance Water Outlook - 50% Meteorology
EOM Sept storage: 2.2 MAF
Trinity profile date : 2/1/2018
Whiskeytown profile date: 1/30/2018
Shasta profile date: 2/6/2018
Side gate: First 8/29/2018, Full 10/4/2018
Shaded area denotes period of model limitations- See Fall Temperature Index
End of September Cold-Water-Pool less than: 56°F: 529 TAF, 52°F: 319 TAF, 50°F: 196 TAF
End of April Cold-Water-Pool less than 52°F: 2.5 MAF
Temperature (°F)
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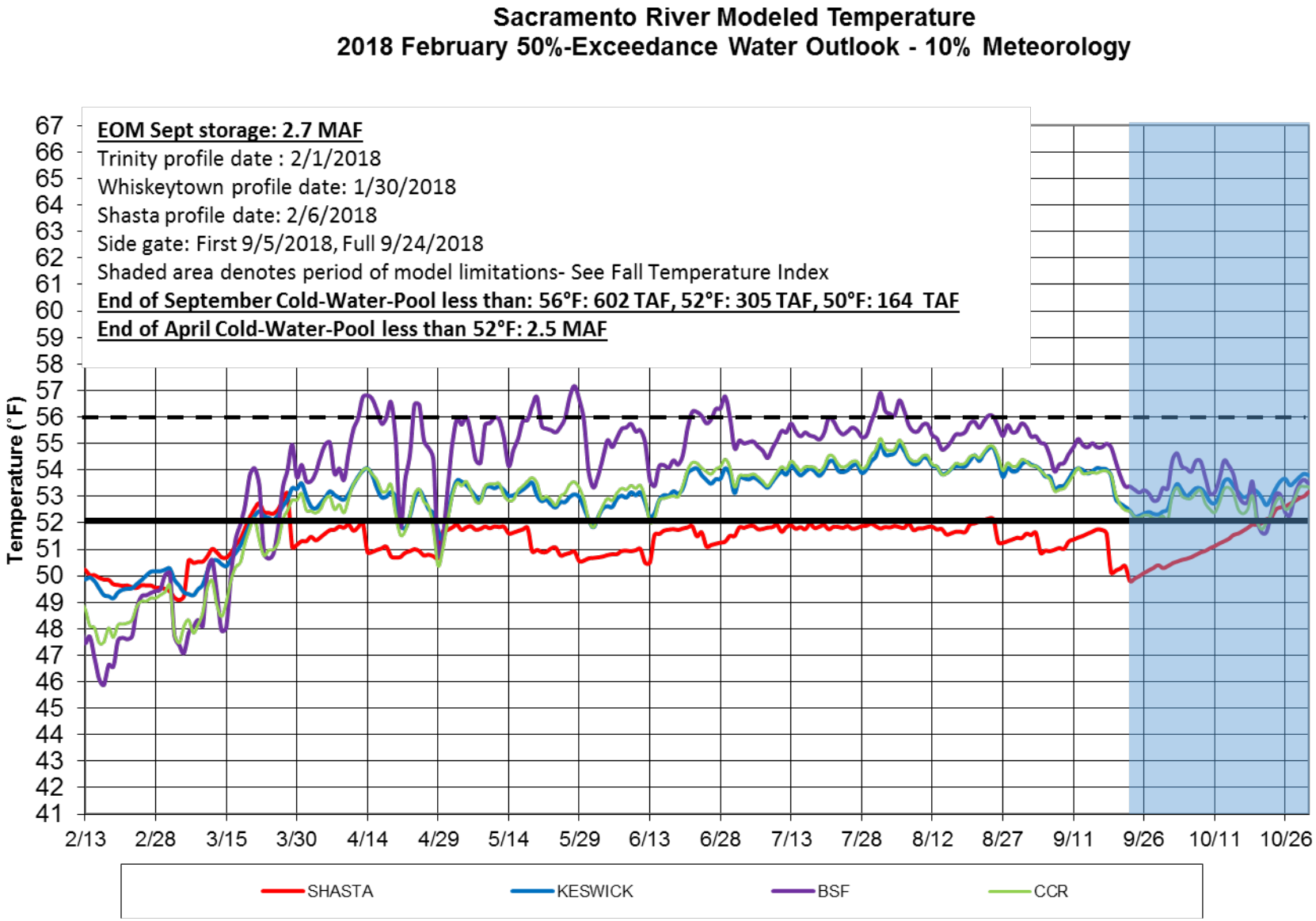
SHASTA
KESWICK
BSF
CCR

Figure 2


Sacramento River Modeled Temperature
2018 February 50%-Exceedance Water Outlook - 10% Meteorology
EOM Sept storage: 2.7 MAF
Trinity profile date : 2/1/2018
Whiskeytown profile date: 1/30/2018
Shasta profile date: 2/6/2018
Side gate: First 9/5/2018, Full 9/24/2018
Shaded area denotes period of model limitations- See Fall Temperature Index
End of September Cold-Water-Pool less than: 56°F: 602 TAF, 52°F: 305 TAF, 50°F: 164 TAF
End of April Cold-Water-Pool less than 52°F: 2.5 MAF
Temperature (°F)
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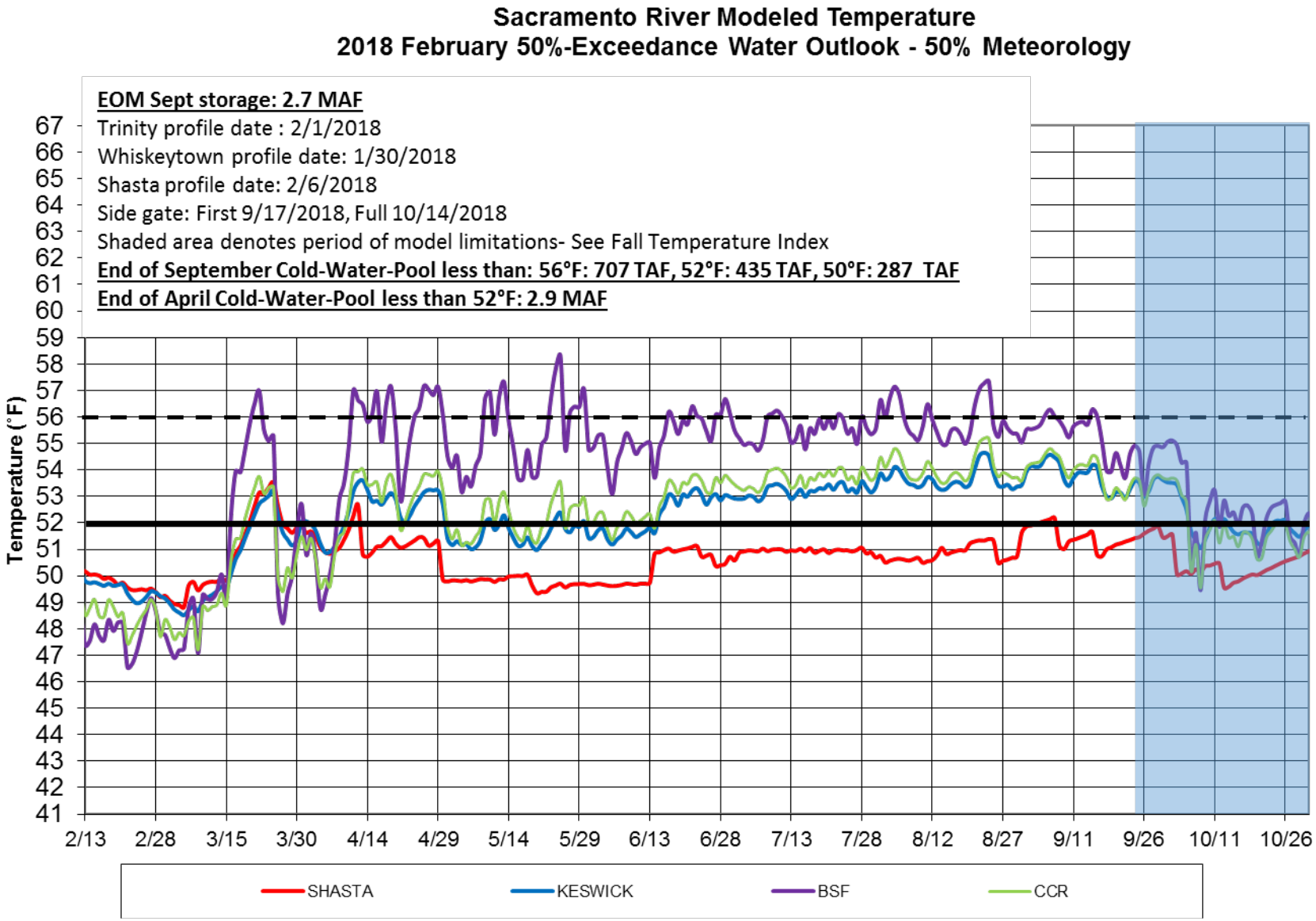
KESWICK
BSF
CCR

Figure 3


Sacramento River Modeled Temperature
2018 February 50%-Exceedance Water Outlook - 50% Meteorology
EOM Sept storage: 2.7 MAF
Trinity profile date : 2/1/2018
Whiskeytown profile date: 1/30/2018
Shasta profile date: 2/6/2018
Side gate: First 9/17/2018, Full 10/14/2018
Shaded area denotes period of model limitations- See Fall Temperature Index
End of September Cold-Water-Pool less than: 56°F: 707 TAF, 52°F: 435 TAF, 50°F: 287 TAF
End of April Cold-Water-Pool less than 52°F: 2.9 MAF
Temperature (°F)
67
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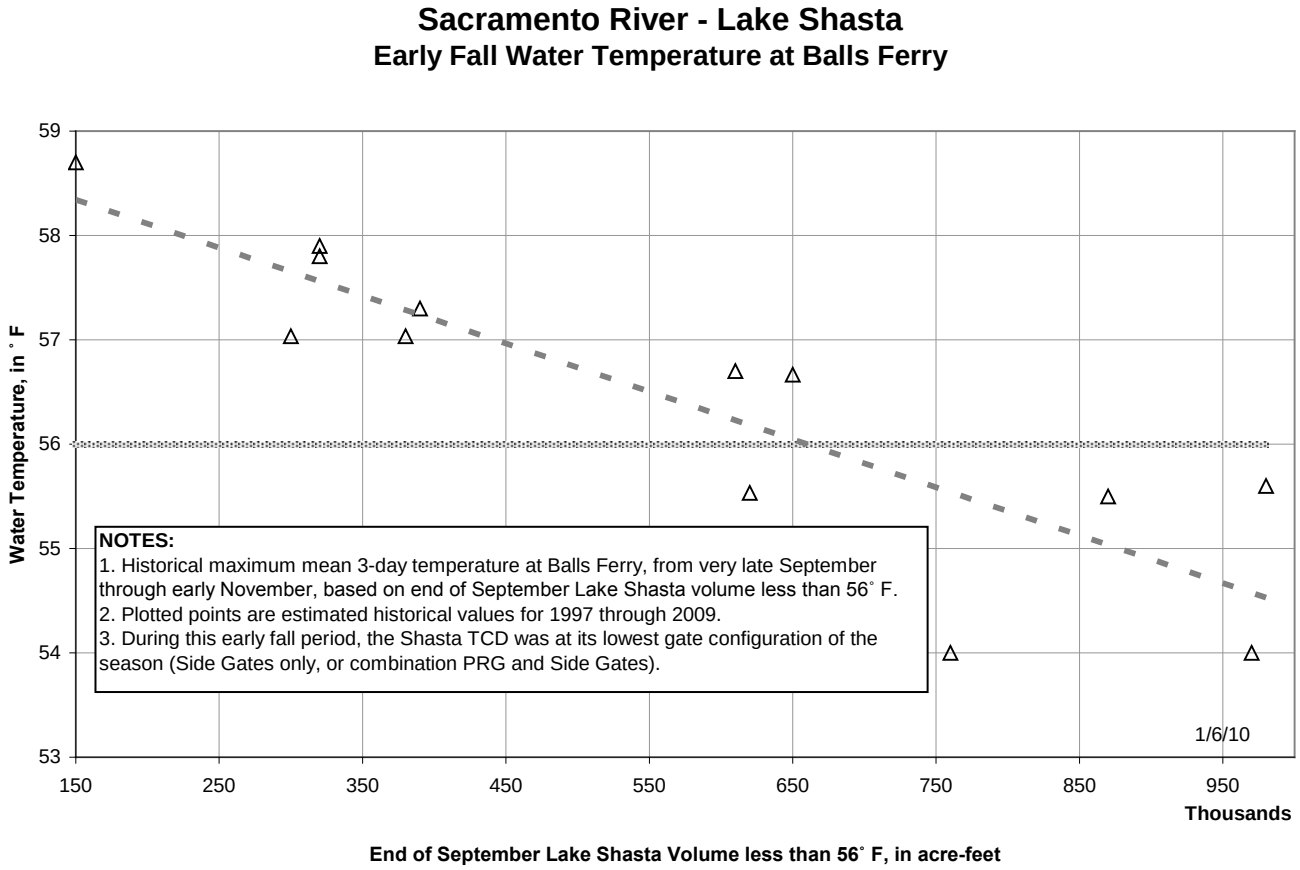
SHASTA
KESWICK
BSF
CCR

Figure 4

Figure 5 Model Performance and Fall Temperature Index:

1. Based on past analyses, the temperature model does not perform well in late September and October. One factor is that the modeled release temperatures are cooler than has historically been achieved when all release is through the side gates (lowest gates), especially when there's a large temperature gradient between the pressure relief gates (PRG) and the side gates.
2. Based on historical records, the end-of-September Lake Shasta volume below 56˚F is a good indicator of fall water temperature in the river reach to Balls Ferry.
3. For river temperatures not to exceed 56 ˚F downstream to Balls Ferry, the end-of-September lake volume less than 56˚F should be greater than about 600 TAF, see chart below:



Enclosure 3

RECLAMATION
Managing Water in the West

Central Valley Project Municipal and Industrial Water Shortage Policy Guidelines and Procedures
EFFECTIVE DATE: FEBRUARY 1, 2017

INTRODUCTION

The Bureau of Reclamation (Reclamation) prepared the Central Valley Project (CVP) Municipal and Industrial (M&I) Water Shortage Policy (WSP) Environmental Impact Statement (EIS) to evaluate the potential impacts of CVP M&I WSP alternatives. A Record of Decision was signed on November 13, 2015, to implement Alternative 4 (Appendix A), Updated M&I WSP (preferred alternative). The purposes of the M&I WSP are to:

- Define water shortage terms and conditions for applicable CVP Contractors.
- Determine the quantity of water made available to CVP Contractors from the CVP that; together with the M&I Contractors' drought water conservation measures and other Non-CVP water supplies, would assist the M&I Contractors in their efforts to protect public health and safety (PHS) during severe or continuing droughts.
- Provide information to Contractors for their use in water supply planning and development of drought contingency plans.

APPLICABILITY

These guidelines apply to Contractors whose CVP contracts (Contracts) reference the M&I WSP. A complete listing of Contractors subject to the M&I WSP is located in Appendix B of this document.

PURPOSE

Reclamation developed these guidelines to ensure consistent and equitable implementation of the M&I WSP throughout the CVP for those Contractors subject to the M&I WSP. These guidelines primarily focus on the administrative process and calculations of PHS and possible adjustments to a Contractor's Historical Use.

GENERAL

The M&I WSP is intended to provide clear and objective guidelines on the water supplies available from the CVP during a Condition of Shortage, thereby allowing CVP Contractors to know when, and by how much, water deliveries may be reduced in drought and/or other low water supply conditions. The M&I WSP will help Contractors better plan for and manage available CVP water supplies and better integrate the use of CVP water with other available Non-CVP water supplies.

For any given water year, the Allocation of CVP water supplies is based upon forecasted reservoir inflows and Central Valley hydrologic conditions, amounts of storage in CVP reservoirs, regulatory requirements, and management of Section 3406(b)(2) resources and refuge water supplies in accordance with implementation of the Central Valley Project Improvement

Act (CVPIA). In some cases, M&I water shortage Allocations may differ between CVP divisions due to regional CVP water supply availability, system capacity, or other operational constraints.

Under a Condition of Shortage, Contractors may experience unique circumstances that are not addressed in these guidelines. Reclamation will work with Contractors to address these unique circumstances as they occur.

To ensure continued compliance with applicable federal and state laws, federal authorities, and CVP operational plans, Reclamation will update or revise these guidelines as necessary.

DEFINITIONS

For the purposes of these guidelines, the following definitions apply:

Allocation- CVP water made available pursuant to a Contractor's Contract, typically expressed as a percentage of Contract Total.

Annual M&I Water Information Request - The letter sent to the Contractor (usually prior to the contract year and initial Allocation) requesting review and concurrence of data and information necessary to calculate PHS needs.

Contractor - An entity having a Contract with the United States for the use of CVP Water pursuant to Federal Reclamation law.

Service or Boundary Area - The area to which the Contractor is permitted to provide CVP Water as described in their Federal contract(s).

Contracting Officer - The Secretary of Interior's duly authorized representative acting pursuant to the contract held between Reclamation and the Contractor.

Condition of Shortage - Periods during any Year when the Contracting Officer is unable to deliver sufficient water to meet the Contract Total.

Contract Total - The maximum amount of water to which the Contractor is entitled pursuant to the terms of the Contract.

Central Valley Project Water (CVP water)- All water that is developed, diverted, stored, or delivered by the Secretary of the Interior in accordance with the statutes authorizing the CVP and in accordance with the terms and conditions of water rights acquired by Reclamation pursuant to California law.

Non-CVP Water –Water from sources other than the CVP used to satisfy M&I demand within the Contractor's Service Area.

Historical Use- The average quantity of CVP water put to beneficial use, within the Contractor's CVP Service Area, during the last three years of unconstrained CVP water deliveries.

Projected Demand- A quantity of water calculated based on what the Commercial, Industrial, and Institutional (CII) need is at the time of a Condition of Shortage.

Public Health and Safety Needs - The amount of water determined to be necessary to sustain PHS.

Public Health and Safety Adjustment - An adjustment to a Contractor's declaration of CVP water made available to assist in meeting unmet PHS needs.

Reduction Credit - The amount of water subtracted from a long-term, newly developed Non-CVP supply available to meet PHS needs.

Standard Criteria- The criteria developed by Reclamation in response to the Central Valley Project Improvement Act of 1992 (CVPIA), Public Law 102-575, and in accordance with the Reclamation Reform Act of 1982, Public Law 97-293, for the development and implementation of Water Management Plans.

Urban Water Management Plan (UWMP) - The 1985 California Urban Water Management Planning Act required M&I users with more than 3,000 connections or use of more than 3,000 acre-feet (AF) per year to prepare an UWMP. The UWMP must include existing and projected water supplies and demands, water supply Allocations, comparison of supplies and demands, water demand management program (conservation), wastewater recycling, and water shortage contingency plans.

Water Management Plan (WMP)- As described in the Central Valley Project Improvement Act, Public Law 102-575, (CVPIA)WMPs completed under the 1982 Reclamation Reform Act include the implementation of all cost effective Best Management Practices that are economical and appropriate, including measurement devices, pricing structures, demand management, public information, and financial incentives.

Year- The period from and including March 1 of each Calendar Year through the last day of February of the following calendar year.

GUIDELINES FOR IMPLEMENTING THE M&I WSP:

A. **HISTORICAL USE ADJUSTMENTS:** During a Condition of Shortage, M&I CVP Allocations are based on a Contractor's Historical Use. At a Contractor's request, Reclamation will consult with the Contractor to consider an adjustment to their Historical Use. Historical Use adjustments are based on the following criteria:
    a. Population Growth
    b. Extraordinary Water Conservation Measures
    c. Use of Non-CVP water
    d. Other Unique or Unusual Circumstances

Alternative 4 of the M&I WSP's final EIS outlines the implementation procedures for Historical Use adjustments.

1. For an M&I Contractor to be eligible for a Historical Use adjustment, the Contractor, if required by federal or state law, must be actively implementing a Reclamation approved WMP that meets the current CVPIA Standard Criteria; measuring such water consistent with section 3405(b) of the CVPIA; have an established operating drought contingency plan designed to protect PHS; and demonstrate a 'need' for additional water.

2. Any requests for a Historical Use adjustment must be submitted to Reclamation, in writing, within 30 days after the Contractor receives Reclamation's annual initial declaration of CVP water being made available under their Contract. Reclamation's review shall be contingent upon the Contractor providing appropriate data and documentation for the adjustment.

B. PUBLIC HEALTH AND SAFETY: The amount of water determined to be necessary to sustain PHS is currently calculated to equal *D+ CI + I + L*
Where[1]:
[2]Domestic use (D) = Current Population X 55 gallons per capita per day[3]
Commercial and Institutional (CI) = 70% of Projected Commercial Demand
Industrial (I) = 70% of Projected Industrial Demand
System (Conveyance) Losses (L) = 10%

Based on the severity of the Condition of Shortage, Reclamation may adjust the CI, and I percentages of demands to ensure domestic use needs are met throughout the CVP.

The following guidelines only apply when Contractors are receiving a PHS Allocation.

1. CII Demand calculation: For the purposes of a PHS calculation, CII demand will be based on previous CII water use as reported in the most recent UWMP, WMP, or the Contractor's previous year reporting response under the Annual M&I Water

[1] If the State's criteria changes in any given year, then Reclamation would modify this equation to remain consistent with the State's approach.
[2] Multi-family residential units are not to be included in CII calculations. Residential water use for multi-family housing units and incidental domestic use for those living on agricultural parcels is taken into account under population and domestic use. For purposes of this document, the definitions in California Water Code Section 10608.12 of CII users apply. "Commercial water user means a water user that provides or distributes a product or service. Industrial water user means a water user that is primarily a manufacturer or processor of materials as defined by the North American Industry Classification System code sectors 31 to 33, inclusive, or an entity that is a water user primarily engaged in research and development. Institutional water user means a water user dedicated to public service. This type of user includes, among other users, higher education institutions, schools, courts, churches, hospitals, government facilities, and nonprofit research institutions."
[3] The per capita water demand rate used to calculate the PHS need shall be consistent with State law. The 55 gallons per capita demand value reflects the requirements defined in California State Senate Bill SBx 7-7. Reclamation may adjust this value over time to reflect future changes in State law. If State criteria does not exist, the contractor will apply criteria developed by Reclamation (in consultation with the contractor) that will be consistent with relevant criteria used by similarly situated California M&I water entities.

Information Request from Reclamation. If a PHS adjustment is requested, the Contractor must provide the Contracting Officer sufficient justification and documentation for the adjustment. Part of this documentation shall include the annual reports of CII use filed through the State Water Resources Control Board's annual reporting for public water systems from previous years. If CII use is not reported in an UWMP or WMP, Reclamation and the Contractor will need to agree on an appropriate method for calculating demand.

2. Water Sources Available to Contractor: During a Condition of Shortage, Reclamation will make CVP water available for delivery to M&I Contractors consistent with the M&I WSP. Contractors are expected to use their CVP water in conjunction with other available water supplies. In considering other water supplies available to the Contractor, the following apply:

    a. Any water (CVP or Non-CVP water) acquired via a short-term water transfer (a transfer of one year or less) during a Condition of Shortage will not be counted as an available water source to meet the PHS needs.

    b. Any water acquired via a long-term transfer (agreements that are more than one year) will be considered an available supply to the Contractor to meet PHS needs, unless such water is CVP water used in calculating the Historical Use of the buyer.

    c. Water transfers made by a Contractor (as the seller) will be counted as water available to the Contractor, unless it's a long-term transfer considered as an available source to a buyer. Long-term CVP transfers where CVP water is calculated as part of a buyer's Historical Use will not be considered an available supply to the seller.

    d. With prior approval from the Contracting Officer, in a year preceding an anticipated PHS year, a Contractor may acquire water (through exchange or transfer) for carryover purposes (in facilities not operated as part of the CVP) to use in the Condition of Shortage for PHS needs. This water will be exempt from calculating supplies available to meet PHS needs. This exemption will only be valid for the Contract year immediately following the acquisition.

    e. Developed non-potable water supplies (water that cannot be properly treated for human consumption) will not be considered for meeting domestic needs. However, the developed non-potable supplies will be included as water available to meet non-potable CII demands, as appropriate. This may include, but is not limited to, recycled water, stormwater runoff, agricultural drainage water, and greywater.

    f. Water supplies required to meet environmental purposes by permit, water rights, or other legal or contractual obligations and are not otherwise available to meet M&I demands, will not be considered available to meet PHS needs.

g. At the sole discretion of the Contracting Officer, the Contracting Officer may exempt water supplies developed and used only during a Condition of Shortage. Such water supplies are developed to minimize losses and damages resulting from drought and are limited to actions that are temporary in nature. Temporary actions may include, but are not limited to, emergency pumps and pipes and the construction of temporary facilities for the conveyance or treatment of water. If a Contractor continues to use the developed water beyond a Condition of Shortage, the developed supply will be counted as available water supply to the Contractor in future years.

h. Water available to meet PHS needs must be operationally available to the Contractor; e.g. water in a reservoir dead pool (water that is too low for release or below intakes), water that cannot be contractually returned from a groundwater bank, or water that is only permitted or licensed for agriculture/irrigation is not considered an available supply.

i. Contractors that operate their own surface water reservoirs (reservoirs not operated as part of the CVP) will be allowed to exempt an amount of surface water stored in reservoirs from available supplies equal to six months of the Contractor's PHS demand. At the sole discretion of the Contracting Officer, the Contracting Officer may adjust this quantity on a case by case basis if an operating plan, a drought plan, a Record of Decision for operations, or an UWMP or WMP outlines a different policy or approach for carryover storage.

    a. Water acquired or developed in 2.d or 2.g above will not be counted in the exemption of 2.i, if such water described in 2.d and 2.g remains in storage. For example, a Contractor's six month PHS demand is 50,000 AF. Under 2.g, the Contractor has 15,000 AF in storage and 2,000 AF acquired under the conditions of 2.d also in storage; therefore, 17,000 (15,000 + 2,000) AF would not be counted as part of the 2.i exemption. In this example, the Contractor can exempt 67,000 AF of supplies stored in their own reservoir (50,000 AF + 17,000 AF).

j. Groundwater that cannot be treated or blended to meet Environmental Protection Act minimum standards under the Safe Water Drinking Act shall not be considered to meet domestic use needs, but may be used to meet certain CII needs, if appropriate.

k. To encourage drought resiliency and the development of long-term, Non-CVP water supplies in a Contractor's Service or Boundary Area, the Contracting Officer, on a case-by- case basis, <u>may</u> issue reduction credits towards the available water supplies to the Contractor. Reduction credits may not exceed 10 percent of the developed supply and will only pertain to water supplies developed after the enactment of the M&I WSP.

a. It is the sole responsibility of the Contractor to provide sufficient documentation and data to the Contracting Officer to determine if reduction credits will be issued.

3. Conditions of PHS Adjustments: If Reclamation allocates additional water beyond the Historical Use Allocation to meet PHS needs (PHS adjustment), the following conditions will apply:

a. Requests for a PHS adjustment must be submitted within 30 days of the Contractor receiving the initial declaration of CVP water made available under the Contractor's Contract. If allocations are decreased after the initial declaration, the Contractor will have 15 days after the decreased allocation notification to submit a request for a PHS adjustment.

b. The Contractor shall not be allowed to transfer any portion of their CVP supply during the Contract year in which the PHS adjustment occurred.

c. If the Contractor transferred/sold water prior to a PHS adjustment (during the same Contract year when the PHS adjustment occurs), the PHS adjustment will be reduced by the gross quantity transferred.

d. Exchanges will be considered on a case-by-case basis. However, exchanges will only be allowed if the exchange occurs during the same Contract year of the Condition of Shortage. Exchanges of CVP water must be done at a minimum of one unit of CVP water to one unit of Non-CVP water (one acre-foot for one acre-foot), meaning that the CVP water exchanged must be equal to or less than the Non-CVP water being received. Under no circumstance will a Contractor receiving a PHS adjustment be allowed to exchange CVP water for a lesser quantity of water in return.

e. The Contracting Officer may provide exceptions for B.3.a-B.3.c. if the transfer or exchange is needed to fulfill a previous contractual obligation that must be met during the Condition of Shortage.

f. There will be no carryover or rescheduling of water made available through a PHS adjustment. The PHS adjustment is only available to the Contractor during the Contract year in which the adjustment is made.

C. Determining Allocations for Contracts with Irrigation and M&I Water Supplies: Several Reclamation Contractors have both irrigation and M&I water supplies contracts (mixed contract); however, there is not a quantity of water associated for each use under contract. In most water service contracts, it states, "Project water furnished under this contract will be allocated in accordance with the then-existing Project M&I Water Shortage Policy. Under the M&I WSP, irrigation allocations for mixed contracts will be calculated as follows:

(Total Contract Quantity – M&I Historical Use) X Irrigation Allocation Percentage =

Irrigation Water Available Under Contract (expressed as a quantity)

For example:
Total Contract Supply = 10,000 AF
Three Year M&I Historic Use = 2,000 AF
Irrigation Allocation Percentage = 50%

Irrigation allocation: (10,000 AF – 2,000 AF) * 50% = 4,000 AF for irrigation water available under contract.

Appendix A: Central Valley Project Municipal and Industrial Water Shortage Policy Guidelines and Procedures

Appendix M

Alternative 4: Updated M&I WSP

Mission Statements

The mission of the Department of the Interior is to protect and provide access to our Nation's natural and cultural heritage and honor our trust responsibilities to Indian Tribes and our commitments to island communities.

The mission of the Bureau of Reclamation is to manage, develop, and protect water and related resources in an environmentally and economically sound manner in the interest of the American public.

Contents

Tables

Figures

Attachment

Abbreviations and Acronyms

AF	acre-foot
AHU	Adjusted Historical Use
BMPs	Best Management Practices
CUWCC	California Urban Water Conservation Council
CVP	Central Valley Project
CVPIA	Central Valley Project Improvement Act
EA	Environmental Assessment
gpcd	gallons per capita demand
gpd	gallons per day
M&I	municipal and industrial
PHS	public health & safety
Reclamation	Bureau of Reclamation
UWMP	urban water management plan
WMP	water management plan
WSP	Water Shortage Policy

Chapter 1
Introduction

The Central Valley Project (CVP) Municipal and Industrial (M&I) Water Shortage Policy (WSP) and implementation guidelines are intended to provide detailed, clear, and objective guidelines for the distribution of CVP water supplies during a Condition of Shortage, thereby allowing CVP water service contractors to know when, and by how much, water deliveries may be reduced in drought and other low water supply conditions. This increased level of clarity and understanding is needed by water managers and the entities that receive CVP water to better plan for and manage available CVP water supplies, and to better integrate the use of CVP water with other available non-CVP water supplies.

Allocation of CVP water supplies for any given water year is based upon forecasted reservoir inflows and Central Valley hydrologic conditions, amounts of storage in CVP reservoirs, regulatory requirements, and management of Section 3406(b)(2) resources and refuge water supplies in accordance with implementation of the Central Valley Project Improvement Act (CVPIA). In some cases, M&I water shortage allocations may differ between CVP divisions due to regional CVP water supply availability, system capacity, or other operational constraints.

The M&I WSP does not apply to: 1) CVP water service or repayment contractors with contracts that do not reference the M&I WSP; 2) settlement, exchange, or other types of contracts or agreements in satisfaction of senior water rights; or 3) CVPIA refuge contracts.

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Chapter 2
CVP M&I Water Shortage Policy

The proposed CVP M&I WSP is presented below. It is similar to the Draft 2001 policy with some modifications made to reflect Alternative 1B in the 2005 Environmental Assessment (EA) and Finding of No Significant Impact and comments received from water service contractors and other stakeholders. These modifications include:

- Deleted reference to the 1996 M&I Water Rates book;
- Replaced the two tables in Terms and Conditions 4 and 5 of the draft 2001 policy with Table 3-5 (Alternative 1B) from the 2005 EA;
- Removed the provision for "75 percent of M&I reliability" since the 2005 EA's Table 3-5 alters this provision;
- Expanded definitions to provide greater clarification of key terms;
- Amended the methodology used to make adjustments to contractors' historical use;
- Removed assumption that the use of CVP water was viewed as supplemental to non-CVP supplies;
- Added recycled water as non-CVP supply, subject to Reclamation approval; and
- Clarified M&I allocation for contracts with both irrigation and M&I use which do not set forth individual Contract Totals for each use.

Chapter 3 contains associated guidelines to provide additional clarification on the implementation process.

2.1 Central Valley Project M&I Water Shortage Policy

The CVP is operated under Federal statutes authorizing the CVP and the terms and conditions of water rights acquired pursuant to California law. During any year, there may be constraints on the availability of CVP water for an M&I contractor. The purposes of the M&I WSP are to:

- Define water shortage terms and conditions for applicable CVP water service contractors, as appropriate.

- Determine the quantity of water made available to CVP water service contractors from the CVP that, together with the M&I water service contractors' drought water conservation measures and other non-CVP water supplies, would assist the M&I water service contractors in their efforts to protect public health and safety (PHS) during severe or continuing droughts.

- Provide information to water service contractors for their use in water supply planning and development of drought contingency plans.

Currently, many M&I contractors are not using their full M&I Contract Total. If the M&I water shortage allocation were applied to full Contract Totals, the resulting allocation for some contractors would exceed their current demand. Therefore, in water short years, allocation for M&I are based on historical use. M&I water demands within the CVP are continually increasing. The Bureau of Reclamation (Reclamation) recognizes that as water conservation measures are implemented there is a hardening of demand that lessens an M&I contractor's ability to reduce demand during shortages.

The capability of the CVP to meet the water supply allocations addressed by this M&I WSP is subject to the availability of CVP water supplies. In any given year, M&I water shortage allocations may differ between CVP divisions due to regional CVP water supply availability, system capacity, or operational constraints. Generally, the supply allocation (percentage) to the various divisions will be the same, unless specific constraints require otherwise.

Reclamation explored the concept of two tiers of M&I water supply reliability as proposed by contractors in the CVPIA Administrative Proposal on Urban Water Supply Reliability. Although Reclamation determined not to adopt two tiers, it will facilitate the sale of CVP water from willing sellers to M&I contractors when necessary.

2.1.1 Definitions

Adjusted For Growth - An adjustment to the contractor's historical use quantity to account for increased demand within the contractor's service area to include (but not be limited to) increases due to population growth and to the number or demand of industrial, commercial, and other entities the contractor serves, based upon the submittal of required supporting documentation to Reclamation.

Adjusted For Extraordinary Water Conservation Measures - An adjustment to the contractor's historical use quantity to account for conservation measures that exceed applicable best management practices (BMPs) adopted by the California Urban Water Conservation Council (CUWCC). A water

conservation measure considered extraordinary in one Year[1] may be a mandatory BMP in a subsequent Year and thus would no longer be considered extraordinary.

Adjusted For Non-CVP Water - An adjustment to the contractor's historical use quantity to account for water sources other than the CVP supplies used to satisfy M&I demand within the contractor's service area, subject to written documentation from the contractor that shows the extent to which use of the non-CVP water actually reduced the contractor's use of CVP water in the last three unconstrained years. A contractor must show that the non-CVP water used in last three unconstrained years reduced the use of CVP water in these years. Non-CVP supplies may include surface water, groundwater, local storage, recycled water (subject to Reclamation approval), and other Reclamation-approved non-CVP supplies. Attachment A provides information on the documentation required by an M&I water service contractor when requesting an adjustment to historical use based on the use of non-CVP supplies in lieu of CVP water supplies.

Agricultural Contractor - A water service contractor delivering water supplies for use in agricultural production, as defined in CVP contracts. Some CVP agricultural water service contractors also deliver M&I supplies.

Condition of Shortage - Periods when Reclamation is unable to deliver the Contract Total pursuant to the terms and conditions of CVP water service, water rights settlement, and/or repayment contracts. Reclamation can determine a Condition of Shortage exists based on various factors, including low water supply conditions during drought periods or severe hydrological conditions, CVP system operational constraints associated with legal decisions, regulatory requirements, and hydrologic reductions. A Condition of Shortage may also be regional and not CVP-wide. For example, limitations on the CVP ability to convey water across the Delta in accordance with State Water Resources Control Board (SWRCB) orders and decisions can result in a Condition of Shortage for CVP water contractors located south of the Delta as compared to CVP water users located north of the Delta.

Contract Total – the maximum amount of water to which the Contractor is entitled pursuant to the terms of the Contractor's water service or repayment contract.

Drought Contingency Plan - A plan provided to Reclamation by each contractor designed to protect public health and safety. The contractor may provide a copy of its urban water management plan (UWMP) or water management plan (WMP) to Reclamation in lieu of a separate drought contingency plan so long as the UWMP or WMP contains the contractor's drought contingency plan.

[1] Water service contractor Year is defined as March 1 of each calendar year through the last day of February of the following calendar year.

Extraordinary Water Conservation Measures - Conservation measures that exceed applicable BMPs, or approved alternative, adopted by the CUWCC. A water conservation measure considered extraordinary in a given year may be a mandatory BMP in a subsequent year and thus would no longer be considered extraordinary.

Historical Use - The average quantity of CVP water put to beneficial use within the service area during the last three years of water deliveries that were unconstrained by the availability of CVP water. At the contractor's request, Reclamation will review documentation for adjustment of the historical use for population growth, extraordinary water conservation measures, or use of non-CVP water supplies. Also, Reclamation may agree to adjust the historical use on the basis of unique circumstances, after consultation with the contractor.

Irrigation Water Contactor - See "Agricultural Contractor"

M&I Water Contractor - A water service contractor delivering water supplies to water users or retailers serving residential, non-agricultural commercial, industrial, and municipal water users. Some CVP M&I water service contractors also deliver agricultural supplies.

Non-CVP Water - Water from sources other than the CVP used to satisfy M&I demand within the contractor's service area, subject to written documentation from the contractor that shows the extent to which use of the non-CVP water actually reduced the contractor's use of CVP water in the unconstrained years. Example sources may include, but are not limited to, local surface water supplies; water rights water; groundwater; transfer water; and, recycled water, subject to Reclamation approval.

PHS Needs - The amount of water determined to be necessary to sustain public health and safety, calculated with the formula in Section 3.3, which may be revised in the future to remain consistent with the State of California's approach. During a Condition of Shortage, Reclamation will strive to make CVP water available for delivery to M&I water service contractors at not less than their unmet PHS need, in conjunction with their use of CVP allocations and other available non-CVP supplies, subject to the availability of CVP water supplies, if: a) the Governor declares an emergency due to water shortage applicable to that contractor; or b) Reclamation, in consultation with the contractor, determines that an emergency exists due to water shortage. At that time, the PHS need would be determined by the contractor and reviewed and approved by Reclamation prior to an adjustment to a contractor's allocation in order to assist in meeting unmet PHS need.

Shortage Allocation - Refers to the allocation of CVP water during a Condition of Shortage, pursuant to the water allocation amounts prescribed in the CVP M&I WSP. The allocation of water is based on the availability of CVP supplies and Reclamation's ability to convey water.

Unconstrained Year – A year in which the M&I water supply allocation is 100 percent of Contract Total by the final allocation announcement.

Urban Water Management Plan - The 1985 California Urban Water Management Planning Act required M&I users with more than 3,000 connections or use of more than 3,000 acre-feet (AF) per year to prepare a UWMP. The UWMP must include existing and projected water supplies and demands, water supply allocations, comparison of supplies and demands, water demand management program (conservation), wastewater recycling, and water shortage contingency plans.

Water Management Plan - As described in CVPIA, WMPs completed under the 1982 Reclamation Reform Act include the implementation of all cost-effective BMPs that are economical and appropriate, including measurement devices, pricing structures, demand management, public information, and financial incentives.

2.1.2 Terms and Conditions

1. During a Condition of Shortage, allocation of M&I water will be based on a contractor's historical use of CVP M&I water. At the contractor's request, Reclamation will consult with the contractor to adjust the contractor's historical use on the basis of: a) *growth*; b) *extraordinary water conservation measures;* and c) *use of non-CVP water*, subject to Term and Condition 3. Reclamation will adjust the historical use to reflect the effect of non-CVP water used in lieu of use of the contractor's CVP water. Crediting for this non-CVP water will be based on 1 AF for 1 AF, unless Reclamation and the contractor agree otherwise after considering unique circumstances. The contractor must fully document use of non-CVP water to clearly demonstrate how much of that water use actually reduced the contractor's use of CVP water in unconstrained years, and submit the documentation in writing to Reclamation when requesting an adjustment (see Attachment A).

2. For an M&I contractor to be eligible for adjustment to its CVP water supply, the contractor's water service contract must reference the M&I WSP. In addition, the CVP contractor must: a) have developed and be implementing a water conservation plan that meets the current CVPIA criteria; b) be measuring such water consistent with section 3405(b) of the CVPIA; c) have and be implementing a drought contingency plan designed to protect public health and safety; and d) demonstrate a 'need' for additional water. Reclamation intends to incorporate a provision in all new, renewed, and amended CVP contracts that references the CVP M&I WSP.

4. Before allocation of M&I water to a contractor will be reduced, allocation of irrigation water will be reduced below 75 percent of Contract Total, as shown in Table 1.

Table 1: Allocation of Irrigation and M&I Water Supply Under a Condition of Shortage

Irrigation Allocation (% of contract entitlement)	M&I Allocation [1]
< 100%	100% (Contract Total)
95%	100%
90%	100%
85%	100%
80%	100%
75%	100%
	M&I Allocation (% of historical use)
70%	95%
65%	90%
60%	85%
55%	80%
50%-25%	75% [2]
20%	70% [2]
15%	65% [2]
10%	60% [2]
5%	55% [2]
0%	50% [2, 3]

(1) For any contract for both irrigation and M&I uses which does not set forth individual Contract Totals for each use, the M&I allocation will be determined by historical use.

(2) Subject to PHS considerations described in Implementation Guidelines.

(3) Nothing in this policy prevents M&I allocation from being reduced below 50% if CVP water availability is insufficient to meet the 50% allocation

5. When allocation of irrigation water has been reduced below 75 percent and still further water supply reductions are necessary, both the M&I and irrigation allocations will be reduced by the same percentage increment. The M&I allocation will be reduced until it reaches 75 percent of historical use, and the irrigation allocation will be reduced until it reaches 50 percent of irrigation Contract Total. The M&I allocation will not be further reduced until the irrigation allocation is reduced to below 25 percent of Contract Total, as shown in Table 1.

6. When allocation of irrigation water is reduced below 25 percent of Contract Total, Reclamation will reassess both the availability of CVP water supply and CVP water demand.

7. Reclamation will strive to deliver CVP water to M&I water service contractors at not less than the amount needed to meet PHS need, taking into consideration contractors' CVP allocations and available non-CVP supplies, provided CVP water is available, if (a) the Governor declares an emergency due to water shortage applicable to that contractor or (b) Reclamation, in consultation with the contractor, determines that an emergency exists due to

water shortage. The contractor will calculate the PHS need using the criteria in Section 3.3 or the most current, which will remain consistent with the State of California's approach, and submit the calculated need to Reclamation along with adequate support documentation for review. Reclamation will ensure that the calculated need is consistent with such criteria. Reclamation may determine that it is necessary to vary the allocation of M&I water by contractor, taking into consideration a contractor's available non-CVP water supply.

8. Each M&I contractor will provide Reclamation its drought contingency plan designed to protect public health and safety. The contractor may provide a copy of its UWMP to Reclamation in lieu of a separate drought contingency plan so long as the UWMP contains the contractor's drought contingency plan.

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Chapter 3
Implementation Guidelines

This section outlines implementation steps for the M&I WSP and describes other factors considered and/or excluded from the M&I WSP.

3.1 Implementation Procedures - General

1. Irrigation contractor allocations are based upon Contract Total.

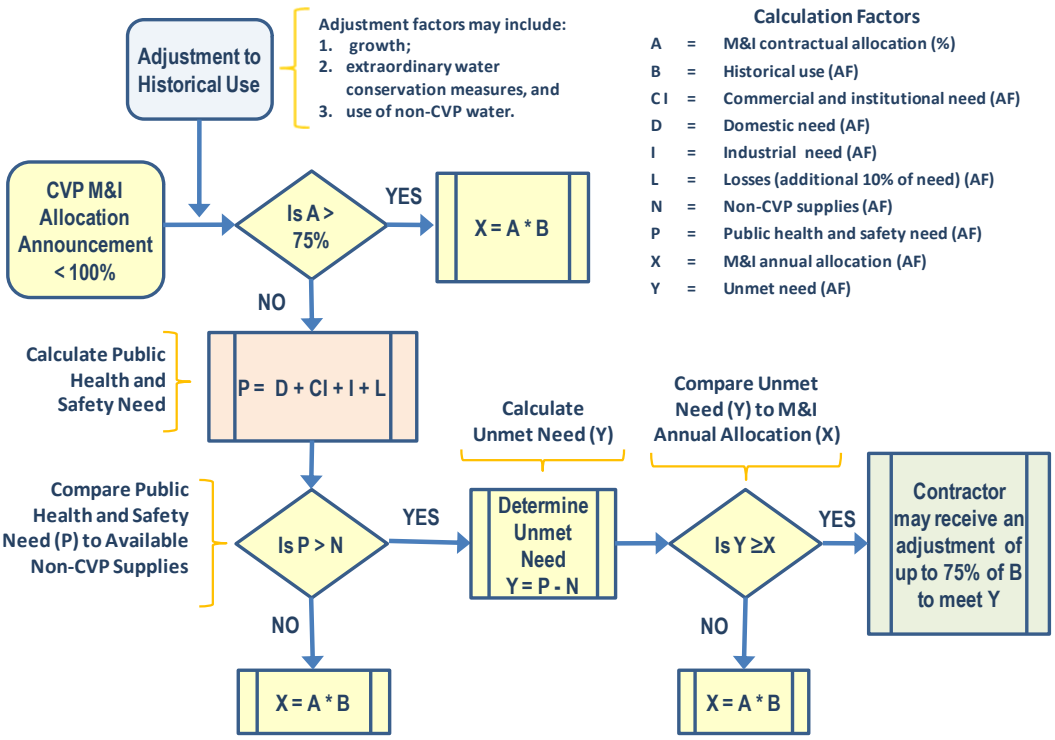
2. When M&I contractor allocations are at 100 percent, the allocation of M&I water will be based on Contract Total.

3. When M&I contractor allocations are below 100 percent, the allocation of M&I water will be based on a contractor's historical use of CVP M&I water.

4. An M&I contractor's historical use will be determined by calculating the average quantity of CVP water put to beneficial use within the service area during the last three years of water deliveries that were unconstrained by the availability of CVP water.

5. The general sequence of steps that Reclamation will use to determine CVP supplies for M&I contractors during a Condition of Shortage is shown in Figure 1.

Figure 1. Steps to be Used to Determine Shortage Allocation for M&I Water Contractors



3.2 Implementation Procedures - Historical Use Adjustments

1. At the contractor's request, Reclamation will consult with the contractor to adjust the contractor's historical use on the basis of:

   a. growth;

   b. extraordinary water conservation measures, and

   c. use of non-CVP water.

   Each of the three most recent unconstrained years will be assessed for adjustment. Adjustment will be made accordingly and prior to calculating the contractor's historical average.

2. Adjustment for Population Growth: If requested by an M&I contractor, an adjustment for population growth may be applied to an M&I contractor's historical use. In such a case, the historical use in each of the last three unconstrained years will be adjusted to reflect the population growth (i.e., difference in respective population between each unconstrained year to

current population). The sum of all adjustments will be calculated prior to averaging.

The following equation shall be used to adjust the historical water demand in each of the three unconstrained years for population growth:

Equation 1: Adjusted Historical Use (AHU_{yearX}) = $HU_{yearX} \times (P_{current} / P_{yearX})$

Where:

- AHU_{yearX} is the historical use in applicable year X (one of the three unconstrained years) adjusted for population growth
- HU_{yearX} is the actual historical use in applicable year X (one of the three unconstrained years)
- $P_{current}$ is the current population
- P_{yearX} is the population in historical use in applicable year under consideration

An M&I contractor may develop and submit to Reclamation, for verification and approval, its own calculation of its historical use and its estimate of the adjustment for population growth.

Reclamation and the contractor may confer and enter into negotiations regarding the calculated historical use and adjustment for population growth, if needed. However, the historical use and any adjustment for population growth will be subject to Reclamation approval and shall not exceed the Contract Total.

3. Adjustment for Extraordinary Water Conservation Measures: If requested by an M&I contractor, an adjustment for water conserved via extraordinary water conservation measures implemented and documented by a contractor may be applied to an M&I contractor's historical use. To be eligible for such an adjustment, the water service contractor must;

   a. have developed and be implementing a water conservation plan that meets CVPIA criteria, and

   b. be measuring such water consistent with section 3405(b) of the CVPIA.

   This adjustment to the contractor's historical use quantity to account for conservation measures that exceed applicable best management practices adopted by the CUWCC must be quantifiable.

4. The following criteria shall be used to quantify and calculate an adjustment for water conserved via extraordinary water conservation measures:

   a. A contractor requesting such an adjustment will be required to provide sufficient documentation to account for the water conserved via extraordinary water conservation measures.

   b. The quantitative data provided by the contractor shall detail the actual quantities of water conserved by exceeding the schedule for implementation of BMPs developed by the CUWCC and/or the CVPIA Criteria for Evaluating Water Management Plans."

   c. As water demand and water supply conditions vary from one year to the next, a contractor's extraordinary water conservation will be required to be documented and calculated for each of the three unconstrained years to be considered in the historical use calculation. The calculated amount of extraordinary water conservation in any one year will only be considered in the adjustment for the respective year.

   d. The calculated annual adjustment for a contractor's extraordinary water conservation will be applied to the respective unconstrained year by adding the calculated adjustment amount (in AF) to the Adjusted Historical Use (AHU_{yearX}) following its adjustment for population growth, if applicable. Each of the three unconstrained years eligible for an adjustment for extraordinary water conservation will be adjusted individually prior to calculation of the average of the adjusted historical use. Adjusted historical use would not exceed Contract Total.

5. Adjustment for "Non-CVP Water" Supplies: If requested by an M&I contractor, an adjustment for use of non-CVP water may be applied to an M&I contractor's historical use. Reclamation will adjust the historical use calculation to reflect the effect of non-CVP water used in lieu of use of the contractor's CVP water. In order to receive an adjustment based on non-CVP water, the contractor must fully document use of non-CVP water to clearly show how much that water use actually reduced the contractor's use of CVP water in the unconstrained years, and submit the documentation in writing to Reclamation (see Attachment A). A list of non-CVP water supplies that may be considered in this adjustment is provided below.

   An M&I water contractor's available non-CVP supply will differ from contractor to contractor and will therefore have to be determined on an individual basis. Reclamation will use information provided by the

contractor, other available information, and the following equation to calculate an M&I water contractor's total available non-CVP supply:

Equation 2: $N\ (AF) = N_1 + N_2 + N_3 \ldots N_n$

Where types of non-CVP supplies (N_x) may Include:

- *Surface water(non-CVP supplies)*
- *Groundwater*
- *Local storage*
- *Recycled water, subject to Reclamation approval*
- *Other Reclamation Approved Non-CVP Supplies*

Note: Units (N) are in AF of available annual water supply yield.

The calculated annual adjustment for a contractor's use of non-CVP water in lieu of use of the contractor's CVP water will be applied to the respective unconstrained year by adding the calculated adjustment amount (in AF) to the Adjusted Historical Use (AHU_{yearX}) following its adjustment for population growth, extraordinary water conservation measures, if applicable, with a maximum of the contract total amount. Each of the three unconstrained years eligible for an adjustment for use of non-CVP water in lieu of use of the contractor's CVP water will be adjusted individually prior to calculation of the average of the adjusted historical use.

Reclamation may also adjust the historical use on the basis of unique circumstances after consultation with the contractor. An example of a unique circumstance is the Year following a Year in which water users implemented extraordinary water conservation measures, or the converse, in which a contractor may use more water than historically used in order to recharge groundwater.

6. The following equation shall be used to average the adjusted historical use in each of the three unconstrained years after the above adjustments are made:

Equation 3: Average Historical Use ($HU_{average}$) =(AHU_{yearX} + AHU_{yearY} + AHU_{yearZ}) ÷ 3

Where:

- *$HU_{average}$ is the average of the three adjusted historical use amounts corresponding to the three unconstrained years)*
- *AHU_{yearX} , AHU_{yearY} and AHU_{yearZ} are adjusted historical use in applicable year X (one of the three unconstrained years), after adjustments for population growth, extraordinary water conservation, and use of non-CVP supplies.*

7. Before allocation of M&I water to a contractor will be reduced, allocation of Irrigation water will be reduced below 75 percent of Irrigation Contract Total. When the allocation of Irrigation water is less than 100 percent but greater than or equal to 75 percent, the allocation of M&I water will based on 100% Contract Total, as shown in Table 2.

Table 2: Allocation of M&I Water When Allocations of Irrigation Water are Above 75 Percent

Irrigation Allocation (% of Contract Total)	M&I Allocation (% of Contract Total)
< 100%	100%
95%	100%
90%	100%
85%	100%
80%	100%
75%	100%

8. When allocation of Irrigation water has been reduced below 75 percent and still further water supply reductions are necessary, both the M&I and Irrigation allocations will be reduced by the same percentage (e.g., 5%) increment. The allocation of M&I water will based on historical use. The M&I allocation will be reduced until it reaches 75 percent of adjusted historical use, and the Irrigation allocation will be reduced until it reaches 50 percent of Contract Total. The M&I allocation will not be further reduced until the Irrigation allocation is reduced to below 25 percent of Contract Total, as shown in Table 3.

Table 3: Allocation of M&I Water When Allocations of Irrigation Water are Less Than 75 Percent and Greater 25 Percent

Irrigation Allocation (% of Contract Total)	M&I Allocation (% of historical use)
70%	95%
65%	90%
60%	85%
55%	80%
50%-25%	75%

9. When M&I water allocations are less than 100 percent, the M&I allocation amount will be calculated using the following equation:

Equation 4: M&I annual allocation **(**X AF) = Average of (HU_{yearX} + HU_{yearY} + HU_{yearZ}) × Z

Where:

- *HU_{yearX} is the actual historical use in applicable year X (one of the three unconstrained years*
- *Z is the corresponding M&I Allocation percent from Table 3 or Table 4.*

Note: Units (X) are in AF, annual M&I shortage allocation of CVP water.

M&I contractors could then request an adjustment to their historical use, if thought necessary.

10. When allocation of Irrigation water is reduced below 25 percent of Irrigation Contract Total, Reclamation will reassess both the availability of CVP water supply and CVP water demand. Due to limited water supplies, during these times M&I water allocation to contractors may be reduced below 75 percent of adjusted historical use.

11. Once an adjustment to a Contractor's historical use is approved by Reclamation, it may increase their allocation quantity for the current water short year.

3.3 Implementation Procedures - Public Health & Safety

1. When M&I allocations are reduced below 75 percent, the M&I allocation will be equal to the greater of the percentage of historical use or PHS need (to a maximum of 75% of historical use), as shown in Table 4.

Table 4: Allocation of M&I Water When Allocations of Irrigation Water are Below 50 Percent

Irrigation Allocation (% of Contract Total)	M&I Allocation (% of historical use)
Between 25% and 50%	75%
20%	Maximum of 70% of historical use or PHS consideration
15%	Maximum of 65% of historical use or PHS consideration
10%	Maximum of 60% of historical use or PHS consideration
5%	Maximum of 55% of historical use or PHS consideration
0%	Maximum of 50% of historical use or PHS consideration

Note: If CVP water is not available, M&I contractors may be reduced below 50%.

2. Reclamation will strive to make CVP water available to an M&I contractor at not less than the amount necessary for PHS need, in conjunction with the use of CVP allocations and other non-CVP supplies, provided CVP water is available, and if:

a. an M&I water contractor submits a request to Reclamation for PHS water supply delivery;

b. the Governor declares an emergency due to water shortage applicable to that contractor; and/or

c. Reclamation, in consultation with the contractor, determines that an emergency exists due to a Condition of Shortage.

3. The PHS will be calculated to reflect the contractor's domestic, commercial, institutional, and industrial demands and system losses, as follows[2]:

Equation 5: *Public Health and Safety Allocation Amount (PHS) = D + CI + I + L*

Where:

Domestic use (D) =	*Current Population X 55 gpd* [3]
Commercial and Institutional (CI) =	*80% of Projected Commercial Demand*
Industrial (I) =	*90% of Projected Industrial Demand*
System (Conveyance) Losses (L) =	*10% of D + CI + I*

4. M&I water contractors will have the option of calculating the PHS need for review and approval by Reclamation or request that Reclamation calculate the PHS on behalf of the M&I water contractor.

5. If an M&I water contractor calculates its own PHS need, Reclamation will review and verify calculations submitted by the contractor. The contractor will calculate its PHS need using criteria noted in Item 18 and will submit the calculated need to Reclamation along with adequate support documentation for review.

6. If Reclamation calculates the PHS need, Reclamation may use information received from the water contractor as well as information from other sources.

7. Reclamation and the contractor may confer and enter into negotiations regarding the calculated PHS need, if needed; however, the final PHS

[2] If the State's criteria changes in any given year, then Reclamation would modify this equation to remain consistent with the State's approach.

[3] The per capita water demand rate used to calculate the PHS need shall be consistent with State law. The 55 gallons per capita demand (gpcd) value reflects the requirements defined in California State Senate Bill SBx 7-7. Reclamation may adjust this value over time to reflect future changes in State law. If State criteria does not exist, the contractor will apply criteria developed by Reclamation (in consultation with the contractor) that will be consistent with relevant criteria used by similarly situated California M&I water entities.

need to be used to determine the M&I water contractor's allocation will be subject to Reclamation approval.

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Attachment A
Documentation Required for Verifying Non-CVP Water Use in Lieu of CVP Water

1. **Data Required for Unconstrained Years**
   a. Contractor provides:
      i. Non-CVP water supply documentation - See No. 2 below, Non-CVP Water Checklists
      ii. Department of Water Resources (DWR), State Water Supply delivery data (Form 3017)
      iii. CVP water delivery data

   b. Reclamation provides:
      i. Area Office's CVP water delivery data
      ii. Area Office's annual declaration letters announcing water allocation
      iii. Area Office's annual rate exhibits annotated with historic average quantity
      iv. Region's water needs assessment
      v. Region's water conservation plan
      vi. Central Valley Operations' water declarations for specific CVP division (identify three unconstrained years based on division)

2. **Non-CVP Water Checklists (Attached):**
   a. For surface water: refer to "Checklist for Surface Water Supply as a Source of Non-CVP Water in Unconstrained Years"
   b. For ground water: refer to "Checklist for Groundwater as a Source of Non-CVP Water in Unconstrained Years)
   c. For water released from a Non-CVP reservoir: refer to "Checklist for Use of Non-CVP Water from a Non-CVP Reservoir in Unconstrained Years"

3. **Other Non-CVP Water Supplies:**
   a. Recycled Water – Reclamation will review documentation on a case by case basis.

Checklist for Surface Water Supply as a Source of Non-CVP Water in Unconstrained Years

1. **Point-of-Contact.** Provide the name, address, and telephone number of the holder of the water right for the non-CVP surface water to be utilized in lieu of CVP water.
2. **Non-CVP Water Source**. Provide the name and location of the source(s) from which the non-CVP water to be utilized in lieu of CVP water can be diverted and indicate whether such surface water, in accordance with the non-CVP water right, is to be directly diverted or diverted to and re-diverted from storage.
3. **Status of Non-CVP Water's Water Right.** Has the right to divert the Non-CVP surface water been abandoned or forfeited? If so, explain.
4. **Post-1914 Surface Water Rights**. Provide:
   a. The application number, permit number and/or license number, if applicable, assigned the non-CVP surface water right, by the SWRCB or its predecessor;
   b. The number(s) and date(s) of all SWRCB decisions and orders that relate to the application, permit and/or license to appropriate the non-CVP surface water to be utilized in lieu of CVP water.
5. **Pre-1914 Surface Water Right**. Provide:
   a. Copies of all Statements of Diversion and Use of the non-CVP water to be utilized in lieu of CVP water that have been filed with the SWRCB for the last three unconstrained years;
   b. The date of priority of the non-CVP surface water right;
   c. Copies of California Environmental Quality Act compliance documents addressing any change in point of diversion, purpose of use, or place of use considered necessary for purposes of effectuating the use in lieu of CVP use.
6. **Description(s) of Non-CVP Surface Water Source(s).** Provide:
   a. a description of the authorized purpose(s) of use and place(s) of use;
   b. the authorized season of diversion of the water; and
   c. the maximum quantity and/or diversion rate authorized for beneficial use.
7. **Identify Court Decree(s) or Adjudication(s).** If any, provide copies.
8. **Identify Water Master?** If there is a water master, (a) describe the bases and scope of the water master's authority to regulate diversions of the non-CVP surface water utilized in lieu of CVP water and provide copies of all relevant reports, directives, etc., issued by the water master; and (b) include written concurrence from the water master that use of the non-CVP water was authorized by the water master and, in the water master's opinion, would not cause injury to another user.
9. **Identify Applicable County Ordinances**. If any, explain and provide copies of such regulating use of non-CVP surface water in lieu of CVP water pursuant to the non-CVP water right.

10. **Submit Applicable Water Right Record(s).** Provide records indicating quantity, type, and season of water use under the water right for each of the last 3 unconstrained years. If monthly historical diversion and use records are available for this surface water right, provide such records. If the information is already available to this level of detail for any particular year as part of (a) a Statement of Diversion and Use filed with the SWRCB that contains the information required for such filing as provided in Part 5.1 of the California Water Code, section 5100, et seq., or (b) information previously reported or included elsewhere in lieu of such filing to the SWRCB as allowed pursuant to Part 5.1, then provide copies of such documentation.

Checklist for Groundwater as a Source of Non-CVP Water in Unconstrained Years

1. **Identify Well Location, Capacity, and Certification.** Provide:
   a. Well owner's name and identification number, District, and District's well identification number
   b. Well's latitude and longitude (DWR standard coordinate system and datum (GCS, NAD 83, decimal degrees)), map (similar detail to 7.5 minute United States Geological Survey quad sheet) with well location and all surface water features within two miles of District boundary
   c. Well capacity
   d. Photographic evidence of the calibrated instantaneous reading and totalizing flow meters installed on each well supplying non-CVP water
   e. Certification by a Professional Engineer or Professional Geologist of proper flow meter installation and calibration performed consistent with the manufacturer's specifications
2. **Volume of Water Pumped**. Provide operational records indicating the volume of groundwater pumped from each well for each of the last three unconstrained years.

Checklist for Use of Non-CVP Water from a Non-CVP Reservoir in Unconstrained Years

1. **Storage Right.** Identify the storage right covering the Non-CVP water, and provide California Environmental Quality Act environmental compliance documents or the SWRCB approval process, as appropriate
2. **Reservoir Operations.** For the last three unconstrained years, provide reservoir operating data including:
   a. Daily reservoir storage
   b. End of month storage
   c. Daily inflow and reservoir releases
   d. Any regulatory or operational obligations affecting reservoir operations.
   e. Location, type, and ownership of water measurement device downstream of the reservoir, as applicable.

Appendix B: Central Valley Project Municipal and Industrial Water Shortage Policy Guidelines and Procedures

Water Service Contractors Subject to the M&I WSP

General Geographical Region	CVP Division	Water Service Contractors	M&I	Ag
North of Delta	Shasta and Trinity River	Bella Vista District	X	X
		Centerville Community Services District	X	-
		City of Redding	X	-
		City of Shasta Lake	X	-
		Clear Creek Community Services District	X	X
		Mountain Gate Community Services District	X	-
		Shasta Community Services District	X	-
		Shasta County Water Agency	X	-
		U.S. Forest Service (Shasta)	X	-
	Sacramento River	4-M Water District	X	X
		Colusa County Water District	X	X
		Corning Water District	X	X
		Cortina Water District	X	X
		Count of Colusa	X	X
		County of Colusa (Stonyford)	X	X
		Davis Water District	X	X
		Dunnigan Water District	X	X
		Elk Creek Community Services District	X	-
		Glenn Valley Water District	X	X
		Glide Water District	X	X
		Holthouse Water District	X	X
		Kanawha Water District	X	X
		Kirkwood Water District	X	X
		La Grande Water District	X	X
		Myers-Marsh Mutual Water Company	X	X
		Orland-Artois Water District	X	X
		Proberta Water District	X	X
		Stony Creek Water District	X	X
		Thomas Creek District	X	X
		U.S. Forest Service (Salt Creek)	X	-
		Westside Water District	X	X
		Whitney Construction, Incorporated	X	-
	American River	City of Roseville	X	-
		East Bay Municipal Utility District	X	-
		El Dorado Irrigation District	X	-
		Placer County Water Agency	X	-
		Sacramento County Water Agency	X	-
		Sacramento Municipal Utility District	X	-
		San Juan Water District	X	-

General Geographical Region	CVP Division	Water service Contractors	M&I	Ag[1]
South of Delta	Delta	Banta-Carbona Irrigation District	X	X
		Byron-Bethany Irrigation District	X	X
		City of Tracy	X	X
		Coelho Family Trust	X	X
		Contra Costa Water District	X	-
		Del Puerto Water District	X	X
		Eagle Field Water District	X	X
		Fresno South Water District	X	X
		James Irrigation District	X	X
		Laguna Water District	X	X
		Mercy Springs Water District	X	X
		Oro Loma Water District	X	X
		Pajaro Valley Water Management Agency, Westlands Water District	X	X
		Patterson Irrigation District	X	X
		Reclamation District No. 1606	X	X
		Tranquility Irrigation District	X	X
		Tranquility Public Utility District	X	X
		~~U.S. Department of Veteran Affairs~~[2]	~~X~~	-
		West Side Irrigation District	X	X
		West Stanislaus Irrigation District	X	X
		Westlands Water District Distribution Districts	X	X
	West San Joaquin	City of Avenal	X	-
		City of Coalinga	X	-
		City of Huron	X	-
		Pacheco Water District	X	X
		Panoche Water District	X	X
		San Luis Water District	X	X
		State of California	X	-
		Westlands Water District	X	X
	San Felipe	San Benito County Water District	X	X
		Santa Clara Valley Water District	X	X
	Cross Valley Canal	County of Fresno	X	X
		County of Tulare	X	X
		Hills Valley Irrigation District (includes Rag Gulch Water District)	X	X
		Kern-Tulare Water District	X	X
		Lower Tule River Irrigation District	-	X
		Pixley Irrigation District	X	X
		Tri-Valley Water District	X	X

[1] Ag = Agricultural water service contractor

[2] Section 3404(b) of the Central Valley Project Improvement Act (CVPIA), provides for up to 850 acre-feet (AF) "delivery in perpetuity" for "quantities sufficient to meet the needs of the San Joaquin Valley National Cemetery, California.. ."

Enclosure 4

Rieker, Jeffrey <jrieker@usbr.gov>

Additional information on modeling runs

Rieker, Jeffrey <jrieker@usbr.gov> Thu, Feb 15, 2018 at 11:28 AM
To: "'Maria.rea@noaa.gov" <maria.rea@noaa.gov>, Garwin Yip - NOAA Federal <garwin.yip@noaa.gov>
Cc: "BARAJAS, FEDERICO" <fbarajas@usbr.gov>, ELIZABETH KITECK <ekiteck@usbr.gov>, RANDI FIELD <rfield@usbr.gov>, "White, Kristin N" <knwhite@usbr.gov>

Maria, Garwin,

Attached is additional information in follow-up to your request to complete a model run that contained similar Keswick release schedules to those found in the draft proposed Shasta RPA. I've discussed this with Garwin, but to describe what we're seeing in the attached; when we attempt to operate the system using the "dry" year type Keswick release constraints from the draft proposal (which is the current designation under the 90% forecast), we find that with minimal pumping, we cannot meet Delta requirements without drawing Folsom down to almost dead pool by July, which is where it would remain the rest of the summer and fall. Resulting Folsom releases from August through the end of the year would be less than 1,000 cfs, which is unlikely to sustain the ecosystem there. There would also be issues with meeting the minimum health and safety needs of the Sacramento area. Since this appears to be an infeasible operation for the system, we did not move forward with conducting a temperature run for this release pattern.

Hopefully this is helpful in reviewing the remainder of the package we've transmitted; please let us know if you have questions or need additional information.

Thanks,
Jeff

Jeffrey Rieker
Operations Manager
Bureau of Reclamation; Central Valley Operations Office
Office: 916-979-2197; Mobile: 916-214-7555
jrieker@usbr.gov

Feb90_WY2018_with NMFS Flow Restrictions_Dry.pdf
18K

Estimated CVP Operations Feb 90% Exceedance

Storages

Federal End of the Month Storage/Elevation (TAF/Feet)

		Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan
Trinity	**1776**	**1800**	**1842**	**1841**	**1676**	**1508**	**1353**	**1253**	**1164**	**1134**	**1116**	**1126**	**1158**
	Elev.	2327	2330	2330	2317	2304	2291	2281	2273	2270	2268	2269	2272
Whiskeytown	**205**	**206**	**206**	**238**	**238**	**238**	**238**	**238**	**230**	**206**	**206**	**206**	**206**
	Elev.	1199	1199	1209	1209	1209	1209	1209	1207	1199	1199	1199	1199
Shasta	**3349**	**3441**	**3812**	**3890**	**3829**	**3559**	**3220**	**2798**	**2548**	**2423**	**2418**	**2544**	**2741**
	Elev.	1026	1041	1041	1041	1031	1017	999	987	980	980	986	996
Folsom	**582**	**576**	**663**	**570**	**513**	**324**	**107**	**112**	**116**	**103**	**96**	**99**	**150**
	Elev.	426	435	425	418	391	338	340	341	336	333	335	353
New Melones	**1981**	**1940**	**1972**	**1901**	**1847**	**1793**	**1716**	**1658**	**1619**	**1589**	**1605**	**1622**	**1637**
	Elev.	1047	1050	1043	1038	1033	1025	1020	1016	1012	1014	1016	1017
San Luis	**973**	**947**	**947**	**904**	**829**	**565**	**254**	**46**	**62**	**169**	**194**	**240**	**412**
	Elev.	521	529	519	503	465	415	365	350	355	361	383	412
Total		8909	9441	9343	8931	7987	6888	6106	5739	5624	5634	5836	6303

State End of the Month Reservoir Storage (TAF)

Oroville	**1408**	**1510**	**1747**	**1748**	**1647**	**1421**	**1200**	**1043**	**1024**	**946**	**843**	**801**	**877**
	Elev.	732	758	758	747	721	693	671	668	656	639	631	644
San Luis	**763**	**808**	**904**	**824**	**718**	**555**	**389**	**228**	**125**	**44**	**58**	**154**	**209**
Total San Luis (TAF)	**1736**	**1755**	**1850**	**1727**	**1546**	**1120**	**643**	**274**	**187**	**213**	**252**	**394**	**621**

Monthly River Releases (TAF/cfs)

Trinity	TAF	17	18	36	92	47	28	28	27	23	18	18	18
	cfs	**300**	**300**	**600**	**1,498**	**783**	**450**	**450**	**450**	**373**	**300**	**300**	**300**
Clear Creek	TAF	11	12	13	13	17	9	9	9	12	12	12	12
	cfs	**200**	**200**	**218**	**216**	**288**	**150**	**150**	**150**	**200**	**200**	**200**	**200**
Sacramento	TAF	194	200	360	492	595	615	615	446	369	268	204	200
	cfs	**3500**	**3250**	**6050**	**8000**	**10000**	**10000**	**10000**	**7500**	**6000**	**4500**	**3320**	**3250**
American	TAF	133	92	245	185	248	267	50	48	49	48	49	61
	cfs	**2400**	**1500**	**4122**	**3014**	**4169**	**4336**	**814**	**809**	**802**	**800**	**800**	**1000**
Stanislaus	TAF	59	12	91	76	22	15	15	15	49	12	12	14
	cfs	**1070**	**200**	**1537**	**1242**	**363**	**250**	**250**	**250**	**797**	**200**	**200**	**226**
Feather	TAF	97	80	101	49	89	92	92	59	61	54	55	58
	cfs	**1750**	**1300**	**1700**	**800**	**1500**	**1500**	**1500**	**1000**	**1000**	**900**	**900**	**950**

Trinity Diversions (TAF)

	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan
Carr PP	20	23	53	112	135	130	71	62	16	21	12	3
Spring Crk. PP	**20**	**30**	**23**	**105**	**120**	**120**	**60**	**60**	**30**	**15**	**12**	**10**

Delta Summary (TAF)

		Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan
Tracy		132	115	24	25	25	25	75	210	236	81	83	210
USBR Banks		0	0	0	0	0	0	0	0	0	0	0	0
Contra Costa		14.0	12.7	12.7	12.7	9.8	11.1	12.7	14.0	16.8	18.4	18.3	14.0
Total USBR		146	128	37	37	35	36	88	224	253	99	101	224
State Export		160	192	18	18	20	25	20	40	66	145	202	210
Total Export		306	320	54	56	55	61	108	264	319	244	303	434
COA Balance		53	33	39	24	7	21	16	55	11	11	0	0
Old/Middle River Std.													
Old/Middle R. calc.		-3,785	-3,875	-152	-279	-901	-1,001	-1,622	-3,637	-3,793	-3,194	-3,838	-5,463
Computed DOI		11400	11403	10405	7597	7598	4994	3497	3009	4002	4690	4506	5677
Excess Outflow		0	0	0	0	0	0	0	0	0	185	0	1171
% Export/Inflow		32%	30%	6%	7%	6%	8%	17%	41%	46%	40%	50%	58%
% Export/Inflow std.		45%	35%	35%	35%	35%	65%	65%	65%	65%	65%	65%	65%

Hydrology

		Trinity		Shasta		Folsom		New Melones	
Water Year Inflow (TAF)		474		3,447		1,562		776	
Year to Date + Forecasted	% of mean	39%		62%		57%		73%	

CVP actual operations do not follow any forecasted operation or outlook; actual operations are based on real-time conditions.
CVP operational forecasts or outlooks represent general system-wide dynamics and do not necessarily address specific watershed/tributary details.
CVP releases or export values represent monthly averages.
CVP Operations are updated monthly as new hydrology information is made available December through May.

2/15/2018

Enclosure 5

Estimated CVP Operations Feb 90% Exceedance

Storages

Federal End of the Month Storage/Elevation (TAF/Feet)

		Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan
Trinity	**1776**	**1800**	**1842**	**1841**	**1676**	**1508**	**1353**	**1228**	**1114**	**1084**	**1066**	**1076**	**1108**
	Elev.	2327	2330	2330	2317	2304	2291	2279	2267	2264	2262	2263	2267
Whiskeytown	**205**	**206**	**206**	**238**	**238**	**238**	**238**	**238**	**230**	**206**	**206**	**206**	**206**
	Elev.	1199	1199	1209	1209	1209	1209	1209	1207	1199	1199	1199	1199
Shasta	**3349**	**3441**	**3812**	**3803**	**3712**	**3383**	**2891**	**2470**	**2192**	**2067**	**2062**	**2188**	**2385**
	Elev.	1026	1041	1040	1037	1024	1003	983	968	961	961	968	978
Folsom	**582**	**571**	**624**	**617**	**590**	**425**	**337**	**305**	**280**	**253**	**231**	**221**	**271**
	Elev.	425	431	430	427	407	393	388	383	378	374	372	382
New Melones	**1981**	**1940**	**1972**	**1901**	**1847**	**1793**	**1716**	**1658**	**1619**	**1589**	**1605**	**1622**	**1637**
	Elev.	1047	1050	1043	1038	1033	1025	1020	1016	1012	1014	1016	1017
San Luis	**973**	**920**	**942**	**899**	**824**	**560**	**273**	**99**	**164**	**284**	**322**	**370**	**542**
	Elev.	519	529	519	503	463	415	370	367	372	381	402	428
Total		8877	9397	9298	8887	7907	6808	5999	5598	5483	5492	5683	6149

State End of the Month Reservoir Storage (TAF)

Oroville	**1408**	**1510**	**1747**	**1748**	**1647**	**1456**	**1236**	**1078**	**1048**	**969**	**864**	**819**	**894**
	Elev.	732	758	758	747	725	698	676	671	659	642	634	647
San Luis	**763**	**805**	**910**	**827**	**717**	**548**	**375**	**210**	**121**	**36**	**60**	**168**	**218**
Total San Luis (TAF)	**1736**	**1725**	**1852**	**1726**	**1541**	**1108**	**649**	**308**	**286**	**320**	**383**	**538**	**760**

Monthly River Releases (TAF/cfs)

Trinity	TAF	17	18	36	92	47	28	53	52	23	18	18	18
	cfs	**300**	**300**	**600**	**1,498**	**783**	**450**	**857**	**870**	**373**	**300**	**300**	**300**
Clear Creek	TAF	11	12	13	13	17	9	9	9	12	12	12	12
	cfs	**200**	**200**	**218**	**216**	**288**	**150**	**150**	**150**	**200**	**200**	**200**	**200**
Sacramento	TAF	194	200	446	523	654	768	615	476	369	268	204	200
	cfs	**3500**	**3250**	**7500**	**8500**	**11000**	**12500**	**10000**	**8000**	**6000**	**4500**	**3320**	**3250**
American	TAF	139	126	159	155	224	137	84	76	62	62	62	61
	cfs	**2500**	**2053**	**2672**	**2514**	**3769**	**2227**	**1368**	**1269**	**1013**	**1045**	**1010**	**1000**
Stanislaus	TAF	59	12	91	76	22	15	15	15	49	12	12	14
	cfs	**1070**	**200**	**1537**	**1242**	**363**	**250**	**250**	**250**	**797**	**200**	**200**	**226**
Feather	TAF	97	80	101	49	54	92	92	71	61	57	58	58
	cfs	**1750**	**1300**	**1700**	**800**	**900**	**1500**	**1500**	**1200**	**1000**	**950**	**950**	**950**

Trinity Diversions (TAF)

	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan
Carr PP	20	23	53	112	135	130	71	62	16	21	12	3
Spring Crk. PP	**20**	**30**	**23**	**105**	**120**	**120**	**60**	**60**	**30**	**15**	**12**	**10**

Delta Summary (TAF)

		Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan
Tracy		135	136	24	25	25	40	100	250	249	95	84	210
USBR Banks		0	0	0	0	0	9	9	9	0	0	0	0
Contra Costa		14.0	12.7	12.7	12.7	9.8	11.1	12.7	14.0	16.8	18.4	18.3	14.0
Total USBR		149	149	37	37	35	60	122	273	266	113	102	224
State Export		161	205	18	18	20	25	20	60	66	160	217	210
Total Export		310	354	54	56	55	85	142	333	332	273	319	434
COA Balance		6	0	5	-10	9	23	19	65	22	22	22	22
Old/Middle River Std.													
Old/Middle R. calc.		-3,840	-4,301	-152	-279	-901	-1,302	-2,047	-4,530	-3,956	-3,570	-4,038	-5,463
Computed DOI		11436	11403	10405	7597	7598	4994	3497	3009	4002	4505	4506	5677
Excess Outflow		36	0	0	0	0	0	0	0	0	0	0	1171
% Export/Inflow		33%	33%	6%	7%	6%	11%	21%	47%	47%	44%	51%	58%
% Export/Inflow std.		45%	35%	35%	35%	35%	65%	65%	65%	65%	65%	65%	65%

Hydrology

	Trinity		Shasta		Folsom	New Melones	
Water Year Inflow (TAF)	474		3,447		1,562	776	
Year to Date + Forecasted % of mean	39%		62%		57%	73%	

CVP actual operations do not follow any forecasted operation or outlook; actual operations are based on real-time conditions.
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CVP releases or export values represent monthly averages.
CVP Operations are updated monthly as new hydrology information is made available December through May.

2/13/2018

Estimated CVP Operations Feb 70% Exceedance

Storages

Federal End of the Month Storage/Elevation (TAF/Feet)

		Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan
Trinity	**1776**	**1802**	**1878**	**1921**	**1811**	**1723**	**1599**	**1474**	**1361**	**1331**	**1312**	**1322**	**1354**
	Elev.	2327	2332	2335	2327	2321	2311	2301	2291	2289	2287	2288	2291
Whiskeytown	**205**	**206**	**206**	**238**	**238**	**238**	**238**	**238**	**230**	**206**	**206**	**206**	**206**
	Elev.	1199	1199	1209	1209	1209	1209	1209	1207	1199	1199	1199	1199
Shasta	**3349**	**3441**	**3882**	**3928**	**3862**	**3527**	**2999**	**2531**	**2267**	**2143**	**2138**	**2268**	**2465**
	Elev.	1026	1043	1045	1043	1030	1008	986	972	965	965	972	983
Folsom	**582**	**611**	**709**	**780**	**822**	**748**	**587**	**516**	**455**	**383**	**318**	**293**	**328**
	Elev.	430	440	447	452	444	427	419	411	400	390	386	392
New Melones	**1981**	**1940**	**1976**	**1908**	**1869**	**1830**	**1757**	**1700**	**1661**	**1631**	**1648**	**1665**	**1679**
	Elev.	1047	1050	1044	1040	1036	1029	1024	1020	1017	1019	1020	1022
San Luis	**973**	**959**	**977**	**897**	**772**	**426**	**162**	**14**	**57**	**187**	**305**	**352**	**524**
	Elev.	522	536	522	501	453	412	381	390	408	427	443	467
Total		8958	9627	9672	9373	8491	7342	6474	6031	5880	5926	6106	6556

State End of the Month Reservoir Storage (TAF)

Oroville	**1408**	**1510**	**1817**	**1863**	**1776**	**1566**	**1348**	**1197**	**1127**	**1049**	**943**	**898**	**974**
	Elev.	732	765	769	761	738	712	693	683	672	655	648	660
San Luis	**763**	**813**	**957**	**868**	**750**	**577**	**460**	**366**	**386**	**398**	**448**	**547**	**621**
Total San Luis (TAF)	**1736**	**1772**	**1935**	**1765**	**1521**	**1003**	**622**	**380**	**443**	**585**	**753**	**899**	**1145**

Monthly River Releases (TAF/cfs)

Trinity	TAF	17	18	36	92	47	28	53	52	23	18	18	18
	cfs	**300**	**300**	**600**	**1,498**	**783**	**450**	**857**	**870**	**373**	**300**	**300**	**300**
Clear Creek	TAF	11	12	13	13	17	9	9	9	12	12	12	12
	cfs	**200**	**200**	**218**	**216**	**288**	**150**	**150**	**150**	**200**	**200**	**200**	**200**
Sacramento	TAF	194	200	446	523	654	799	676	476	369	268	200	200
	cfs	**3500**	**3250**	**7500**	**8500**	**11000**	**13000**	**11000**	**8000**	**6000**	**4500**	**3250**	**3250**
American	TAF	139	123	113	115	153	218	132	119	108	104	77	77
	cfs	**2500**	**2000**	**1899**	**1863**	**2564**	**3553**	**2145**	**2000**	**1750**	**1751**	**1250**	**1250**
Stanislaus	TAF	59	12	91	76	22	15	15	15	49	12	12	14
	cfs	**1070**	**200**	**1537**	**1242**	**363**	**250**	**250**	**250**	**797**	**200**	**200**	**226**
Feather	TAF	97	80	101	49	89	123	123	119	61	57	58	58
	cfs	**1750**	**1300**	**1700**	**800**	**1500**	**2000**	**2000**	**2000**	**1000**	**950**	**950**	**950**

Trinity Diversions (TAF)

	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan
Carr PP	2	15	45	92	102	99	70	62	16	21	12	3
Spring Crk. PP	**20**	**30**	**23**	**90**	**90**	**90**	**60**	**60**	**30**	**15**	**12**	**10**

Delta Summary (TAF)

		Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan
Tracy		174	120	24	25	25	150	192	250	259	175	84	210
USBR Banks		0	0	0	0	0	18	18	18	0	0	0	0
Contra Costa		14.0	12.7	12.7	12.7	9.8	11.1	12.7	14.0	16.8	18.4	18.3	14.0
Total USBR		188	133	37	37	35	179	223	282	276	193	102	224
State Export		153	237	18	18	20	85	98	180	171	191	217	210
Total Export		341	370	54	56	55	264	321	462	447	384	319	434
COA Balance		6	6	-27	-60	-85	-35	19	125	156	155	155	155
Old/Middle River Std.													
Old/Middle R. calc.		-4,035	-4,340	-152	-279	-780	-3,500	-4,224	-6,140	-5,323	-4,938	-3,980	-5,346
Computed DOI		12841	12916	10977	7597	7598	4994	3497	3009	4002	4505	7564	9272
Excess Outflow		1441	1513	0	0	0	0	0	0	0	0	3058	4766
% Export/Inflow		32%	31%	5%	7%	6%	30%	39%	55%	55%	53%	39%	44%
% Export/Inflow std.		45%	35%	35%	35%	35%	65%	65%	65%	65%	65%	65%	65%

Hydrology

	Trinity		Shasta		Folsom	New Melones	
Water Year Inflow (TAF)	605		3,692		1,756	819	
Year to Date + Forecasted % of mean	50%		67%		65%	77%	

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2/28/2018

Estimated CVP Operations Feb 50% Exceedance

Storages

Federal End of the Month Storage/Elevation (TAF/Feet)

		Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan
Trinity	**1776**	**1805**	**1901**	**1994**	**1912**	**1849**	**1742**	**1605**	**1477**	**1439**	**1426**	**1456**	**1521**
	Elev.	2327	2334	2341	2335	2330	2322	2312	2301	2298	2297	2300	2305
Whiskeytown	**205**	**206**	**206**	**238**	**238**	**238**	**238**	**238**	**230**	**206**	**206**	**206**	**206**
	Elev.	1199	1199	1209	1209	1209	1209	1209	1207	1199	1199	1199	1199
Shasta	**3349**	**3445**	**3985**	**4073**	**4012**	**3702**	**3177**	**2806**	**2548**	**2483**	**2473**	**2618**	**3024**
	Elev.	1026	1047	1050	1048	1037	1015	999	987	983	983	990	1009
Folsom	**582**	**579**	**669**	**754**	**855**	**727**	**522**	**408**	**353**	**306**	**277**	**266**	**310**
	Elev.	426	436	445	455	442	419	404	396	388	383	381	389
New Melones	**1981**	**1952**	**1922**	**1864**	**1819**	**1768**	**1703**	**1643**	**1602**	**1562**	**1583**	**1610**	**1644**
	Elev.	1048	1045	1040	1035	1031	1024	1018	1014	1010	1012	1015	1018
San Luis	**966**	**966**	**966**	**881**	**740**	**427**	**181**	**39**	**68**	**178**	**363**	**568**	**704**
	Elev.	525	540	524	499	455	407	359	371	393	430	461	477
Total		8954	9648	9805	9576	8710	7563	6739	6278	6173	6328	6723	7408

State End of the Month Reservoir Storage (TAF)

Oroville	**1408**	**1677**	**2053**	**2125**	**2008**	**1784**	**1535**	**1386**	**1300**	**1206**	**1139**	**1201**	**1378**
	Elev.	750	788	794	783	761	734	717	706	694	685	693	716
San Luis	**763**	**838**	**1019**	**910**	**761**	**598**	**395**	**197**	**246**	**290**	**421**	**513**	**552**
Total San Luis (TAF)	**1729**	**1804**	**1985**	**1791**	**1501**	**1025**	**576**	**235**	**315**	**468**	**783**	**1082**	**1255**

Monthly River Releases (TAF/cfs)

Trinity	TAF	17	18	32	180	47	28	53	52	23	18	18	18
	cfs	**300**	**300**	**540**	**2,924**	**783**	**450**	**857**	**870**	**373**	**300**	**300**	**300**
Clear Creek	TAF	11	12	13	13	17	9	9	9	12	12	12	15
	cfs	**200**	**200**	**218**	**216**	**288**	**150**	**150**	**150**	**200**	**200**	**200**	**240**
Sacramento	TAF	205	200	446	492	625	799	615	506	338	327	246	200
	cfs	**3700**	**3250**	**7500**	**8000**	**10500**	**13000**	**10000**	**8500**	**5500**	**5500**	**4000**	**3250**
American	TAF	194	154	149	108	228	272	178	119	123	119	123	108
	cfs	**3500**	**2500**	**2500**	**1750**	**3839**	**4432**	**2891**	**2000**	**2000**	**2000**	**2000**	**1750**
Stanislaus	TAF	59	93	83	96	56	18	18	18	49	12	12	14
	cfs	**1070**	**1521**	**1400**	**1555**	**940**	**300**	**300**	**300**	**797**	**200**	**200**	**232**
Feather	TAF	97	80	119	92	119	187	156	143	123	104	61	108
	cfs	**1750**	**1300**	**2000**	**1500**	**2000**	**3050**	**2540**	**2400**	**2000**	**1750**	**1000**	**1750**

Trinity Diversions (TAF)

	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan
Carr PP	22	35	36	24	71	84	85	76	26	25	9	0
Spring Crk. PP	**35**	**60**	**15**	**25**	**60**	**75**	**75**	**75**	**40**	**20**	**12**	**20**

Delta Summary (TAF)

		Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan
Tracy		143	112	48	49	128	250	270	261	270	260	260	200
USBR Banks		0	0	0	0	0	26	26	26	0	0	0	0
Contra Costa		14.0	12.7	12.7	12.7	9.8	11.1	12.7	14.0	16.8	18.4	18.3	14.0
Total USBR		157	125	60	62	138	287	309	301	287	278	278	214
State Export		200	300	42	43	102	76	65	269	262	325	260	200
Total Export		357	425	102	105	240	363	374	570	549	603	538	414
COA Balance		0	0	0	0	0	0	0	138	138	138	138	138
Old/Middle River Std.													
Old/Middle R. calc.		-3,244	-3,490	71	281	-2,711	-4,527	-4,726	-7,386	-6,535	-7,652	-6,577	-4,903
Computed DOI		18677	22563	14876	10867	7598	6507	4002	3009	4246	4572	8329	14966
Excess Outflow		7276	11159	3614	3091	0	0	0	0	244	67	3823	10460
% Export/Inflow		25%	23%	9%	11%	27%	35%	43%	62%	59%	64%	50%	31%
% Export/Inflow std.		45%	35%	35%	35%	35%	65%	65%	65%	65%	65%	65%	65%

Hydrology

		Trinity		Shasta		Folsom		New Melones	
Water Year Inflow (TAF)		754		3,937		1,944		887	
Year to Date + Forecasted	% of mean	62%		71%		71%		84%	

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