From: Bruce McLaughlin
To: commentletters
Subject: Comment Letter - 2016 Bay-Delta Plan Amendment & SED
Date: Friday, March 17, 2017 11:19:08 AM
Attachments: image001.png
20170317 HPOC Comments on Phase 1 SED.pdf

Jeanine Townsend, Clerk to the Board

State Water Resources Control Board

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Please find attached in PDFA format, the Hydropower Operations Committee Comments on the Revised Draft Substitute Environmental Document (SED) for Flow Objectives on the Lower San Joaquin River and Salinity Objectives for the Southern Delta

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Jeanine Townsend, Clerk to the Board
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RE: Hydropower Operations Committee Comments on the Revised Draft Substitute Environmental Document (SED) for Flow Objectives on the Lower San Joaquin River and Salinity Objectives for the Southern Delta

The Hydropower Operations Committee (HPOC), comprised of Central Valley Project (CVP) power customers,[1] was formed to provide technical and operational subject matter expertise to industry and regulatory forums that have the potential to impact Federal hydropower generation. The HPOC is monitoring activities at the State Water Resources Control Board (Water Board), the United States Bureau of Reclamation, as well as other industry forums where CVP hydropower generation could be affected.

INTRODUCTION

In the SED, the Water Board concluded the Bay-Delta plan amendments would result in adverse impacts on resources for certain environmental categories. The HPOC concurs with this assessment and provides the following comments on SED Chapter 14, *Energy and Greenhouse Gases;* SED Chapter 20 *Economic Analyses*, and Appendix J, *Hydropower and Electric Grid Analysis of LSJR Flow Alternatives.* The HPOC acknowledges the significant time, resources, and effort that resulted in the draft SED analysis, but is nevertheless concerned that the document does not accurately capture the energy resource impacts to the CVP. Our comments are intended to identify areas of additional work and analyses that are needed to supplement the record and to ensure decision makers have all the information they need to make informed decisions.

> **The HPOC believes that the SED did not incorporate an analytical framework that used the appropriate controlling statutory and administrative regulations and/or operational limitations as applied to the energy sector in California. Therefore, the SED analyses of significant impacts and feasible mitigations are incomplete and possibly incorrect. Specifically, the SED did not discuss or evaluate the Lower San Joaquin River (LSJR) Alternatives in accordance with the current regulatory paradigm as framed by SB 350 (Clean Energy and Pollution Reduction Act of 2015), SB 32 (California Global Warming Solutions Act of 2006: emissions limit), AB 197 (State Air Resources Board: greenhouse gases regulations) and the current grid reliability restrictions resulting from over-generation and integrating intermittent renewable resources.[2]**

HPOC DISCUSSION AND COMMENTS ON SED CHAPTER 14

SED Section 14.4 presented an evaluation of potential impacts of the LSJR Alternatives on energy resources and climate change. The LSJR Alternatives would potentially affect energy and climate change by impacting production at hydropower facilities along the LSJR's three eastside tributaries. In accordance with CEQA Guidelines Appendix F, energy impacts would be significant if the LSJR Alternatives resulted in: (a) adversely affecting the reliability of California's electric grid; and/or (b) the inefficient, wasteful, and unnecessary energy consumption. Similarly, in accordance with CEQA Guidelines Appendix G, climate change impacts would be significant if the LSJR Alternatives: (a) resulted in generation of GHG emissions, either directly or indirectly, that may have a significant impact on the environment; and/or (b) conflict with an applicable plan, policy, or regulation adopted for the purposes of reducing GHG emissions. A SED must also identify feasible mitigation measures for each significant environmental impact identified in it.[3]

SED Table 14.1 comprised a summary of the potential impacts of the LSJR alternatives on energy and GHG emissions. These were listed as Impacts EG-1 through EG-5. Below, are extracts from the SED's analysis of Impacts EG1 through EG-4, followed by the HPOC's comments.

Impact EG-1: ***Adversely affect the reliability of California's electric grid***

SED evaluation: LSJR Alternatives 2, 3, and 4 (Less than significant/Less than significant with adaptive implementation)

SED reasoning: This analysis relied on SWB's water supply effects (WSE) model to estimate the effects of the LSJR Alternatives on reservoir releases, storage, and diversions. The calculated changes in *monthly and annual energy production* were inputs to electric grid reliability modeling, which evaluated the potential impacts of the changes on the electric grid reliability under peak load and outage contingency scenarios. Reliability assessments were based on evaluating sub-station voltages and transmission line loadings. A steady state power flow assessment of the California grid was performed to check if reduction in hydropower capacities of the three rim dams would adversely impact the grid reliability. No reliability violations were found except under LSJR Alternative 4. However, the results indicated that a simple re-dispatch of generator facilities would correct the minor violation. The new loading of the analysis element after this re-dispatch was 99.81 percent of the long-term emergency rating. Therefore, there would be no violation after the re-dispatch.

HPOC Comment: The electricity grid analysis should incorporate the impacts of California's current Renewable Portfolio Standard (RPS).[4] The SED's analysis of the power grid is backwards looking, drawing conclusions from historical data that does not reflect current or likely future conditions of the electrical grid, such as the 50% RPS and 40% reduction in GHG emissions from 1990 levels by 2030.[5] A study from the California Independent System Operator Corporation (CAISO) and GE Energy Consulting on the integration of renewable resources into the California power grid identified that hydropower "typically provides a large fraction of the regulation utilized by the CAISO, and is among the most flexible resources available, so anything that impacts its ability to provide the service has a noticeable impact on the market."[6] As additional renewable energy resources are introduced into the energy grid, "higher levels of renewable resources will increase the overall system variability and uncertainty and need for operational flexibility."[7] Although SED Appendix J references grid reliability and Section J.3.2 summarizes

the Ancillary Services Market, there is no indication of the impact resulting from the proposed LSJR Alternatives. Impact EG-1 listed in Section 14 focuses exclusively on transmission when identifying adverse effects to the reliability of California's electric grid. The CAISO system currently experiences extremely high ramping events as renewable facilities (predominately solar and wind) stop generating, such as in the evening or when wind stops blowing across hundreds of megawatts (MW) of wind turbines. In these events, the renewable energy must be replaced by more flexible generating units quickly enough to ensure that load is served in a reliable manner. The CAISO has also reported that between 6,000 and 8,000 MW of over-generation is expected this spring,[8] which indicates that ramping requirements will become more intense and strongly predicts the continued need for the clean generation and flexibility offered by hydropower.

The LSJR Alternatives, which require greater flow volume during the spring months, would result in more hydropower generation in the spring and less in the summer with the dual effect of: (a) increasing curtailment of renewable facilities in the spring, which negatively affects the economic value of resources required for RPS compliance; and (b) less hydropower available in the summer when it is needed most to serve peak load using zero-GHG emission energy.

The HPOC recommends that the Water Board coordinate with the CAISO and other state energy agencies to determine the full effect of lost flexibility to the energy grid when combined with the ongoing effort to integrate increasing amounts of renewable capacity to meet the 50% RPS mandate and carbon reduction goals.

Impact EG-2: ***Result in inefficient, wasteful, and unnecessary energy consumption***

SED evaluation: LSJR Alternatives 2, 3, and 4 (Less than significant/Less than significant with adaptive implementation)

SED reasoning: The SED found that LSJR Alternatives 2, 3, and 4, with or without adaptive implementation, could result in: (a) additional energy consumption by potentially increasing groundwater pumping; and (b) additional energy generation at other facilities to compensate for the loss of hydropower. The SED stated that the increased electricity generation was not inefficient, wasteful, and unnecessary, since it would be generated to maintain the energy supply level that is currently supplied by hydropower.

HPOC Comment: The SED does not adequately evaluate the environmental benefits of hydropower or the deleterious environmental impacts caused by changes in seasonal, daily or even hourly flows. Components of SED Section 14 understate the GHG impact of the proposed LSJR Alternatives. The conclusions reached in EG-2 focus on groundwater pumping and consumptive use of energy, without capturing the full and significant impacts of water usage for power generation. Consumption is not the only consideration recommended under the CEQA Guidelines Appendix F,[9] and the LSJR Alternatives fail all three criteria for achieving this energy conservation. This is shown in the table on page 4, below.

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CEQA Energy Conservation Goals	Effect of Plan Alternatives
1. Decreasing overall per capita energy consumption	Requires additional groundwater pumping to meet irrigation and drinking water needs, which will be much more significant during dry years than described by the averages used in SED Tables 14-11 and 14-12.
2. Decreasing reliance on fossil fuels such as coal, natural gas and oil	With less storage available to use for hydropower generation in the summer, electric utilities will be required to use less efficient, GHG emitting resources to meet their energy needs.
3. Increasing reliance on renewable energy sources	Non-hydro renewable energy sources are not capable of replacing the regulation service provided by hydropower. The practical effect is that conventional natural gas units will serve as replacement generation.

In contradiction to CEQA Guidelines Appendix F, the LSJR Alternatives will directly cause an increasing reliance on fossil fuels and decreasing reliance on renewable resources. This will be especially true due to California's over-generation problem (described below in the Impact EG-3 Comments). Reducing the availability of flexible zero-GHG hydropower will actually cause the curtailing of non-flexible renewable resources like solar and wind. By the very definition provided in the CEQA Guidelines, this curtailment of available renewable energy is wasteful and inefficient. These impacts, which are significant, were not satisfactorily addressed in the SED. And, since the SED incorrectly categorized the impacts as less than significant, the SED did not include a mitigation analysis.

Impact EG-3: ***Generate GHG emissions, either directly or indirectly, that may have a significant impact on the environment***

SED evaluation: LSJR Alternative 2 (Less than significant/Less than significant with adaptive implementation)

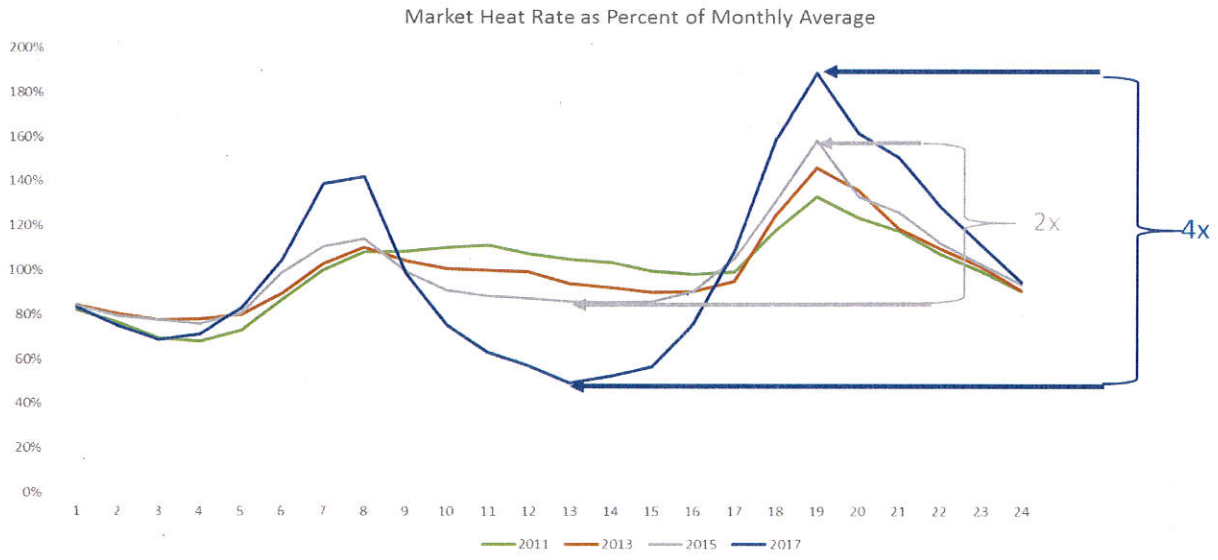
LSJR Alternatives 3, 4 (Significant and unavoidable/Significant and unavoidable with adaptive implementation)

SED reasoning: The SED calculated the annual GHG emissions generated from: (a) the increased power generation at other [fossil] generation facilities to balance the loss of hydropower production; and (b) the increased energy consumption for groundwater pumping to compensate for the reduction of surface water supply. The total GHG emissions generated by LSJR Alternatives 2, 3, and 4 are compared against a significance threshold of 10,000 MT CO_2e per year. The impacts of LSJR Alternatives 3 and 4 were deemed significant since GHG emissions would exceed the threshold. The SED stated that a review of GHG mitigation measure guidance documents was conducted to determine if additional actions could be taken to reduce GHG emissions. The listed

actions were almost exclusively demand side efficiency measures that would require regulatory action by the Water Board. The SED stated, however, that since the Water Board has limited resources to pursue such actions, the imposition of the identified mitigation measures is infeasible and impacts under LSJR Alternatives 3 and 4 are significant and unavoidable.

The Impact Analysis also reviewed various adaptive implementations that involved changing the timing or rate of unimpaired flow and changing the timing of the release of the volume of water within the February–June time frame to other parts of the year. The SED stated that these changes would not affect diversions or groundwater pumping, and on average it would have little effect on hydropower generation. But, neither would any adaptive implementations reduce the impacts under LSJR Alternatives 3 and 4, which would remain significant and unavoidable.

HPOC Comment: The SED discussion of Impact EG-3 overlooked the capability for adaptive management to mitigate GHG emissions. Intermittent renewable generation like solar and wind present challenges to grid reliability because their output fluctuates over multiple time horizons, forcing the grid operator to adjust its day-ahead, hour-ahead, and real-time operating procedures. The dramatic increases in solar generation in California is decreasing the need for mid-day, carbon-emitting generation in the energy market and is also decreasing GHG concentrations in the same timeframe. In contrast, the morning and evening energy demand has consistently driven increases in carbon intensity in the energy market as more fast responding carbon emitting thermal resources (typically, natural gas-fired units) are required to integrate the increasing amount of renewable resources. Another integration challenge is the "over-generation" that occurs when the generation resources deemed as "must-run" exceed California's entire electricity load and exports. Hydropower generation serves an important function for integrating solar because it can displace thermal generation that is typically called upon to maintain grid stability. Time-of-day hydropower operations have become increasingly important to achieve state-mandated carbon reduction goals by providing vital regulation of intermittent generation from renewable facilities as well as serving the peak summer demand with no carbon emissions. The graph below uses market heat rate as a proxy for GHG generation to show the normalized February hourly heat rates in 2011, 2013, 2015, and 2017. GHG emissions during peak demand are roughly four times higher than mid-day in 2017. Loss of hydropower and ever-increasing amounts of solar power will only exacerbate this trend.



Additionally, time-of-year generation has carbon implications as well. The SED analysis yielded increased hydropower generation in spring and decreased hydropower generation in summer for the LSJR Alternatives. As stated in the CAISO's GHG Emission Tracking Report, there are significantly more GHG emissions in summer months compared to the spring.[10] The hydropower generated by CVP dams represents a sizable percentage of California's GHG-free power generation. Specifically, the New Melones Dam located in the LSJR Watershed is operated to provide generation during periods of peak demand when energy generation from other renewable sources, such as wind and solar, are in decline or unavailable. We estimate that the GHG emissions during average peaking hours in August 2017 will be at least six times higher than during mid-day hours in spring 2017. This trend is expected to increase as California reaches the 50% RPS goal and beyond. Hydropower provided by New Melones Dam is capable of meeting this peak demand, and providing GHG-free energy during a time when it is also most valuable to air quality.

The SED's unimpaired flow power sector impact analysis addressed some GHG impacts from increased pumping and facility generation, but the analysis did not capture the increase in time of day and time of year carbon emissions through the loss in operational flexibility. This flexibility is pertinent to meet the state mandates, particularly to mitigate the increasing carbon density of resources serving load prior to sunrise and after sunset.

The SED did evaluate some mitigation measures but only certain demand side measures that would require regulatory action to implement and enforce. Based on the sources cited, the SED failed to even consider any meaningful supply side (operational) mitigation measures that would involve optimizing hydropower flexibility concomitant with achieving Water Board environmental goals. The SED must be updated to consider these impacts and reassess its analysis of feasible mitigation measures.

Impact EG-4: ***Conflict with an applicable plan, policy, or regulation adopted for the purposes of reducing GHG emissions***

SED evaluation: LSJR Alternative 2 (Less than significant/Less than significant with adaptive implementation)

LSJR Alternatives 3, 4 (Significant and unavoidable/Significant and unavoidable with adaptive implementation)

SED reasoning: As discussed for Impact EG-3, LSJR Alternatives 3 and 4 would generate GHG emissions greater than 10,000 MT CO_2e per year, which is inconsistent with the state goals listed in AB 32 or in any state policies and plans adopted to reduce GHG emissions. This impact was deemed significant. Like the Impact EG-3 mitigation analysis, the SED reasoned that the Water Board cannot feasibly impose identified mitigation measures and the impact would remain significant and unavoidable.

HPOC Comment: The HPOC arguments and comments made for Impact EG-3 also apply to Impact EG-4. As stated above, the SED evaluated some mitigation measures but only certain demand side measures that would require regulatory action to implement and enforce. The SED did not consider any meaningful supply side (operational) mitigation measures that would involve optimizing hydropower flexibility concomitant with achieving Water Board environmental goals. The SED must be updated to consider these impacts and reassess its analysis of feasible mitigation measures.

HPOC DISCUSSION AND COMMENTS ON SED CHAPTER 20 AND APPENDIX J

SED Energy Analysis: Appendix J and Section 20 rely on some technical assumptions and outdated data that introduce inaccuracies to the SED analysis. First, the New Melones plant's defined maximum potential capacity in the SED is 300 MW. However, New Melones Dam's installed capacity is 384 MW, with one 191.6 MW turbine at each of the two units and has historically been operated above 300 MW.[11] This affects the analyses for both the electric grid and related economic impacts. Second, the SED's reliance on the 82-year simulation data from CALSIM II omits scientific data following operational changes introduced since 2003, including information and recommendations for the protection of delta smelt, salmonids, and green sturgeon during long-term operations of the CVP found in the Biological Opinions of the US Fish & Wildlife Service[12] and the National Marine Fisheries Service.[13] The 82-year CALSIM II data also does not reflect operations during recent drought years.

SED Economic Analyses: Chapter 20's hydropower revenue valuation using a monthly time-step does not accurately capture economic impacts to hydropower. To derive the effects of LSJR Alternatives 2, 3, and 4 on hydropower revenue, the estimated change in monthly power generated over the 82-year simulation period was multiplied by an assumed monthly price of hydropower. While this information is valuable to estimate seasonal revenue impacts, a more granular analysis comparing hourly generation changes against hourly market prices needs to be conducted to account for the value and operational flexibility that hydropower provides. This hourly analysis will help to determine if increasing flows in spring months will exacerbate negative prices in the energy market, a phenomenon in which excess energy above demand causes generators to pay utilities to have resources consumed.[14] In a negative market price scenario hydropower operators may spill water before allowing it to flow through the generators. Without an hourly hydropower impact analysis it is unknown if the proposed water release changes force hydropower into a spilling state in high water years. It is also not clear if the proposed water release changes will allow New Melones to continue to operate as a valuable peaking unit in which it predominately generates in high energy demand hours and shuts down in saturated hours. Additionally, market prices used in the SED Economic Analysis were based on 2006 because they "most closely match the median price during years in which price data are available." At the time of the SED's publication, much more recent data were available, and are significantly different from the range analyzed.

Non-Flow Measures and Adaptive Management: The Economic Analyses Section 20.3.7 provides a general overview of recommended non-flow measures and their associated costs. However, there is no identified link between non-flow measures and adaptive management decisions, and similarly, there is no identified link between the cost of these "potential compliance actions that could be taken to inform the body of scientific literature and assist with adaptive implementation" and beneficiaries. The CVP power and water customers pay a surcharge for Central Valley Project Improvement Act (CVPIA) activities that already support many related projects, including many of those referenced in the section for cost comparison. The proposed adaptive management does not clearly define how it will respond to non-flow measures, introducing the risk of severing the relationship between the cost of maintaining watershed health and the benefits that are provided by the related water projects.

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CONCLUDING STATEMENT

In sum, the SED must be updated to consider the current regulations applicable to the electric sector, current system operating data and the most recent electricity planning tools. The impact of LSJR Alternatives must be evaluated in light of the rapid growth in renewable resources and the significant advancements made by the electric sector toward reaching California's renewable energy and greenhouse gas reduction goals. The SED must consider all feasible mitigation measures that incorporate Water Board goals while also reducing the carbon impacts to utilities that may conflict with state carbon policy, including cost increases to covered electric, industrial and agricultural entities complying with the California Cap-and-Trade program.[15]

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[1] City of Redding, City of Roseville, Modesto Irrigation District, Northern California Power Agency, Power & Water Resources Pooling Authority, Sacramento Municipal Utility District, and Trinity Public Utilities District. Technical support provided by the U.S. Bureau of Reclamation and Western Area Power Administration.

[2] See e.g., *California Energy Commission – Tracking Progress: Resource Flexibility,* http://www.energy.ca.gov/renewables/tracking_progress/documents/resource_flexibility.pdf ; *What the duck curve tells us about managing a green grid,* http://www.caiso.com/Documents/FlexibleResourcesHelpRenewables_FastFacts.pdf;

[3] Cal. Code Regs., tit. 23, § 3777(b)(3).

[4] SB 350, *Clean Energy and Pollution Reduction Act of 2015* (2015).

[5] SB 32, *California Global Warming Solutions Act of 2006: emissions limit* (2016); AB 197, *State Air Resources Board: greenhouse gases: regulations* (2016).

[6] *Integration of Renewable Resources,* https://www.caiso.com/Documents/Integration-RenewableResources-OperationalRequirementsandGenerationFleetCapabilityAt20PercRPS.pdf, at page 42.

[7] *Integration of Renewable Resources,* at page 22.

[8] *Memorandum to ISO Board of Governors,* http://www.caiso.com/Documents/CEOReport-Feb2017.pdf

[9] 2016 CALIFORNIA ENVIRONMENTAL QUALITY ACT STATUTE AND GUIDELINES, http://resources.ca.gov/ceqa/docs/2016_CEQA_Statutes_and_Guidelines.pdf, Appendix F: Energy Conservation, at page 276.

[10] *Greenhouse Gas Emission Tracking Report,* February 28, 2017, http://www.caiso.com/Documents/GreenhouseGasEmissions-TrackingReport-February2017.pdf

[11] The New Melones 300 MW plant capacity value was based on a 0.9 power factor. Bureau of Reclamation operates at 1.0 power factor. In addition, the units were rated at 115%. The 300 MW was divided by 0.9 power factor and then multiplied by 115% to arrive at 384 MW. https://www.usbr.gov/projects/pdf.php?id=47.

[12] US Fish & Wildlife Service, December 2008. *Biological Opinion regarding Proposed Coordinated Operation of the Central Valley Project (CVP) and State Water Project (SWP).* File number 81420-2008-F-1481-5, available at https://www.fws.gov/sfbaydelta/documents/SWP-CVP_OPs_BO_12-15_final_OCR.pdf.

[13] NOAA National Marine Fisheries Service. June 2009. *Biological and Conference Opinion regarding Long-term Operational of the Central Valley Project (CVP) and State Water Project.* File number 2008/09022, available at http://www.westcoast.fisheries.noaa.gov/central_valley/water_operations/ocap.html.

[14] *What the duck curve tells us about managing a green grid,* http://www.caiso.com/Documents/FlexibleResourcesHelpRenewables_FastFacts.pdf; at page 3.

[15] Cal. Code Regs., tit. 17, §§ 95801-96022.