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BEFORE THE
CALIFORNIA STATE WATER RESOURCES CONTROL BOARD

HEARING IN THE MATTER OF
CALIFORNIA DEPARTMENT OF
WATER RESOURCES AND UNITED
STATES BUREAU OF
RECLAMATION
REQUEST FOR A CHANGE IN POINT
OF DIVERSION FOR CALIFORNIA
WATER FIX

SURREBUTTAL TESTIMONY OF
DEIRDRE DES JARDINS

Surrebuttal Testimony of Deirdre Des Jardins
I, Deirdre Des Jardins, do hereby declare:

I. OVERVIEW

My name is Deirdre Des Jardins and I have previously testified in this matter. A summary of my expertise is included in Exhibit DDJ-108 Errata and a true and correct copy of my statement of qualifications has previously been submitted as Exhibit DDJ-100.

This sur-rebuttal testimony provides a response to information and testimony on climate change, provided in rebuttal by Armin Munevar, as well as oral testimony on State Water Project Operations by State Water Project Chief Operator John Leahigh, both testifying for the Department of Water Resources.

The testimony is organized into three sections:

1. Planning for Drought
2. Climate Change and shifts in Hydrology
3. Sea Level Rise

1. Planning for Drought

Mr. Munevar states in his testimony (Exhibit DWR-86),

“As to Mr. Bourez’s point (2) and Dr. Paulsen’s contention, it is not possible to represent measures that may be in response to a specific drought in a long-term planning model, as it would dependent on the circumstances specific to that event and it would be speculative to assume any such measures.” (p. 30)

Nancy Parker also stated in recross-examination that “droughts are unique.”

What we can observe from, I guess, recent experience is that policy and regulatory decisions that govern project operations in a particular drought are unique to the characteristics of that drought; i.e., the timing, the locality, the specific nature of precipitation, and other considerations. And that logic has not been generalized to the point that it can be included in a planning model. (R.T. May 12, 2017, 58:21-59:3.)

These statements are misleading. It is possible to plan for drought, and a 1983 publication of the Department of Water Resources (DWR), Bulletin 160-83, documents that the State Water Project was designed for a repeat of the 1928-34 drought. The same Bulletin also documents that the planned operation of the State Water Project to provide a reliable water supply in long-term droughts was...
abandoned. The change was made with the conscious decision to take increased risk with carryover storage to increase exports. I believe it is because of this fundamental shift in operations that droughts require special policy and regulatory intervention. As discussed later in this testimony, carryover targets for Oroville were relaxed so much that modeling for the No Action Alternative shows that Temporary Urgency Change Petitions (TUCPs) could be necessary with only a single critically dry year following a wet year.

For these reasons, it may not be true, as Mr. Munevar asserts in his written testimony (Exhibit DWR-86), that

If the model shows that water deliveries to these users, and the frequency of stressed water supply conditions for the project scenario matches the no action alternative, as is the case in this analysis, it indicates that the project scenario does not have any impact to the water users. (p. 7:15-18.)

The Board needs to assess whether the reservoir operations in the No Action Alternative and Preferred Alternative meet the obligations of the Coordinated Operating Agreement and Decision 1641. If they do not, then both the Preferred Alternative and No Action Alternative scenarios show likely impacts to other water users.

State Water Project Designed for a Repeat of 1928-34 Drought

DWR’s Bulletin 160-83 ( Exhibit DDJ-209) documents that Oroville reservoir was designed for long-term carryover storage in case of a repeat of the six year drought. But DWR also proposed in Bulletin 160-83 to take greater risks with State Water Project carryover storage to increase deliveries. This was done on the basis that the 1928-1934 drought only had a probability of recurrence of 1 in 200 years, which is now known to be incorrect.

Bulletin 160-83 ( Exhibit DDJ-209) states:

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Rebuttal Testimony of Deirdre Des Jardins
A few major reservoirs were developed for long-term carryover storage (water stored for use over several dry years), which means that storage capacity is several times the firm annual yield. Examples of such facilities are Shasta, Oroville, Berryessa, and New Melones. (p. 23)

Bulletin 160-83 (Exhibit DDJ-209) further states:

**Supply Dependability and Risk**

The thrust in California water development over the past few decades has been to increase water supplies to match needs, and in many areas, to increase the dependability of supplies. Much attention has been given to this by the SWP and the CVP which were designed to withstand reoccurrence of the 1928-1934 drought. Projects, facilities, and programs of other agencies have similar built-in-risks. But uncertainty regarding the capability of increasing developed supplies over the next several decades may justify and in fact may require taking greater risks in delivering water to customers.

Selection of the 1928-1934 drought to evaluate yield was not based on the relation of drought frequency to cost of facilities. Rather, it was based on the fact that both the CVP and SWP received popular support following the 1928-1934 drought, and Californians wanted the projects to provide essentially a full supply during the entire drought, regardless of its frequency of reoccurrence. Of course, during normal and above-normal years, projects can deliver much more water than is defined as yield under this criterion. Surface water projects of other agencies use different yield-determining dry periods, but the concept is the same. This operational procedure works well where adequate water supplies are already developed to meet existing and future uses. Unfortunately, the State's water uses are outpacing the rate at which increased supplies are being added.

Some water projects would take greater risks by delivering a higher annual supply, leaving less carryover storage in case of drought. This would allow growing needs to be met in normal years. While the final answer lies in what nature will actually provide, there is a good argument that, in the present era of uncertainty regarding future water development, given the frequency of reoccurrence of droughts, existing facilities may be operating in a more conservative manner than is necessary. The 1928-1934 dry period is estimated to have a reoccurrence of one in 200 to 400 years. However, such dry periods could occur in successive decades. Nevertheless, with such a small frequency probability, it may be that projects should take a greater risk and deliver a higher annual average supply. (p. 255-256, underlining added)

**Drought Recurrence**

The estimate that the 1928-1934 dry period has a reoccurrence of one in 200 to 400 years is not supported by the Sacramento Valley hydrology reconstructed from tree rings by David Meko. Six year droughts of similar severity occurred in the 1840s and 1780s. (Exhibit PCFFA-74, Table 2, p. 7.) And four years after Bulletin 160-83, the 1987-92 drought began.

Bulletin 160-83 does not disclose what the specific proposed changes were to carryover storage. But these changes were disclosed in a 1988 article in the academic journal Climatic Change by William
E. Riebsame, “Adjusting Water Resources Management to Climate Change” (Exhibit DDJ-210).²


![Diagram of End of Year Storage](image)

![Diagram of Delivery Shortage](image)

Fig. 5. Simulated SWP operations based on the 1977 rule curve and two alternatives proposed in 1985, for a hypothetical drought beginning with 1985 precipitation and storage conditions, and following the pattern of the 1929–34 design drought: (a) Total project storage at the end of each simulated year; (b) Delivery shortfalls from contract amounts. Source: California Department of Water Resources.

This rule curve was shown to State Water Project Chief Operator John Leahigh on cross-examination in Part 1A of the WaterFix hearing. Leahigh stated in response:

I wouldn't describe this as any kind of change in operations. The procedures for making delivery determinations have changed many -- many times over the years as far as getting a good balance. (R.T. August 19, 2016, 22:7-22:20.)

Leahigh also stated in written rebuttal testimony (Exhibit DWR-78):

the track record of the Projects for meeting water quality standards has been excellent other than for recent examples… Based on this record, I find the broad assertion by CSPA that the Projects systematically leave insufficient water in storage to meet water quality standards to be without merit. (7:11-16.)

But during cross-examination in rebuttal, Leahigh admitted that the carryover storage for Oroville had a “floor” of one million acre-feet for End of September storage, which is shown in the formula on p. 7 in Exhibit DWR-902, and is also discussed below. There is documentation that the rule was further relaxed from a more conservative rule in 2005.

Exhibit DDJ-206 is a copy of the presentation by Ryan Wilbur to the California Water and Environmental Modeling Forum on modifying the Oroville Carryover Target and associated CALSIM II allocation module for the State Water Project by Wilbur. It states:

DWR SWP Operations Control Office Requested analysis of water supply guidelines used to develop SWP allocations (p. 2)

Exhibit DDJ-206 was shown to John Leahigh on cross-examination. Leahigh acknowledged this consultation (R.T. May 11, 2017 65:21-23.)

The table in Exhibit DDJ-206 showing the pre-2005 rule and 2005 rule is on the next page (from p. 7.) The table shows that before 2005, the carryover target was 1 million acre feet + 0.5 * (previous September – 1 million acre feet). The 2005 rule changed to 1 million acre feet +X*(previous September - 1 million acre feet), where X = 0.5*allocation%. Exhibit DWR-902, p. 8, and associated testimony by Mr. Leahigh shows that the 2005 rule was the rule until recently.

Exhibit DDJ-206 states that the reason for the change was that the pre-2005 rule was “too conservative.”

The pre-2005 operating guidelines are very conservative and provides room for improvements in delivery capability with little risk of lower reservoir storages

This analysis provided the basis for the 2005 SWP water supply guidelines update used for determining allocations (p. 11.)
Exhibit DDJ-213 is a copy of OroRuleCurv from the No Action Alternative CALSIM code. It shows that the CALSIM II model hard codes the 2005 Oroville Rule Curve.

Table 3-1 extracted from Table 3-1 of Exhibit SVWU-201. It shows that in eight dry and critical years, Oroville end of September carryover storage is below 1 million acre feet. This happens even though some of the years are preceded by above normal and wet years. This is not conservative operation, and it shows that carryover storage targets are so low that even a single year of drought could push reservoir storage to levels where a TUCP is necessary.

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Rebuttal Testimony of Deirdre Des Jardins
Mr. Leahigh testified that the “floor” was increased to 1.3 million acre feet, but this may still not be enough, given that the 2013 End of September carryover storage was about 1.6 million acre-feet.

Mr. Leahigh testified that the “floor” was changed to 1.3 million acre feet.

2. Climate Change and Shifts in Hydrology

Mr. Munevar states the following with respect to hydrology (Exhibit DWR-86):

Based on the extensive climate change analyses conducted for BDCP/CWF, including the recent Q2 climate change analysis in the BA, the findings were consistent across the multiple climate change projections considered. Overall the incremental changes due to the CWF operations as compared to the NAA evaluated under a variety of future climate change scenarios considered, were similar to that described under the Q5 climate change projection included in the DWR and USBR’s Part 1A direct testimony.

As shown on the graph on the next page from the BA, the response was to have lower End of September carryover storage in Oroville. This exacerbates the effects discussed in the preceding section. These effects will also be worse for higher sea level rise scenarios, because increased outflows are needed to repel salinity.
Sea Level Rise

Armin Munevar’s testimony (Exhibit DWR-86 Errata) states,

These assumptions were also consistent with Vermeer and Rahmstorf (20096), the USACE 2011 guidance for incorporating sea level change in civil works programs, and the National Research Council sea level rise projections from 2012 [SWRCB-4, Table 29-2]. (p. 33)

However, an examination of the USACE 2011 guidance for incorporating sea level change in civil works programs shows that the assumptions were not consistent with that guidance. Exhibit DDJ-211 is the 2011 Army Corps of Engineers’ Circular EC 1165-2-212, Sea-Level Change Considerations for Civil Works Programs. ³

In the circular, Army Corps recommends using “low”, “intermediate”, and “high” rates of sea level rise for the project lifetime, calculated from curves modified from the National Research Council’s sea level rise guidance. The Army Corps of Engineers’ Regulation, *Incorporating Sea Level Change in Civil Works Programs*, 2011.

³ Exhibit DDJ-211 is a true and correct copy of Engineer Circular EC 1165-2-212, Sea-Level Change Considerations for Civil Works Programs, U.S. Army Corps of Engineers, 2011.
Civil Works Programs, released in December 2013, superceded EC 1165-2-212. Exhibit DDJ-213 is a copy of the Regulation. It states:

(3) The low, intermediate, and high scenarios at NOAA tide gauges can be obtained through the USACE on-line sea level calculator at http://www.corpsclimate.us/ccaceslcurves.cfm

The closest NOAA tide gauge to the Delta is at Port Chicago. The USACE low, intermediate, and high scenarios at the NOAA tide gauge at Port Chicago were provided in testimony in Part 1B for Pacific Coast Federation of Fishermens’ Associations / Institute for Fisheries Resources (PCFFA/IFR.) as a graph in exhibit PCFFA-65 and a table in exhibit PCFFA-64.

The curves in exhibit PCFFA-65 were provided through 2135, which was the end of the estimated 100 year lifetime of the project, and within the lifetime of the Change Petition. The USACE intermediate and high rates of sea level rise are somewhat lower than those estimated by NOAA, but similar.

With respect to using the “low”, “intermediate”, and “high” sea level rise estimates, the 2011 Army Corps sea level rise guidance (Exhibit DDJ-211) states


[...]
The 2011 Army Corps sea level rise guidance (Exhibit DDJ-211) also states

c. Determine how sensitive alternative plans and designs are to these rates of future local mean SLC, how this sensitivity affects calculated risk, and what design or operations and maintenance measures should be implemented to minimize adverse consequences while maximizing beneficial effects. Following the approach described in 6b above, alternative plans and designs are formulated and evaluated for three SLC possible futures. Alternatives are then compared to each other and an alternative is selected for recommendation. The approach to formulation, comparison and selection should be tailored to each situation. The performance should be evaluated in terms of human health and safety, economic costs and benefits, environmental impacts, and other social effects. There are multiple ways to proceed at the comparison and selection steps. Possible approaches include:

(1) Working within a single scenario and identifying the preferred alternative under that scenario. That alternative’s performance would then be evaluated under the other scenarios to determine its overall potential performance. This approach may be most appropriate when local conditions and plan performance are not highly sensitive to the rate of SLC. (p. 2)
While the Department of Water Resources has worked within a single, intermediate sea-level rise scenario, and identified alternatives under that scenario, the alternative’s performance has not been evaluated under other sea level rise scenarios to determine its potential performance.

Evaluating the performance of the project and risk of adverse consequences under other sea level rise scenarios was exactly what was recommended in Part 1B.

Executed on this 9th day of June, 2017 in Santa Cruz, California.

Deirdre Des Jardins