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10 Attorneys for California Department of Water  
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12 **BEFORE THE**

13 **CALIFORNIA STATE WATER RESOURCES CONTROL BOARD**

14 **HEARING IN THE MATTER OF CALIFORNIA  
15 DEPARTMENT OF WATER RESOURCES  
16 AND UNITED STATES BUREAU OF  
17 RECLAMATION REQUEST FOR A CHANGE  
18 IN POINT OF DIVERSION FOR CALIFORNIA  
19 WATER FIX**

20 **TESTIMONY OF EN-CHING HSU**

21 I, En-Ching Hsu, do hereby declare that I am an expert in the HEC5Q and  
22 Reclamation Temperature Model that were utilized to assess the California WaterFix  
23 (CWF). As a project engineer in DWR's Bay-Delta Office, I have run temperature models  
24 for Bay Delta Conservation Plan studies, the predecessor to the CWF, and analyzed the  
25 model inputs and outputs to assure the accuracy of data preparation and model  
26 computation.

27 HEC5Q is a modeling tool that simulates daily reservoir and river water temperature  
28 based on daily flow, reservoir storage, and 6-hour meteorological data. (Exhibit DWR-  
1088.) HEC5Q is often used for long-term planning analyses and has been applied to  
numerous rivers across the United States. For the CWF Biological Assessment (BA)  
(SWRCB-104), HEC5Q was applied to the Trinity-Sacramento, American, and Stanislaus  
Rivers. Monthly CalSim II outputs, with a period of record of October 1921 to September  
2003, were downscaled to daily time series as inputs to the HEC5Q model. The model  
simulates the Temperature Control Device (TCD) operations by making upper level

1 releases in the winter and spring, mid-level releases in the late spring and summer, and low  
2 level releases in the late summer and fall. To accomplish this function, the Shasta and  
3 Folsom temperature models operate to meet mean monthly tail-water temperature targets  
4 that function as a surrogate for downstream temperature compliance.


5 The Reclamation Temperature Model simulates monthly reservoir and stream  
6 temperatures used for evaluating the effects of CVP/SWP project operations on mean  
7 monthly water temperature in the basin. (Exhibit DWR-1083.) For the current BA, the use of  
8 the Reclamation Temperature Model was limited to simulating water temperature in the  
9 Feather River system.

10 The Trinity-Sacramento River HEC5Q model was last calibrated for the period of  
11 1998-2002 (Exhibit DWR-1084), and a validation was performed in 2015 to incorporate  
12 additional Gerber CIMIS data collected through 2012. (Exhibit DWR-1085.) The American  
13 River HEC5Q model was last fully calibrated in 2013 using a calibration period of 2003-  
14 2011 and a validation procedure was performed in 2015. (*Id.*) The Stanislaus River-Lower  
15 San Joaquin River HEC5Q model was last fully calibrated in 2013, with a calibration period  
16 of 1990-2010. (Exhibits DWR-1086 and DWR-1087.)

17 Detailed descriptions of the HEC5Q and Reclamation Temperature Model are  
18 included in Appendix 5C and its references, along with a description of how the models  
19 were used in assessing the effects of CWF H3+ in comparison to the No Action Alternative.  
20 (See SWRCB-104.)

21 Based upon my expertise I am able to answer technical questions regarding the  
22 usefulness, accuracy, functioning, and applicability of the HEC5Q and Reclamation  
23 Temperature Models.

24  
25 Executed on this 28th day of November, 2017 in Sacramento, California.

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(En-Ching Hsu)

AD Consultants, Resource Management Associates, Inc. (RMA), Watercourse Engineering, Inc (WCI). 2007. Stanislaus – Lower San Joaquin River Water Temperature Modeling and Analysis.

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Resource Management Associates (RMA). 1998. HEC-5 Users Manual: Simulation of Flood Control and Conservation Systems, Appendix on Water Quality Analysis.

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US Bureau of Reclamation (Reclamation). 2008. Appendix H Reclamation Temperature Model and SRWQM Temperature Model. OCAP Biological Assessment.

US Bureau of Reclamation (Reclamation). 2015. Final Environmental Impact Statement for the Coordinated Long-Term Operation of the Central Valley Project and State Water Project: Appendix 6B Surface Water Temperature Modeling.

Exhibit SWRCB-104. Biological Assessment for the California WaterFix. 2016.