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BEFORE THE CALIFORNIA STATE WATER RESOURCES CONTROL BOARD

In the matter of 2016 SWRCB Hearing re CalWaterFix Petition for Change

REBUTTAL TESTIMONY OF GOMATHISHANKAR PARVATHINATHAN, MBK ENGINEERS

PROFESSIONAL BACKGROUND AND QUALIFICATIONS

1. I am a registered civil engineer in the State of California. I specialize in hydrologic modeling. I am an engineer at MBK Engineers, located at 455 University Avenue, Suite 100, Sacramento, CA 95825. MBK Engineers specializes in water resources engineering and performs these engineering services for local public agencies and private clients principally in the Delta and the Sacramento Valley. MBK Engineers was formed in 1967 (then known as Murray, Burns and Kienlen) and currently employs approximately 23 engineers. Exhibit NDWA-6, which has been previously admitted into evidence in this proceeding, is a true and correct copy of my professional qualifications.

2. Exhibit NDWA-5 is a true and correct copy of my written testimony in this proceeding, which was previously admitted into evidence. On October 28, 2016 I provided oral testimony in support of the case in chief of North Delta Water Agency and its member districts.

3. I have reviewed the testimony submitted by Petitioners in support of the case-in-chief in this proceeding, together with the supporting exhibits, and my findings and observations are included herein.

SUMMARY OF TESTIMONY

4. In DWR 66, Dr. Tehrani testifies "[m]odel results at times show modeling anomalies. A small fraction of these anomalies represent modeled exceedances at some locations." DWR-66, p. 3. Dr. Tehrani restated during his oral presentation and cross-examination that the modeled exceedances of D-1641 water quality objectives under both baseline and proposed Cal WaterFix operations are modeling anomalies and are not expected to occur in reality.

5. From the standpoint of a professional modeler, modeling anomalies are deficiencies that arise as a result of the inherent limitations and uncertainties in the model's mathematical representation of the real-time processes.

6. CalSim II and DSM2, like any other models, are not perfect in simulating reality and can produce anomalous results. However, Dr. Tehrani's conclusion that all exceedances are due to modeling anomalies has not been scientifically demonstrated in a quantitative manner.

7. My rebuttal testimony will demonstrate a need to investigate the modeled exceedances in detail before they can be dismissed as modeling anomalies.

8. To illustrate, DWR Exhibit 513 Figure C1 presents the probability of exceedance of D-1641 water quality objectives at Emmaton under different scenarios. Based on this figure, D-1641 compliance is shown to be approximately 88 percent under the No Action Alternative (NAA) and approximately 78 percent under the Boundary 1 Scenario. In other words, the probability of exceeding the D-1641 water quality objectives under the baseline is 12 percent whereas it is approximately 22 percent under Boundary 1, an increase of 10 percent under Boundary 1.

9. The issue is whether the increase in modeled exceedances of 10 percent is a realistic potential effect of the proposed Cal WaterFix operations or a modeling anomaly.

10. The Petitioners have testified that the increase in modeled exceedances is not a realistic potential effect of the proposed Cal WaterFix operations, because in real time the operators will be able to meet the D-1641 water quality objectives. *See* Hearing Transcript, Vol. 14, pp. 47-50.

11. While it is plausible that the operators could meet the D-1641 water quality objectives even under the proposed Cal WaterFix operating conditions, the ability to do so would depend on the volume of freshwater that could be made available in the Delta which further depends on several factors such as: (i) the severity of Delta salinity conditions under the proposed Cal WaterFix operations; (ii) the availability of water upstream; and (iii) other physical and operational constraints to release stored water or to take other actions. In reality, it is quite plausible that there could be a scenario in the future when, under Cal WaterFix operations Delta water quality exceeds D-1641 objectives and a large quantity of freshwater would be required to be released from upstream storages in order to comply with D-1641 objectives, but the water may not be physically available or allowed to be released.

12. Even if one were to assume that the operators would somehow meet the D-1641 water quality objectives by additional release of stored water or other actions, the Petitioners' operations modeling does not assess whether additional freshwater is available to meet the water

quality objectives during the periods when the modeling shows exceedances. By not accounting for the additional volume of stored water that may be required to meet water quality objectives, the modeling may have under-estimated water supply impacts to water users which could be significant depending on the salinity conditions, water supply and demand.

13. The volume of freshwater required to eliminate the additional modeled exceedances of the D-1641 water quality objectives due to Cal WaterFix operations has not been determined by Petitioners at this time. However, it is possible to determine how much additional freshwater would be needed to eliminate these exceedances through an iterative modeling process where the system can be re-operated using CalSim II either by releasing more stored water or by other actions to provide additional freshwater flows and simulate water quality conditions in the Delta using DSM2 based on revised boundary flows. This process can be performed iteratively until the water quality results show compliance is with water quality objectives is achieved. This iterative process would demonstrate the most likely frequency of meeting the objectives in the future under the proposed Cal WaterFix operations and also quantify impacts to water supplies.

14. To conclude, the petitioners have not explained in detail what these modeling anomalies are and how these anomalies can cause modeling exceedances in a detailed quantitative manner. Even if one were to assume that the all of the modeled exceedances are modeling anomalies and are not expected to occur in reality due to more efficient real-time operations of the system, the operations modeling fails to account for the additional volume of water that may be required to obtain compliance under the proposed Cal WaterFix operations. In other words, by allowing violation of D-1641 water quality objectives in some months, the petitioners may have under-estimated the cost to meet compliance under D-1641.

15. Until further technical details are presented on the modeling exceedances and how these exceedances may indicate a water supply impact that is not currently evaluated, it is not reasonable to dismiss the modeled exceedances as a modeling anomaly.