EXHIBIT WDCWA-100

TESTIMONY OF WALTER BOUREZ, P.E.

1. I am a registered civil engineer in the State of California and am employed by the firm of MBK Engineers ("MBK"). I hold Bachelor of Science and Master of Science degrees in Civil Engineering from California State University, Sacramento.

2. I have over 20 years of experience in water resources engineering and have worked on numerous projects involving the modeling of surface water systems, including many projects involving the operation of CalSim models of state and federal water systems in the Central Valley.

3. A sample of the projects in which I have been involved include: (1) revising CalSim II to better represent the physical characteristics of the Sacramento River, Colusa Basin Drain and Stony Creek; (2) working with the federal Bureau of Reclamation to document aspects of the CalSim II model hydrology; (3) serving as a key developer of the CalSim model's depiction of the San Joaquin River system, including the operations of numerous upstream reservoirs in that system and of all water districts in the San Joaquin River basin; and (4) performing hydrologic modeling analysis to determine potential impacts to river systems tributary to the Sacramento – San Joaquin River Delta and in the Delta from proposed actions and projects including: DWR's Franks Tract Project, San Joaquin River Restoration, Upper San Joaquin River Basin Storage Investigation, Delta-Mendota-Canal Recirculation Study, Sacramento Water Forum EIR, EIR/EIR for serving CVP contracts under Public Law 101-514, Hamilton City Pumping Plan Fish Screen Improvement Project EIR/EIS, DWR's Delta Risk Management Strategy, San Luis Low Point Improvement Project EIS, water transfers analysis, and numerous other projects.

4. A copy of my resume, which accurately describes my education and experience, is Exhibit WDCWA-101.

5. For this hearing, I was asked to prepare exhibits and testimony on the following subjects:
    a. Background information describing how Term 91 diversion prohibition works;
    b. Background information on the CalSim II hydrological model;
    c. My update of the CalSim II modeling that was performed for the 2007 Davis-Woodland Water Supply Project (DWWSP) EIR to include most recent Central Valley Project (CVP) and State Water Project (SWP) system operating criteria; and
    d. The results of this updated CalSim II modeling including:
        i. The numbers of months during which the Term 91 diversion prohibition would be in effect and the amounts of water that would be available for diversion under the DWWSP water-right permits during a repeat of the 82-

year simulation period; and

  ii. The impacts of these DWWSP diversions on Sacramento River and Delta flows and CVP/SWP system operations;

e. The effects of potential future changes in Delta outflow requirements on the amounts of water that will be available for diversion under the DWWSP water-right permits; and
f. Claims that water in the Bay-Delta Watershed is greatly over appropriated.

TERM 91 BACKGROUND

6. Standard Permit Term 91 originally was adopted by the State Water Resources Control Board (SWRCB) on November 19, 1981 and is described in SWRCB Order WR 81-15. Order WR 81-15 and the subsequent Water Right Decision 1594 and Order WR 84-2 developed a method, which became Standard Permit Term 91. Term 91 specifies a method for determining when water is not available for diversion under post-1965 water-right permits for diversions in the Delta watershed. Water-right permits and licenses with Term 91 are junior in priority to any Delta regulatory standards adopted by the SWRCB in the past and any new Delta regulatory standards that may be adopted by the SWRCB in the future.

7. Diversions must be curtailed under permits with Term 91 when satisfaction of inbasin entitlements requires release of supplemental Project water by the CVP or the SWP.

8. Inbasin entitlements are defined as all rights to divert water from streams tributary to the Sacramento-San Joaquin Delta or the Delta for use within the respective basins of origin or the Legal Delta, unavoidable natural requirements for riparian habitat and conveyance losses, and flows required by the State Water Resources Control Board for maintenance of water quality and fish and wildlife. Export diversions and Project (CVP and SWP) carriage water are specifically excluded from the definition of inbasin entitlements.

9. Supplemental Project water is defined as that water imported to the basin by the Central Valley Project and State Water Project plus water released from Project storage which is in excess of export diversions, Project carriage water, and Project inbasin deliveries.

10. The SWRCB notifies permittees of curtailments of diversion under Term 91 when the SWRCB finds that supplemental Project water has been released or will be released. The SWRCB advises permitees of the probability of imminent curtailment of diversions under Term 91 as far in advance as practicable based on anticipated requirements for supplemental Project water provided by the CVP and SWP operators.

11. Implementation of Standard Permit Term 91 is expressed in the following equation:

$$SW = SR - (EX + CW)$$

SW - Supplemental Project water
SR - Total amount of water released from CVP and SWP storage and import facilities
EX - Total CVP and SWP export diversions from the Delta
CW - Carriage water associated with CVP and SWP exports

CalSim II BACKGROUND

WRIMS

12. The Water Resources Integrated Modeling System (WRIMS) is a generalized water resources software program developed by the Bay-Delta Office of the Department of Water Resources (DWR). WRIMS is entirely data driven and can be applied to most reservoir-river basin systems. WRIMS represents a given physical system (reservoirs, streams, canals, pumping plants, etc.) through a network of nodes and arcs. The model user describes system connectivity and various operational constraints using a modeling language known as Water Resources Simulation Language (WRESL). WRIMS simulates facility operations using optimization techniques to route water through the network based on mass balance accounting. A mixed integer programming solver determines an optimal set of decisions at each monthly time step for a set of user-defined priorities (weights) and system constraints.

CalSim II

13. Because the CVP and SWP are California's largest water projects, their operations influence, and at times control, flow in the Sacramento and San Joaquin river basins and the Delta. For this hearing, we simulated water conditions and facility operations in the Delta and upstream areas using the CalSim II model.

14. CalSim II is an application of the WRIMS software that was jointly developed by the Bureau of Reclamation (Reclamation) and DWR for performing planning studies related to CVP and SWP operations. The primary purpose of CalSim II is to evaluate the water supply reliability of the CVP and SWP at current or future levels of development (e.g., 2005, 2030), with and without various assumed future facilities, and with different modes of facility operations. Geographically, the model covers the drainage basin of the Delta, and CVP and SWP exports to the San Francisco Bay Area (Bay Area), Central Coast, and Southern California. The model assumes that facilities, land use, water supply contracts, and regulatory requirements are constant over the period of simulation, representing a fixed level of development. The historical flow record of October 1921 to September 2003, adjusted for the influences of land use changes and upstream flow regulation, is used to represent the possible range of future hydrological conditions. Upstream water use is based on best available estimates of diversions and depletions using land use and irrigation factors to depict actual water use as accurately as possible. Major Central Valley rivers, reservoirs, and CVP and SWP facilities are represented by a network of arcs and nodes. CalSim II uses monthly mass balance accounting, and

therefore cannot simulate the tidal hydrodynamics of the Delta, and has limited ability to represent Delta water quality.

15. CalSim II can be used in either a comparative or an absolute mode. In the absolute mode, results of a single model run, such as the amount of delivery or reservoir levels, are considered directly. The comparative mode consists of comparing two model runs: one that contains a proposed project alternative and one that does not. Differences in certain factors, such as deliveries, river flows, and reservoir storage levels, are analyzed to determine the effects of the project alternatives on system-wide operations. All of the assumptions are the same for the No Action/No Project alternative and action alternative model runs, except for assumptions regarding the action itself, and the focus of the analysis is on the differences in the results. In comparative analysis, model biases tend to cancel out. As such, the measured differences in comparative analysis are generally considered more accurate than the absolute values of the individual studies.

16. Results from a single simulation may not necessarily correspond to actual system operations for a specific month or year, but are representative of general water supply conditions. Model results are best interpreted using various statistical measures such as long-term or year-type averages.

17. For a few months of the 82-year simulation period, CalSim II can simulate significantly different operations under similar conditions. The reasons for this are the threshold triggers used in CalSim operations logic. For example, in CalSim II, when modeled Lake Oroville storage falls below 1 MAF, modeled Oroville storage releases are made solely to support in-basin uses and in-stream flow requirements. Under such conditions, any modeled release from Oroville storage that supports south-of-Delta exports is incidental. On the other hand, if modeled Oroville storage is above 1 MAF, significant modeled releases are allowed from Oroville storage to support south-of-Delta exports when needed. For this reason, CalSim II modeling could result in a significantly different modeled operation for a given month if Oroville storage begins the month at 1.001 MAF in one study and at 0.999 MAF in another. Of course, in real-time, SWP operators would be equally protective of Oroville storage in both cases if everything else in the system was roughly the same. This is just one example of several threshold triggers that can cause differences between different model runs.

18. Such simulated changes in operations are modeling artifacts, and for the most part, differences due to these modeling artifacts tend to average out over the simulation period. Thus, while one study may have large exports in one month, the alternative will likely have increased exports in another. During wetter years the differences in modeled impacts are typically minimal. However, during drought years, the response to the threshold triggers can cause significant differences in modeled Delta water quality and project deliveries between different model runs, even though differences in assumptions for the different model runs are not large. When caused by modeling artifacts, such differences in model results are not an accurate measure of actual project impacts. Therefore, modeled operations are closely examined to determine when changes are "real", and when they are "artificial." In the few cases where artificial changes caused

unrealistic modeled project impacts (both positive and negative), the operations logic was changed to allow for more reasonably similar modeled operations for similar conditions. Even with these changes, all regulatory standards were left in place.

19. To conduct the hydrologic analysis for DWWSP diversions under its requested water-right permits, I used the version of the CalSim II model that was used by DWR to develop its 2009 State Water Project Delivery Reliability Report study, which DWR released to the public on January 29, 2010. This model is available for download from DWR's Web site at:

http://baydeltaoffice.water.ca.gov/modeling/hydrology/CalSim/Downloads/CalSimDownloads/CalSim-IIStudies/SWPReliability2009/index.cfm

20. I have reviewed the version of the CalSim II model described above, and for the analyses described in this testimony, the following minor adjustments were made to this model to shorten model run time and prevent oscillations between model cycles:

    a. Condensed model from a two-step TXFR study to a single-step CONV study;
    b. Operated Contra Costa Water District Delta diversions to DSM2 pre-processed intake salinity instead of ANN calculated intake salinity; and
    c. Minor adjustment to the implementation of the Delta Cross Channel RPA in the Delta Smelt Biological Opinion.

21. All of the scenarios were modeled over the 82-year period of hydrological record from 1922 through 2003. Existing levels of development in the Sacramento Valley, San Joaquin Valley, and export service areas were assumed. For a list of detailed assumptions, refer to Appendix A in the State Water Project Delivery Reliability Report (December 2009).

UPDATED CalSim II MODELING

22. The purpose for updating the CalSim II modeling of the DWWSP is to evaluate the project under current CVP/SWP system operating criteria. Since the CalSim II analysis of DWWSP was developed in support of the 2007 DWWSP EIR, changes have occurred that could affect the assessment of DWWSP water availability and impacts. These changes are:
    a. The salmon and smelt Biological Opinions were updated due to a decision by Judge Wanger nullifying the previous Biological Opinions. The updated biological opinions established new flow criteria in the Delta and its tributaries for the protection of salmon and smelt.
    b. The University of California at Davis reduced its project demand for DWWSP water, thereby reducing project demand from 56,717 AF/year to 46,136 AF/year.

23. Assumptions regarding the DWWSP described in the 2007 EIR modeling technical appendix are implemented in the updated modeling and the same CalSim II modeling methodology (with the updates described above) is used for the updated analysis.

24. For the updated analysis four modeling scenarios were performed:
    a. Existing Conditions
    b. Existing Conditions With Project
    c. Cumulative Conditions
    d. Cumulative Conditions Without Project.

25. The Existing Conditions scenario assumes existing facilities and operating criteria and the Existing Conditions With Project scenario assumes the DWWSP is added to the Existing Conditions scenario. For future level of development the Cumulative Conditions scenario includes reasonably foreseeable projects, including the DWWSP. The Cumulative Conditions Without Project assumes reasonably foreseeable projects without the DWWSP.

26. To determine the effects of the DWWSP on Sacramento River and Delta flow, the Existing Conditions With Project model simulation is compared to Existing Conditions, and the Cumulative Conditions model simulation is compared to Cumulative Conditions Without Project. The results of the comparisons of these model simulations are in Exhibits WDCWA-102 WDCWA-102and WDCWA-103,WDCWA-103 which include the following:

    a. DWWSP modeled diversions;
    b. Percentages of time when Term 91 curtailments are in effect;
    c. Summary results of comparisons;
    d. Summaries of average Delta flows and changes;
    e. Modeled Delta outflows and differences; and
    f. Modeled Sacramento River flows at Freeport and differences.

27. These results are described in detail in the following paragraphs.

28. Exhibit WDCWA-102, page 2 is a table of monthly DWWSP diversions under the proposed water-right permits for the Existing Conditions With Project model run. The maximum annual diversion is 46,136 AF and the minimum annual diversion is 21,900 AF. Although the seasons when Term 91 curtailments would be in effect in the updated modeling are similar to these seasons in the modeling performed for the 2007 EIR, there are variations in how often the Term 91 curtailments would be in effect. Exhibit WDCWA-102, page 3 lists the monthly frequencies of when the Term 91 diversion curtailment would be in effect under both scenarios.

29. Exhibit WDCWA-102, page 4 lists annual and dry year averages for key system parameters for both scenarios with the updated modeling. Although the Existing Conditions scenario in the updated modeling differs from the Existing Conditions scenario for the 2007 EIR because of recent changes in CVP and SWP operating criteria,

the relative differences in flows in the updated modeling are very similar to differences in the 2007 EIR modeling.

30. Exhibit WDCWA-102, page 5 is a schematic of Delta channels with labels at key locations listing the location name, Existing Conditions (labeled as "Base") average flow, and average change in flow. The magnitudes of flow changes in the updated modeling are similar to those in the 2007 EIR modeling and all still are minor relative to the magnitudes of flows in the Existing Conditions modeling.

31. Exhibit WDCWA-102, page 6 lists average monthly Delta outflows for the Existing Conditions scenario, Exhibit WDCWA-102, page 7 lists average monthly Delta outflows for the Existing Conditions With Project scenario, and Exhibit WDCWA-102, page 8 lists the average monthly differences in Delta outflows between these two scenarios.

32. Exhibit WDCWA-102, page 9 lists average monthly Sacramento River flows at Freeport for the Existing Conditions scenario, Exhibit WDCWA-102, page 10 lists average monthly Sacramento River flows at Freeport for the Existing Conditions With Project scenario, and Exhibit WDCWA-102, page 11 lists the average monthly differences in Sacramento River flows at Freeport between these two scenarios.

33. Exhibit WDCWA-103, page 2 is a table of monthly diversions for the Cumulative Conditions model run. The maximum annual diversion under the proposed DWWSP water-right permits is 46,136 AF and the minimum annual diversion is 18,300 AF. Although the seasons when Term 91 curtailments would be in effect in the updated modeling are similar to these seasons in the modeling performed for the 2007 EIR, there are variations in how often Term 91 curtailments would be in effect; Exhibit WDCWA-103, page 3 lists the monthly frequencies of Term 91 curtailments for both scenarios.

34. Exhibit WDCWA-103, page 4 lists annual and dry year averages for key system parameters for both scenarios with the updated modeling. Although the Cumulative Conditions scenario in the updated modeling differs from the Cumulative Conditions scenario for the 2007 EIR because of recent changes in CVP and SWP operating criteria, the relative differences in flows in the updated modeling and the 2007 modeling are very similar.

35. Exhibit WDCWA-103, page 5 is a schematic of Delta waterways with labels at key locations listing the location name, Cumulative Conditions (labeled as "Base") average flow, and average change in flow. The magnitudes of flow changes in the updated modeling are similar to those in the 2007 EIR and all still are minor relative to the magnitudes of flows in the Cumulative Conditions scenario.

36. Exhibit WDCWA-103, page 6 lists average monthly Delta outflows for Cumulative Conditions Without Project, Exhibit WDCWA-103, page 7 lists average monthly Delta outflows for the Cumulative Conditions scenario, and Exhibit WDCWA-103, page 8 lists the average monthly difference in Delta outflows between these two scenarios.

37. Exhibit WDCWA-103, page 9 lists average monthly Sacramento River flows at Freeport for the Cumulative Conditions Without Project scenario, Exhibit WDCWA-103, page 10 lists average monthly Sacramento River flows at Freeport the for Cumulative Conditions scenario, and Exhibit WDCWA-103, page 11 lists the average monthly differences in Sacramento River flows at Freeport between these two scenarios.

38. Exhibits WDCWA-102 and WDCWA-103 demonstrate that the modeled effects of DWWSP diversions under its proposed water-right permits in the updated modeling are very similar to the modeled effects in the modeling done for the 2007 EIR. The conclusions in the 2007 EIR that are based on this hydrological modeling therefore, will not change because of the updated modeling.

POTENTIAL FUTURE CONDITIONS

39. The purpose of this portion of my testimony is to address the State Water Board's key hearing issue of whether water is available for appropriation pursuant to Applications 30358A and 30358B. I also address the Protestants' argument in their August 16, 2010 letter to the SWRCB that, because diversions from the Sacramento River should be reduced by 3 to 5 maf/yr to provide for greater Delta outflows, the SWRCB should not issue any water-right permits for the DWWSP.

40. The SWRCB's August 2010 Delta flow criteria report does not adopt any new flow requirements, and my understanding is that the SWRCB must balance all competing demands on the available water supplies before it may establish any new flow requirements. Nevertheless, to address the Protestants' argument, we performed an analysis to estimate the monthly frequencies of when water would be available for diversion under the proposed DWWSP water-right permits if the SWRCB were to adopt the Delta flow criteria in the August 2010 report.

41. This analysis was performed by comparing the proposed SWRCB Delta flow criteria to flows in the output from the version of the CalSim II model that was used by DWR to develop its 2009 State Water Project ("SWP") reliability study and was also used in our updated CalSim II analysis that is described above. For this analysis, the following flow criteria were compared to corresponding flows in the CalSim II output:
    a. Minimum Delta outflow at 75% of unimpaired Delta outflow from January through June;
    b. Minimum Sacramento River at Rio Vista at 75% of Sacramento River unimpaired flow from November through June;
    c. Minimum Sacramento River below Georgiana Slough of 13,000 cfs in November, April, and May; and
    d. Minimum San Joaquin River flow at Vernalis at 60% of San Joaquin River unimpaired flow from February through June.

42. Flow criteria for Old and Middle Rivers (OMR) are listed in the August 2010 SWRCB Delta flow criteria report but are not addressed in our analysis. This is because OMR

flow criteria result in decreases in CVP and SWP Delta exports and increases in Delta outflows and potentially in Delta outflow surpluses, and the frequency of water available for diversion under the DWWSP therefore, probably would increase if these OMR criteria were included in our analysis.

43. For this analysis, water available for diversion is calculated as the minimum of the surplus flow in the Sacramento River at Rio Vista, the surplus flow in the Sacramento River below Georgiana Slough, and surplus Delta outflow. San Joaquin River flow criteria are only considered when we were estimating surplus Delta outflows. The table in Exhibit WDCWA-104 lists the percentages of time during each month when surpluses would be present in the Sacramento River and the Delta under this analysis. The monthly percentages in this table indicate how often water would be expected to be available for diversion under the proposed DWWSP water-right permits if the SWRCB were to adopt the flow criteria in the 2010 report as regulatory requirements. As this table indicates, even if the SWRCB were to adopt such regulatory requirements, water still would be available for diversion under the proposed DWWSP water-right permits during December through March of many water years. With such requirements, Term 91 still would prohibit the DWWSP from diverting water under its proposed water-right permits during times when surplus flows would not be present.

44. This conclusion is consistent with the facts that there are times when the Sacramento River Basin is in flood conditions, and even if 75% of unimpaired flow under such conditions must flow out of the Delta, there still would be significant amounts of water available for diversion under the proposed DWWSP water-right permits. The aerial photograph in Exhibit WDCWA-105, page 2 is of the flood of March 1940 and was taken looking east toward the Sutter Buttes, with the town of Colusa on the Sacramento River in the right foreground. Under these conditions, the Sutter Basin, a natural overflow area incorporated into the flood control project as a bypass, was filled entirely with water stretching from the Sacramento River east levee to the foot of the Sutter Buttes. Water was entering the Basin through overbank flows along the east bank of the upper Sacramento River, and through two of the fixed weirs, Moulton Weir and Colusa Weir (just upstream, to the left of this photo). The Sutter Basin empties into the Sutter Bypass, a wide flood channel that carries excess Sacramento River flood water parallel to the River down to the confluence of the Feather and Sacramento Rivers.

45. The two aerial photographs in Exhibit WDCWA-105, page 3 of the Sacramento River and Fremont Weir were taken on February 20, 2004 by Joseph Countryman of MBK Engineers. When the Sacramento River flow reaches about 56,000 cfs, water begins to flow over the Fremont Weir into the Yolo Bypass. In 2004, the flow over the weir was greater than 50,000 cfs.

46. Under conditions like these, water would be available for diversion under the proposed DWWSP water-right permits, even if the SWRCB were to adopt the flow criteria in its August 2010 report as regulatory requirements.

ALLEGED OVER APPROPRIATION OF WATER IN BAY-DELTA WATERSHED

47. The purpose of this portion of my testimony is to address the State Water Board's hearing issue of whether water is available for appropriation pursuant to Applications 30358A and 30358B. In addition, I address the Protestants' reliance on claims that water in the Bay-Delta Watershed is greatly over-appropriated. Claims by the Protestants, relative to the Bay-Delta Watershed, appear to rely on work that was done for, and statements that were made by, the Delta Vision Blue Ribbon Task Force. As discussed in the following paragraphs, these statements rely on inappropriate data and do not consider pertinent water-rights and water-use information, data, and knowledge.

48. The Protestants have used two different portions of the SWRCB's September 26, 2008 letter to Delta Vision to support their position. It is clear the SWRCB's letter, when read in its entirety, was attempting to suggest a comparison of water right face value with the unimpaired flow is not appropriate. Rather than attempt to interpret the SWRCB letter for use in this hearing, I will leave it to the SWRCB, with its understanding of face values of water rights, actual diversions and use, and other relevant information to evaluate the usefulness of this letter for this hearing. However, I do provide the following pertinent details.

49. All references to water right data in my testimony are based on the State Water Board's eWRIMS database. The database I am relying on is dated March 2010.

50. It is my understanding the data used in arriving at the statements of over appropriation are based on water right data and information for both consumptive and non-consumptive uses. This often can lead to incorrect conclusions, because the same water often is diverted and used under several different water-right permits and licenses. For example, a review of the eWRIMS database for the Pit River System demonstrates that the Pacific Gas and Electric Company ("PG&E") has appropriative water rights for direct diversions for hydroelectric power generation at eight different powerhouses upstream of Shasta Lake on the Pit River System. (We have not included the PG&E Powerhouse, known as the James Black Powerhouse, as it diverts water from the McCloud River and Iron Canyon Creek and complicates the point being made here.) Exhibit WDCWA-106 is a map showing the locations of these powerhouses. A table summarizing the key water right data is provided in Exhibit WDCWA-107. As can be seen on Exhibit WDCWA-106, three of these powerhouses are on two separate upstream tributaries.

51. The sum of the direct diversion rates contained in the water rights for the eight powerhouses on the main stem of the Pit River and the two upstream tributaries is 42,875 cfs, with a range from 500 cfs to 8,000 cfs. The total face value of these water rights is 31,055,303 acre-feet.

52. Water that is diverted at each powerhouse is returned to the Pit River system and then is diverted by the next downstream powerhouse. For this reason, the same water can be

appropriated and diverted up to seven times. (Water diverted by the Hat Creek Powerhouse No. 1 and Hat Creek Powerhouse No. 2 is not diverted by the Pit River No 1 Powerhouse, so no water goes through all eight powerhouses.) The highest diversion rate of any of these powerhouses is 4,850 cfs, therefore this is the maximum being diverted. Thus, it would be most accurate to state that a total of 4,850 cfs has been appropriated by PG&E for use at eight different powerhouses, even though the simple addition of all of the direct-diversion rights results in a total of 42,875 cfs. This demonstrates that simply adding up the face value of all of the water-right permits, licenses, and statements in the Delta watershed significantly overestimates the amounts of water that is diverted and used in the watershed. Moreover, none of the water that is diverted by any of these powerhouses is consumed; instead, all of it continues to flow downstream, where it is available for subsequent appropriations by direct diversions and diversions to storage for consumptive and non-consumptive purposes.

53. Exhibits WDCWA-106 and WDCWA-107 also demonstrate that a single powerhouse may be covered by multiple water rights. For example, the Pit River No. 3, Pit River No. 4, Pit River No. 6, and Pit River No. 7 Powerhouses all are subject to both post-1914 applications and statements of diversion and use, which were filed for claims of riparian or pre-1914 appropriative rights. Thus, each of these powerhouses may have multiple entries in the eWRIMS database for the same diversions and uses. These separate entries should not be added to determine the total amounts of water that are appropriated for these powerhouses.

54. Water is appropriated for direct diversion and storage for both consumptive and non-consumptive purposes. This is demonstrated by a brief review of the water rights for Shasta Dam that are on file with the SWRCB. There are three water rights for consumptive use and two water rights for non-consumptive use at Shasta Dam. These are summarized in Exhibit WDCWA-108. The water rights for consumptive and non-consumptive uses are for the same water. This was, and continues to be, the standard practice for water right applications for multi-purpose projects. As a result, there are two or more entries in the eWRIMS database for diversions of the same water. Also, as discussed above, a portion of the water that is appropriated at Shasta Dam has previously been appropriated upstream several times by PG&E in the Pit River watershed, from which water flows into Shasta Lake. Similar examples are provided in Exhibits WDCWA-109 and WDCWA-110 for Oroville and Folsom Dams, respectively.

55. The entries in the eWRIMS database are for the amounts of maximum authorized diversions, not the amounts of consumptive use or depletions. A water user must hold a water right sufficient to cover its maximum diversion. These diversions must be adequate to cover transportation losses, deep percolation, and other losses as well as consumptive use requirements of the irrigated crop when the water used is for irrigation. To fully meet the consumptive use requirements of a crop, some level of tailwater is necessary. The current method for flood irrigating rice includes a level of flow-through to manage water quality; this is referred to as cultural water. The tailwater and cultural water returns to the stream system and is available for appropriation. Even the entries in

the eWRIMS database for irrigation water rights therefore almost always overstate the amounts of water that are consumptively used pursuant to these rights.

56. Moreover, many water rights contain a term specifying an amount for maximum authorized diversion and use that can be significantly less than the face value of the water right that appears in the eWRIMS database. For example, the four water rights shown in Exhibit WDCWA-109 for Oroville Dam have terms limiting the combined maximum diversion to storage to 3,880,000 acre-feet per year. This total is far less than the total face value of the storage portion of these four water rights which total 7,960,000 acre-feet per year. This total does not include the direct diversion portion of the four water rights shown in Exhibit WDCWA-109.

57. Also, there are a large number of water right holders within the Sacramento Valley that have agreed to maximum diversions under their water rights that are far less than total the face values of their water rights through water-rights Settlement Contracts with the U.S. Bureau of Reclamation and the Department of Water Resources. These include the Sacramento River Settlement Contractors with the U.S. Bureau of Reclamation and the State Water Contractors on the Feather River System with the Department of Water Resources.

58. The claims of over appropriation also do not address the physical availability of water for diversion under a particular water right. In many streams, the physical availability of water limits the amount of water that may be diverted under a particular water right to an amount that is far less than the water right's face value. For example, the eWRIMS database contains entries for numerous water rights for diversions of water from west side tributaries to the Sacramento River. Based on my knowledge of this system and U.S. Geological gages, there are many times no water is physically available in these west side tributaries for diversion during times when the water rights authorize such diversions. Entries in the eWRIMS database for such water rights significantly overstate the amounts of water that actually can be diverted under these rights.

59. The claims of over appropriation include the water rights of the CVP and SWP for exports of water from the Sacramento Valley. These water rights are junior in priority to, and contingent on meeting, in-basin needs and environmental needs of the Bay-Delta Estuary. Also, authorized diversions under these water rights have been greatly restricted under the federal Endangered Species Act. The face values of these water rights in the eWRIMS database therefore are significantly greater than the actual amounts of water that may be diverted under these water rights.

60. The SWRCB's September 26, 2008 letter states that "actual use under existing water rights is clearly a better metric to compare with unimpaired flow than is face value but the State Water Board has limited information on actual use". Through my work on the Delta planning models, I have evaluated the estimated maximum annual depletion within the Sacramento Valley to be approximately 5 MAF. This does not include the areas above the major reservoirs, such as Shasta Lake and Lake Oroville. However, the depletion from these latter area is insignificant in comparison. The annual unimpaired

flow for the Sacramento River watershed is approximately 9 MAF for the 90% exceedance (dry year) and 32 MAF for a 10% exceedance (wet year). Exhibit WDCWA-111 provides this information in graphical form. While this also is not a completely appropriate comparison, particularly because it does not consider month-to month variations in water availability. Still, as discussed in the SWRCB's letter, this is a better metric for estimating availability of water for appropriation.

61. The best available tool for determining when water will be available for appropriation is the CalSim II modeling discussed above. As discussed above, our CalSim II modeling work shows that water is available for appropriation by the DWWSP, and that Term 91 will prohibit the DWWSP from diverting water under its proposed water-right permits during times when there is no unappropriated water.