CITY OF STOCKTON
Office of the City Attorney
JOHN M. LUEBBERKE, ESQ (SBN 164893)
TARA MAZZANTI, ESQ, (SBN 186690)
City Attorney
425 N. El Dorado Street, 2nd Floor
Stockton, CA 95202-1997
Telephone: (209) 937-8333
Facsimile: (209) 937-8898
john.luebberke@stocktonca.gov
tara.mazzanti@stocktonca.gov

SOMACH SIMMONS & DUNN
A Professional Corporation
PAUL S. SIMMONS, ESQ. (SBN 127920)
KELLEY M. TABER, ESQ. (SBN 184348)
KRISTIAN C. CORBY, ESQ. (SBN 296146)
500 Capitol Mall, Suite 1000
Sacramento, CA 95814
Telephone: (916) 446-7979
Facsimile: (916) 446-8199
psimmons@somachlaw.com
ktaber@somachlaw.com
kcorby@somachlaw.com

Attorneys for CITY OF STOCKTON

BEFORE THE

CALIFORNIA STATE WATER RESOURCES CONTROL BOARD

HEARING ON 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.	**REBUTTAL TESTIMONY OF SUSAN PAULSEN, Ph.D., P.E.**

BACKGROUND AND QUALIFICATIONS

My name is Susan Paulsen and I am a Registered Professional Civil Engineer in the State of California (License # 66554). My educational background includes a Bachelor of Science in Civil Engineering with Honors from Stanford University (1991), a

Master of Science in Civil Engineering from the California Institute of Technology (Caltech) (1993), and a Doctor of Philosophy (Ph.D.) in Environmental Engineering Science, also from Caltech (1997). My education included coursework at both undergraduate and graduate levels on fluid mechanics, aquatic chemistry, surface and groundwater flows, and hydrology, and I served as a teaching assistant for courses in fluid mechanics and hydrologic transport processes.

I currently am a Principal and Director of the Environmental and Earth Sciences practice of Exponent, Inc. (Exponent). Prior to that, I was employed by Flow Science Incorporated, in Pasadena, California, where I worked for 20 years, first as a consultant (1994-1997), and then as an employee in various positions, including President (1997-2014). I have 25 years of experience with projects involving hydrology, hydrogeology, hydrodynamics, aquatic chemistry, and the environmental fate of a range of constituents.

My Ph.D. thesis was entitled, "A Study of the Mixing of Natural Flows Using ICP-MS and the Elemental Composition of Waters," and the major part of my Ph.D. research involved a study of the mixing of waters in the Sacramento-San Joaquin Bay-Delta (the "Delta") using source water fingerprints. I also directed model studies to use chemical source fingerprinting to validate the volumetric fingerprinting simulations using Delta models (including the Fischer Delta Model (FDM) and the Delta Simulation Model (DSM)). I have designed and directed numerous field studies within the Delta using both elemental and dye tracers, and I have designed and directed numerous surface water modeling studies within the Delta.

For my testimony in this matter, I am familiar with and knowledgeable about the City of Stockton's ("Stockton" or "City") water rights, water operations, and water diversion.

A copy of my curriculum *vitae* is included as Appendix A to the Report on the Effects of the California WaterFix Project on the City of Stockton in Exhibit STKN-026.

///

SUMMARY OF TESTIMONY

I was retained by Stockton to assist the City in its evaluation of the California WaterFix Project ("WaterFix" or "Project"). My testimony responds to assertions made by Petitioners Department of Water Resources (DWR) and U.S. Bureau of Reclamation in their Part 1 case-in-chief testimony and exhibits in the State Water Resources Control Board (SWRCB) proceedings on the WaterFix Water Rights Change Petition (Petition), as well as statements and evidence included in the WaterFix Final Environmental Impact Report/Environmental Impact Statement (FEIR/EIS), regarding the Project's effect on Stockton as a legal user of water, and more specifically on the Project's impacts on the City's municipal water supply derived from its intake on the San Joaquin River. My testimony includes comments on the changes in hydrodynamics and water quality that are expected to occur in the Delta after implementation of the WaterFix Project, and to rebut Petitioners' assertions that the WaterFix Project will not have an impact on the supply and quality of water available to Stockton, which uses fresh water from the Delta for potable municipal supply. My testimony presents six primary opinions in rebuttal to Petitioner's case-in-chief:

- Opinion 1: DWR did not evaluate water quality at Stockton's intake. Water quality impacts as evaluated by DWR at Buckley Cove are not representative of the impacts that will occur at Stockton's intake.
- Opinion 2: Contrary to DWR's assertions, Exponent's analysis shows that the WaterFix Project will result in significant water quality impacts at Stockton's intake.
- Opinion 3: Water quality will be harmed at the City's intake whether or not D-1641 water quality objectives are met.
- Opinion 4: Long-term averages cannot be used to determine the impacts of the WaterFix project on Stockton. When model results are evaluated using daily or sub-daily timesteps, water quality impacts are significant.
- Opinion 5: WaterFix operations are not clearly defined, and as such it is not possible to determine and understand the impacts of the WaterFix Project.

- Opinion 6: DWR does not use appropriate Delta baseline conditions.

Additional details of my opinion are provided in the report entitled, "Report on Effects of the California WaterFix Project on the City of Stockton." (Exhibit STKN-026.)

TESTIMONMY

Rebuttal Opinion #1: DWR did not evaluate water quality at Stockton's intake. Water quality impacts as evaluated by DWR at Buckley Cove are not representative of the impacts that will occur at Stockton's intake.

In the Recirculated Draft EIR (RDEIR)/Supplemental Draft EIS (SDEIS) and the FEIR/EIS, DWR evaluated water quality at Buckley Cove, and DWR stated that water quality at Buckley Cove was representative of water quality at the location of Stockton's surface water intake on the San Joaquin River at the southwest tip of Empire Tract. Testimony in Part 1 of the Petition proceedings by DWR's modeling panel reiterated DWR's position that its evaluation of Project-related water quality changes at Buckley Cove in the RDEIR/SDEIS was representative of water quality changes that would occur at Stockton's intake.

The City pointed out in its Part 1 case-in-chief (STKN-003, STKN-004, and STKN-010) that its intake is not near Buckley Cove. Exhibit STKN-001 shows that Stockton's intake is located more than eight (8) miles from Buckley Cove. DWR nevertheless continued in the FEIR/EIS, issued on December 22, 2016, to describe impacts at the City's intake using modeling information obtained for the Buckley Cove location, stating: "For municipal intakes located in the Delta interior, locations at Contra Costa Pumping Plant No. 1 and Rock Slough are taken as representative of Contra Costa's intakes at Rock Slough, Old River and Victoria Canal, and the assessment location at Buckley Cove is taken as representative of the City of Stockton's intake on the San Joaquin River." (FEIR/EIS, p. 8-165:20-24).

In response to DWR's continued assertions that Buckley Cove is representative of Stockton's intake location, Stockton asked me to evaluate the source and quality of water at the two locations. My analysis found that (a) source water fingerprints show that the source and composition of water at Buckley Cove are very different than at the

City's intake, and (b) water quality impacts simulated using DWR's model input files at these two locations are very different.

Exponent used DWR's DSM2 model input files to conduct DSM2 modeling runs to evaluate the source of water at Stockton's intake location and at Buckley Cove, and our analysis of the source water fingerprints found that water at the two locations exhibited different source fingerprints. For example, source water fingerprints describing no-Project conditions (both the existing baseline condition (EBC2) and future no action alternative (NAA) scenarios) in Exhibit STKN-026, Figure 4, show that Sacramento River water is the dominant source of water at the City's intake in dry years, with concentrations ranging from 30 percent (in April) to more than 90 percent (in July, August, and December). The San Joaquin River constitutes between 0 and 50 percent of the water at the City's intake, and agricultural drainage constitutes between 5 and 15 percent (Exhibit STKN-026, Figure 4). In contrast, Sacramento River water is absent from Buckley Cove in dry years in all months except the summer months, when it constitutes up to 20 percent of the water at Buckley Cove. San Joaquin River water comprises about 45 to nearly 100 percent of the water at Buckley Cove, and agricultural return flows represent up to 30 percent, during all months of dry water years (Exhibit STKN-026, Figure 5). Results in other year types are similar and are included in Exhibit STKN-026.

Water quality at Stockton's intake is also notably different than at Buckley Cove. As discussed in the methods section of Exhibit STKN-026, the yearly average salinity of the San Joaquin River is higher (343 milligrams per liter (mg/L) total dissolved solids (TDS) in 2015) than the Sacramento River (103 mg/L TDS in 2015); because the Sacramento River represents a larger fraction of the water at the City's intake (up to 90 percent in July, August, and December), the salinity at Stockton's drinking water intake is generally lower than at Buckley Cove. Exhibit STKN-026, Figure 7 and Figure 8 show the average simulated chloride concentration at Stockton's intake and at Buckley Cove, respectively, during dry water years under the EBC2 and NAA model scenarios.

During dry water years, the average chloride concentration at Stockton's intake varies from a low of 25 mg/L (June) to a high of about 100 mg/L (March) (Exhibit STKN-026, Figure 7). In contrast, the average chloride concentration at Buckley Cove varies from approximately 80 mg/L (October) to 180 mg/L (February and March) (Exhibit STKN-026, Figure 8). Simulated chloride concentrations for other water year types show similar patterns and are presented in Exhibit STKN-026, Attachment 4.

The data and analysis presented in STKN-026 demonstrate that DWR's assertion that water quality conditions at Buckley Cove are representative of Stockton's water supply is erroneous. DWR's response to the City's comments on the RDEIR/SDEIS, which have provided maps and information showing the different locations, states that "the effects of alternatives at the locations assessed are considered representative of the effects of the alternatives in various portions of the Delta as a whole." DWR has maintained that water quality conditions at Buckley Cove are representative of the "eastern Delta, where the City's intake is located." (FEIR/EIS, RDEIR/SDEIS Comments and Responses to Comments, REC, IRC Letter Numbers 2400-2499, at pp.156-157.) Exponent's DSM2 modeling analysis, which was performed using DWR's DSM2 model input files, shows a high degree of variability in water quality and the source of water in the eastern Delta. Exponent's analysis further demonstrates that water quality modeled at Buckley Cove does not and cannot represent the range of impacts that are expected at Stockton's water supply intake under the Project.

Rebuttal Opinion #2: Exponent's analysis shows that the WaterFix Project will result in significant water quality impacts at the City's intake. The Boundary scenarios and the operations starting point proposed in the FEIR/EIS, Alternative 4A, all show water quality impacts at Stockton's intake, and these impacts are significant.

DWR did not analyze water quality at the City's intake (see Rebuttal Opinion #1). Instead, DWR evaluated water quality impacts at Buckley Cove and asserted, despite the City's concerns, that these impacts were representative of impacts at the City's intake. Because DWR did not evaluate impacts at the City's intake, the City asked me to evaluate water quality impacts at its intake using DWR's model input files. Rebuttal

Opinion #2 was formulated from these independent analyses based on DSM2 results.

As explained in Section 5.1 of Exhibit STKN-026, DWR has stated in written and oral testimony that they may operate within the bounds defined by the Boundary scenarios, and that the Boundary scenarios should be used to evaluate impacts. However, as described in Rebuttal Opinion #1, neither the information provided in DWR's Petition, exhibits, or testimony to the SWRCB nor the FEIR/EIS evaluates the impacts of any of the Project alternatives, including Alternative 4A, the FEIR/EIS preferred alternative, at the location of Stockton's intake. My analysis of DSM2 results shows that, under Alternative 4A, the source and quality of water at Stockton's intake is markedly different from both the EBC2 and the NAA scenarios. Modeling demonstrates that under Alternative 4A, the volume of higher quality Sacramento River water at Stockton's intake is expected to decrease substantially relative to the EBC2 and NAA scenarios, while the volume of more saline and lower quality San Joaquin River water and agricultural flows is expected to increase (see Exhibit STKN-026, Section 8.1).

In addition, Exponent compared the source of water and water quality at Stockton's intake for the boundary scenarios to the preferred Alternative 4A and to the EBC2. Exponent's analysis demonstrates that the source of the water at Stockton's intake, and the fraction of Sacramento River water, will change significantly if Scenario Boundary 2 or Alternative 4A are implemented relative to EBC2, for all year types (Exhibit STKN-026 Figure 9, and Appendix D). Changes for Scenario Boundary 2 relative to EBC2 are most pronounced during dry and critical water years. For example, in December of a dry water year, operation to Boundary 2 parameters would decrease the amount of Sacramento River water at the intake from 90 percent (EBC2) to 55 percent (Boundary 2) (Exhibit STKN-026, Figure 9). Operation to Boundary 2 would also increase the volume of lower quality San Joaquin River water relative to EBC2 during all water year types (STKN-026, Figure 9 and Appendix D). Alternative 4A shows a substantial decrease in Sacramento River water compared to EBC2 during December of dry water years as well, decreasing to 50 percent (Boundary 2) from 80 percent

(EBC2) by the start of January. In general, Alternative 4A and Boundary 2 scenarios result in less Sacramento River water and more San Joaquin River water at Stockton's intake throughout the year.

DSM2 results show that the number of days that chloride will exceed the City's 110 mg/L threshold during critical water years will increase from 35 days under EBC2 to 53 days under Alternative 4A, and to 75 days under the Boundary 2 scenario (Exhibit STKN-026, Table 3). Similarly, the number of days that chloride will exceed the 110 mg/L threshold during dry years is simulated to increase from 31 days per year under EBC2 to 58 days per year under Alternative 4A, and to 77 days for the Boundary 2 scenario (Exhibit STKN-026, Table 3). This difference represents up to an 87 percent increase in the number of days that water in the San Joaquin River at the City's intake will not be useable by the City under Alternative 4A and a 151 percent increase under the Boundary 2 scenario (see dry water year, Exhibit STKN-026, Table 3).

During dry water years, higher chloride concentrations resulting from Alternative 4A operations (relative to existing baseline) will occur at Stockton's intake from January to May, while during normal and wet water years, higher chloride concentrations will occur during June and December (Exhibit STKN-026, Figure 10 and Appendix E).

In addition to increases in salinity, the residence time of water in the Delta will increase for scenarios B1, B2, and Alternative 4A relative to the existing condition EBC2 and NAA (Exhibit STKN-026, Table 5). The greatest change in residence times from the existing baseline condition (EBC2) will occur during the months of July to December, and residence times for Alternative 4A and the Boundary 1 and 2 scenarios will increase markedly with respect to EBC2. For example, residence times will be 37% longer, on average, during the month of August in dry years for the Boundary 2 scenario relative to EBC2. In addition, residence times will be similar for the no action alternative (NAA) and the EBC2, demonstrating that the increase in residence times is caused primarily by the proposed WaterFix project and not by sea level rise or climate change. In addition,

Microcystis growth is correlated with residence time and temperature, and the greatest increases in residence time that will be caused by the WaterFix Project will occur in months (e.g., August) when water temperature is highest. For this reason, it is likely that the WaterFix Project will cause an increase in *Microcystis* growth within the Delta.

Rebuttal Opinion #3: Water quality will be harmed at the City's intake whether or not D-1641 water quality objectives are met.

DWR's primary testimony stated that if the WaterFix Project is operated to meet D-1641 criteria, water users within the Delta will not be harmed: "A reduction in water quality that is within the objectives contained in D-1641 would not interfere with the ability of other legal users to put water to beneficial use." (DWR-53 at p. 13:18-20.) However, not all the proposed operations scenarios will be operated to meet D-1641 criteria. The Boundary 1/Existing Outflow scenario, for example, "represents an operational scenario with most of the existing regulatory constraints… but does not include additional spring Delta outflow, additional OMR flows, existing I/E ratio, and the existing Fall X2 flow requirement imposed in the existing BiOp for Delta Smelt." (DWR-51 at p. 13:18-21.) Further, D-1641 municipal and industrial (M&I) beneficial use criteria are not evaluated at or near Stockton's intake. And, as described in Rebuttal Opinion #2, our analysis, performed using DWR's model input files for the various scenarios, shows that significant water quality impacts and a decrease in the useability of water at the City's intake are expected to occur as a result of the WaterFix Project.

Rebuttal Opinion #4: Long-term averages cannot be used to determine the impacts of the WaterFix project on Stockton. When model results are evaluated using daily or sub-daily timesteps, water quality impacts are significant.

DWR evaluated water quality impacts using long-term averages (see, for example, DWR-513, Figures EC1-EC6 and Figures CL1-CL3, which show 16-year monthly average electrical conductivity and chloride concentrations, respectively, at locations distant from Stockton's intake). In contrast, water purveyors such as Stockton operate in real time. DSM2 is capable of (and was designed to) model tidal variations in

flows and water quality, which occur on hourly or sub-hourly timesteps. DSM2 is frequently used with monthly input data (such as the data generated by CalSim II) to simulate hydrodynamics and water quality within the Delta. Aggregating model output into long-term averages, as was done by DWR, masks project impacts and does not provide the level of detail needed for the City to understand the impacts of the WaterFix Project on its operations. As detailed in Exhibit STKN-026, Section 8.2 and in Rebuttal Opinion #2, our analysis using DWR's model input files indicates that the WaterFix Project will have significant impacts on the City's operations and on water quality at the City's intake.

Rebuttal Opinion #5: Despite DWR's assertions to the contrary, WaterFix operations are not clearly defined, and as such it is not possible to determine and understand the impacts of the proposed WaterFix project.

In its case-in-chief for Part 1 of the WaterFix proceedings before the SWRCB, DWR presented four scenarios (H3, H4, Boundary 1, and Boundary 2) to describe the WaterFix Project. In the body of the FEIR/EIS issued on December 22, 2016, DWR presented extensive detail for a new preferred alternative, Alternative 4A, along with 17 additional scenarios (1A, 1B, 1C, 2A, 2B, 2C, 3, 4, 5, 6A, 6B, 6C, 7, 8, 9, 2D, and 5A). Despite the introduction and description of the new preferred alternative, it is uncertain under which conditions DWR will operate to Alternative 4A, and it is clear that operations may include the Boundary 1 and Boundary 2 operations scenarios. For example, DWR testified that:

> Alternative 4A is described by initial operational criteria that provides for a range of outflows. This range is described as initial operational scenarios H3 and H4. However, prior to operation of the project, there will be specific initial operating criteria as set forth in the CWF BiOp. These criteria may be based on adaptive management. The boundary analysis will provide a broad range of operational criteria and the initial operating criteria will fall within this range. (DWR-51 at p. 10:4-11).

In contrast to detailed descriptions of expected water quality conditions for the 18 scenarios listed above, the Boundary 1 and Boundary 2 scenarios were presented in cursory fashion within an appendix to the FEIR/EIS, and the boundary scenarios do not appear to have been considered by DWR in the same level of detail as the other

scenarios in the FEIR/EIS evaluation of the environmental impacts of the Project. DWR has indicated to the SWRCB that operations will probably begin in the H3-H4 (Alternative 4A) range, but that it is possible that they may operate between Boundary 1 and Boundary 2. DWR testified to evaluating "a range call [sic] Boundary 1 to Boundary 2. And the purpose of that is because… this project also includes the collaborative science and adaptive management program and the ability to make adjustments to the initial operating criteria based on science and monitoring… So Boundary 1 and 2 represent what we think at this time, based on those uncertainties, are the range of potential adjustments that may be made." (See Transcript of Jennifer Pierre Oral Testimony before the SWRCB in the WaterFix Change Petition Proceedings, Part 1A Volume 4, July 29, 2016 at p. 40:4-15.)

As noted in the FEIR/EIS, the Petition proceedings, and in DWR's testimony, Project operations under any scenario may be adjusted according to the adaptive management and monitoring program (AMMP). However, the AMMP was not defined adequately in either the WaterFix proceedings or the FEIR/EIS. DWR described the AMMP in vague terms, and indicated that the AMMP will be implemented in consideration of the benefits to fish, not M&I beneficial uses (see FEIR/EIS pp. 3-283, 5-167). Substantial literature on the application of adaptive management to the Delta is available and should have been used by DWR as a guide for describing how project operations will be adjusted over time. For example, DWR should have specified the goals and objectives of the AMMP; decision criteria and a description of the type(s) of information that will be considered to implement changes in operations; logistical details regarding who will participate, when they will meet, and how members of the public or water users can participate in the process; details of the monitoring, data management, data sharing, performance metrics, and decision-making process; and procedures to be implemented when disputes or disagreements occur and cannot be readily resolved. In addition, DWR should have included measures or triggers based on the protection of water quality for M&I uses, and the formal inclusion of representatives of M&I drinking

water intakes within the Delta in the decision-making process.

Despite multiple recommendations for adaptive management specific to the Delta, and despite existing models of adaptive management that have been developed for the Delta (see Exhibit STKN-026, Section 5.2), the FEIR/EIS provided almost no detail on the AMMP proposed by DWR, and fails to include the details and standards for adaptive management for the Delta that have been described consistently by the scientific community since at least 2009. The potential impacts of the Project cannot be determined without a clearly structured, well-defined adaptive management proposal, including the thresholds or decision criteria that would result in changes to operations and the process that would be used to change operations.

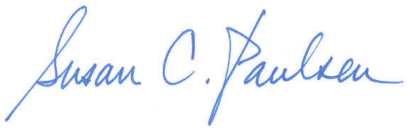
Rebuttal Opinion #6: DWR does not use appropriate Delta baseline conditions.

DWR included only a future no action condition, the NAA, in analyses presented during the WaterFix proceedings. The NAA scenario was intended to represent the future no action baseline at the year 2025, including climate change effects and the Fall X2 standard. The FEIR/EIS includes the existing biological conditions (EBC1) existing condition scenario in addition to the NAA to evaluate WaterFix Project impacts under the preferred Alternative 4A scenario. However, the EBC1 baseline is flawed and inappropriate as it does not include the Fall X2 provision of the 2008 U.S. Fish and Wildlife Service Biological Opinion (2008 BiOp) that governs Central Valley Project/State Water Project operations (see FEIR/EIS at p. 4-6). Failing to include the Fall X2 provision in EBC1 increases the modeled salinity of the existing condition, which in turn makes the water quality impacts of the Project appear less significant than they would with the appropriate baseline. Because the 2008 BiOp presents the requirement to manage Delta outflows and operate water storage and releases to achieve the Fall X2 provision, the existing condition evaluated to assess Project impacts should reflect operations conducted to meet this requirement. DWR previously released modeling that utilized a baseline condition designed to meet Fall X2; the EBC2 scenario was included

by DWR in the 2013 Revised Administrative Draft EIR (DEIR). However, the 2013 DEIR/EIS, the 2015 RDEIR/SEIS, and the 2016 FEIR/EIS used only the EBC1 scenario.

My analysis shows that the number of days existing source water at Stockton's intake exceeds a chloride concentration of 110 mg/L is greater under the EBC1 scenario than under the EBC2 scenario for most water year types. For example, the average number of days in a dry water year that the chloride concentration at the City's intake exceeds 110 mg/L is 58 under the EBC1 baseline and 31 under the EBC2 scenario (Exhibit STKN-026 Table 1). Thus, the baseline water quality condition used by DWR in the FEIR/EIS EBC1 is more saline as a result of the failure to operate to Fall X2 conditions. Because the EBC2 scenario more appropriately represents an accurate baseline condition by adhering to the Fall X2 requirement, DWR should have evaluated Project impacts using the EBC2 baseline condition.

EXPONENT, INC.

DATED: March 23, 2017 By 

Dr. Susan Paulsen, Ph.D., P.E.