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On Behalf of California Sportfishing Protection Alliance

**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

PHASE II TESTIMONY OF G. FRED  
LEE

I, G. Fred Lee, do hereby declare:

**Introduction**

My testimony for Phase I of these hearings (CSPA-6-Revised) discussed a number of the water quality impacts in the Delta that the proposed WaterFix diversions could, or could reasonably be expected to, cause or exacerbate. Impacts on fisheries, recreation, aesthetics, and other aspects of water quality were omitted from that testimony because the Water Resources Control Board (WRCB) ruled that such aspects were to be presented in Phase II of these hearings. Thus, those water quality aspects are the focus of my Phase II testimony.

Much of the technical foundation and background to this Phase II testimony concerning reasonably anticipated and potential impacts of the proposed WaterFix project on fisheries, recreation, and aesthetic aspects of water quality, and deficiencies in the evaluations of those impacts by the CA Department of Water Resources (DWR) and the US Bureau of Reclamation (USBR) was provided in my Phase I testimony. Therefore, my Phase I testimony (CSPA-6-Revised, CSPA-56-Revised) is incorporated by reference into this Phase II testimony. Certain elements of that technical foundation are reiterated or expanded upon here as necessary to provide clarifying technical foundation to the discussion presented.

### Summary of Findings

**Overall, I find that the assessment made by the CA Department of Water Resources and the US Bureau of Reclamation concerning the water quality/beneficial uses impacts of the Delta WaterFix north Delta diversions of Sacramento River water falls far-short of adequately evaluating the potential impacts of the proposed “WaterFix Tunnel Project” for diverting Sacramento River water around the Delta.**

**The WaterFix diversion of Sacramento River water as proposed will reduce the amount of Sacramento River water entering the Central Delta through Turner Cut. The maintenance of the fisheries, recreation, and aesthetic water quality of the Central Delta relies on the dilution of the lower-quality San Joaquin River (SJR) input with higher-quality Sacramento River water that flows through the Central Delta to the South Delta pumps. The diversion of Sacramento River water around the Central Delta will significantly reduce the dilution of San Joaquin River water in the Central Delta and thereby adversely impact fisheries, recreation, and aesthetic aspects of water quality in the Central Delta. The final EIR/EIS for the proposed project did not reliably identify and address these issues.**

**The WaterFix diversion of Sacramento River water as proposed will also cause a reduction in the amount of water pumped from the South Delta. This reduction in pumping will increase the water retention time in the South Delta Old River Channel allowing greater exertion of oxygen demand in the channel and increased fish kills and other adverse impacts. The final EIR/EIS for the proposed project did not reliably identify and address these issues.**

### Expertise and Experience

My professional background, expertise, and experience in evaluating Delta water quality are presented in my Phase I testimony (CSPA-6-Revised, CSPA-56-Revised)

### DWR/USBR Approach for Evaluating Water Quality Impacts

The California Department of Water Resources (DWR) and the US Department of the Interior Bureau of Reclamation (USBR) have asserted that the proposed diversion of up to 9,000 cfs of Sacramento River water at the proposed North Delta WaterFix diversion intakes on the Sacramento River will not cause adverse impacts on Delta water quality/beneficial uses. The WaterFix project testimony of Parviz Nader-Tehrani (dwr\_66WQ) stated on page 3 lines 11 and 12:

*“The focus of my testimony is on possible changes to water quality and water levels.”*

As discussed in my Phase I testimony, a critical review of his testimony shows, however, that the consideration of “water quality impacts” of the proposed WaterFix tunnel diversions is very narrowly defined to consider only meeting minimum requirements of D-1641, which focus on salinity (EC) for only part of the Delta. Also modeled was the

chloride concentration in a small area of the Western Delta. Explicitly not considered with that limitation is the wide range of existing and potential pollutants that impair the water quality/beneficial uses of substantial areas of the Central Delta and that stand to be impacted by the proposed WaterFix diversions. My Phase I testimony included discussion of the conditions that must be met to comply with Porter Cologne Water Quality Control Act definitions of water quality and beneficial uses.

Furthermore, the California WaterFix – Water Right Change Petition and Water Quality Certification Process (updated July 21, 2016) Fact Sheet

[[http://www.waterboards.ca.gov/waterrights/water\\_issues/programs/bay\\_delta/california\\_waterfix/docs/ca\\_waterfix\\_factsheet.pdf](http://www.waterboards.ca.gov/waterrights/water_issues/programs/bay_delta/california_waterfix/docs/ca_waterfix_factsheet.pdf)] included with my Phase I testimony as Exhibit CSPA-57 states,

*“In order for the State Water Board to approve a change petition, the petitioner must: 1) demonstrate that the change will not initiate a new water right or injure any legal users of water; and 2) provide information on how fish and wildlife would be affected by the change and identify proposed measures to protect them from any unreasonable impacts of the change.”*

The so-called “water quality impact” evaluation made by the Petitioners does not meet those conditions.

A technically reliable evaluation of potential water quality/beneficial use impairment consequences of the proposed WaterFix project should incorporate the broadest sense of potential adverse impacts. Any impairment of the beneficial uses of Delta waters by people and for fish, and aquatic and terrestrial life needs to be included in the assessment in order to provide reliable assurance that water quality/beneficial uses of the Delta will not be adversely impacted by the Delta WaterFix project. Simply asserting that minimum D-1641 requirements will be met, or indeed a guarantee of meeting of those requirements, is not adequate to provide assurance that water quality/beneficial uses of the Delta will not be harmed.

At the WaterFix petition hearing, several cross-examiners of the DWR/USBW witnesses questioned the fact that the current proposal being considered does not address the broad range of constituents that could be impacted by the proposed WaterFix Sacramento River diversions around the Delta. The response by the DWR/USBW members and their consultants was that those issues are covered in the BDCP draft EIR/EIS. I discussed these issues in comments I submitted on the Bay Delta Conservation Plan (BDCP) Draft EIR/EIS Chapter 8 – Water Quality, Chapter 25 – Public Health document cited in and incorporated into my Phase I testimony as Exhibit CSPA-58.

My comments included my overall technical assessment as follows:

**“Overall Assessment**

*Overall, the draft BDCP EIR/EIS and approaches used in its development are inadequate in scope and reliability for evaluating the potential impacts of diverting substantial amounts of Sacramento River water around or through the Delta on chemical constituents and water quality in Delta channels. The draft EIR/EIS basically used model output of expected changes in the concentrations of a few water quality parameters ... at a few selected locations in the Delta as was done for this draft and final EIR/EIS. The approach used does not adequately or reliably consider the range of water quality impacts caused by the wide variety of potential pollutants present in the various Delta channels, that can be expected to result from the removal of large amounts of high-quality Sacramento River water from the Delta by this project.”*

*“An area of the Delta of importance and with which Dr. Lee is particularly familiar is the Central Delta where the Sacramento River mixes with the San Joaquin River below Columbia Cut.”*

This area was not adequately evaluated in either the Draft or the Final EIR/EIS for the proposed WaterFix project.

My Phase I testimony included, as Exhibit CSPA-59, a summary of comments I submitted on the Water Quality Section of BDCP/California WaterFix RDEIR/RDEIS (*Appendix A – Revisions to the Draft EIR/EIS - Chapter 8 – Water Quality – 508*). Those comments discussed the unreliability of the approach used in developing the BDCP draft EIR/EIS for addressing water quality impacts. Since the evaluation made of “water quality impacts” of the proposed diversion at the North Delta intakes described in the testimony of Parviz Nader-Tehrani (dwr\_66WQ) followed the same approach as that described for Alternative 4A in the RDEIR/SDEIS, those comments apply equally well to the proposed diversion of Sacramento River.

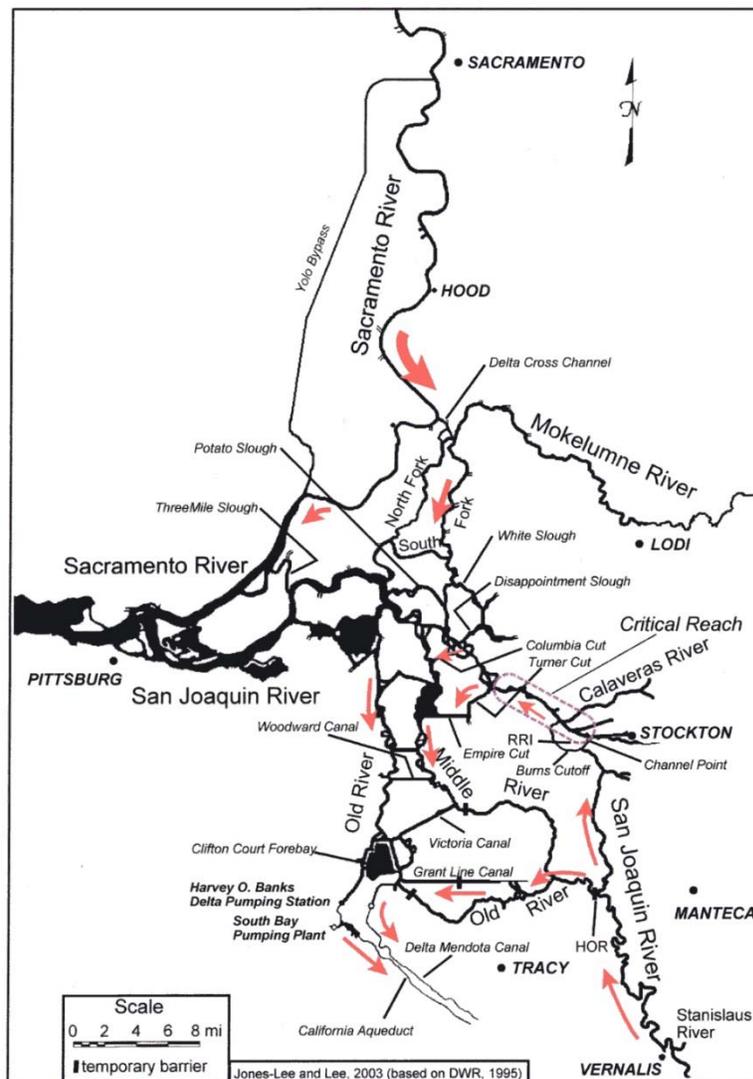
Review of the DWR/USBR response to my comments on the final WaterFix RDEIR/SDEIS [<http://baydeltaconservationplan.com/FinalEIREIS.aspx> [http://baydeltaconservationplan.com/Libraries/Dynamic\\_Document\\_Library/RECIRC\\_Comment\\_Responses\\_Letters\\_2300-2399.sflb.ashx](http://baydeltaconservationplan.com/Libraries/Dynamic_Document_Library/RECIRC_Comment_Responses_Letters_2300-2399.sflb.ashx)], which was released after the deadline for submission of Phase I testimony, reveals that the project proponents have still failed to adequately and reliably evaluate the impact of the proposed WaterFix tunnel diversions on Central Delta and South Delta Channel water quality – beneficial uses.

**Examining the Flow Conditions in Central Delta**

Figure 1, included in my Phase I testimony as Exhibit CSPA-64, is a map of the Delta, showing the San Joaquin River (SJR), Turner Cut, and Columbia Cuts as well as arrows showing the direction of flow in River and Delta channels, pertinent to this testimony.

As discussed in my Phase I testimony, during the SJR DWSC low-DO study we found that the low-DO condition in the SJR rarely occurred downstream of Turner Cut. That finding prompted me to organize several sampling cruises of Delta channels including Turner Cut and Columbia Cut. DeltaKeeper provided the boat and crew for the cruises. The findings of those cruises were presented in our "Summary of Results from the July 17, 2003, and September 17, 2003, Tours of the Central Delta Channels" report [<http://www.gfredlee.com/SJR-Delta/Central-Delta-Tours.pdf>] included in my Phase I testimony as Exhibit CSPA-65. As discussed in that report, the cruises of the Central Delta confirmed that the SJR DWSC water is drawn into the Central Delta primarily via Turner Cut and to a lesser degree via Columbia Cut.

Figure 1 – Exhibit CSPA-64.  
Map of the Delta Showing Flow Direction



The current flow of Sacramento River and SJR water is such that the South Delta export pumps pull Sacramento River water into the Central Delta via Turner Cut and Columbia Cut, which dilutes pollutants in the SJR DWSC as it is drawn into the Central Delta. Further information about this phenomenon and its water quality implications is provided in our reports on these issues on our website (in the SJR-Delta section at [http://www.gfredlee.com/SJR\\_Delta\\_Water\\_Quality.html](http://www.gfredlee.com/SJR_Delta_Water_Quality.html)).

### **Inadequacies of WaterFix Impact Assessment**

As discussed below associated with the operation of the WaterFix diversions at the north diversion location the South Delta export pumps will still withdraw at least 45% of the exported water from the South Delta. Therefore, there will continue to be a strong pull of Sacramento River water to the South Delta that will still draw SJR water and its pollutants into the Central Delta.

As discussed in my Phase I testimony the potential impacts of the WaterFix Tunnel diversions of Sacramento River on pollutant concentrations can be understood by examining the SWRCB 303-d list of impaired waterbodies in the Delta. It is clear that the SJR DWSC at Turner Cut has high pollutant concentrations/loads that are drawn into the Central Delta primarily via Turner Cut. The Sacramento River is also drawn into the Central Delta at Turner Cut where it mixes with the SJR DWSC water. The operation of the proposed WaterFix northern intake diversion of Sacramento River will reduce the volume/flow of Sacramento River presently available to dilute the pollutants derived from the SJR DWSC water that enters the Central Delta. The net result is that with the proposed WaterFix north diversion, the pollutants in Turner Cut will have an increased adverse impact on Central Delta water quality beneficial uses.

The DWR/USBR evaluation of “water quality impacts” of the proposed WaterFix project fails to discuss the fact that the tunnel diversion will at times deprive the Central Delta of several thousand cfs of Sacramento River water that currently dilutes the SJR flow and its pollutant loads that enters the Central Delta at Turner and Columbia Cuts.

The DWR/USBR assessment of “Delta water quality impacts” that will be caused by the WaterFix relied on model predictions of exceedance of water quality standards (objectives) for EC at current water quality monitoring locations in the Delta. That approach is not reliable for assessing current water quality in the Delta, much less for evaluating the anticipated impact of altering the amount of Sacramento River water that enters the Delta channels.

### **USGS Review of Effects of Delta Flow Diversions**

Several scientists with the USGS discussed impacts of flow manipulations, barriers, and exports on Delta water quality in their paper referenced below and incorporated into my Phase I testimony as Exhibit CSPA-73.

Exhibit CSPA-73. Monsen, N., Cloern, J., and Burau, J., “Effects of Flow Diversions on Water and Habitat Quality: Examples from California’s Highly Manipulated Sacramento-San Joaquin Delta,” *San Francisco Estuary & Watershed Science*, 5(3):1-16, July (2007). <http://repositories.cdlib.org/jmie/sfews/vol5/iss3/art2>

They summarized their work in their abstract:

*“We use selected monitoring data to illustrate how localized water diversions from seasonal barriers, gate operations, and export pumps alter water quality across the Sacramento-San Joaquin Delta (California). Dynamics of water-quality variability are complex because the Delta is a mixing zone of water from the Sacramento and San Joaquin Rivers, agricultural return water, and the San Francisco Estuary. Each source has distinct water-quality characteristics, and the contribution of each source varies in response to natural hydrologic variability and water diversions. We use simulations with a tidal hydrodynamic model to reveal how three diversion events, as case studies, influence water quality through their alteration of Delta-wide water circulation patterns and flushing time. Reduction of export pumping decreases the proportion of Sacramento- to San Joaquin-derived fresh water in the central Delta, leading to rapid increases in salinity. Delta Cross Channel gate operations control salinity in the western Delta and alter the freshwater source distribution in the central Delta. Removal of the head of Old River barrier, in autumn, increases the flushing time of the Stockton Ship Channel from days to weeks, contributing to a depletion of dissolved oxygen. Each shift in water quality has implications either for habitat quality or municipal drinking water, illustrating the importance of a systems view to anticipate the suite of changes induced by flow manipulations, and to minimize the conflicts inherent in allocations of scarce resources to meet multiple objectives.”*

Their Table 1, presented below, shows the concentrations of various constituents in the SJR at Vernalis. The concentrations of some of those constituents will be increased in the DWSC as a result of wastewater discharge to the SJR by the city of Stockton wastewater treatment plant. That discharge occurs just upstream of the DWSC.

They highlighted the importance of considering the effects of manipulations of the Delta water on impacts of pollutants on page 12 of their paper:

*“Processes that change concentration fields of pollutants are ecologically important because the toxicity and accumulation of pollutants in food webs are concentration dependent. The new pyrethroid pesticides are extremely toxic to invertebrates with sublethal effects at concentrations measured in parts per trillion (Oros and Werner 2005); the herbicide diuron inhibits phytoplankton photosynthesis in the Delta at concentrations > 2 ug L-1 (Edmunds et al. 1999); phytoplankton accumulate methyl mercury at concentrations 10,000 times those in water (Davis et al. 2003); bioaccumulation of toxic metals (e.g. copper, cadmium, silver, chromium) in invertebrates and fish depends on concentrations of those elements in water and prey*

(Luoma and Rainbow 2005). We have learned empirically how individual diversions modify salt concentrations across the Delta, but we have not yet considered how they modify distributions of land-derived pollutants and their threats to wildlife or human health.”

Exhibit CSPA-73 Table 1. Water quality comparison between the Sacramento River, San Joaquin River, and In-Delta Agricultural Return water for water years 1999-2001.

Water Quality Parameter	Sacramento at Freeport <sup>1</sup>	San Joaquin at Vernalis	In-Delta Agricultural Return Water <sup>2</sup>
Specific Conductance (mmhos cm <sup>-1</sup> )	144 ± 28	621 ± 183	562 ± 206
pH	7.8 ± 0.2	8.0 ± 0.4	6.8 ± 0.4
Alkalinity (mg CaCO <sub>3</sub> L <sup>-1</sup> )	55 ± 12	85 ± 24	83 ± 18
Dissolved Oxygen (mg L <sup>-1</sup> )	9.8 ± 1.4	9.6 ± 1.4	5.5 ± 2.1
Nitrite+Nitrate (mg N L <sup>-1</sup> )	0.12 ± 0.05	1.62 ± 0.59	
Orthophosphate (mg P L <sup>-1</sup> )	0.024 ± 0.007	0.107 ± 0.054	
Dissolved Organic Carbon (mg C L <sup>-1</sup> )	1.84 ± 0.53	2.83 ± 0.47	14.1 ± 7.7
Total Dissolved Selenium <sup>3</sup> (nmol L <sup>-1</sup> )	0.91 ± 0.27	8.6 ± 2.5	Negligible <sup>4</sup>

<sup>1</sup> USGS Water Quality Database (WY1999-WY2001) for Sacramento (USGS 11447650) and San Joaquin (USGS 11303500) rivers unless otherwise noted.

<sup>2</sup> California Department of Water Resources Municipal Water Quality Investigations Program (WY1999-WY2001) for Bacon Island Pumping Plant (DWR B9V75881342), and Twitchell Island Pumping Plant 1 (DWR B9V80661391) (CDWR 2003); DOC data only from Bacon Island. Different crops produce varying levels of DOC, agricultural return water DOC is expected to vary significantly throughout the Delta.

<sup>3</sup> Sacramento river average from two studies (1984-2000). San Joaquin average from 1997-2000 sampling period. (Cutter and Cutter 2004)

<sup>4</sup> Personal communication AR Stewart, 14 May 2003

Their Table 1 shows that the Sacramento River water has a much lower concentration of several potential pollutants compared to the SJR.

### DISB Review

On September 30, 2015 the Delta Independent Science Board (ISB) submitted to the Delta Stewardship Council (DSC) its final comments on the partially Recirculated Draft

Environmental Impact Report/Supplemental Draft Environmental Impact Statement (RDEIR/SDEIS) for the Bay Delta Conservation Plan/California WaterFix. The ISB comments were reviewed by the DSC on October 23, 2015 and accepted by the Council. Those comments and letter of submittal of the comments to the DSC and CA Department of Fish and Wildlife, are available at [<http://deltacouncil.ca.gov/docs/final-delta-isb-comments-partially-recirculated-draft-environmental-impact-reportsupplemental>] and were incorporated my Phase I testimony as Exhibit CSPA-74. The letter of transmittal summarized the overall conclusion of the ISB concerning the technical merit and deficiencies of the partially RDEIR/SDEIR for the Bay Delta Conservation Plan/California WaterFix by stating:

*“We focused on how fully and effectively it considers and communicates the scientific foundations for assessing the environmental impacts of water conveyance alternatives. The review is attached and is summarized below.”*

*“The effects of California WaterFix extend beyond water conveyance to habitat restoration and levee maintenance. These interdependent issues of statewide importance warrant an environmental impact assessment that is more complete, comprehensive, and comprehensible than the Current Draft.”*

The ISB comments (Exhibit CSPA-74) included a section “Water Quality (Chapter 8)” that summarized several deficiencies in the WaterFix draft REIR/SEIS Water Quality discussion of the impacts of the Sacramento River Tunnel Diversion project. Comments included the following, referencing pages of Chapter 8:

*“8-75, line 6: The failure to consider dissolved P (DP) should be addressed; there is much greater uncertainty. The adherence of some P to sediment does not prevent considerable discharge of P as DP. Also on page 8-95 line 40, qualify predictions due to lack of consideration of DP.”*

Additional information on these issues is available in Dr. Erwin van Nieuwenhuyse’s presentation at the California Water Environmental Modeling Forum (CWEMF) nutrient modeling workshop. The PowerPoint slides of his presentation were incorporated into my Phase I testimony as Exhibit CSPA-75.

Exhibit CSPA-75. vanNieuwenhuyse, E., “Response of Chlorophyll to Reduced Phosphorus Concentration in the Delta and the Rhine River,” Presentation at CWEMF Technical Workshop, Sacramento, CA, March 25 (2008).

<http://www.cwemf.org/workshops/DeltaNutrientsWrkshp/VanNieuwenhuyse.pdf>

In that presentation, Dr. van Nieuwenhuyse summarized his paper (incorporated in my Phase I testimony as Exhibit CSPA-76):

CSPA-76. van Nieuwenhuyse, E., “Response of Summer Chlorophyll Concentration to Reduced Total Phosphorus Concentration in the Rhine River (Netherlands) and the Sacramento– San Joaquin Delta (California, USA),” *Can. J. Fish. Aquatic, Sci.*

64(11):1529-1542 (2007).

[<http://www.ingentaconnect.com/content/nrc/cjfas/2007/00000064/00000011/art00006>]

and described the response of average summer algal chlorophyll concentration in the Central Delta to an abrupt and sustained reduction in phosphorus discharge from the Sacramento County Regional Sanitation District wastewater treatment facility. His paper and presentation provides important information on the impact of Sac Regional phosphorus discharge on Delta planktonic algae in the Delta.

As discussed in the van Nieuwenhuysse's workshop presentation and published paper, and in my presentation at the CWEMF Technical Workshop on Overview of Delta Nutrient Water Quality Problems: Nutrient Load – Water Quality Impact Modeling, [<http://www.cwemf.org/workshops/NutrientLoadWrkshp.pdf>], “Developing Site-Specific Nutrient Criteria & Allowable Discharge Limits,” [<http://www.cwemf.org/workshops/DeltaNutrientsWrkshp/GFredLeeOverview.pdf>] (incorporated into my Phase I testimony as Exhibit CSPA-77), backup information, papers referenced in his presentations, and in

Exhibit CSPA-78. Lee, G. F., and Jones-Lee, A., “Synopsis of CWEMF Delta Nutrient Water Quality Modeling Workshop – March 25, 2008, Sacramento, CA,” Report of G. Fred Lee & Associates, El Macero, CA, May 15 (2008).  
[http://www.gfredlee.com/SJR-Delta/CWEMF\\_WS\\_synopsis.pdf](http://www.gfredlee.com/SJR-Delta/CWEMF_WS_synopsis.pdf)

it is well established that reducing the phosphorus load and in-waterbody concentrations effects reductions in the phytoplankton biomass in Delta waters. This occurs even in situations in which the available phosphorus concentrations in the waterbody remain surplus compared to growth-rate-limiting concentrations. The decrease in planktonic algae in the Delta associated with decreased phosphorus loads to the Delta must be discussed in a creditable discussion of the impact of nutrients and the impact of Sacramento River diversions on Delta water quality.

The amount of dissolved phosphorus transported into the Central Delta by the Sacramento River has a significant impact on the phytoplankton population in the Central Delta. The proposed WaterFix project's diversion of Sacramento River water will reduce the amount of Sacramento River water that enters the Central Delta and thereby impact the phosphorus input to the Central Delta and the phytoplankton population in that area of the Delta. The reduction in dilution of phosphorus concentration in the Central Delta leads to impaired water quality and adverse impacts/injuries to the public/users of Central Delta waters. Such uses that stand to be adversely impacted include fishing, boating, swimming, aesthetic quality of water, owing to increased algae and aquatic plants, water supply odors, low DO, ag intake screens' plugging, sediment toxicity, floating scum, and other effects of phosphorus and flow alterations – owing to increased algae and aquatic

plants.

While the DWR and USBR claimed that the diversion of Sacramento River around the Delta through the WaterFix tunnels will not adversely affect users of the Delta, that claim cannot be made without proper evaluation of impact of the North Delta water diversions and associated changes in phosphorus loading and phytoplankton populations in the Delta. This issue should have been discussed in the DWR USBR WaterFix evaluation of the impact of the WaterFix North Delta diversions on Delta water quality/beneficial uses. The DWR USBR WaterFix evaluation of tunnel diversions on Delta water quality is significantly deficient in its failure to evaluate the importance of dissolved inorganic phosphorus as a key component in impacting Delta water quality, especially Central Delta aquatic plant-related water quality

### **South Delta Old River Impacts**

In our low-DO studies of the DWSC we found that the diversion of SJR into Old River at the Head of Old River resulted in more severe low-DO problems in the DWSC. Major diversion of SJR at that location reduced the SJR flow through the DWSC and increased the residence time of SJR water and oxygen-demanding materials in the DWSC leading to greater low-DO problems. In order to investigate this matter, I organized a cruise of the Old River channels in the Southern Delta. The DeltaKeeper provided the boat and crew; members of the CVRWQCB and US EPA staff also participated in this cruise.

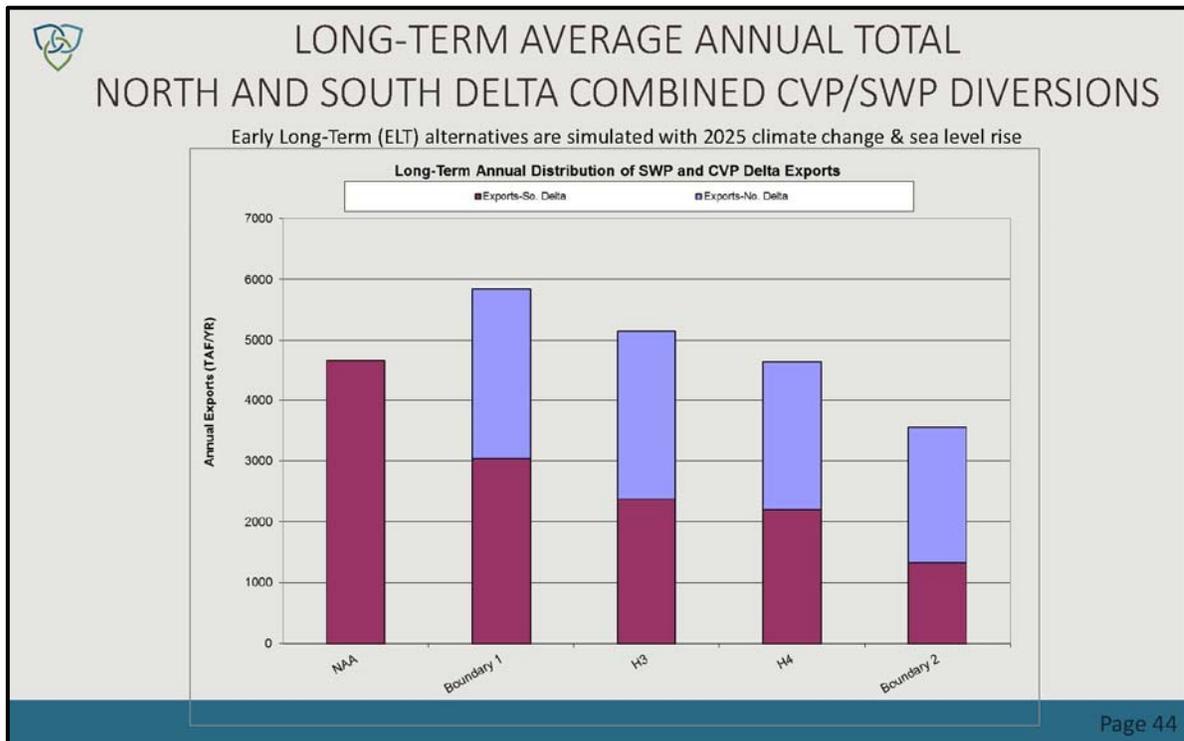
A summary of our findings from our cruise of the South Delta Channels was presented in our report that is incorporated into my Phase I testimony as Exhibit CSPA-80.

Exhibit CSPA-80. Lee, G. F.; Jones-Lee, A. and Burr, K., "Results of the August 5, 2003, Tour of the South Delta Channels," Report of G. Fred Lee & Associates, El Macero, CA, February (2004). <http://www.gfredlee.com/SJR-Delta/South-Delta-Tour.pdf>

During the South Delta cruise we found that a large fish kill had recently occurred in the South Delta Old River Channel near the Tracy Blvd bridge. According to the DWR continuous DO monitoring of that channel, the dissolved oxygen had been very low in the channel the night before the cruise; that condition likely led to the fish kill. That low-DO condition results from the low flow in the channel, which results from the presence of the DWR barrier at the western end of that part of the Old River Channel, which is impacted by the pumping at the Banks and Jones export pumps.

Associated with the operation of the proposed WaterFix North Delta water diversions on the Sacramento River, the amount of water exported at times by the South Delta diversions will be decreased. That relationship is shown on page 44 of Exhibit DWR\_5\_errata show below.

## Exhibit DWR\_5\_errata



That exhibit shows that under the various proposed alternatives for WaterFix operation, the amount of South Delta water exported will be less than that which occurs during NAA (the no action alternative). Such reduced pumping from the South Delta can be expected to reduce the flow of water through the South Delta channel at the barrier and thereby increase the residence time of water in the channel between the Tracy Blvd bridge and the barrier. Increased residence time of water in that area will likely, at times, cause even greater DO depletion than would occur under the no action alternative. This is potentially another significant adverse impact of the proposed North Delta diversion of Sacramento River water that should have been evaluated by DWR and USBR for the proposed WaterFix project.

### Unrecognized and Unregulated Pollutants

I have had considerable experience in developing, evaluating, and appropriately applying water quality criteria, standards, and objectives including service as an invited peer-reviewer for the National Academies of Science and Engineering “Blue Book” of water quality criteria, American Fisheries Society peer-review panel for the US EPA “Red Book” of water quality criteria, and US EPA invited peer-reviewer of the “Gold Book” of water quality criteria. A summary of my experience in this area was presented in Exhibit CSPA-81:

Exhibit CSPA-81. G. Fred Lee and Anne Jones-Lee Expertise and Experience in Water Quality Standards and NPDES Permits Development and Implementation into

NPDES Permitted Discharges [<http://www.gfredlee.com/exp/wqexp.html>]

It is well known that relying only on the exceedance of a limited number of water quality objectives, as has been done by the DWR and USBR in evaluating the impact of the North Delta Sacramento River diversions, is highly unreliable for evaluating the impact of the diversion on water quality/beneficial uses of the Delta.

The approach used by DWR and USBR to claim that the WaterFix Tunnel diversions of large amounts of Sacramento River water around the Delta for use by agriculture and for domestic purposes will not be adverse to Delta water quality/beneficial uses is, at best, highly shortsighted. While the Sacramento River water no-doubt contains some unregulated pollutants, in general it is of much higher quality than San Joaquin River water; diminution of Sacramento River water flow will certainly diminish water quality at the confluence of the Sacramento and San Joaquin Rivers. Diverting large amounts of Sacramento River as proposed by DWR and USBR will deprive the Delta of dilution needed to benefit water quality in the Delta as discussed in numerous publications listed in my Phase I testimony. The proposed diversion can be expected to result in exposure of fish and other aquatic life to higher concentrations of under-regulated pollutants as well as unregulated and unrecognized pollutants for which there are no water quality standards that alone, or together with other pollutants, are adverse to fish and other aquatic life in the central Delta.

Through my work as a member of the National Academies of Science and Engineering Water Quality Criteria Committee and the US EPA Water Quality Criteria Review Committee, and my continued involvement in the development and use of water quality criteria, standards, and objectives over the past nearly five decades, I am well aware that of the some of the US EPA water quality criteria and California water quality standards/objectives are based on political considerations; it is well known that the meeting of some water quality criteria/standards/objectives does not provide assurance of protection of human and aquatic organism health. In addition, water quality criteria and state standards do not consider synergistic impacts among chemicals; meeting individual criteria/standards for such chemicals may well not be protective of human and aquatic health in aquatic system like the Delta that receives pollutants from a wide variety of sources. The DWR's evaluation of aquatic life-related water quality impacts of the proposed WaterFix has been limited to mechanical application of US EPA and California water quality criteria/standards for known pollutants; it has given inadequate attention to aquatic life impacts from the myriad unregulated, under-regulated, and unrecognized pollutants that can be reasonably expected to occur in elevated concentrations in the Delta with reduction in Sacramento River water for dilution. The evaluation conducted of potential impacts on aquatic life-related water quality in the Delta that can be readily anticipated to be caused or exacerbated by the proposed WaterFix project has been inadequate and misleading in its assurances of protection of aquatic life or the public

interests.

### **Impact on City of Stockton SJR DWSC Water Supply Intake Water Quality**

During the hearing an attorney representing the City of Stockton cross-examined the DWR/USBR Petitioner witnesses on the anticipated impact of the proposed WaterFix northern diversion of Sacramento River water on the quality of the City of Stockton water supply intake located on the DWSC near Station 5 (Exhibit CSPA-66). The Petitioner witnesses were unable to answer that question, evidently because it had not been evaluated.

As discussed in my Phase I testimony, the water in the DWSC near Station 5 during the summer and fall has been found by DWR SJR water quality monitoring cruises to be Sacramento River water based on the EC of that water. This is the result of the South Delta export pumps' drawing Sacramento River water across the DWSC. The proposed North Delta WaterFix intakes would, at times, significantly reduce the amount of Sacramento River water that is drawn through the Delta to the South Delta intake pumps. Based on my many years of professional experience in evaluating impacts of raw water quality on water treatment and the quality of the treated water, reducing the amount of Sacramento River water at the city's intake will be strongly detrimental to the city's ability to produce a high-quality treated water supply. The impact of the proposed diversion of Sacramento River water on the quality of water taken by the City of Stockton SJR DWSC intake should have been properly evaluated in assessing the impact of the proposed WaterFix tunnel diversion on raw water supply water quality.

### **Summary of Key WaterFix Operation Impacts**

- Amount of P Entering Turner Cut Influenced by Amount of SJR DWSC Water Entering
  - Affected by South Delta Export Pumping of South Delta Water
  - WaterFix Operations Will Impact Amount of P Entering Central Delta
    - Will Impact Aquatic Plant Growth & Water Quality/Beneficial Uses of Central Delta
- Less Water Entering Turner Cut Will
  - Increase Residence Time of Pollutants in Central Delta
  - Increase Water Quality Impacts/Harm from Aquatic Plants
- P Carried into Central Delta via Sacramento River
  - Impacts Phytoplankton Growth & Impacts/Harms Central Delta Water Quality
- Operation of Proposed WaterFix Diversions Will
  - Increase Pollutant Concentrations in Central Delta
  - Increase Residence Time of Pollutants in Central Delta
  - Increase Water Quality Impacts/Harm to Users of Central Delta Water
  - Increase Water Quality Impacts/Harm to South Delta Old River Channel Users

Due to Increased Water/Pollutant Residence Time

- **All of These Impacts/Harms to Delta Water Users Should Have Been Evaluated by DWR/USBR in Its Petition to Change Point of Diversion of Sacramento River Water**

Executed on November 28, 2017 in El Macero, CA

A handwritten signature in black ink, appearing to read "G. Fred Lee", written over a horizontal line.

G. Fred Lee