

Testimony of G. Fred Lee, PhD, BCEES, F.ASCE

Hearing DWR/USBR Request for Change in Point of Diversion
for CA WaterFix – Phase II
2017

Impacts of WaterFix on Water Quality – Fisheries, Recreation, Aesthetics –

- Essential Technical Foundation & Background Provided in Phase I Testimony (CSPA-6-Revised)
 - Certain Elements Reiterated/Expanded Here to Extent Necessary for Clarity

Summary Expertise & Experience

Detailed in Phase I Testimony Exhibit CSPA-5

- >50 yrs Professional Experience Water Quality Evaluation
 - Environmental Engineering, Aquatic Chemistry, Water Quality/Public Health
 - Investigation/Management Water Quality Problems: Domestic Water Supply; Beneficial Uses of Surface, Ground, Estuarine, Nearshore Marine Waters
- Education
 - BA San Jose State University – Environmental Health Science
 - MSPH University North Carolina, Chapel Hill – Public Health
 - PhD Harvard University – Environmental Engineering (minors: Water Chemistry, Public Health)
- Fellow, ASCE; Outstanding Senior Life Member, Sacramento Section ASCE
- US EPA-Appointed US Representative to Steering Committee for \$50-million, 5-yr OECD Eutrophication Study
 - Quantification of Relationships between Nutrient Load & Waterbody Response

> 25 yrs SJR Delta-Related Expertise & Experience

(Exhibit CSPA-60) <http://www.gfredlee.com/SJR-Delta/GFLAII-Delta-EXP-REV.pdf>

- Consultant to Delta Wetlands, Inc. 1989 - Assess Anticipated Utility of & Water Quality in Proposed Delta Island Water Supply Reservoirs
- Consultant to DeltaKeeper (W. Jennings) on Low-DO in SJR DWSC near Stockton
- Advised SJR DWSC Low-DO TMDL Steering Committee on Low-DO Problems in DWSC
- Selected to Help Rewrite Originally-Rejected Proposal for CALFED Support to Investigate Causes, Implications & Potential Remedies for Low-DO; Revised Proposal Was Funded
- Selected PI for \$2-million, 12-Investigator CALFED Low-DO Project
 - Developed Synthesis Report of Project Findings (Exhibit CSPA-62)
<http://www.gfredlee.com/SJR-Delta/SynthesisRpt3-21-03.pdf>
 - Developed Supplemental Reports, Including (Exhibit CSPA-63)
<http://www.gfredlee.com/SJR-Delta/SynthRptSupp.pdf>

Summary of Findings

- DWR & USBR Assessment of Water Quality/Beneficial Use Impacts of Proposed WaterFix North Delta Diversions of Sacramento River Water
 - Inadequate Evaluation of Potential Impacts on Fisheries, Recreation & Aesthetics

Summary of Findings

- Proposed WaterFix Diversion of Sacramento River Water
 - Will Reduce Amount of Sacramento River Water Entering Central Delta via Turner Cut
 - Maintenance of Fisheries, Recreation & Aesthetic Quality of Central Delta Relies on Dilution of Lower-Quality SJR Input with Higher-Quality Sacramento River Water That Flows through Central Delta to South Delta Pumps
 - Diversion of Sacramento River Water around Central Delta Will
 - Significantly Reduce Dilution of SJR Water in Central Delta
 - Increase Residence Time of Pollutants – Recognized & Unrecognized – Regulated, Under-Regulated, Unregulated
 - Adversely Impact Fisheries, Recreation & Aesthetics in Central Delta
 - Final EIR/EIS Did Not Reliably Identify & Address These Issues

Summary of Findings

- Proposed WaterFix Diversion of Sacramento River Water
 - Will Cause Reduction in Amount of Water Pumped from South Delta, Which Will:
 - Increase Water Retention Time in South Delta Old River Channel
 - Allow Greater Exertion of Oxygen Demand in Channel
 - Lead to Increased Fish Kills & Other Adverse Impacts
 - Final EIR/EIS Did Not Reliably Identify & Address These Issues

DWR/USBR Assessment of Water Quality/Beneficial Use Impacts of Proposed WaterFix

- DWR/USBR Asserted: Proposed Diversion 9,000 cfs Sacramento River Water at Proposed North Delta Intakes
 - Will Not Cause Adverse impacts on Delta Water Quality
- P. Nader-Tehrani (p.3 l.11-12 dwr_66WQ):
“The focus of my testimony is on possible changes to water quality and water levels.”
- Consideration of “Water Quality Impacts”
 - Narrowly Defined – Minimum D-1641
 - Salinity (EC) for Only Part of Delta
 - Cl⁻ for Limited Area of Delta
- Not Considered:
 - Wide Range of Existing & Potential Pollutants Impairing Water Quality/Beneficial Uses of Central Delta

Porter Cologne Act Definitions

CHAPTER 2. DEFINITIONS [13050. - 13051.] (Chapter 2 added by Stats. 1969, Ch. 482.)

§ 13050. [Definitions]

- *(f) “Beneficial uses” of the waters of the state that may be protected against quality degradation include, but are not limited to, domestic, municipal, agricultural and industrial supply; power generation; recreation; aesthetic enjoyment; navigation; and preservation and enhancement of fish, wildlife, and other aquatic resources or preserves.*
- *(g) “Quality of the water” refers to chemical, physical, biological, bacteriological, radiological, and other properties and characteristics of water which affect its use.*

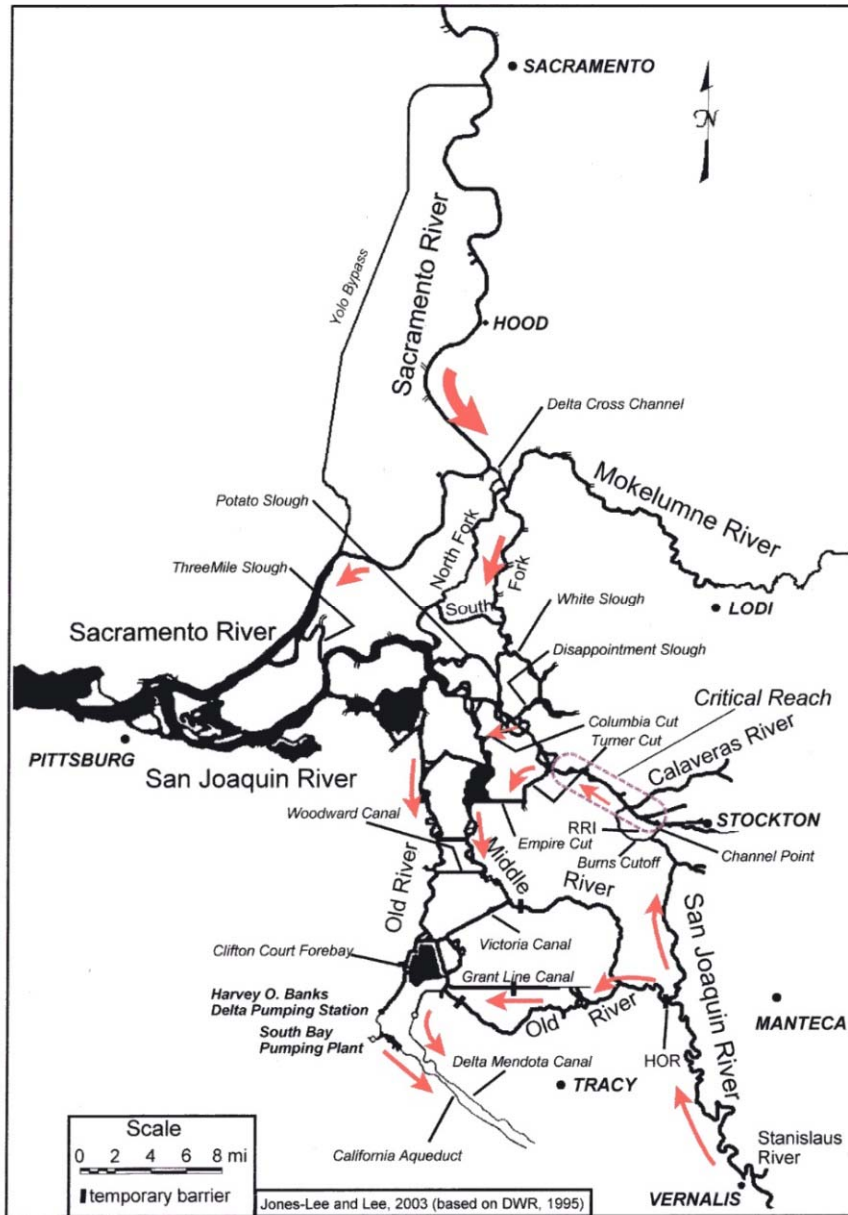


Figure 1 – Exhibit CSPA-64

Map of the Delta

- San Joaquin River (SJR)
- Turner Cut
- Columbia Cuts
- Flow Direction

Impact of WaterFix on Central Delta Water Quality

- SJR DWSC at Turner Cut – High Pollutant Concentrations/Loads
 - Drawn into Central Delta Primarily via Turner Cut
- Sacramento River Water Drawn into Central Delta
 - Mixes with SJR DWSC Water
 - Dilutes Pollutants from SJR DWSC – Aiding Water Quality
- Proposed WaterFix North Delta Diversion of Sacramento River:
 - Will Reduce Volume/Flow of High Quality Sacramento River Water Entering Central Delta
 - Will Increase Adverse Impacts of Pollutants in Turner Cut on Water Quality/Beneficial Uses of Central Delta Waters

Algae & Aquatic Plants

- ISB Comments Summary of WaterFix Draft REIR/SEIS Water Quality Discussion of Impacts of Tunnel Diversion Project. Comments included the following, referencing 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.”*
- Amount of Dissolved P Transported into Central Delta by Sacramento River Significantly Impacts phytoplankton population in Central Delta
 - Reducing P Load & Concentrations Reduces Algal Biomass in Delta – Even When Available P Is Surplus
- Proposed WaterFix Diversion of Sacramento River Water Will
 - Reduce Amount of Sacramento River Water That Enters Central Delta
 - Effectively Increase Phosphorus Input to Central Delta
 - Effectively Increase Phytoplankton Population in Central Delta

Algae & Aquatic Plants

- Reduced Dilution of P Concentration in Central Delta Leads to
 - Impaired Water Quality including:
 - increased algae & aquatic plants
 - odors
 - low DO
 - sediment toxicity
 - floating scum
 - blocked ag water intake screens
 - Adverse Impacts/Injuries to Public/Users of Central Delta
 - fishing
 - boating
 - swimming
 - aesthetic quality of water

South Delta – Old River

- Low-DO Studies of DWSC Showed Diversion of SJR into Old River at Head of Old River Resulted in more severe Low-DO Problems in DWSC
 - Reduced SJR flow through DWSC
 - Increased Residence Time of SJR Water & Oxygen-Demanding Materials in DWSC
 - Result: Greater Low-DO Problems
- Arranged Special Cruise of South Delta Channels
 - Summary of Findings:
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>

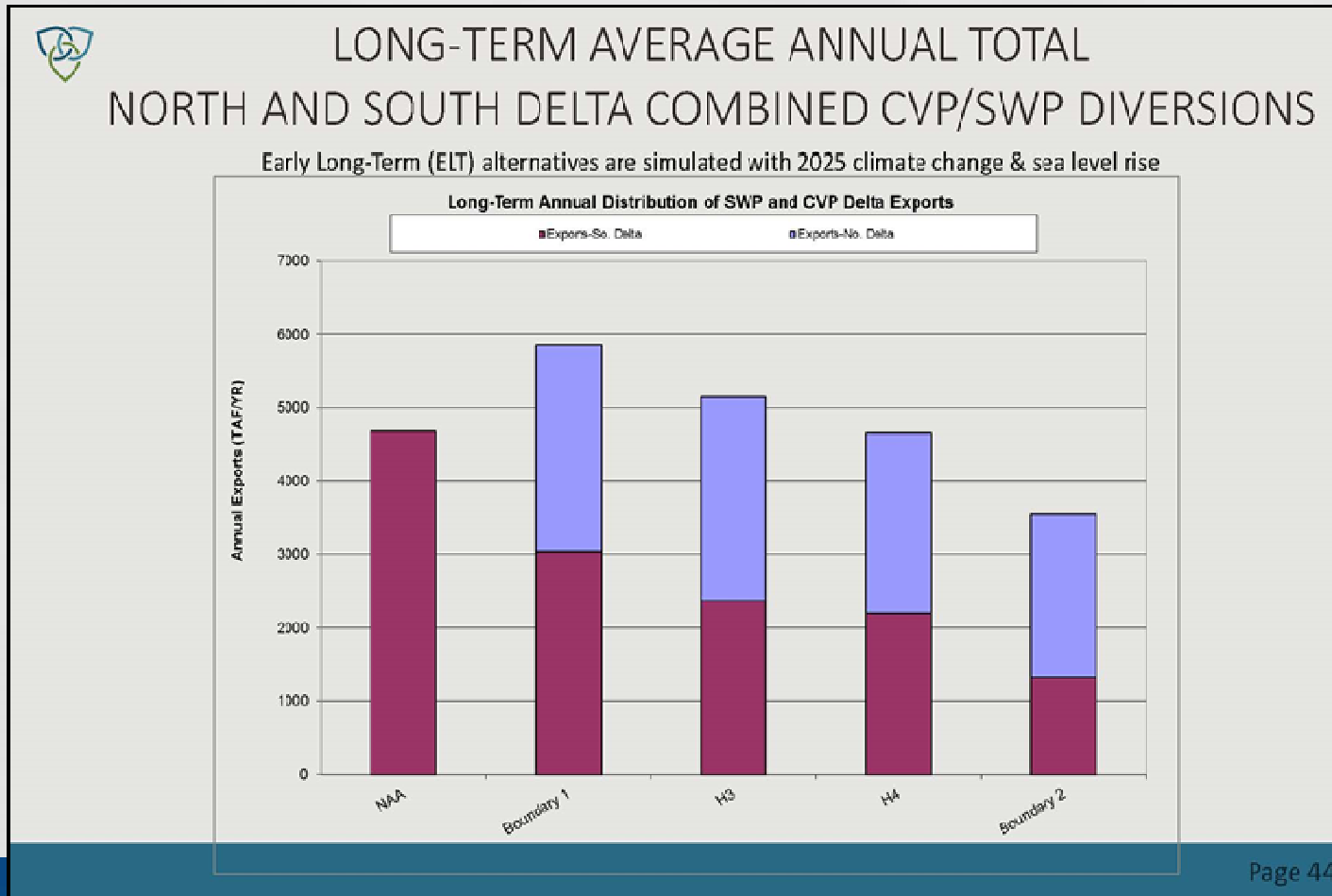
South Delta Cruise Findings

- Recent Large Fish Kill in South Delta Old River Channel near Tracy Blvd Bridge
 - DWR Continuous DO Monitoring: DO Low Night Before Cruise
- Low-DO Condition
 - Likely Cause of Fish Kill
 - Results from Low Flow in Channel
 - Owing to Presence of DWR Barrier at Western End of That Part of Old River Channel
 - Impacted by pumping at Banks & Jones Export Pumps
- Proposed WaterFix North Delta Water Diversions on Sacramento River Will, at Times, Result in Decrease in Amount of Water Exported by South Delta Diversions

Impact of WaterFix on South Delta

- Amount of South Delta Water Exported Will Be Less Than Occurs during NAA (no action alternative)

Exhibit DWR-5-errata



Reduced Pumping from South Delta

- Can Be Expected to
 - Reduce Flow of Water thru South Delta Channel at Barrier
 - Increase Residence Time of Water in Channel between Tracy Blvd Bridge & Barrier
 - At Times, Result in Greater DO Depletion Than Would Occur under NAA
- This is Another Potentially Significant Adverse Impact of Proposed North Delta Diversion of Sacramento River Water
 - Should Have Been Evaluated by DWR/USBR

Effects of Delta Flow Diversions - USGS Scientists' Review

- Exhibit CSPA-73 - Mosen, 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/sfew/s/vol5/iss3/art2>
- Excerpts from 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)."*
 - *"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."*

Effects of Delta Flow Diversions - USGS Scientists' Review

- Monsen et al. (Exhibit CSPA-73) Highlighted Importance of Considering Effects of Manipulation of Delta Water on Pollutant Impact: *(Excerpts)*
 - *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*
 - *the herbicide diuron inhibits phytoplankton photosynthesis in the Delta at concentrations $> 2 \text{ ug L}^{-1}$*
 - *phytoplankton accumulate methyl mercury at concentrations 10,000 times those in water*
 - *bioaccumulation of toxic metals (e.g. copper, cadmium, silver, chromium) in invertebrates and fish depends on concentrations of those elements in water and prey*
 - *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.*

Unrecognized & Unregulated Pollutants

- Experience in Developing, Evaluating, Applying Water Quality Criteria, Standards, Objectives for Protection of Water Quality, Including Invited Peer-Reviewer for
 - NAS-NAE “Blue Book” of Water Quality Criteria
 - AFS Peer-Review Panel for US EPA “Red Book” of Water Quality Criteria
 - US EPA “Gold Book” of Water Quality Criteria
- Summary of Experience in 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.htm>
- DWR/USBR Evaluation of Impact of North Delta Sacramento River Diversions Relies on Exceedance of Limited Number of WQOs
 - Highly Unreliable for Evaluating Impacts on Water Quality/Beneficial Uses

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**