

Comments on Draft Cease and Desist Order on Compliance with South Delta Salinity Standards

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Primary Issue of Concern

- Salinity Standard Compliance Tied to Development of Operable Barriers
 - Technically Invalid Approach
- Water Quality Standards Should Be Based on Concentrations of Chemicals That Will Protect the Beneficial Uses of Waterbody
- Should Not Be Based on Method of Compliance

Background in Development of Water Quality Criteria/Standards

- G. Fred Lee Active in This Topic Since mid-1960s
 - Advisor to Governmental Agencies & Others
 - Peer-Reviewer of National Academies of Science & Engineering “Blue Book” of Water Quality Criteria – 1970s
 - Peer-Reviewer for US EPA Water Quality Criteria “Gold Book” Criteria – mid-1980s
 - See Written Testimony for Other Involvement

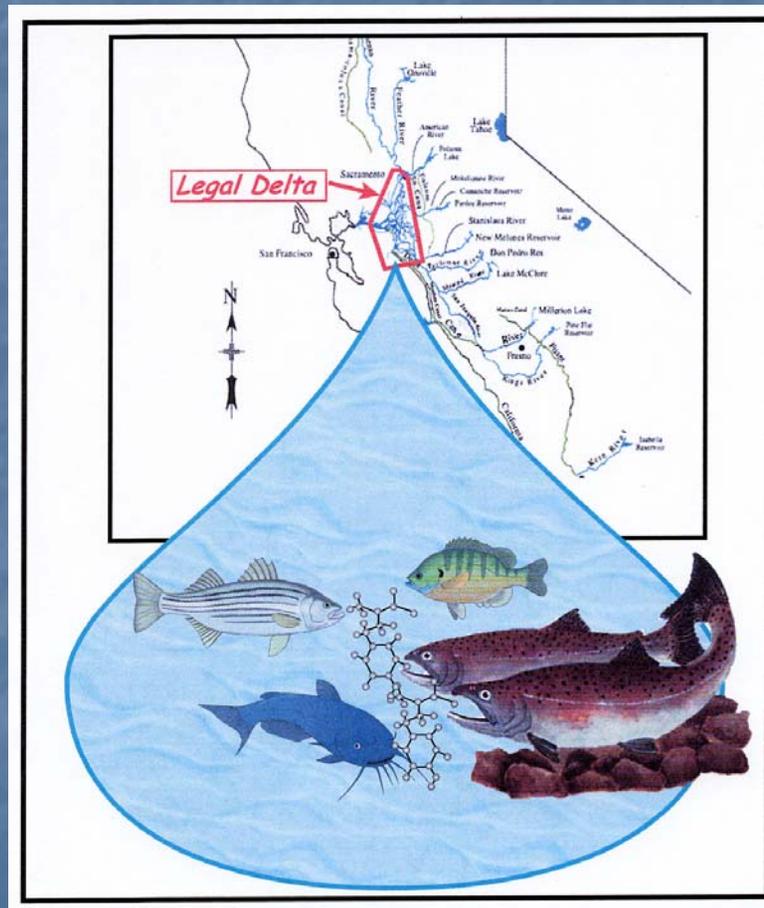
Operable-Barrier Impact Issues

◀ Salinity ▶

- Should Not Be Assumed That Development of South Delta Operable (Permanent) Barriers Will Solve Water Quality Problems in South Delta Channels
- Problems of Excessive Salinity Are Related to Excessive Salinity in SJR at Vernalis
 - If SJR Vernalis Standard Allowed to Remain at 0.7 and 1.0 mS/cm, South Delta Channels Will Have Excessive Salinity
- With SJR Vernalis Salinity Standard Equal to South Delta EC Standard
 - Irrigated Agriculture in South Delta Will Not Be Able to Farm without Causing Violations of South Delta EC Standard in Some Channels

Overview of Sacramento-San Joaquin River Delta Water Quality Issues

G. Fred Lee, PhD, DEE Anne Jones-Lee, PhD



Operable-Barrier Impact Issues

◀ Other Pollutants ▶

- South Delta Channels Are Listed As “Impaired” Due to Other Pollutants
 - Mercury – Sulfate
 - Low Dissolved Oxygen
 - Pesticides – Toxicity
 - Unknown-Caused Toxicity
 - Excessive Bioaccumulation of Organochlorine
“Legacy” Pesticides
 - ~~~~~
 - Excessive Nutrients

Operable-Barrier Impact Issues

◀ Other Pollutants ▶

- Operation of Operable Barriers Will Impact Water Quality in South Delta
 - Impact of Other Pollutants Poorly Understood
 - Need to Require That South Delta Water Exporters (DWR & USBR) Fund Studies to Define How Operation of South Delta Barriers Will Impact Water Quality

Low-Head Reverse-Flow Pumping across Permanent Barriers

- Adds More Higher-Quality Sacramento River Water to South Delta
- Low-Head Reverse-Flow Pumping Could Help Solve Many of the Water Quality Problems
- DWR Should Be Required to Conduct Public Review of Full Range of Benefits of Low-Head Reverse-Flow Pumping across Operable (Permanent) Barriers
 - Consider Economic Benefits in Helping to Solve South Delta Water Quality Problems

Recommendations

- Require DWR & USBR to Comply with South Delta Salinity Standards, Independent of Existence and Operation of Permanent Barriers
- Require That DWR/USBR Fund Independent Studies of Impact of Operation of Permanent Barriers on All Aspects of South Delta Water Quality
- Require Comprehensive Review of Water Quality & Economic Benefits of Low-Head Reverse-Flow Pumping across Operable (Permanent) Barriers

Further Information
Consult Website of
Drs. G. Fred Lee and Anne Jones-Lee



<http://www.gfredlee.com>

SWRCB (2000) Decision 1641 page 85

“The Central Valley RWQCB is currently in the process of setting salinity objectives for the San Joaquin River. (R.T. p. 4847.) The Central Valley RWQCB is hereby directed promptly to develop and adopt salinity objectives and a program of implementation for the main stem of the San Joaquin River upstream of Vernalis.”

SWRCB (2000) Decision 1641 page 88

“The construction of permanent barriers alone is not expected to result in attainment of the water quality objectives. (R.T. pp. 3672, 3710, 3787-3788; DWR 37, p. 15; SWRCB 1e, pp. [IX 30]-[IX-41].) The objectives can be met consistently only by providing more dilution or by treatment. (R.T. p. 3737.)”

CSPA Exhibit I
Testimony G. Fred Lee, PhD, DEE

October 11, 2005

Division of Water Rights
State Water Resources Control Board
P.O. Box 2000
Sacramento, CA95812-2000

Attn: Jean McCue,

I have reviewed the recent draft Cease and Desist Order issued by the State Water Resources Control Board (SWRCB) regarding the non-compliance with South Delta Salinity standards and wish to make the following comments. That order reveals a significant error in the development of the current D-1641, that is, the linking of the determination of compliance with the development of the South Delta operable barriers. Water quality standards should not be dependent on, or considered equivalent to, a particular method of compliance.

I have been involved in the development and review of water quality standards since the mid-1960s as an advisor to the National Academies of Sciences and Engineering, American Fisheries Society, US EPA, several states, and various local and private agencies/entities. A fundamental principle of the development of water quality criteria/standards (objectives) is that they be based on the protection of the beneficial uses of waterbodies; the approach used for achieving the standard by a discharger should not be part of the standard.

With respect to establishing the salinity standard/objective for protection of South Delta agriculture, the South Delta salinity objective should be based only on the salinity (electrical conductivity, EC) necessary to protect South Delta agriculture. From my review of the situation, I agree that an EC limit of 0.7 mmhos/cm, as established by the SWRCB as the salinity standard for the South Delta, is appropriate to support unlimited irrigated agriculture in the South Delta; EC values above that level can be detrimental to the use of water for some types of agriculture. It was inappropriate, however, to adopt the provisions in D-1641 that allow the presence of operable barriers in the South Delta to be considered equivalent to achieving the 0.7 mmhos/cm salinity standard. The SWRCB does not have a technically reliable basis upon which to assume that the existence/operation of the operable barriers will effect the meeting of the 0.7 mmhos/cm salinity objective. It should be noted that on page 88 of D-1641 the SWRCB (2000) stated,

“The construction of permanent barriers alone is not expected to result in attainment of the water quality objectives. (R.T. pp. 3672, 3710, 3787-3788; DWR 37, p. 15; SWRCB 1e, pp. [IX 30]-[IX-41].) The objectives can be met consistently only by providing more dilution or by treatment. (R.T. p. 3737.)”

Therefore, the SWRCB should proceed with the Cease and Desist Order without reference to the existence/operation of the operable barriers. In accord with conventional approaches and legal requirements, DWR and the USBR should be required to solve the salinity problem in the South Delta in order to protect South Delta agriculture. The operation of the operable barriers should be assessed and established based on by a variety of factors as discussed subsequently.

Impact of Barrier Operation on SJR DWSC Low-DO & Other Water Quality Problems

Since June 1999, I have been following the impact of the South Delta barriers on water flow in the San Joaquin River (SJR) Deep Water Ship Channel (DWSC), and on water quality in the South Delta channels. During 2003/2004 Dr. Anne Jones-Lee and I conducted a detailed review of Delta water quality issues including South Delta salinity issues. These issues are reviewed in the reports, Lee and Jones-Lee (2004a, 2005a). From 2000 through 2003 I served as a coordinating principal investigator for a \$2 million CALFED project on the low-DO problem in the SJR DWSC. That effort incorporated with work of 12 investigators; Dr. Anne Jones-Lee and I developed the Synthesis Report (Lee and Jones-Lee 2003) summarizing and integrating the information on the low-DO problem in the SJR DWSC. Since then we have developed several supplements to that report including Lee and Jones-Lee (2004b); those reports and others are on our web site at <http://www.gfredlee.com/psjriv2.htm>. As discussed therein, the current South Delta barriers have a significant impact on water quality in the South Delta and in the DWSC. The operation of the operable barriers can have significant impacts on water quality in the South Delta and the Central Delta, some of which could be highly detrimental to South Delta water quality.

One of the projects in the CALFED-supported SJR DWSC Low-DO study was a DWR staff study of South Delta barriers with emphasis on the potential for over-the-barrier low-head pumping of west Delta water into the eastern Delta. Ever since DWR announced the development of the South Delta Improvement Program (SDIP) I have been following its progress (to the extent possible based on information provided by DWR staff) with particular attention to the presence and operation of the operable barriers. In response to a request for comments on the scope of the SDIP Environmental Impact Statement (EIS/EIR), I provided comments on the water quality issues that need to be addressed in this EIS/EIR (Lee, 2002). In those comments I stated,

“A credible, certifiable EIR/EIS for the SDIP should include a detailed evaluation of the full range of water quality problems caused by the South Delta diversions and how they will be corrected as part of implementing the SDIP.”

I also stated,

“As discussed in these reports, the South Delta currently has significant water quality problems of low DO, currently-used pesticide caused aquatic life toxicity, legacy organochlorine pesticide excessive bioaccumulation in edible fish which are a threat to cause cancer in people who use the fish as food, excessive nutrients and elevated salts and TOC. Dr. Anne Jones-Lee and I have just completed a review for the Central Valley

Regional Water Quality Control Board on the organochlorine pesticide and PCB excessive bioaccumulation problems in Central Valley fish, which shows that Old River and Paradise Cut fish have excessive concentrations of legacy pesticides that are a threat to the health of those who use these fish as food.”

There is no doubt that the impact of the presence and operation of the permanent operable barriers will have water quality impacts, many of which are currently unrecognized. There is a variety of factors that should ultimately govern how the operable barriers will be operated. Salinity is only one of those factors. Others include potential implications for the low DO problems, excessive bioaccumulation of mercury and organochlorine “legacy” pesticides and PCBs that accumulate in fish that are a threat to health of those who use the fish and some other organisms as food, aquatic life toxicity and other pollutants in several of South Delta channels. Lee and Jones-Lee (2004a) have provided a comprehensive review of Delta water quality issues that need attention as part of the SDIP.

Recently the CVRWQCB (2005) indicated that the operation of the South Delta barriers affects the methylation of mercury that could impact excessive bioaccumulation of mercury in edible fish tissue. A similar concern exists with respect to the impact of the operation of operable barriers on the excessive bioaccumulation of organochlorine legacy pesticides and PCBs. Lee and Jones-Lee (2002a, 2004c) reviewed the excessive bioaccumulation of these legacy pesticides/PCBs in aquatic life in the South Delta. This has become a significant problem that needs to be controlled in order to protect human health. It should be noted that this also has important environmental justice implications and needs immediate attention from this perspective as well.

Related South Delta Salinity Issues

Lee and Jones-Lee (2004a) have discussed several aspects of the South Delta salinity issues. One of the most important is the SJR Vernalis EC objective. The SWRCB’s establishment of the SJR Vernalis EC objective at 0.7 mmhos/cm can make it impossible for South Delta irrigated agriculture to discharge tailwater to the channels without causing and/or contributing to excessive EC in South Delta channels. As discussed by Lee and Jones-Lee (2004a,d), while South Delta irrigated agriculture tailwater return does not contribute additional total salt load to the Delta channels, the concentration of salt in the tailwater can be about three times the concentration in the water that had been removed from the channel for irrigation because of evaporation that takes place in the agricultural use. This can lead to violation of the 0.7 mmhos/cm objective in the vicinity of the tailwater discharges. In order to protect irrigated agriculture in the South Delta, the SWRCB/CVRWCB needs to lower the SJR Vernalis EC objective so that farmers in the South Delta can practice irrigated agriculture without causing violations of EC in the South Delta channels.

The SWRCB (2000) Decision 1641, page 85 stated,

“Several parties argued that the Central Valley RWQCB should adopt water quality objectives for salinity for the San Joaquin River at locations upstream from Vernalis. In SWRCB Order WQ 85-1, the SWRCB directed the Central Valley RWQCB to initiate a

process to develop specific water quality objectives for the San Joaquin River basin that will result in the adoption of appropriate basin plan amendments by the Regional Board and the development of a program to regulate agricultural drainage discharges. (SWRCB 5(l), p. 34.) The Central Valley RWQCB is currently in the process of setting salinity objectives for the San Joaquin River. (R.T. p. 4847.) The Central Valley RWQCB is hereby directed promptly to develop and adopt salinity objectives and a program of implementation for the main stem of the San Joaquin River upstream of Vernalis.”

The CVRWQCB (<http://www.waterboards.ca.gov/centralvalley/programs/tmdl/upstream-salt-boron/index.html>) is in the process of developing the SJR upstream EC objective. An area of the SJR where there is the greatest concern for excessive EC is near Hills Ferry/Patterson, CA. At times, the EC in the river at that location is on the order of 1.5 mmhos/cm. Achieving a 0.7 mmhos/cm objective in that reach of the SJR could be a major step toward reducing the excessive salt in the mid-SJR and at Vernalis; this, in turn, would help the South Delta irrigated agriculture avoid violation of EC objectives associated with tailwater discharge. Meeting the requirement of the August 2004, US District Judge Lawrence K. Karlton (2004) decision for USBR to restore the fisheries in the SJR below Friant Dam could be another important step toward reducing the magnitude of excessive EC in the SJR especially near Hills Ferry/Patterson.

Low-Head Reverse-Flow Pumping across the Permanent Barriers

Hildebrand (2000) suggested that installation and operation of low-head reverse-flow pumps to pump water from the west side of the operable barriers to the barriers' east sides could control many of the South Delta water quality problems and problems with low water levels in South Delta channels. This approach would bring higher-quality Sacramento River water into the central and eastern part of the South Delta. DWR staff (Rajbhandari et al., 2002) conducted a CALFED-supported study of this approach. They *“...concluded that there are potentially significant benefits to the DO concentrations in the SJR DWSC through the use of auxiliary pump flows.”* Lee and Jones-Lee (2003) discussed this issue in their Synthesis Report and summarized potential benefits of adopting that approach. Unfortunately, DWR senior staff, without public review, deemed that approach inappropriate because it would be “too expensive.” In making that assessment, however, the staff did not adequately consider the numerous potential benefits of this approach to water quality in the South Delta and the SJR DWSC.

Incorporating the low-head reverse-flow pumping of west side South Delta water into the central South Delta would be a significant step toward improving the quality of water that is exported by the federal export project at Tracy since higher-quality Sacramento River water would make up a greater proportion of the waters exported at the Tracy pumps than it does now. Another advantage of this approach is that it would begin to address the high salt content associated with the federal project by the USBR in the Delta Mendota Canal.

This approach would also eliminate the need for the state and federal South Delta export projects to withdraw essentially all of the San Joaquin River water through the Head of Old River to South Delta export pumps at Tracy and Banks; this would then alleviate, and

in some situations eliminate, the low-DO problem in the DWSC. Adopting this approach could also eliminate or greatly reduce the need for SJR upstream agricultural interests and wildlife refuges to control nutrient discharges that contribute to the growth of algae in Mud and Salt sloughs and along the SJR.

It is likely that a properly conducted, comprehensive economic analysis of low-head pumping across the barriers would show it to be of overall economic and environmental benefit. Since the South Delta water quality problems are caused by the existence and operation of the DWR and USBR export projects, those agencies and those who benefit from the exported water should be the ones to pay for installation and operation of the low-head pumping as part of their water rights to export water from the Delta.

Need for Monitoring of Water Quality Impact of Barrier Operations Impacts

In recent testimony to the SWRCB D-1641 water rights workshop I stressed the importance of requiring the South Delta water exporters (USBR and DWR) to fund a comprehensive water quality monitoring program to determine the impacts of South Delta water exports on South Delta water quality (Lee, 2005b,c). The SWRCB should require an investigation of the impact of the operation of the South Delta barriers on the full range of water quality issues that could potentially be affected by that operation. The current DWR barrier monitoring program is not adequate to meet the need for information on water quality impacts of barrier operations or the impacts of the South Delta state and federal export projects on Delta water quality.

Information on key critical components of such a monitoring program has been provided in Lee and Jones-Lee (2002b, 2004a, 2005 b,c). As discussed by Lee and Jones-Lee (2005b,c) the water quality monitoring program should be administered by the State Water Resources Control Board, and not by CALFED, DWR, IEP or the USBR, i.e., those agencies that have a vested interest in showing that there are no water quality problems in the Delta due to exports of water or barrier operations. This monitoring program should be organized and implemented through a SWRCB-appointed advisory panel that would plan the studies, oversee their implementation, and critically review draft reports that are developed by the contractors conducting the monitoring.

Overall

The SWRCB should separate the issues of DWR/USBR's compliance with the D-1641 concentration limits for salt in the South Delta (0.7 mmhos/cm during the irrigation season and 1 mmhos/cm during the rest of the year) and the development and use of the South Delta permanent barriers. The operation of such barriers will need to be controlled in such a way so as not only to protect irrigated agriculture with respect to salt content of South Delta channel waters but also to consider water levels within the channels and the impact of barrier operation on all the other South Delta water quality problems.

The SWRCB should critically review the feasibility and benefit of using low-head across permanent barrier pumping of westside Delta water into the eastern South Delta as a means of improving water quality within the South Delta, maintaining water levels within

the South Delta channels, and enhancing the flow of the SJR through the SJR Deep Water Ship Channel to help alleviate the low-DO problems in the DWSC.

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CSPA Exhibit II

Background of Drs. G. Fred Lee and Anne Jones-Lee Pertinent to Assessment of San Joaquin River and Delta Water Quality

Dr. G. Fred Lee is President of G. Fred Lee & Associates, a specialty environmental quality consulting firm located in El Macero, CA, near Sacramento. He and Dr. Anne Jones-Lee, the principals of the firm, work on issues, projects, and problems of water supply water quality, water and wastewater treatment, water pollution control in both fresh and marine surface waters, and solid and hazardous waste impact evaluation and management, with particular emphasis on groundwater quality protection. Their client base includes governmental agencies, industry, public interest groups, and individuals.

Dr. Lee earned a BA degree from San Jose State College in environmental health sciences in 1955, a Master of Science in Public Health degree focusing on water quality issues from the University of North Carolina in 1957, and a PhD degree in environmental engineering/environmental science from Harvard University in 1960. For a period of 30 years beginning in 1960, he held university graduate-level professorial teaching and research positions at several major US universities, including the University of Wisconsin, Madison, the University of Texas system, and Colorado State University. In the 1980's he was Distinguished Professor of Civil and Environmental Engineering at the New Jersey Institute of Technology and Director of the Site Assessment and Remediation division of a multi-university hazardous waste research center there; for a several-year period, he also served as Director of the Water Quality Program for the State of New Jersey Sea Grant Program. During his university teaching and research career he conducted in excess of five million dollars of research and published over 500 papers and reports on those efforts.

Dr. Anne Jones-Lee earned a BS degree in biology from Southern Methodist University and a PhD degree in Environmental Sciences in 1978 from the University of Texas at Dallas focusing on water quality evaluation and management. She held university professorial positions for 11 years in environmental engineering and environmental sciences. Most recently she held the position of Associate Professor of Civil and Environmental Engineering with tenure at the New Jersey Institute of Technology. She and Dr. Lee have worked together as a team since the mid-1970s.

In 1989, Dr Lee retired from university teaching and research; with Dr. Jones-Lee he expanded his part-time consulting activities into a full-time activity, and moved their base of operation to the Central Valley of California. They have continued to be active in publishing the results of their studies; in the past 15 years they have developed another

600 papers and reports covering work they have done in their various areas of activity, one of which is San Joaquin River and Delta water quality.

Dr Lee's areas of expertise include the fate, effects and impacts of chemical constituents and pathogens on various aspects of water quality/beneficial uses of waterbodies. He has frequently served as an adviser to local, state, national and international governmental agencies and other entities on a variety of aspects of water quality, including the development and implementation of water quality criteria and standards. He served as an invited peer reviewer for the National Academies of Science and Engineering "Blue Book" of water quality criteria in 1972, a member of the American Fisheries Society Water Quality Committee that reviewed the US EPA's "Red Book" water quality criteria of 1976, and a US EPA invited peer reviewer in the early 1980s for the approach that the Agency then proposed, and ultimately adopted, for developing water quality criteria for protection of aquatic life. That criteria development approach is still in use today. Further, Dr Lee was involved as a US EPA invited peer reviewer for several criteria documents. His work on water quality issues is somewhat unusual, in that, in addition to having a strong background in the chemical and biological sciences pertinent to water quality evaluation, he has an engineering background that provides a foundation for developing and evaluating control programs for chemical constituents in point and nonpoint source discharges.

Dr. Lee's involvement in Delta water quality issues began in the late 1980's when, while still in New Jersey, he became involved in three different consulting projects in California; one was concerned with Delta water quality issues, another with Lake Tahoe water quality, and the third with groundwater quality protection in the San Gabriel Basin on behalf of the Metropolitan Water District of Southern California. As a consultant to Delta Wetlands on water quality issues associated with the development of in-Delta storage reservoirs he became familiar with Delta water quality issues. Since then, Dr. Lee's work on Delta water quality issues has included participating in various CALFED (now California Bay-Delta Authority – CBDA) committees, subcommittees, working groups, etc., concerned with water quality issues in the Delta and its tributaries.

Beginning in the mid-1990s Dr. Lee became involved in the details of water quality issues in both the Sacramento and San Joaquin River watersheds. One aspect of his involvement was as a volunteer technical advisor to the DeltaKeeper (William Jennings) to help the DeltaKeeper establish and maintain a technically sound grounding as it addresses issues pertinent to the protection and enhancement of water quality in the Delta and its tributaries. Dr. Lee's work with the DeltaKeeper has included such matters as managing aquatic life toxicity in the Central Valley and Delta caused by runoff/discharges of pesticides from agricultural and urban areas; reviewing and managing excessive bioaccumulation of organochlorine legacy pesticides and PCBs in Central Valley waterbodies and the Delta; reviewing potential environmental impacts of aquatic pesticides used for aquatic weed control in the Central Valley and Delta; assessing the impacts of flow management in and from the South Delta on water quality; and providing guidance on environmental aspects of dredging and dredged sediment management in the Delta.

Another key aspect of Dr. Lee's involvement continues to be the low-DO problem in the San Joaquin River Deep Water Ship Channel. In 1999, Dr. Lee began to work closely with the SJR DO TMDL Steering Committee, as well as the Central Valley Regional Water Quality Control Board (CVRWQCB) staff, in helping to improve the level and quality of science and engineering incorporated in the San Joaquin River low-DO TMDL program. Dr. Lee was awarded a contract with the CVRWQCB to develop an "Issues" report to identify and discuss the issues that need to be addressed as part of formulating a TMDL to control the low-DO problem in the San Joaquin River DWSC (Lee and Jones-Lee, 2000).

Dr. Lee worked closely with the CVRWQCB lead staff (Dr. Chris Foe) in developing a coherent two-million-dollar proposal, which was funded by CALFED. Dr. Lee served as the coordinating PI for the 12 projects that were conducted under this proposal. From the work, Lee and Jones-Lee (2003) developed the "synthesis report" that presents a summary/synthesis of approximately four years and four million dollars of studies on the SJR DWSC low-DO problem. Since completion of that synthesis report in March 2003, Drs. Lee and Jones-Lee have continued to be active in Delta water quality issues and develop a supplement to synthesis report (Lee and Jones-Lee, 2004a).

They have also developed a comprehensive report on Delta water quality issues (Lee and Jones-Lee, 2004b). That work included a detailed review of San Joaquin River water quality. These and other reports on these issues are available from their website, www.gfredlee.com, in the San Joaquin River Watershed section at <http://www.gfredlee.com/psjriv2.htm>.

Further information on Drs. Lee and Jones-Lee's expertise and experience pertinent to assessment of Delta water quality issues is available on their website, www.gfredlee.com, or upon request.

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