

Enhanced Delta Flows Needed to Help Control
Water Quality Impacts of Delta Pollutants

Testimony for CA State Water Resources Control Board Public Workshop:
Comprehensive (Phase 2) Review & Update to Bay-Delta Plan
Workshop 1: Ecosystem Changes and the Low Salinity Zone
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Synopsis

Overall Finding:

In establishing Public Trust flows into and through the Delta channels, the SWRCB should incorporate flow levels necessary for mitigating water quality impacts of Delta pollutants.

Issue 1:

It is important to establish tributary flow into the Delta and through the Delta channels that is sufficient to minimize water quality impacts of pollutants discharged to the Delta tributaries and within the Delta

- Delta waters are polluted with wide variety of known regulated, as well as known unregulated, and unrecognized pollutants from agricultural tailwater and stormwater discharges, municipal wastewater, and stormwater runoff that are a threat to Delta water quality – aquatic life, other beneficial uses, and protection of the Public Trust Resource
- Clean Water Act pollution control approach will not adequately control pollution of Delta waters from agricultural and urban sources
 - Clean Water Act approach based on exceedance of water quality objectives (WQOs) and establishment of total maximum daily loads (TMDLs) for known, regulated pollutants
 - Applicable to known, regulated pollutants from discrete readily controllable sources
 - Some pollutants in Delta are:
 - known pollutants but not regulated by water quality objectives
 - presently unrecognized pollutants – new and expanded-use chemicals
 - not amenable to cost-effective control
 - Inadequate screening of chemicals and materials that can be in urban and agricultural wastes/runoff added to Delta waters
 - Impacts of some pollutants in Delta greatly affected by flow
 - Inadequate scope of monitoring and funding
 - No water quality criteria, standards, objectives for all known and potential pollutants
- CVRWQCB “balance” approach to reduce cost of pollution control for discharges from irrigated agriculture and dairies allows pollution of SJR and Delta waters
- Impact of Flow on low-DO problem in Delta
 - Low SJR flow through DWSC is major cause of DO WQO violations

- Low DO in SJR DWSC
 - blocks fall run of Chinook salmon to home stream waters
 - associated with & exacerbated by diversions of Delta flow by export projects
 - will be essentially eliminated by establishment of adequate SJR DWSC flow of about 1,000 cfs, which will greatly reduce the cost of other measures for controlling the low-DO WQO violations
- South Delta low-DO problem
 - DWR export project and its channel barriers
 - create stagnant zones in South Delta channels
 - result in violations of DO WQO
 - cause/contribute to documented fish kills
- Current federal and state water diversion projects in South Delta cause loss of SJR watershed home-stream water signal to guide fall-run of Chinook salmon to home stream for spawning
- SWRCB and IEP Delta monitoring to assess impacts of South Delta water export projects under D-1641 grossly inadequate to evaluate the impacts of the Delta water export on Delta water quality
 - Must understand and monitor the impacts of altering Delta flows on Delta water quality as part of implementing Water Rights permit

Conclusions:

- Dilution-flows into and through the Delta channels are needed to reduce impacts of regulated pollutants, unregulated known pollutants, and unrecognized pollutants in Delta waters

Recommended Approach:

- Implement Clean Water Act pollution control approach to the maximum extent possible based on reliable technical information and assessment, and available funding
- Establish Public Trust flows in the Delta that are sufficient to help reduce the impacts of inadequately controlled pollutants

Issue 2:

The proposed BDCP tunnel Sacramento River diversion project has the potential to result in significant adverse impacts on water quality/beneficial uses in Delta channels and Delta Public Trust resources.

- Thus far the BDCP and Delta Stewardship Council Plan have not adequately addresses this issue
- Diversion project should not proceed until the potential impacts of the alterations in Delta channel flows on water quality in the Delta are fully known.

As part of consideration of Delta flow alterations, such as the BDCP-proposed tunnel diversion of Sacramento River water under the Delta, it is critical to:

- evaluate the impacts of the proposed flow alterations on water quality in the Delta channels and Delta, and
- adequately mitigate for adverse impacts on flows and water quality in Delta channels

The impact of this diversion project must be closely, **independently** monitored and corrective action should be implemented if major adverse impacts on Delta water quality begin to result from the BDCP tunnel diversion project

Qualifications of G. Fred Lee:

- 5 decades of research documented in more than 1,100 publications, many of which can be downloaded from www.gfredlee.com
- More than 20 years of investigation on Delta water quality documented in about 100 professional papers and reports
- Detailed qualifications described at www.gfredlee.com

Discussion

Introduction

This testimony provides an overview of some of the ways in which flow into and through the Delta impacts the manifestation of water quality problems in the Delta, and how manipulation of that flow, such as would occur with the proposed Sacramento River tunnel diversion project, can be expected to exacerbate those problems. It addresses technical foundation for the importance of establishing adequate flow into the Delta and through the Delta channels as a valuable component in minimizing water quality impacts of known, unregulated, and unrecognized pollutants discharged to Delta tributaries and within the Delta. It summarizes information and findings we have discussed in more than 100 professional papers and reports we have written during our more than two decades of work on Delta water quality issues; much of that work has focused on understanding how the flow in the Delta channels and tributaries impacts Delta water quality/aquatic life-related beneficial uses. Citations are provided to selected pertinent professional publications, reports, and comments that we have published (which contain references to other professionals' work as well) on the issues raised.

Dr. Lee anticipates highlighting key elements of this written testimony at the State Water Resources Control Board (SWRCB) hearing on "Developing Flow Criteria for Protection of the Public Trust Aquatic Life Resources of the Delta." There he will also note technical inadequacies and unreliability of recent discussions of Delta flow/water quality issues provided by the BDCP consultant and Delta Stewardship Council staff.

It is critical that the planning and implementation of the proposed changes in the flow into and through the Delta include technically reliable evaluation of the impacts of the proposed manipulations on Delta water quality/beneficial uses. As part of establishing Public Trust protection of the designated beneficial uses of the Delta, it is essential that the SWRCB establish adequate flows into the Delta and within the Delta channels to enable reliable protection of water quality/beneficial uses through the dilution and more-rapid transport of pollutants in the Delta.

In establishing appropriate Delta flow objectives, the SWRCB should include consideration of benefits of enhanced Delta tributary flows into the Delta and in-channel flows for mitigating water quality impacts of Delta pollutants. The Sacramento San Joaquin Delta contains some known but unregulated pollutants, presently unrecognized pollutants, as well as regulated pollutants, that are impairing the aquatic-life-related and other beneficial uses of the Delta and its tributaries. Enhanced water flow through the Delta provides important dilution to reduce the concentrations of those pollutants and hence their impacts on aquatic life. Enhanced flows also contribute to protection of water quality by shortening the residence time of pollutants in the Delta, and by reducing the areas over which pollutants exert adverse impacts.

It can be argued that enhancing Delta flows for this purpose is tantamount to the control of water pollution through dilution, and that it is more appropriate to control pollutants in the Delta at their sources. However, the reality is that it is doubtful that agricultural and municipal sources of pollutants to the Delta can be controlled through the current Clean Water Act-TMDL approach of identifying violations of water quality criteria/standards and implementing workable TMDLs

that can, in fact, eliminate the causes of water quality impairment. This is true even for known, regulated pollutants from point sources in the Delta. Even less likely is the ability to control, in the foreseeable future, point sources of presently unregulated and/or unrecognized pollutants to the Delta that impact water quality near the source much less within the Delta channels where pollutants from a number of sources are mixed. Further, and most important with regard to Delta water quality, while the Clean Water Act water quality criteria/standards–TMDL approach has been somewhat effective for controlling a number of known, regulated pollutants from municipal and industrial wastewater sources, it is not effective in controlling nonpoint sources of pollutants in agricultural tailwater and stormwater runoff sources or in urban stormwater runoff.

The importance of the amount of flow in Delta channels in influencing water quality in Delta channels became clear to us as we became involved in reviewing Delta water quality issues in 1989. Since that time we have developed about 100 professional papers and reports on Delta water quality issues, many of which specifically address impacts of Delta flows on water quality in Delta channels; a summary of those publications is presented in:

Lee, G. F., and Jones-Lee, A., "Experience in Reviewing Delta Water Quality Issues," G. Fred Lee & Associates, El Macero, CA, April 3 (2011).

<http://www.gfredlee.com/SJR-Delta/GFLAJL-Delta-EXP-REV.pdf>

Presented herein is a summary of a number of key issues with particular reference to post-August 2010 activities that reflect inadequacies in consideration of the impact of Delta flow on water quality.

Previous Comments on Delta Flow Water Quality Issues

We became aware of impacts of Delta flow on Delta water quality in 1989 when, as consultants to the Delta Wetlands Delta Island water storage project, we reviewed Department of Water Resources (DWR) and US Geological Survey (USGS) data and observed the marked differences in pollutant concentrations in Delta channels. It was clear that with Delta water as their supply, the proposed island storage reservoirs would release poor-quality water.

In the late 1990s, as advisors to the San Joaquin River Dissolved Oxygen TMDL Steering Committee, we became involved in reviewing the low dissolved oxygen (DO) problem in the San Joaquin River (SJR) Deep Water Ship Channel (DWSC) near the Port of Stockton. That committee and CALFED selected us to serve as the principal investigators for the CALFED-supported, \$2-million, two-year Low-DO Project. In that capacity we coordinated the studies of the 12 project investigators on various aspects of the causes of the low DO in the DWSC and developed overall project synthesis reports. As discussed in our synthesis report cited below, that work revealed that low flow in the SJR through the DWSC was a key factor contributing to the low-DO conditions in the DWSC.

Lee, G. F., and Jones-Lee, A., "Synthesis and Discussion of Findings on the Causes and Factors Influencing Low DO in the San Joaquin River Deep Water Ship Channel near Stockton, CA: Including 2002 Data," Report Submitted to SJR DO TMDL Steering Committee/Technical Advisory Committee and CALFED Bay-Delta Program, G. Fred Lee & Associates, El Macero, CA, March (2003). <http://www.gfredlee.com/SJR-Delta/SynthesisRpt3-21-03.pdf>

Lee, G. F. and Jones-Lee, A., "San Joaquin River Deep Water Ship Channel Low DO Problem and Its Control," PowerPoint slides presented at SETAC World Congress Portland, OR, November 2004. Updated December (2004).
<http://www.gfredlee.com/SJR-Delta/LowDOSummaryDec2004.pdf>

Following the completion of the synthesis report we developed a series of supplemental reports, including the report cited below, that specifically addressed the impact of the flow in the SJR through the DWSC on the magnitude, extent, and location of the low-DO problem.

Lee, G. F. and Jones-Lee, A., "Supplement to Synthesis Report on the Low-DO Problem in the SJR DWSC," Report of G. Fred Lee & Associates, El Macero, CA, June (2004).
<http://www.gfredlee.com/SJR-Delta/SynthRptSupp.pdf>

In August 2004, with the aid of the Deltakeeper's boat and staff, we also conducted a series of cruises on the South Delta channels to specifically examine South Delta channel flow patterns relative to the flows of the SJR and Sacramento River in those channels. Our reports on that work include:

Lee, G. F., and Jones-Lee, A., "Impact of State and Federal Delta Water Export Projects on Delta Water Quality and Aquatic Resources: Issues That Need to Be Addressed," Report of G. Fred Lee & Associates, El Macero, CA, October (2004).
<http://www.gfredlee.com/SJR-Delta/ImpactDelExpProj.pdf>

Several other reports of ours on these issues are posted on our website, www.gfredlee.com, in the Watershed Studies – San Joaquin River Watershed–Delta subsection,
<http://www.gfredlee.com/psjriv2.htm>.

It was clear from our studies that the low-DO problem in the DWSC is due in part to low flow in the SJR through the DWSC. It was also well-established that the state and federal export projects in the South Delta were a major contributor to the low flows of the SJR through the DWSC that led to low DO in the DWSC. We found that as long as the flows of the SJR through the DWSC were above about 1,200 cfs low DO conditions did not develop in the DWSC.

The low-flow-related low-DO problems that have been documented in the SJR DWSC have also been found to occur in the South Delta channels, especially the southern-most Old River channel. The DWR Banks export pumps of the state water project have been found to draw water from the South Delta channels faster than that water is replaced by natural flow. This results in the lowering of water levels in the channels to a sufficient extent to prevent Delta island agricultural water intakes from drawing water from the channels. The low water levels in some of the channels also inhibit recreational boating. In an effort to try to correct that problem, in the summer DWR constructs temporary rock barriers across several South Delta channels to maintain water levels in the channels. Those barriers, however, also limit flow through some of the South Delta channels, which increases the residence time of the water as well as of oxygen-demand loads developed from increased algal growth supported by algal nutrients and longer residence times. This situation is especially acute in the southern most section of the Old River channel where violations of the DO water quality objective frequently occur. During our August 2004 DeltaKeeper-supported cruise on the Old River channel we observed a large number of dead fish floating on the water's surface. Based on the records of a nearby water quality

monitoring station, the DO in the Old River channel near the fish kill had been near zero for several hours the night before the fish kill. In order to correct such problems it will be necessary to establish and maintain sufficient flow through that channel to reduce the residence time of water in the channel.

We also found through our supplemental studies of the South Delta channels that the state and federal export projects' pumps bring Sacramento River water into the South Delta through SJR DWSC to Columbia Cut and especially Turner Cut. The drawing of high-quality Sacramento River water into the South Delta by the export projects has been a major factor limiting the extent and duration of the low-DO problem in the DWSC to Turner and Columbia Cuts. It also greatly improves the quality of the water in the South Delta channels compared with that which would be present if only the much poorer-quality SJR water were present in those channels. The water of the SJR contains high concentrations of a number of pollutants from agricultural tailwater and stormwater runoff discharges. We have developed several reports that discuss these SJR water quality issues, including the following:

Lee, G. F., Jones-Lee, A., "San Joaquin River Water Quality Issues," Report of G. Fred Lee & Associates, El Macero, CA, June (2006).
<http://www.gfredlee.com/SJR-Delta/sjr-WQIssues.pdf>

Lee, G. F., and Jones-Lee, A., "Water Quality Issues of Irrigated Agricultural Runoff/Discharges—San Joaquin River, Central Valley, California," Presented at Agriculture and the Environment - 2007 Conference, Central Coast Agricultural Water Quality Coalition, Monterey, CA, November (2007).
<http://www.gfredlee.com/SJR-Delta/SJR-WQ-Ag-Monterey.pdf>

Lee, G. F., and Jones-Lee, A., "Potential Water Quality Impacts of Agriculture Runoff/Discharges in the Central Valley of California," Presented at Central Coast Agricultural Water Quality Coalition's 2007 National Conference on Agriculture & the Environment, Monterey, CA, PowerPoint Slides, G. Fred Lee & Associates, El Macero, CA, November (2007).
<http://www.gfredlee.com/SJR-Delta/SJRAgImpactsMontereyNov2007.pdf>

Those papers/reports and others on our website also discuss current violations of water quality objectives and known pollutants in the SJR that are adversely impacting SJR and Delta water quality, unregulated pollutants in the SJR for which water quality objectives have not been established, and other potential pollutants in the SJR that have not yet been identified as chemicals that are impairing SJR/Delta water quality.

Delta Water Quality Issues

During the year following the completion of the SJR DWSC synthesis report we developed the following, unsponsored, comprehensive report concerning water quality in the Delta:

Lee, G. F. and Jones-Lee, A., "Overview of Sacramento-San Joaquin River Delta Water Quality Issues," Report of G. Fred Lee & Associates, El Macero, CA (2004).
<http://www.gfredlee.com/SJR-Delta/Delta-WQ-IssuesRpt.pdf>

A number of key elements of that overview that are pertinent to this testimony are described below.

- That overview report, based on our review of Central Valley Regional Water Quality Control Board (CVRWQCB), SWRCB, and US Environmental Protection Agency (US EPA) reports of violations of water quality objectives that have been found in Delta Channel waters, was the first comprehensive report on Delta water quality to focus on known violations of water quality standard in the Delta. Dr. Lee's five decades of professional expertise and experience in the development and implementation of water quality criteria and state water quality standards, and their appropriate use (as well as common misuse) for the evaluation and regulation of water quality are summarized in:

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>

Lee, G. F., and Jones-Lee, A., "Clean Water Act, Water Quality Criteria/Standards, TMDLs, and Weight-of-Evidence Approach for Regulating Water Quality," *Water Encyclopedia: Water Law and Economics*, Wiley, Hoboken, NJ, pp 598-604 (2005). <http://www.gfredlee.com/SurfaceWQ/WileyCleanWaterAct.pdf>

Lee, G. F. and Jones-Lee, A., "Appropriate Use of Numeric Chemical Water Quality Criteria," *Health and Ecological Risk Assessment*, 1:5-11 (1995). <http://www.gfredlee.com/SurfaceWQ/chemcri.htm>

- Our overview also addressed known pollutants in the Delta that are adversely impacting Delta water quality but for which water quality objectives have not been established, and other potential pollutants in the SJR and Delta that have not yet been identified as chemicals that are impairing SJR/Delta water quality. As discussed below, because of this wide array of recognized as well as undefined pollutants that are not amenable to straightforward regulation, it is important to maintain high flows into and through the Delta channels in order to reduce their impacts on Delta water quality.

- During 2004 Dr. Lee was appointed to a panel to review the Interagency Ecological Program (IEP) monitoring program that, according to its charge by SWRCB Water Right Decision D-1641, was supposed to evaluate the impacts of the South Delta water diversions by the state and federal export projects on aquatic resources of the Delta. In the panel discussions Dr. Lee noted that the current IEP monitoring program was not addressing the issues of its charge; the SWRCB member of the review panel was aware of this deficiency in the IEP D-1641 Delta monitoring program. It became evident that water diversions by the state and federal export projects were allowed to take place without proper evaluation of their impacts on water quality/beneficial uses of the Delta.

Our writings concerning impacts of flow diversions on Delta water quality include:

Lee, G. F., and Jones-Lee, A., "Impact of SJR & South Delta Flow Diversions on Water Quality," PowerPoint Slides, Presentation to CA Water Resources Control Board, D1641 Water Rights Review, January 24 (2005). <http://www.gfredlee.com/SJR-Delta/D1641SlidesSWRCBJan2005.pdf>

Lee, G., F., and Jones-Lee, A., "Need for Reliable Water Quality Monitoring/Evaluation of the Impact of SWRCB Water Rights Decisions on Water Quality in the Delta & Its Tributaries," PowerPoint Slides Submitted to CA Water Resources Control Board Workshop on D-1641 Water Rights, Sacramento, CA, March 22 (2005).
<http://www.gfredlee.com/SJR-Delta/DeltaWaterExportImpactsPowerPoint.pdf>

Lee, G., F., and Jones-Lee, A., "Need for Reliable Water Quality Monitoring/Evaluation of the Impact of SWRCB Water Rights Decisions on Water Quality in the Delta and Its Tributaries," Submitted to CA Water Resources Control Board Workshop on D-1641 Water Rights, Sacramento, CA, March 22 (2005).
<http://www.gfredlee.com/SJR-Delta/DeltaWaterExportImpactsPaper.pdf>

- Our 2004 Delta water quality overview report also discussed the fact that that CALFED program was not addressing the impacts of pollutants in the Delta on aquatic life resources of the Delta. Except for supporting the SJR DWSC low-DO project driven by political pressure, CALFED had no program to evaluate the impacts of the large number of well-documented pollutants in Delta waters on aquatic life. Rather, the CALFED “water quality” program was directed solely toward improving the quality of Delta water that was to be exported to municipalities for domestic water supply use.

- Our 2004 Delta water quality report discussed significant inadequacies in the water quality monitoring program for Delta waters. While several years earlier a CALFED committee had developed a proposed water quality monitoring program, it was never funded. The CVRWQCB recognized many of the deficiencies in its water quality monitoring and management program for the Delta but efforts to correct those deficiencies were also not funded. It was not until 2005, associated with the pelagic organism decline (POD), that attention began to be devoted to addressing those deficiencies. Even today, however, the monitoring of Delta waters for water quality impacts of pollutants is far less than needed to begin to develop the data required to understand the impacts of flow alterations on water quality. The CVRWQCB is now attempting to develop, and identify funding for, a comprehensive Delta water quality monitoring program similar to that being conducted in the San Francisco Bay. It will be important that such a program include studies of the impacts of Delta channel flows on Delta water quality. Information on that CVRWQCB Delta water quality monitoring program is available at:
http://www.waterboards.ca.gov/rwqcb5/water_issues/delta_water_quality/comprehensive_monitoring_program/index.shtml

- We have developed several follow-up reports to our 2004 overview concerning Delta water quality issues, including:

Lee, G. F., and Jones-Lee, A., “Overview—Sacramento/San Joaquin Delta Water Quality,” Presented at CA/NV AWWA Fall Conference, Sacramento, CA, PowerPoint Slides, G. Fred Lee & Associates, El Macero, CA, October (2007).
<http://www.gfredlee.com/SJR-Delta/DeltaWQCANVAWWAOct07.pdf>

Lee, G. F., “Comments on the CVRWQCB Review of Delta Water Quality Issues,” Comments submitted to K. Longley, Chair Central Valley Regional Water Quality

Control Board, by G. Fred Lee & Associates, El Macero, CA, March (2008).
<http://www.gfredlee.com/SJR-Delta/DeltaIssuesLongleyMarch08.pdf>

Lee, G. F., "New & Updated Presentations/Publications on Delta and SJR Water Quality Issues," Comments to J. Grindstaff, Director CALFED, Sacramento, CA, G. Fred Lee & Associates, El Macero, CA, October 2 (2007).
<http://www.gfredlee.com/SJR-Delta/PubsPresentsDeltaSJR.pdf>

Lee, G. F., and Jones-Lee, A., "Delta Water Quality Standards Violations" and "Comments on Water Quality Sections of the Delta Vision Strategic Plan, Third Staff Draft – dated August 14, 2008," Submitted to Delta Vision Blue Ribbon Task Force, Sacramento, CA. Report of G. Fred Lee & Associates, El Macero, CA, September 1 (2008). <http://www.gfredlee.com/SJR-Delta/DeltaVisionWQViolations.pdf>

Impact of Flow on Fish Homing

The primary justification for CALFED's support of the SJR DWSC low-DO project was that California Department of Fish and Game (DFG) had reported that the low DO in the DWSC blocked the migration of the fall run Chinook salmon to their home-stream waters for spawning. Water quality aspects of that issue were discussed in our 2004 synthesis report cited above. We also found that the manipulations of Delta flows by the South Delta export projects that draw all SJR water down Turner Cut and Columbia Cut prevented SJR watershed home-stream chemical signals from reaching San Francisco Bay. This issue was discussed in a number of our papers including:

Lee, G. F., and Jones-Lee, A., "Review of Impacts of Delta Water Quality and Delta Water Exports on the Decline of Chinook Salmon in the SJR Watershed," Comments submitted to NMFS Southwest Fisheries Science Center, NOAA, Santa Cruz, CA, by G. Fred Lee & Associates, El Macero, CA, August (2008).
<http://www.gfredlee.com/SJR-Delta/Salmon-NOAAcom.pdf>

Lee, G. F., and Jones-Lee, A., "Water Quality Issues That Could Influence Aquatic Life Resources of the Delta," Comments submitted to CALFED Science Program, Sacramento, CA, by G. Fred Lee & Associates, El Macero, CA, November 28 (2005).
<http://www.gfredlee.com/SJR-Delta/POD-Com.pdf>

Lee, G. F., and Jones-Lee, A., "Need for SJR Watershed Water to Reach San Francisco Bay," Comments submitted to Delta Stewardship Council, Sacramento, CA by G. Fred Lee & Associates, El Macero, CA, May 22 (2011).
<http://www.gfredlee.com/SJR-Delta/NeedSJRtoSFBay.pdf>

The following report discussed the significance of SJR DWSC flows to maintaining adequate DO with particular reference to impacts on fisheries and Chinook salmon home-stream migration for spawning:

Lee, G. F., “Impact of San Joaquin River Deep Water Ship Channel Watershed and South Delta Flow Manipulations on the Low-DO Problem in the Deep Water Ship Channel,” Submitted to the US Bureau of Reclamation OCAP Biological Assessment, Sacramento, CA, Report of G. Fred Lee & Associates, El Macero, CA, July 10 (2003).
<http://www.gfredlee.com/SJR-Delta/FlowImpact.pdf>

Delta Water Quality Flow Issues

Associated with SWRCB’s efforts to develop appropriate Delta flow standards to protect the Public Trust, we have developed and offered to the Board our comments, findings, and perspective on key pertinent water quality issues, out of our experience and understanding of that system, including the following:

Lee, G. F., and Jones-Lee, A., “Discussion of Water Quality Issues That Should Be Considered in Evaluating the Potential Impact of Delta Water Diversions/Manipulations on Chemical Pollutants on Aquatic Life Resources of the Delta,” Report of G. Fred Lee & Associates, El Macero, CA, February 11 (2010).
http://www.gfredlee.com/SJR-Delta/Impact_Diversions.pdf

Lee, G. F., and Jones-Lee, A., “Comments on Water Quality Issues Associated with SWRCB’s Developing Flow Criteria for Protection of the Public Trust Aquatic Life Resources of the Delta,” Submitted to CA State Water Resources Control Board as part of Public Trust Delta Flow Criteria Development, by G. Fred Lee & Associates, El Macero, CA, February 11 (2010).
http://www.gfredlee.com/SJR-Delta/Public_Trust_WQ.pdf

Dr. Lee was appointed to a University of California Davis expert panel that reviewed the DFG draft flow criteria report. In the panel’s report, cited below, Dr. Lee specifically discussed water quality issues that DFG should include in its recommended flow report.

Gross, E.S., Lee, G. F., Simenstad, C. A., Stacey, M., Williams, J.G., (Expert Panel Members), “Panel Review of the CA Department of Fish and Game’s Quantifiable Biological Objectives and Flow Criteria for Aquatic and Terrestrial Species of Concern Dependent on the Delta,” DFG Water Rights Program Documents Senate Bill X7 1 DFG Implementation, Submitted to California Department of Fish and Game, October (2010). Available through http://www.dfg.ca.gov/water/water_rights_docs.html or http://www.gfredlee.com/SJR-Delta/Final_Panel_Review_DFG_BOFC_Draft.pdf

Delta Stewardship Council (DSC) and Bay Delta Conservation Plan (BDCP) Fall Short of Adequately Addressing Impacts of Flow on Water Quality

We have closely followed the deliberations of the Delta Stewardship Council in its development of a Delta Plan. We have submitted several sets of comments on drafts of the plan to identify and discuss technical inadequacies and unreliable aspects, with particular emphasis on managing Delta water quality issues. Comments we submitted include:

Lee, G. F., Comment on Delta Stewardship Council Discussion of Cause of SJR Low-DO Problem, email to J. Grindstaff, Executive Director, Delta Stewardship Council, Comments from G. Fred Lee & Associates, El Macero, CA, February 10 (2012).
<http://www.gfredlee.com/SJR-Delta/DSC-LowDO-Comment.pdf>

Lee, G. F., and Jones-Lee, A., “Comments on the DSC Staff Fifth Draft of Chapter 6 Devoted to Delta Water Quality Issues in the Delta Plan,” Comments Submitted to Delta Stewardship Council, Sacramento, CA, by G. Fred Lee & Associates, El Macero, CA, August 21 (2011). <http://www.gfredlee.com/SJR-Delta/DeltaPlan5DraftCh6Comm.pdf>

Lee, G. F., and Jones-Lee, A., “Comments on Delta Stewardship Council Staff May 14, 2012 Draft of the Delta Plan,” Comments to Delta Stewardship Council by G. Fred Lee & Associates, El Macero, CA, June 13 (2012).
<http://www.gfredlee.com/SJR-Delta/DSC-Comments-May2012-StaffDraft.pdf>

Lee, G. F., Comments to Delta Vision Foundation on Implementation Progress for the Delta Vision Strategic Plan, email to C. Gardiner. Comments submitted by G. Fred Lee & Associates, El Macero, CA, May 6 (2012).
<http://www.gfredlee.com/SJR-Delta/DeltaVisionFoundationComments.pdf>

We have found, and continue to find, inadequacies and unreliability in technical information put forth in the DSC staff drafts concerning issues that need to be addressed by the DSC in managing Delta aquatic resources. Many of those deficiencies have gone unaddressed. For example, we have repeatedly recommended in our comments that the DSC include information on the impacts of Delta flows on water quality with particular reference to the impacts of altering Delta flows on Delta water quality/beneficial uses. Thus far the DSC has not discussed those issues in a public meeting.

We have also followed the BDCP public meetings and have found that in developing the proposed tunnel diversion of Sacramento River water around the Delta BDCP has thus far failed to address the significant water quality problems that will occur in the South and Central Delta as a result of that diversion.

We recently provided comments to the CA Natural Resources Agency and the DSC pointing out unreliable information provided by a BDCP consultant concerning the current state of management of the residual low-DO problem in the SJR DWSC.

Lee, G. F., “Comments on Chris Earle’s Brief Summary of Conservation Measures as presented in Chapter 3 of the BDCP,” Comments to Karla Nemeth, CA Natural Resources Agency, G. Fred Lee & Associates, El Macero, CA, March 28 (2012).
http://www.gfredlee.com/SJR-Delta/BDCP_ConservationMeasures_Com.pdf

Lee, G. F., Comments on SJR DWSC Low-DO issues discussed at March 28, 2012 BDCP meeting. Comments submitted to J. Grindstaff, Executive Officer, Delta Stewardship Council, by G. Fred Lee & Associates, El Macero, CA, April 28 (2012).
http://www.gfredlee.com/SJR-Delta/Comments_SJR_DO_Issues_DSC.pdf

We have discussed technical aspects of current issues in managing the residual low-DO problem in the SJR DWSC:

Lee, G. F., and Jones-Lee, A., “Issues in Controlling the Residual Oxygen Demand in the SJR DWSC That Leads to DO WQO Violations,” Report of G. Fred Lee & Associates, El Macero, CA, November 3, 2010; updated February 6 (2011).
<http://www.gfredlee.com/SJR-Delta/Residual-Ox-Demand-DWSC.pdf>

Lee, G. F., and Jones-Lee, A., “Background Information on SJR Upstream Oxygen Demand Control Issues,” Prepared for San Joaquin River Technical Work Group, Report of G. Fred Lee & Associates, El Macero, CA, July 11 (2010).
<http://www.gfredlee.com/SJR-Delta/Bkgrnd-SJR-DO.pdf>

Lee, G. F., “Comments on SWRCB Review of South Delta Channel Water Quality,” Report of G. Fred Lee & Associates, El Macero, CA, January 15 (2011).
<http://www.gfredlee.com/SJR-Delta/SoDeltaWQ1-11.pdf>

Lee, G. F., and Jones-Lee, A., “Issues in Controlling Residual Oxygen Demand in SJR DWSC That Leads to Violations of DO WQO,” PowerPoint Slides, G. Fred Lee & Associates, El Macero, CA, February (2011).
<http://www.gfredlee.com/SJR-Delta/Issues-Ox-Demand-DWSC-Ppt.pdf>

With the control of most of the ammonia in the city of Stockton’s domestic wastewater discharges to the SJR just upstream of the DWSC, the low-DO problem in the SJR DWSC has become less severe, but it still occurs. One of the keys to controlling the residual low-DO problem in the SJR DWSC will be maintaining a flow of at least 800 to 1,000 cfs in the DWSC past the Port of Stockton. The elimination of the South Delta export projects’ pumping of Delta water, which will come with the tunnel diversion of Sacramento River water, will exacerbate the residual low-DO problem and cause it to extend much farther down the DWSC than occurs now.

Managing the Pollutant Load to the Delta

As discussed above, the current drawing of Sacramento River water through the Delta greatly dilutes pollutants that enter the South and Central Delta from the SJR and in-Delta agricultural sources. The proposed tunnel diversion project would eliminate that dilution, which would intensify water quality impacts of pollutants that enter the Delta. The supporters of the Sacramento River tunnel diversion approach assert that when the agricultural wastewater discharges and municipal stormwater runoff to the Delta and its tributaries are controlled, the water quality problems enhanced by the diversion of the Sacramento River water around/under the Delta will be controlled. However based on our experience in reviewing the sources of pollutants in agricultural discharges and the potential for their control, it will be difficult to control agricultural discharges sufficiently to achieve high water quality in the San Joaquin River and the Delta; it could well be cost-prohibitive to achieve adequate control of pollutant loads from irrigated agriculture and urban stormwater runoff. While it may be possible to increase the cost of agricultural crops to cover additional pollution control, competition with the same agricultural products in other areas and in other counties will make it very difficult to increase the costs sufficiently to achieve complete control while maintaining the agricultural operations.

Regulating Irrigated Agriculture Runoff

Dr. Lee has been involved in evaluating and developing water quality management approaches

for urban-area stormwater runoff and agricultural stormwater runoff and discharges throughout most of his five-decade-long career. In the early 2000s we developed several reports on behalf of the CVRWQCB/SWRCB that addressed the evaluation and management of pollution from nonpoint sources, including:

Lee, G. F. and Jones-Lee, A., "Organochlorine Pesticide, PCB and Dioxin/Furan Excessive Bioaccumulation Management Guidance," California Water Institute Report TP 02-06 to the California Water Resources Control Board/Central Valley Regional Water Quality Control Board, 170 pp, California State University Fresno, Fresno, CA, December (2002). <http://www.gfredlee.com/SurfaceWQ/OCITMDLRpt12-11-02.pdf>

Lee, G. F. and Jones-Lee, A., "Issues in Developing a Water Quality Monitoring Program for Evaluation of the Water Quality - Beneficial Use Impacts of Stormwater Runoff and Irrigation Water Discharges from Irrigated Agriculture in the Central Valley, CA," California Water Institute Report TP 02-07 to the California Water Resources Control Board/ Central Valley Regional Water Quality Control Board, 157 pp, California State University Fresno, Fresno, CA, December (2002). <http://www.gfredlee.com/SurfaceWQ/Agwaivemonitoring-dec.pdf>

Lee, G. F. and Jones-Lee, A., "Review of Management Practices for Controlling the Water Quality Impacts of Potential Pollutants in Irrigated Agriculture Stormwater Runoff and Tailwater Discharges," California Water Institute Report TP 02-05 to California Water Resources Control Board/Central Valley Regional Water Quality Control Board, 128 pp, California State University Fresno, Fresno, CA, December (2002). http://www.gfredlee.com/SurfaceWQ/BMP_Rpt.pdf

From our expertise and experience we have found that the current CVRWQCB program to manage the water quality impacts of pollutants in irrigated agricultural discharges in the Central Valley is inadequate. The following reports and comments address some of the significant deficiencies:

Lee, G. F., and Jones-Lee, A., "Comments on 'Draft Program Environmental Impact Report for a Waste Discharge Regulatory Program for Irrigated Lands within the Central Valley Region,'" Submitted to Irrigated Lands Regulatory Program (ILRP), Sacramento, CA, September 25 (2010). <http://www.gfredlee.com/SurfaceWQ/ILRPcomments.pdf>

Lee, G. F., and Jones-Lee, A., "Comments on the Tentative California Regional Water Quality Control Board Central Valley Region Monitoring and Reporting Program Order No. R5-2008-__for Coalition Groups under Amended Order No. R5-2006-0053 Coalition Group Conditional Waiver of Waste Discharge Requirements for Discharges from Irrigated Lands, Revision 26 November 2007," Submitted to Central Valley Regional Water Quality Control Board, Sacramento, CA, by G. Fred Lee & Associates, El Macero, CA, December 28 (2007). <http://www.gfredlee.com/SurfaceWQ/AgWaiverMRPNov07.pdf>

Lee, G. F., and Jones-Lee, A., "Issues in Regulating Water Quality Impacts from Irrigated Agricultural Runoff and Discharges in the Central Valley of California," Report of G. Fred Lee & Associates, El Macero, CA, February 4 (2009).
<http://www.gfredlee.com/SurfaceWQ/Impacts-Ag-Runoff.pdf>

Lee, G. F. and Jones-Lee, A., "Background Information on Evaluating the Water Quality Impacts of Irrigated Agricultural Discharges/Runoff," Report of G. Fred Lee & Associates, El Macero, CA, January, 2005. Updated May (2005).
<http://www.gfredlee.com/SurfaceWQ/BG-WQImp-IrrigAg.pdf>

Lee, G.F. and Jones-Lee, A., "Developing Central Valley, California, Agricultural Runoff/Discharges Water Quality Monitoring Programs," Proceedings of 2003 AWRA Spring Specialty Conference, "Agricultural Hydrology and Water Quality," American Water Resources Association, Kansas City, MO, May (2003).
http://www.gfredlee.com/SurfaceWQ/AWRA_KC_Pap-Lee-web.pdf

As discussed in those papers/reports, the current CVRWQCB irrigated lands runoff monitoring program falls far-short of being able to generate the information needed to define the current pollution by irrigated agriculture's stormwater runoff and tailwater discharges. Without a substantial expansion of the evaluation program for runoff and its impact, it will not be possible to control the water quality impacts of known, regulated pollutants in agriculture runoff, much less the known but unregulated pollutants and currently unrecognized pollutants.

The limited nature of the runoff monitoring and impact evaluation program has been justified on the basis that a comprehensive program would be too expensive for many agricultural interests to undertake and stay in business. As discussed in our reports and noted above, it will be very difficult, if not impossible, to control agricultural runoff/discharges in the Central Valley sufficiently to meet water quality objectives with no more than one exceedance every three years (the current Clean Water Act requirement). Moving to such a level of pollutant control for that industry will greatly change the ability to undertake profitable agriculture in the Central Valley.

Control of Nutrients in Ag Discharges. Aquatic plant nutrients (nitrogen and phosphorus compounds) comprise a group of pollutants of great concern for impairment of water quality in the Delta. We have been involved in the investigation and management of water quality impacts of nutrients – excessive fertilization – in many areas of the US and abroad since 1960s. A summary of our expertise and experience, as well as access to many of our papers and reports in this area, is provided on our web site, www.gfredlee.com, in the Excessive Fertilization section at <http://www.gfredlee.com/pexfert2.htm>. We have been active in excessive fertilization issues in the Delta since 1989. In 2008 we organized a one-day workshop for the California Water and Environmental Forum devoted to Delta nutrient water quality issues; information on that workshop is available in:

Lee, G. F., and Jones-Lee, A., "Delta Nutrient-Related Water Quality Problems," PowerPoint Slides Presented at CALFED Science Conference, Sacramento, CA, October 24 (2008). http://www.gfredlee.com/SJR-Delta/CALFED_SciConf10-08.pdf

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

“Overview of Delta Nutrient Water Quality Problems: Nutrient Load – Water Quality Impact Modeling,” Agenda for Technical Workshop sponsored by California Water and Environmental Modeling Forum (CWEMF), Scheduled for March 25, 2008 in Sacramento, CA (2008).
http://www.gfredlee.com/SJR-Delta/CWEMF_Workshop_Agenda.pdf

That workshop provided a good overview of issues by a variety of experts on Delta nutrient water quality issues. We have pointed out to the DSC that much of the technical information presented and discussed at that workshop has been ignored in the development of the DSC staff draft reports on the Delta Plan.

Lee, G. F., and Jones-Lee, A., “Comments on the Adequacy of C. Dahm’s Discussion of Delta Eutrophication Issues & Delta N/P Ratios as a Cause of Adverse Impact on Delta Fish,” Comments to Delta Stewardship Council, Report of G. Fred Lee & Associates, El Macero, CA, November 17 (2011). <http://www.gfredlee.com/SJR-Delta/DSC-Comments-Dahm-Eutroph.pdf>

In our writings on water quality impacts of irrigated agriculture and on Delta water quality issues we have commented on the need to develop nutrient water quality objectives. While various staff drafts have made recommendations for the DSC to require the CVRWQCB to develop nutrient water quality objectives for the Delta, those recommendation have not reflected an understanding of approaches that will have to be followed to develop technically reliable and implementable nutrient water quality objectives for Delta waters. We provided comments on this matter to the CVRWQCB and discussed a range of nutrient-related water quality problems that need to be considered in:

Lee, G. F., “Comments on Developing Nutrient Criteria for SJR Delta,” email to Christine Joab, Central Valley Regional Water Quality Control Board, Rancho Cordova, CA, March 29 (2011). <http://www.gfredlee.com/SJR-Delta/Delta-Nutr-Criteria-Com.pdf>

While the SWRCB is developing nutrient water quality criteria, it will require extensive research and many years to develop comprehensive water quality objectives for nutrients in the Delta. Even once they are developed and implemented, however, it will be extremely difficult for irrigated agriculture in the SJR watershed and within the Delta to meet such objectives in accord with Clean Water Act requirements.

A key issue that will need to be evaluated in developing phosphorus nutrient criteria for the Delta is that decreasing the phosphorus loads to the Delta will also reduce the production of phytoplankton in Delta waters, which in turn can be expected to reduce fish production in the Delta. As discussed in our writings on nutrient management issues in the Delta, decreasing the phosphorus load in the Sacramento Regional County Sanitation District wastewater treatment plant discharge to the Sacramento River decreased the phytoplankton concentrations in the Delta. The relationships among phosphorus load, phytoplankton production, and fish biomass found in

many waterbodies worldwide are discussed in detail in our paper:

Lee, G. F. and Jones, R. A., "Effects of Eutrophication on Fisheries," *Reviews in Aquatic Sciences*, 5:287-305, CRC Press, Boca Raton, FL (1991).

<http://www.gfredlee.com/Nutrients/fisheu.html>

The development of nutrient criteria for the Delta will need to balance the control of excessive fertilization of the Delta channels with maintaining adequate phytoplankton production to support the aquatic food web. Altering the flows in the Delta channels will significantly impact how nutrients loads to the Delta impact water quality.

Dairy Waste Regulation Balance

There has been considerable interest in the impacts of dairy wastes in the Central Valley on surface and groundwater quality. We discussed approaches that the CVRWQCB recently adopted to regulate the water quality impacts of dairy wastes, particularly animal manure, in the following report:

Jones-Lee, A., and Lee, G. F., "Impact of Dairy Wastes on San Joaquin River and Delta Water Quality Issues," Report to As You Sow, San Francisco, CA, Report of G. Fred Lee & Associates, El Macero, CA, January 24, (2012).

http://www.gfredlee.com/SJR-Delta/Dairy_Waste_Impact_Issues.pdf

Dairy herds are treated with hormones, steroids, and pharmaceuticals that have the potential to be present in manure and hence in runoff from lands on which dairy wastes have been disposed; it has recently been found that dairy manure contains steroid hormones. Those compounds are part of the vast array of unregulated chemicals in wastes in the Central Valley that have the potential to impact Delta water quality.

As discussed in our report, the CVRWQCB has adopted a "balance" approach toward regulating nutrients and other pollutants in runoff from areas in which dairy wastes (manure) are managed by land application. CVRWQCB has acknowledged that it "balances" the control requirements with the ability of the dairy industry to meet the requirements and still stay in business. This so-called balanced approach, which allows exceedances of water quality objectives for nutrient components and other pollutants in order to safeguard the dairy industry, is not in keeping with Clean Water Act requirements for regulating pollutants for which there are water quality objectives.

Regulating Water Quality Impacts of Urban Stormwater Runoff

Dr. Lee has been involved in the investigation and management of water quality impacts of urban stormwater runoff since the mid-1960s and has published extensively on these issues. A summary of our experience (<http://www.gfredlee.com/exp/stmwatrv.htm>) and many of our publications on these issues (<http://gfredlee.com/pswqual2.htm#runoff>) are available on our website. In addition, for 13 years we have written and published our *Stormwater Runoff Water Quality Newsletter*. That newsletter, which is distributed at no-cost to more than 8,000 subscribers, provides technical information on various issues pertinent to evaluating and regulating water quality impacts of urban stormwater runoff. Past *Newsletter* issues are available at: <http://www.gfredlee.com/newsindex.htm>.

The following is one of our papers that discusses some of the issues that need to be evaluated to regulate water quality impacts of urban stormwater runoff in a technically valid, cost-effective manner:

Jones-Lee, A., and Lee, G. F., "Modelling Water Quality Impacts of Stormwater Runoff: Why Hydrologic Models Are Insufficient," Chapter 4 IN: Modelling of Pollutants in Complex Environmental Systems, Volume I, ILM Publications, St. Albans, Hertfordshire, UK, pp.83-95 (2009).
<http://www.gfredlee.com/Runoff/HydrologicModelsInadeq.pdf>

Many of our writings have addressed why the conventional Clean Water Act water quality criteria/standards-based regulatory approach is not appropriate for regulating stormwater runoff. Contrary to recommendations made by DSC staff in its draft Delta Plans, even if it were appropriate it is not possible to achieve compliance with Clean Water Act requirements applied to urban stormwater runoff – of having no more than one violation of a water quality objective every three years – owing to the cost alone. Given the nature of runoff events, such regulation would have to make storage and treatment provisions scaled to peak flows that occur during the comparatively infrequent major runoff events. To do so would cost on the order of a dollar per person per day for those served by the urban stormwater collection system and effect no improvement in receiving water quality beyond that which could be achieved with a less expensive more targeted approach. This situation is well-understood by the US EPA and is the primary reason that the US EPA has not required that urban areas control potential pollutants in stormwater runoff in accord with Clean Water Act requirements. In writings on our website we have discussed approaches to gather needed information to develop technically valid, cost-effective control programs for real, significant water quality impacts of potential pollutants in urban-area stormwater runoff, including developing wet-weather water quality standards that reflect the conditions that occur in urban stormwater runoff situations.

Lee, G.F. and Jones-Lee, A., "Evaluation Monitoring for Stormwater Runoff Water Quality Impact Assessment and Management," Presented at Society of Environmental Toxicology & Chemistry 18th Annual Meeting, San Francisco, CA, November (1997).
<http://www.gfredlee.com/Runoff/setace.html>

Lee, G. F. and Jones-Lee, A., "The Appropriateness of Using US EPA Water Quality Criteria as Goals for Urban Area and Highway Stormwater Runoff Water Quality Management," Report G. Fred Lee & Associates, El Macero, CA, May (1997).
<http://www.gfredlee.com/Runoff/wqstgoal.htm>

Lee, G. F. and Jones, R. A., "Suggested Approach for Assessing Water Quality Impacts of Urban Stormwater Drainage," IN: Symposium Proceedings on Urban Hydrology, American Water Resources Association Symposium, November 1990, AWRA Technical Publication Series TPS-91-4, AWRA, Bethesda, MD, pp. 139-151 (1991).
http://www.gfredlee.com/Runoff/storm_wa.html

Unrecognized Pollutants

Our 2004 Delta water quality report contained a section concerning unrecognized pollutants in Delta waters. As discussed there, and in other of our writings, at this time the current regulatory

approach of developing water quality criteria that are implemented through water quality standards and control of violations through the TMDL approach, addresses a very small portion of the potential pollutants in wastewaters. This is discussed further in the following publication:

Lee, G. F., and Jones-Lee, A., "Unrecognized Environmental Pollutants," *Water Encyclopedia: Surface and Agricultural Water*, Wiley, Hoboken, NJ pp 371-373 (2005).
<http://www.gfredlee.com/SurfaceWQ/WileyUnrecognizedPollutants.pdf>

The topic index to our *Stormwater Runoff Water Quality Newsletter* (http://www.gfredlee.com/swnews_indexa.pdf) contains links to additional information on the unrecognized pollutants in surface and groundwaters. Of particular relevance are Newsletter Volume 13 numbers 1 and 4 (<http://www.gfredlee.com/Newsletter/swnewsV13N1.pdf> and <http://www.gfredlee.com/Newsletter/swnewsV13N4.pdf>).

In the early 1970s Dr. Lee was an advisor to the Council on Environment Quality on developing a regulatory program for screening new chemicals for public health and environmental impacts. That work led to the development of the Toxics Substances Control Act (TSCA). While the original intent of TSCA was to provide a framework for effectively screening new chemicals, the version that was adopted was weakened and has been largely ineffective in screening new and expanded-use chemicals for environmental impact. At this time there is no effective program at the federal or state level to screen new and expanded-use chemicals for potential impacts. The failure of the regulatory system to address unrecognized and otherwise unregulated potential pollutants is increasingly significant.

The California Department of Toxic Substances Control (DTSC) recently proposed program, "Safer Consumer Products Alternatives" Title 22 California Code of Regulations Department Reference Number R-2011-02 dated July 2012, for screening new commercial chemicals is a step in the right direction, although it needs to be expanded to include evaluation of the environmental impacts for all new and expanded-use chemicals.

In its description of the proposed "Safer Consumer Products Alternatives" program the DTSC noted that there are more than 80,000 approved chemicals for federal use in the US, and made the following statement:

"Each day a total of 42 billion pounds of chemical substances are produced or imported in the US for commercial and industrial uses. And that each year 1,000 chemicals are introduced into commerce each year. Approximately one new chemical comes into market every 2.6 second. The average U.S. consumer today comes into contact with 100 chemicals per day. In 2009, the U.S. Centers for Disease Control and Prevention conducted the Fourth National Report on Human Exposure to Environmental Chemicals, which measured 212 chemicals in the blood and urine of a representative population of California."

Some of those chemicals are present in domestic and animal wastewaters and are part of the vast array of unrecognized chemicals that are a threat to Delta water quality.

Overall

A critical review shows that the ability to manage water quality in the Delta to comply with Clean Water Act requirements for eliminating violations of water quality objectives in agricultural and urban area stormwater runoff/discharges is many decades away, if it can ever be achieved. This means that dilution flows into and within the Delta will be needed to minimize the water quality impacts of pollutants that are added to Delta tributaries and within Delta channels. To begin to control the water quality problems that occur in Delta channels due to unregulated and unrecognized pollutants it will be necessary to add sufficient flows to the Delta channels to dilute the pollutants. As part of its review and establishment of Delta flows to enhance and protect the Public Trust resources of the Delta, the SWRCB should include the need for adequate Delta flows to provide substantial Delta inflow and channel flows.