Comments on
Water Quality Issues Associated with SWRCB's Developing Flow Criteria for Protection of the Public Trust Aquatic Life Resources of the Delta

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In accord with the California Legislature's Senate Bill No. 1, the State Water Resources Control Board (SWRCB) is required to develop new flow criteria for the Sacramento San Joaquin Delta ecosystem to protect public trust ecosystem and the aquatic life resources of the Delta. The legislature has also required that in developing those criteria the SWRCB consider the impacts of Sacramento (Sac) and San Joaquin River (SJR) water flow into, and flow within, the Delta channels on the aquatic life resources of the Delta. The SWRCB has scheduled an informational meeting to obtain input on these issues. This discussion summarizes the known water quality problems that have occurred in the Delta as a result of the operation of the DWR and USBR South Delta export projects and presents a summary of the water quality issues/potential chemical contaminant impacts to Delta aquatic life resources that need to understood and controlled as part of developing public trust flows into and in the Delta.

We have been involved in Delta and Delta tributary water quality issues for more than 20 years. Over this period we have found that the SWRCB's water rights decisions pertaining to allowed water diversions and flow manipulations have significantly adversely impacted the aquatic life resources of the Delta. Impacts on aquatic life/public trust aquatic life resources of the Delta have been largely ignored or disregarded in the SWRCB's water rights decisions. It will be important that the SWRCB's implementation of the legislature's mandated public trust review of impact of Delta inflow and flow through the Delta channels directions and magnitude include appropriate and reliable consideration of water quality issues that, in turn, impact the aquatic life resources of the Delta.

Many of our work and findings on these issues have been addressed in the following report, which is being submitted as an attachment to these comments:

> Lee, G. F., and Jones-Lee, A., "Updated and Expanded Discussion of Water Quality Issues That Should Be Considered in Evaluating the Potential Impact of Water Manipulations of Chemical Pollutants on Aquatic Resources of the Delta," Report of G. Fred Lee & Associates, El Macero, CA, February 11, (2010).
> gfredlee.com/SJR-Delta/UpdateWQIssuesDelta.pdf

That report discusses how the DWR and USBR South Delta export projects at the Tracy (Jones) and Banks pumping plants impact the flow of SJR and Sac River water into the Delta and through the Delta channels; as discussed, the flow manipulations effected by those projects have adversely impacted water quality in the Delta. One of the most significant is the alterations of the SJR flow through the Deep Water Ship Channel (DWSC) that are brought about by the operations of the export pumps that contribute to low-DO conditions in channel near the Port of

Stockton; the low-DO conditions, in turn, lead to blockage of the migration of fall-run Chinook salmon to their home stream for spawning in the SJR tributaries upstream of the DWSC. In addition, the low DO in the DWSC near the Port of Stockton also adversely affects a variety of aquatic life resources of the DWSC and other areas of the Delta.

The alterations in flow of SJR through the upper South Delta and Middle Delta brought about by the export projects pumps also interferes with the transport of the fish homing chemical signals from the SJR tributaries that guide the fall-run salmon to their home streams for spawning in SJR tributaries upstream of the DWSC. This interference appears to result in salmon's straying from their home stream for spawning, which could adversely impact reproduction of anadromous fish.

The DWR and USBR export of South Delta water adversely impacts agricultural use of South Delta for irrigation because it lowers water levels in the South Delta channels sufficiently to prohibit the pumping of channel water for irrigation. In an effort to try to minimize the low water levels in South Delta channels, DWR constructed barriers on some channels. Those barriers have resulted in the development of null/no-flow zones that lead to low-DO conditions in some South Delta channels. Those low-DO conditions have adverse impacts on aquatic life resources and have resulted in fish kills.

The SJR USBR export of South Delta water has resulted in the drawing of sea water into the western Delta Old River channel, which leads to reverse flow from the northwest Delta to the pumps. In addition to causing the loss (capture) of larval fish in the pump screens/pumps, and increased salinity in the South Delta, these projects' import of sea water increases the amount of bromide in South Delta waters. Bromide is a significant pollutant causing brominated trihalomethane carcinogenic chemicals in water treated for domestic water supply by ozone for disinfection. The import of sea water-derived bromide has contaminated the USBR Delta Mendota canal water with bromide that through the use of the canal water for irrigation and the associated tailwater releases pollutes the SJR with bromide.

Another unaddressed issue is the impact of the DWR USBR export of South Delta water and the associated alteration of Delta flow on the location and magnitude of known violations of water quality standards/objectives that are impacting south Delta aquatic resources. The export could also be affecting the presence of unmonitored, unregulated chemicals that are possibly adversely impacting aquatic life resources in Delta channels both by lethal and sublethal toxic impacts as well as by the excessive bioaccumulation of legacy pesticides and PCBs in Delta fish that pose a threat to human health when those fish are eaten by people.

The proposed Bay Delta Conservation Plan (BDCP) steering committee's deliberation on developing altered flow of Sacramento River around and/or through the Delta (peripheral canal) to "improve the reliability, quantity, and quality of the water exported to south and west of the Delta" has the potential to significantly adversely impact Delta water quality and aquatic life resources. While such a Sac River diversion may decrease the capture of listed fish species in the South Delta pumps, it can significantly adversely impact Delta aquatic life resources. As part of its consideration of altered flow of the Sac River around and/or through the Delta, and under the public trust protection mandate for the Delta, the SWRCB needs to conduct a full review of

the potential impacts of flow diversion on Delta water quality and all aquatic life resources of the Delta and its tributaries.

Information on each of the issues summarized above concerning the DWR USBR South Delta export projects is provided in the appended report and in references contained therein.

As discussed in these comments, there continue to be numerous, known violations of water quality standards/objectives in the Delta that are likely to cause adverse impacts on aquatic life resources of the Delta. We have documented, through our own studies and those of others, that SWRCB-permitted operation of the DWR USBR South Delta export projects are causing significant, recognized adverse impacts on Delta water quality that, in turn, adversely impact Delta aquatic life resources. The magnitude and location of adverse impacts are influenced by allowed flow manipulations in the Delta as part of the operations of the SJR USBR South Delta export projects. The impacts of known, current violations of water quality standards, however, are only a small part the real water quality problems that exist in the Delta. There exist CWA water quality impairments in the Delta and SJR that are caused by TOC, nutrients, and other contaminants for which there are no federal or state water quality criteria/objectives. In addition to there being no water quality criteria for those common water pollutants, there are situations in which the current water quality criteria/standards are well-recognized as not being protective of aquatic life resources. For example, the water quality criterion for selenium in the SJR and Delta is not protective of some aquatic life.

Beginning in the late 1960s, Dr. G. Fred Lee pioneered in the development of approaches for evaluating the water quality/environmental impact of chemicals. His work has focused on the integration of aquatic chemistry and toxicology in evaluating the sources, fate, water quality impact, and control of chemicals in aquatic systems. Dr. Lee has also been involved in the development, evaluation, and implementation of water quality criteria and state standards since the early 1960s. A summary of his experience in those areas is provided at http://www.gfredlee.com/exp/wqexp.htm. During the 1960s, while he held the position of Professor of Water Chemistry and Director of the Water Chemistry Program at the University of Wisconsin, Madison he served as an advisor to the Wisconsin Department of Natural Resources on the development and implementation of water quality criteria and standards. During that time and subsequently he has served as an advisor to numerous governmental agencies including municipalities, industry, and environmental/citizens' groups on water quality criteria issues. During the 1960s through the mid-1970s he served as an advisor to the International Joint Commission for the US-Canadian Great Lakes in developing water quality objectives for the Great Lakes, and in their implementation. His about $1 million studies in the 1970s served as the basis for the US Army Corps of Engineers development of dredged sediment disposal criteria. These criteria are still being used today by the US EPA and Corps of Engineers to regulated dredged sediment disposal in open waters.

In the early 1970s Dr. Lee served as an invited peer reviewer for the National Academies of Science and Engineering's "Blue Book" "Water Quality Criteria - 1972." In the late 1970s, he served as an invited member of the American Fisheries Society Water Quality Panel that conducted a review of the US EPA's 1976 "Red Book" of water quality criteria. In the early to mid-1980s he served as a US EPA invited peer reviewer for the water quality criteria

development approach used for the 1986 “Gold Book” water quality criteria, and for several of the specific chemical criteria. His pioneering work on PCB pollution in the 1960s led to his being selected to head the US Public Health Service committee on developing drinking water standards for PCBs.

It is with this background that Dr. Lee can authoritatively discuss the potential importance of the failure of the existing water quality criteria to address many of the issues that need to be considered in evaluating the potential impacts of chemicals on aquatic life. The current US EPA criteria development approach only considers some and in some cases a small part of the impacts of chemical contaminates on aquatic life. For example, the approach currently used to develop water quality criteria does not include additive/synergistic properties of regulated chemicals that occur in concentration below the water quality criteria allowing unanticipated adverse impacts to aquatic life. Adverse impacts of chemicals to aquatic life that occur for especially sensitive species, such as zooplankton which serve as fish food organism were not included in the development of the water quality criteria. These criteria are only applicable to protecting about 90% of the species. Therefore there could readily be fish species in the Delta and its tributaries that are more sensitive to a chemical than those used to establish the water quality criterion value. There is also very limited information on chronic exposure to sublethal impacts of a chemical and mixtures of chemicals to fish populations. Another issue is that other stressor such as low DO, ammonia etc. that can impact the lethal and especially sublethal impacts of chemicals. It has been well know for over 40 years through biomarker studies that fish and other organism show organisms biochemical responses to chemical exposures at concentrations well below the water quality criterion. The significance of these biomarker responses to an organism or group of organisms is largely unknown. Chemicals can adversely impact the health of the fish and other aquatic life that weaken their ability to resist adverse impact of stressors such as low DO, elevated temperature and predation as well to disease. It’s been known for over 40 years that very low levels of copper affect the “breathing” rate of some fish.

Overall a water sample that meets all the current water quality criteria/standards should not be considered a suitable habitat for development of unrestricted healthy fish populations.

The US EPA water quality criteria development program has had limited support for the development of new or revised water quality criteria for chemicals that have the potential to be adverse to aquatic life. As discussed in our Stormwater Runoff Water Quality Newsletters at http://www.gfredlee.com/newsindex.htm as well as in Delta water quality issues reports, many thousands of unregulated chemicals, including pharmaceuticals and personal care products, industrial chemicals, and other potentially hazardous chemicals, are discharged to waterways, including the Delta and its tributaries, in domestic wastewaters, agricultural runoff and waste waters. Some of those are now being found to be adverse to aquatic life; many have yet to be investigated.

In April 2009, a California Ocean Protection Council et al. workshop, “Managing Contaminants of Emerging Concern in California: A Workshop to Develop Processes for Prioritizing, Monitoring and Determining Thresholds of Concern,” was held in Costa Mesa, CA; a report on issues and discussions at that workshop was made available in September (2009) [http://www.nwri-usa.org/pdfs/CACCECReport.pdf].

Figure 1 presents a summary, derived from that report, of current information on numbers of chemicals from various sources that are of concern as potential pollutants.

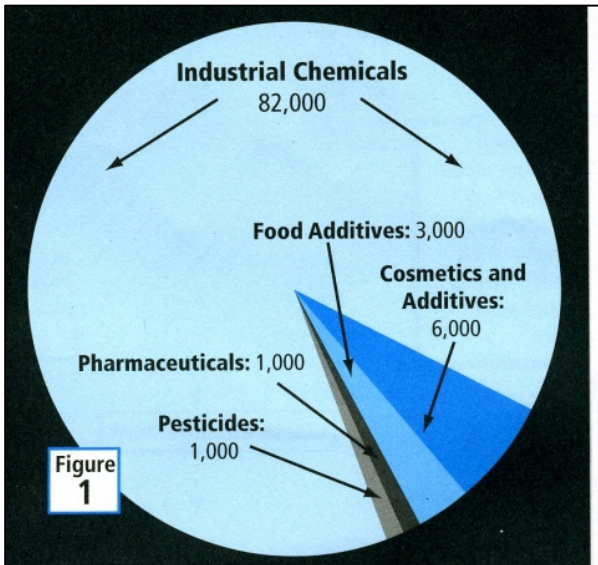

Figure 1. Approximately 100,000 individual chemicals have been registered for commercial use in the United States over the past 30 years. Chemical classes that receive the majority of public attention (e.g., pharmaceuticals, cosmetics and food additives, and pesticides) constitute only a small percentage of this inventory. Very little environmental fate and toxicity information is available for the majority of these chemicals and analytical methods are currently available for only several hundred of the non-regulated chemicals.

Source:
Published in *Estuary News* 18(6) December (2009).
[http://www.sfestuary.org/pages/newsletter.php]
(Based on Figure 1 in: Muir, D., and Howard, P., "Are There Other Persistent Organic Pollutants? A Challenge for Environmental Chemists," *Environ. Sci. & Technol.* 40:7157-7166 (2006);
subsequently updated in: "Managing Contaminants of Emerging Concern in California: Developing Processes for Prioritizing, Monitoring, and Determining Thresholds of Concern," Report of California Ocean Protection Council et al. workshop, "Managing Contaminants of Emerging Concern in California: A Workshop to Develop Processes for Prioritizing, Monitoring and Determining Thresholds of Concern," Costa Mesa, CA, April 28-29 (2009);
[http://www.nwri-usa.org/pdfs/CACCECReport.pdf]
and updated further for *Estuary News*.)

Many of these same types of sources and chemicals can be part of the Delta's chemical soap that can be affecting aquatic life in the Delta that is in turn impacted by allowed flow diversions and manipulations as part of diversion projects .

As part of developing public trust flows to protect the Delta ecosystem/aquatic life resources of the Delta, the SWRCB must also consider the array of chemicals whose aquatic life impacts are presently unknown due to the present inadequacy of investigation and information. To afford aquatic life resource protection, adequate flows of high-quality Sierra runoff water are needed to dilute the large number of pollutants discharged to the Delta and its tributaries. Such dilution flows should be used to rapidly transport the pollutants through the Delta.