Agriculture-Related Water Quality Problems in the San Joaquin River

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Topics

- Summary of San Joaquin River Water Quality Issues
- Constituents of Concern & Water Quality Impacts

Acronyms/Definitions

- CALFED — California Federal Bay-Delta 303(d) Section of CWA
- CTR — California Toxics Rule
- CVP — Central Valley Project (Federal Project)
- CVRWQCB — CA Central Valley Regional Water Quality Control Board
- CWA — Clean Water Act
- DDT — Dichlorodiphenyltrichloroethane (a legacy pesticide)
- DMC — Delta Mendota Canal
- DO — Dissolved Oxygen
- DOC — Dissolved Organic Carbon
- DWR — CA Department of Water Resources
- DWSC — Deep Water Ship Channel
- EC — Electrical Conductivity
- HOR — Head of Old River
- IEP — Interagency Ecological Program
- N — Nitrogen
- OCls — Organochlorines including organochlorine legacy pesticides (DDT, chlordane, dieldrin, toxaphene), PCBs, dioxins/furans
- OP — Organophosphorus Pesticide

Acronyms/Definitions

- PAHs — Polynuclear Aromatic Hydrocarbons
- PBDEs — Polybrominated Diphenyl Ethers
- PCBs — Polychlorinated Biphenyls
- PPCPs — Pharmaceuticals and Personal Care Products
- SDIP — South Delta Improvement Program
- SJR — San Joaquin River
- SQO — Sediment Quality Objective
- SWP — State Water Project (State Project)
- SWRCB — State Water Resources Control Board
- TDS — Total Dissolved Solids
- THMs — Trihalomethanes
- TIEs — Toxicity Identification Evaluations
- TMDL — Total Maximum Daily Load
- TOC — Total Organic Carbon
- TUC — Toxicity of Unknown Cause
- USBR — US Bureau of Reclamation
- US EPA — US Environmental Protection Agency
- VAMP — Vernalis Adaptive Management Plan
- WQO — Water Quality Objective

San Joaquin River Water Quality Issues

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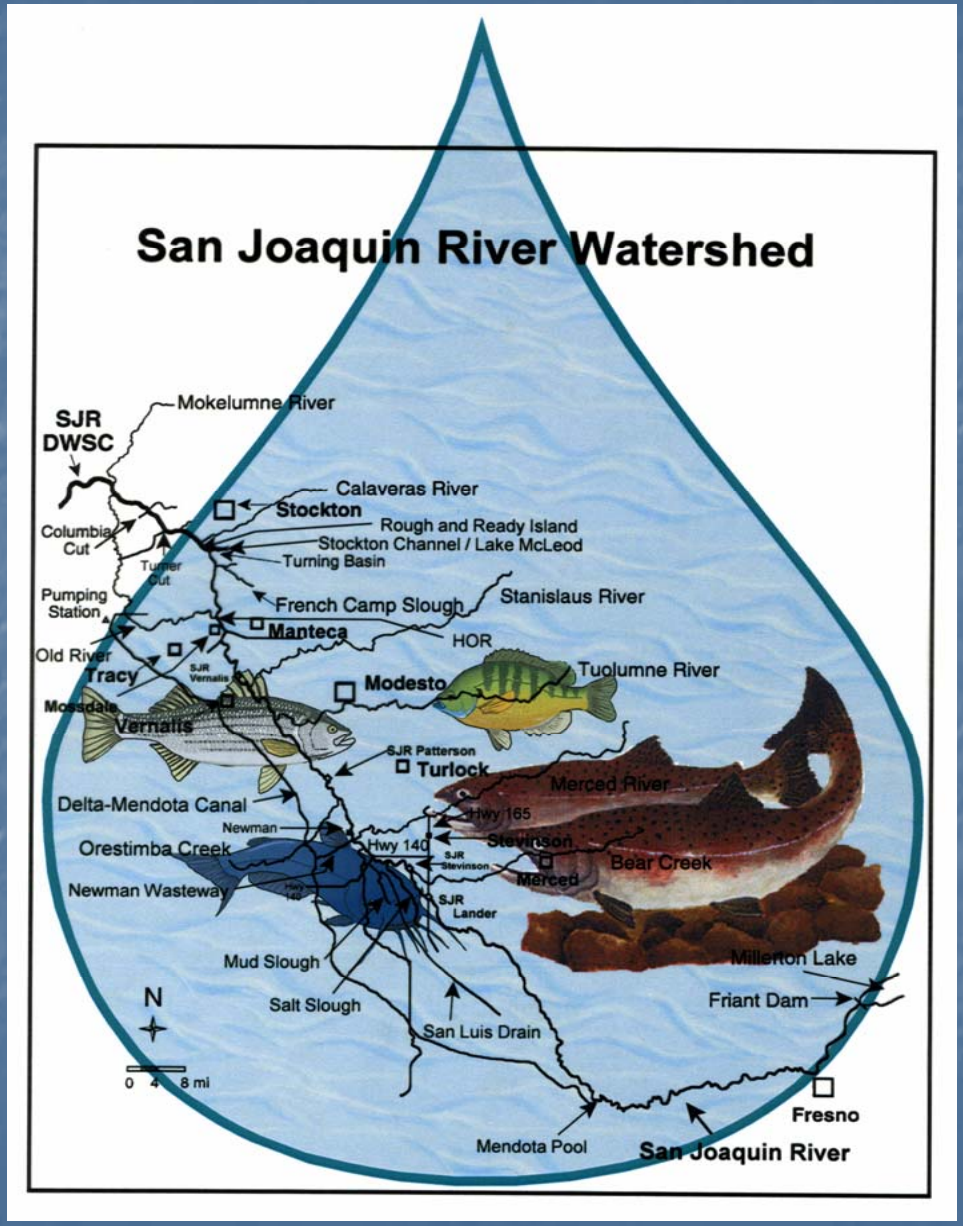
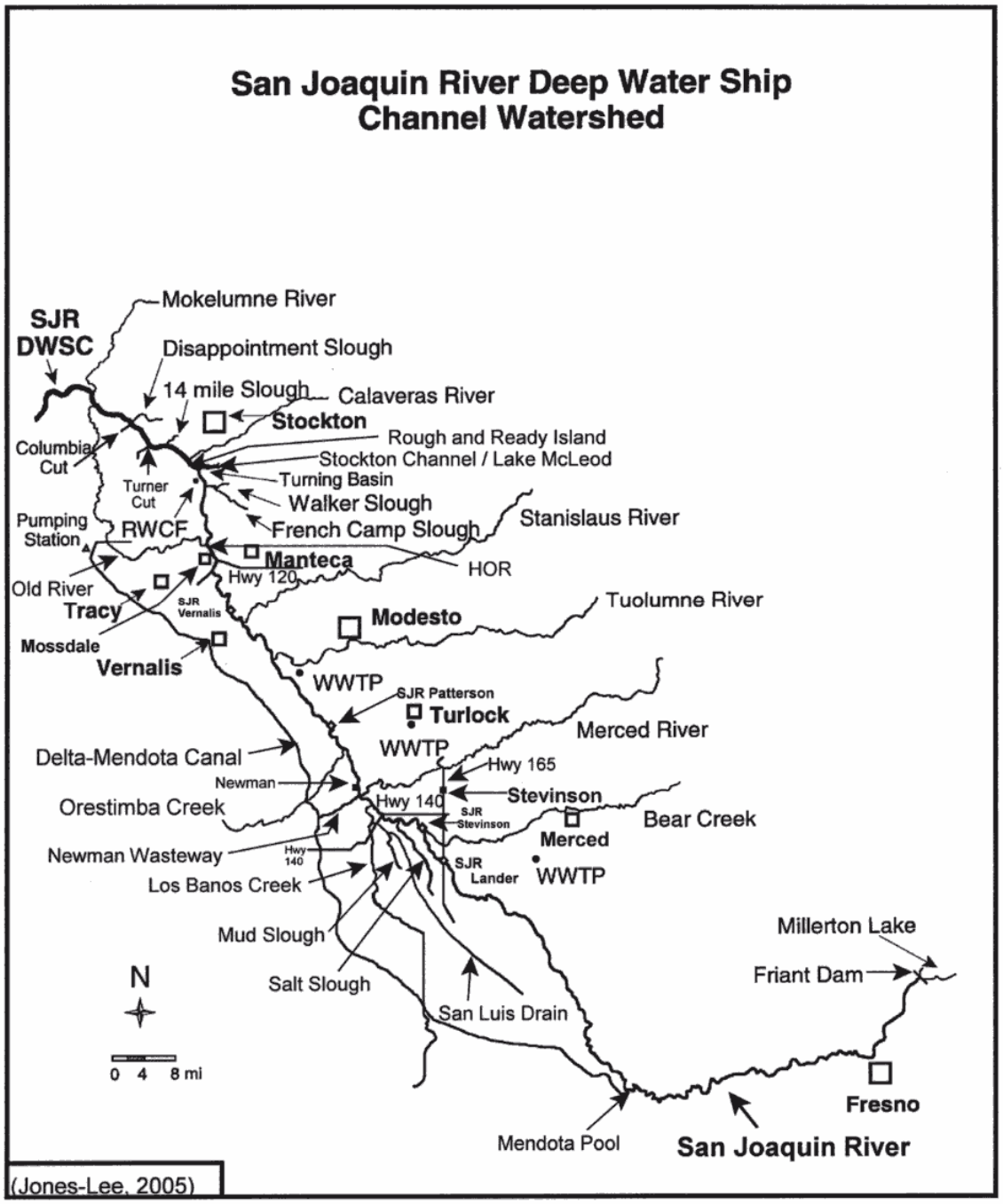
Available from

www.gfredlee.com



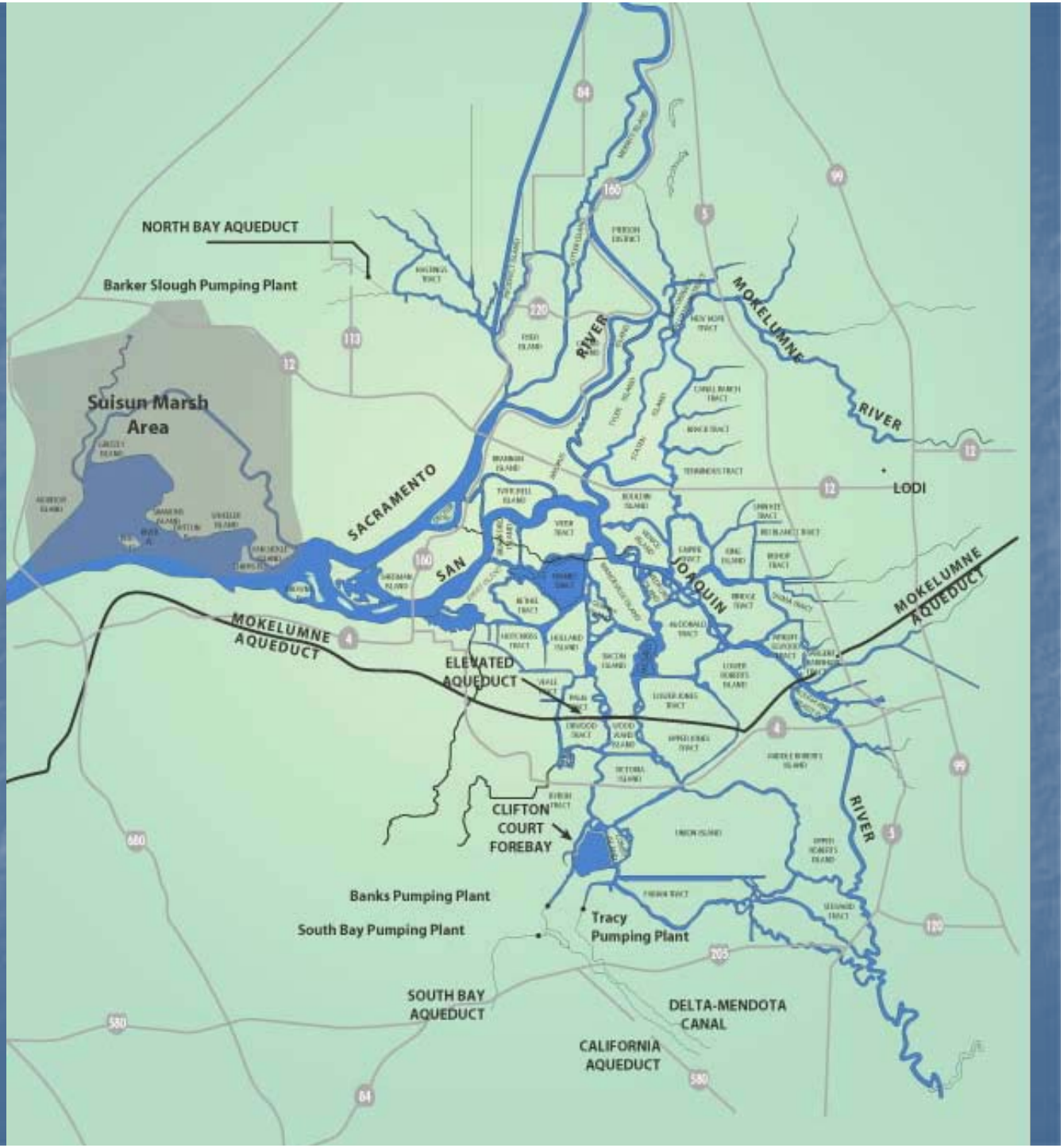
Background to Developing SJR Water Quality Issues Report

- Involved in Delta Water Quality Issues since 1989
- Involved in SJR Water Quality Issues since 1999
  - Technical Advisor to SJR DO TMDL Steering Committee
  - Coordinating PI for CALFED-Supported $2-million Study of SJR DWSC Low-DO Problem
- Developed Numerous Papers & Reports Discussing Issues, including:
  - Lee, G. F. & 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 and CALFED Bay-Delta Program, G. Fred Lee & Associates, El Macero, CA, March (2003).
  - Lee, G. F. & 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.members.aol.com/duklee2307/SynthRptSupp.pdf
  - Lee, G. F. & Jones-Lee, A., "San Joaquin River Water Quality Issues," Preliminary draft Report of G. Fred Lee & Associates, El Macero, CA, February (2006). http://www.members.aol.com/annejlee/SJR-WQIssuesPrelimDraft.pdf
  - *See also www.gfredlee.com Watershed Studies, San Joaquin River Watershed Delta*


San Joaquin River Deep Water Ship Channel Watershed
Mokelumne River
SJR DWSC
Disappointment Slough
14 mile Slough
Calaveras River
Stockton
Rough and Ready Island
Columbia Cut
Stockton Channel / Lake McLeod
Turner Cut
Turning Basin
Walker Slough
Pumping Station
RWCF
French Camp Slough
Stanislaus River
Manteca
HOR
Hwy 120
Old River
Tracy
SJR Vernalis
Modesto
Tuolumne River
Mossdale
Vernalis
WWTP
SJR Patterson
Turlock
Merced River
Delta-Mendota Canal
WWTP
Hwy 165
Newman
Hwy 140
Stevinson
Orestimba Creek
SJR Stevinson
Bear Creek
Merced
Newman Wasteway
Hwy 140
SJR Lander
WWTP
Los Banos Creek
Mud Slough
Millerton Lake
Friant Dam
N
Salt Slough
San Luis Drain
0 4 8 mi
Fresno
Mendota Pool
San Joaquin River
(Jones-Lee, 2005)

Map of Delta

(CA Dept Fish & Game, 2005)



Chemical Analysis Output as Basis for Evaluation of SJR Water Quality Issues

- 1972 Federal "Clean Water Act" Requires That Each State
  - Establish Water Quality Standards to Protect the Designated Beneficial Uses of State's Waters
  - Designate the Beneficial Uses of Waterbodies
  - Determine If Its Waterbodies Have Violations of Water Quality Standards
  - List Those Waterbodies with Violations of Water Quality Standards as CWA 303(d) "Impaired"
  - Develop Total Maximum Daily Loads (TMDLs) for All 303(d) Impaired Waterbodies
- Examine Current, Pending, Potential TMDLs for the SJR

Summary of SJR Water Quality Issues

◄ Current (Active) SJR Watershed TMDLs ►

- **Selenium**
  - Source: Agricultural Drainage
  - Concern: Aquatic Life and Water Fowl
- **Salinity** at Vernalis, Total Dissolved Solids (TDS), Electrical Conductivity (EC)
  - Source: Agricultural Drainage & Other Sources
  - Concern: Adverse to Agriculture & Domestic Water Supplies
- **Boron**
  - Source: Agricultural Runoff/Drainage
  - Concern: Adverse to Agriculture
- **Organophosphorus (OP) Pesticides** (Diazinon, Chlorpyrifos)
  - Source: Agricultural Runoff
  - Concern: Toxic to Aquatic Life
- **Oxygen-Demanding Substances** (BOD/Algae, Ammonia, Organic N)
  - Source: Agricultural Drainage/Runoff
  - Concern: Low DO in DWSC & South Delta; Adverse to Aquatic Life

Summary of SJR Water Quality Issues

◄ Pending TMDLs (to Be Developed) ►

- **Mercury**
  - Source: Former Gold & Mercury Mining Activities
  - Concern: Bioaccumulation in Edible Fish
    Neurotoxin to Fetuses & Young Children
    Sulfate Impacts Bioaccumulation of Mercury
- **Organochlorine "Legacy" Pesticides** (e.g., DDT, Chlordane, Dieldrin, Toxaphene)
  - Source: Agricultural Drainage/Runoff
  - Concern: Excessive Bioaccumulation in Edible Fish – Cancer in Humans
- **PCBs** - Industrial Chemicals
  - Source: Industrial Discharges
  - Concern: Excessive Bioaccumulation in Edible Fish – Cancer in Humans
- **Dioxins/Furans**
  - Source: Industrial Chemicals; Combustion Byproduct
  - Concern: Excessive Bioaccumulation in Edible Fish – Cancer in Humans

Summary of SJR Water Quality Issues

◄ Pending TMDLs (to Be Developed) ►

- **Pathogen-Indicator Organisms** (*E. coli,* Fecal Coliforms)
  - Source: Agricultural & Urban Runoff/Discharges
  - Concern: Diseases (Contracted from Contact Recreation - Swimming)
    Drinking Water Quality
- **Toxicity of Unknown Cause**
  - Source/Cause: Unknown
  - Concern: Adverse to Aquatic Life
- **Salinity** Upstream of Vernalis
  - Source: Agricultural Drainage/Runoff
  - Concern: Adverse to Agriculture & Domestic Water Supplies

Summary of SJR Water Quality Issues
◄ Potential Future TMDLs (to Be Evaluated) ►

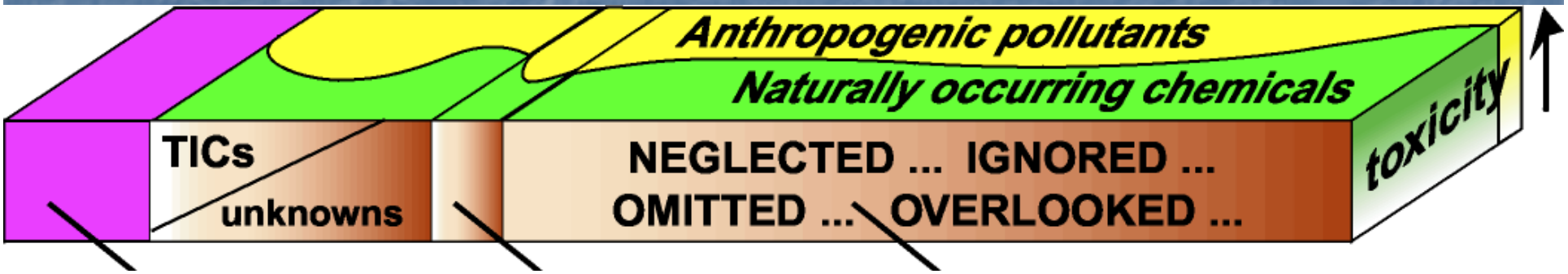
Based on Water Quality Problems in SJR, Delta & Downstream, Need Water Quality Objectives for Some Potential Problems

- **Nutrients –** Excessive Fertilization (Nitrogen and Phosphorus Compounds)
  - Source: Agricultural & Urban Drainage & Discharges
  - Concern: High pH, Low DO (Associated with Photosynthesis/Respiration)
    - Impair Recreation, Domestic Water Supplies
- **Alternative Pesticides** to OP Pesticides (Including Pyrethroid-Based Pesticides)
  - Source: Agricultural & Urban Drainage & Discharges
  - Concern: Causing Toxicity to Aquatic Life; Watercolumn & Sediment Toxicity
- **PBDEs** - Fire Retardants
  - Source: Urban Sources - Wastewaters & Stormwater Runoff
  - Concern: Excessive Bioaccumulation in Edible Fish – Cancer in Humans
- **Total Organic Carbon** & Other Chemicals That Develop into Disinfection Byproducts (Trihalomethanes) in Treated Domestic Water Supplies (e.g., **Bromide**)
  - Source: Agricultural, Wetland & Urban Drainage/Discharge
  - Concern: Cancer in People Who Use Treated Domestic Water Supplies

Summary of SJR Water Quality Issues
◄ Potential Future TMDLs (to Be Evaluated) ►

- **Excessive Sediment, Erosion, Turbidity**
  - Source: Erosion from Agricultural Lands
  - Concern: Shoaling Water Depth
    Adverse to Light Penetration
- **Herbicides**
  - Source: Agricultural & Roadside Drainage/Runoff
  - Concern: Toxicity to Algae & Other Aquatic Plants
- **Aquatic Sediment Toxicity** (Pesticides, Nutrients/Algae/Sediment Ammonia, Heavy Metals, PAHs and other Chemicals)
  - Source: Agricultural & Urban Discharges/Runoff
  - Concern: Toxicity to Aquatic Organisms; Human Health Effects
- **Unrecognized Pollutants** (Pharmaceuticals & Other Unregulated Chemicals Discharged by Confined Animal Facilities (e.g., Dairies, Feedlots) & Domestic Wastewaters)
  - Source: Agricultural & Urban Wastewater Discharges
  - Concern: Toxicity / Sublethal Impacts on Aquatic Life
    Human Health Effects

Typical
Environmental Sample Analysis



"TARGET" ANALYTES	RECOGNIZABLE ARTIFACT	Large portion of naturally occurring and anthropogenic chemicals of varied toxicity

TICs = tentatively identified compounds

Figure from: Daughton, C. C., "The Critical Role of Analytical Chemistry," July (2002)
http://www.epa.gov/nerlesd1/chemistry/pharma/critical.htm

Impact of Water Diversions & Agricultural Discharges on SJR Water Quality

- Diversions of Water for Agricultural & Domestic Supply Drastically Reduce SJR Flow
  - Less Dilution of Pollutants from Agricultural & Urban Discharge
- Court-Ordered Releases of Water from Friant Dam to SJR Channel
  - Could Have Significant Beneficial Impact on Water Quality in SJR & Delta
  - Could Significantly Reduce Cost of Managing Currently Known & Potential Water Quality Problems in SJR
  - To Optimize Benefit of Friant Releases for SJR & Delta Water Quality
    - Need Adequate Water Release
    - Allow Released Water to Pass through SJR to at Least Turner Cut in DWSC

Conclusions

- **SJR**, Many of Its Tributaries & Parts of Delta That Receive SJR Water – Highly **Impacted By Known Pollutants** from
  - Irrigated Agriculture
  - Other Agricultural Activities Involving Animal Husbandry
  - Public Wetlands, Wildlife Refuges, Private Gun Clubs
  - Urban Stormwater & Wastewater Discharges
- **SWRCB Water Rights Decisions** That Allow Water Diversion/Exports Exacerbate Adverse Impacts on Beneficial Uses of Waters of SJR & Delta
- **Inadequate State & Federal Funding** Hampers Ability of CVRWQCB to Address These Water Quality Problems

Overall

- Need to Develop Focused, Large-Scale Water Quality Monitoring/Evaluation Management Program to
  - Address Known Water Quality Impairments
  - Identify Water Quality Impairments Not Yet Recognized
  - Provide CVRWQCB Technical Basis to Restore Beneficial Uses of SJR, Its Tributaries & Delta
- Funds to Conduct Program Should Be Derived from
  - All Who Discharge Wastewaters & Stormwater Runoff to SJR, Its Tributaries, Including Irrigated Agriculture
  - All Who Derive Benefits from Using SJR Watershed Waters
- Meeting TMDL Requirements Will Require Significant Changes in Agricultural Practices & Urban Stormwater Wastewater Management in SJR & Delta Watersheds

Further Information

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

http://www.gfredlee.com