Potential Water Quality Impacts of Agriculture Runoff/Discharges in the Central Valley of California

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Topics

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

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San Joaquin River Water Quality Issues

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Available from

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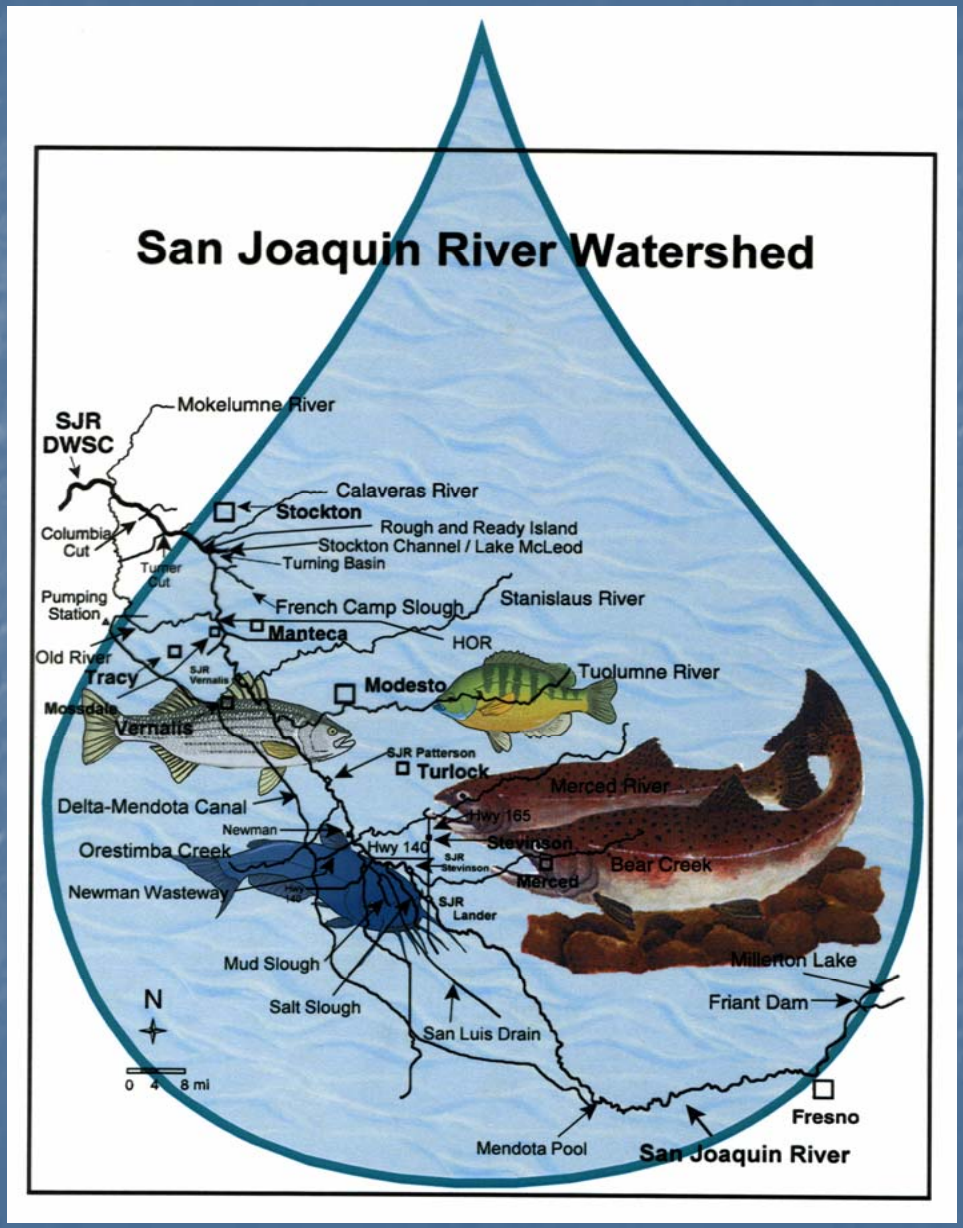
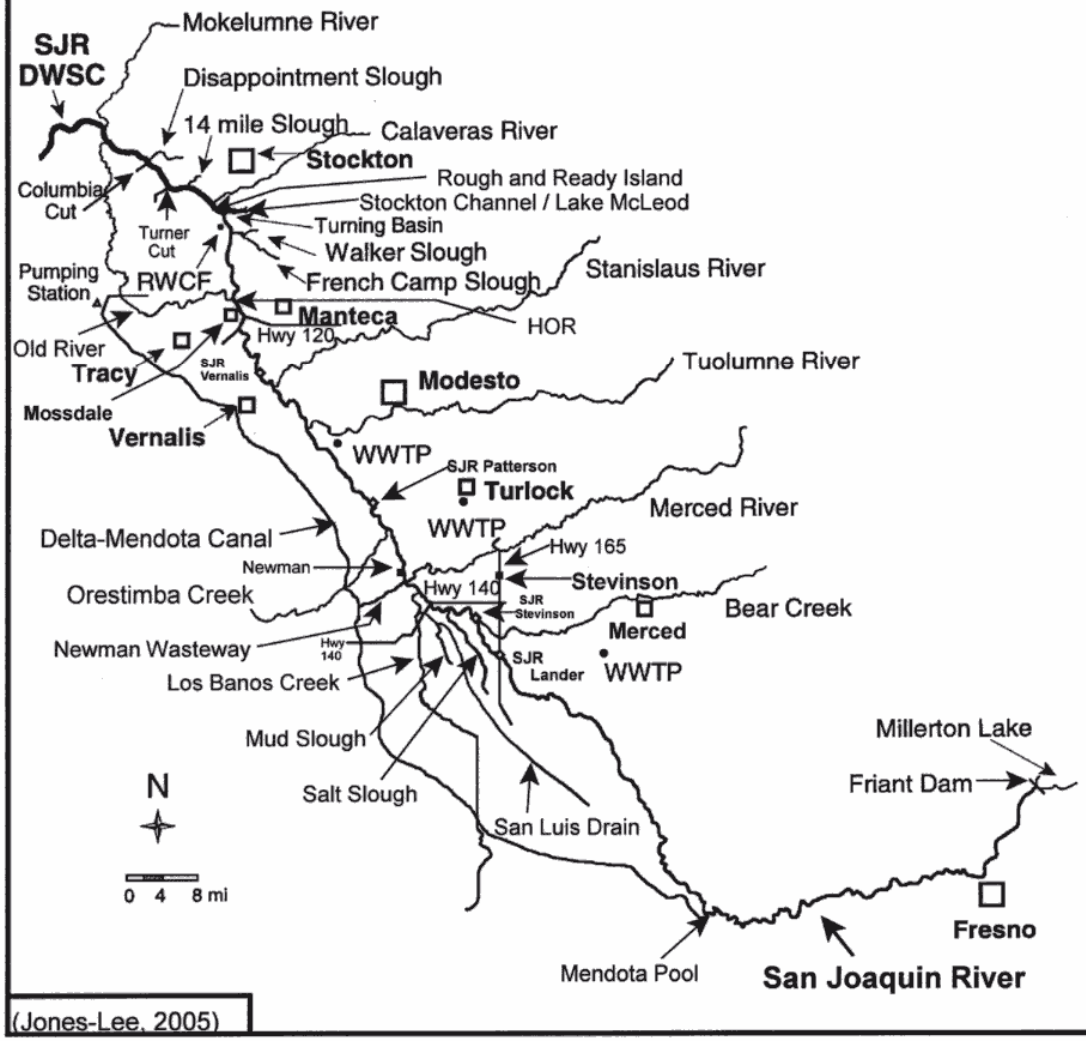


San Joaquin River Deep Water Ship Channel Watershed



(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
  - Designate the Beneficial Uses of Waterbodies
  - Establish Water Quality Standards to Protect the Designated Beneficial Uses of State’s Waters
  - 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

2006 CWA 303(d) List of Water Quality Limited ("Impaired") Reaches of San Joaquin River (SWRCB, June 2007)

Pollutant*/Stressor	River Reach (see key below)							Potential Sources (see key below)		
	FMP	MPB	BMS	MSM	MTR	TRS	SDB	Ag	SU	RE
DDT		X	X	X	X	X	X	X		
Group A Pesticides (legacy)		X	X	X	X	X	X	X		
EC/TDS		X	X	X				X		
Exotic Species	X								X	
Mercury			X	X	X	X	X			X
Unknown Toxicity		X	X	X	X				X	
						X	X	X		
Boron		X	X	X				X		
Toxaphene							X		X	
Selenium				X				X		

River Reach Designations
FMP - Friant Dam to Mendota Pool
MPB - Mendota Pool to Bear Creek
BMS - Bear Creek to Mud Slough
MSM - Mud Slough to Merced River
MTR - Merced River to Tuolumne River
TRS - Tuolumne River to Stanislaus River
SDB - Stanislaus River to Delta Boundary

Group A Pesticides	
aldrin	heptachlor epoxide
dieldrin	hexachlorocyclohexane
chlordane	(incl. lindane)
endrin	endosulfan
heptachlor	toxaphene

Source Designations
Ag - Agriculture
SU - Source unknown
RE - Resource Extraction

CWA - Clean Water Act

* Violates water quality objective

SJR & Downstream Downstream of Vernalis Impaired Waters Not Listed on CWA 303(d)

Should Be Listed	Known Impairments
PCBs	Excessive bioaccumulation in edible fish
Pathogen-indicator organisms — *E. coli* , fecal coliforms	Contact recreation
Nutrients (nitrogen & phosphorus compounds)	Excessive fertilization High pH (photosynthesis/respiration) Low DO in Delta (algal decomposition)
Alternatives to OP pesticides (including pyrethroid-based pesticides*)	Watercolumn toxicity Sediment toxicity
Total organic carbon & other chemicals such as bromide	Disinfection byproducts (trihalomethanes) developed in treatment of downstream waters for domestic water supply
Excessive sediment	Erosion, turbidity

Pyrethroids
bifenthrin lambda cyhalothrin efenvalerate/fedvalerate permethrin

SJR & Downstream Downstream of Vernalis
Impaired Waters Not Listed on CWA 303(d)

Could Be Listed	Need Investigation for Potential Impacts
Herbicides	Toxicity to algae
Sulfate	Impact on bioaccumulation of mercury
PBDEs	Bioaccumulation
Aquatic sediment toxicity (pesticides, nutrients/algae/sediment ammonia, heavy metals, PAHs, other chemicals)	Toxicity
Unrecognized pollutants (pharmaceuticals & other unregulated chemicals dischargd by confined-animal facilities - dairies, feedlots, etc. - & domestic wastewaters	Various

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) ►

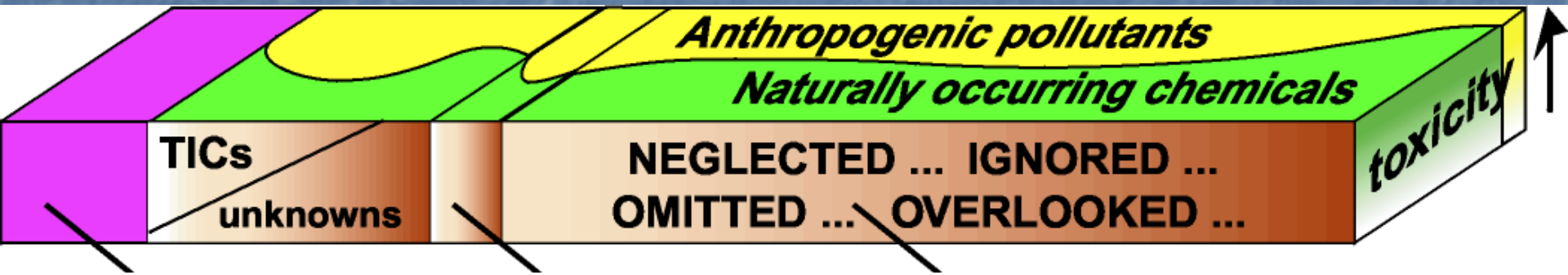
Based on Water Quality Problems in SJR, Delta & Downstream, Need Water Quality Objectives for Some Potential Problems

- **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
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http://www.gfredlee.com