From: 303dlist
To: "mrhodes@westlandswater.org".mime.Internet
Date: 10/5/01 7:56AM
Subject: Re: 303(d) List Draft Report on Recommended Changes: San Luis Reservoir Addition

The San Luis Reservoir was mistakenly left on the draft 303(d) list for impairment due to elevated copper levels. We will not include it in our final recommendations to the State Water Resources Control Board. Our original solicitation for information included a cutoff date of May 15, 2001 for submittal of information. We received information from the Department of Water Resources after May 15, 2001, which indicated that copper levels were above US EPA standards. Since the information was received after the cutoff date, we can not use it as the basis for our recommendations for changes to the 303(d) list. If you have any other questions, you may contact me at (916) 255-3368.

Joe Karkoski

>>> "Mark Rhodes" <mrhodes@westlandswater.org> 10/04/01 02:29PM >>>
The draft report Table 1. and Table 2. include the San Luis Reservoir to be added
to the list of impacted bodies of water for 2002.

REGION 5 STAFF REPORT

The following appendix contains no fact sheet to support this addition:

Appendix B - Fact Sheets for Recommended Changes to the 303(d) List

Unless I have overlooked it, I could find no information supporting or detailing
why San Luis should be listed as an impacted body of water. Can you provide a link or source that documents why San Luis has been recommended for addition
and or a report or data that indicates the source for "copper" contamination.

Best Regards

Mark Rhodes
Associate Resources Analyst
Westlands Water District
mrhodes@westlandswater.org

CALIFORNIA ENVIRONMENTAL PROTECTION AGENCY
REGIONAL WATER QUALITY CONTROL BOARD
CENTRAL VALLEY REGION

Draft Staff Report on Recommended Changes to California's Clean Water Act Section 303(d) List

27 September 2001

State of California

California Environmental Protection Agency

REGIONAL WATER QUALITY CONTROL BOARD
CENTRAL VALLEY REGION

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This publication is a technical report by staff of the California Regional Water Quality Control Board, Central Valley Region. No policy or regulation is either expressed or intended.

CALIFORNIA ENVIRONMENTAL PROTECTION AGENCY

REGIONAL WATER QUALITY CONTROL BOARD
CENTRAL VALLEY REGION

Draft Staff Report on Recommended Changes to California's Clean Water Act Section 303(d) List

September 2001

REPORT PREPARED BY:

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California Regional Water Quality Control Board, Central Valley Region
Draft Staff Report on Recommended Changes to California's Clean Water Act Section 303(d) List

Table of Contents

1 Executive Summary

Each of California's nine Regional Water Quality Control Boards has been asked to assist the State Water Resources Control Board in preparing an update to the State's Clean Water Act Section 303(d) list (SWRCB, 2001). The 303(d) list identifies surface waters that do not or are not expected to attain water quality standards.

California Regional Water Quality Control Board, Central Valley Region (Regional Board) staff began the process for developing the 303(d) list by conducting a public solicitation for information, which lasted from 21 February 2001 to 15 May 2001 (CRWQCB-CVR, 2001b). Three public workshops were held during the public solicitation period. Over 70 documents were received from 28 individuals or groups.

Regional Board staff reviewed those documents, as well as over 200 other documents available in the Regional Board files. In reviewing the available information, Regional Board staff evaluated whether applicable water quality objectives adopted by the Regional Board, State Board, or U.S. Environmental Protection Agency were being attained. In those cases in which numeric water quality objectives were not available for a particular pollutant and/or waterbody, Regional Board staff interpreted narrative water quality objectives. Regional Board staff used applicable criteria and guidelines developed by other state and federal agencies, guidelines developed by the National Academy of Sciences and the Canadian Council of Ministers of the Environment, and results of toxicity tests and bioassay to interpret the narrative water quality objectives.

In the absence of new information or criteria, Regional Board staff generally recommended keeping those currently listed water bodies on the 303(d) list. Fact sheets were developed to describe the basis for recommended additions, deletions, or changes to the 303(d) list.

The Regional Board staff recommended changes to the 303(d) list includes the addition of 56 new water bodies and pollutants to the list; removal of 3 water bodies and pollutants from list; and changes to the description of most other water bodies currently listed (e.g. refinement of identified impaired reaches, changes in priority, schedule etc). Regional Board staff has also identified some waters and pollutants that should be assessed further in order to determine whether water quality objectives are being met. The staff recommended 2002 303(d) list for waters in the Central Valley region is shown in Table 1. Recommended additions to the 303(d) list are in **bold** and recommended deletions are shown in strikethrough.

Regional Board staff will consider public comment on the draft staff recommendations until 2 November 2001.

Table 1. California Regional Water Quality Control Board, Central Valley Region Staff Recommended Changes to California's Clean Water Act Section 303(d) List

Waterbody	Pollutant/Stressor	Affected Size[1]	Units	Priority	TMDL End Date (Year)[2]
American River, Lower	~~Group A Pesticides~~[3]	~~23~~	~~Miles~~	~~Low~~	~~12/11~~
	Mercury	23	Miles	~~Medium~~ **Low**	~~12/11~~ **After 2015**
	Unknown Toxicity	23	Miles	Low	~~12/11~~ **After 2015**
Arcade Creek	Chlorpyrifos	10	Miles	~~Medium~~ **High**	~~12/11~~ **2003**
	Diazinon	10	Miles	~~Medium~~ **High**	~~12/11~~ **2003**
	Copper	**10**	**Miles**	**Low**	**After 2015**
Avena Drain	**Ammonia**	**10**	**Miles**	**Low**	**After 2015**
Bear Creek	**Mercury**	**28**	**Miles**	**High**	**2005**
Bear River, Lower	**Diazinon**	**18**	**Miles**	**Medium**	**2006**
Bear River, Upper	**Mercury**	**8**	**Miles**	**Medium**	**2015**
Berryessa Lake	Mercury	20,700	Acres	~~High~~	~~2005~~ **After 2015**
Black Butte Reservoir	**Mercury**	**4,500**	**Acres**	**Medium**	**2008**
Butte Slough	**Diazinon**	**7.5**	**Miles**	**Medium**	**2009**
	Molinate	**7.5**	**Miles**	**Low**	**After 2015**
Cache Creek	Mercury	~~35~~ **81**	Miles	High	~~12/2005~~ **2004**
	Unknown Toxicity	~~35~~ **81**	Miles	Medium	~~12/11~~ **After 2015**
Calaveras River, Lower	**Diazinon**	**30**	**Miles**	**Medium**	**2012**
	Dissolved Oxygen	**5**	**Miles**	**Low**	**After 2015**
	Pathogens	**8**	**Miles**	**Low**	**After 2015**
Camanche Reservoir	**Aluminum**	**7,622**	**Acres**	**Low**	**After 2015**
	Copper[5]	**7,622**	**Acres**	**Low**	**After 2015**
	Zinc[5]	**7,622**	**Acres**	**Low**	**After 2015**
Camp Far West Reservoir	**Mercury**	**2,002**	**Acres**	**Medium**	**2015**

Waterbody	Pollutant/Stressor	Affected Size[1]	Units	Priority	TMDL End Date (Year)[2]
Chicken Ranch Slough	Chlorpyrifos	5	Miles	~~Medium~~ **High**	~~12/11~~ **2003**
	Diazinon	5	Miles	~~Medium~~ **High**	~~12/11~~ **2003**
Clear Lake	Mercury	43,000	Acres	High	~~12/2005~~ **2002**
	Nutrients	43,000	Acres	~~Low~~ **Medium**	~~12/11~~ **2008**
Clover Creek	**Fecal Coliform**	**10**	**Miles**	**Low**	**After 2015**
Colusa Drain	**Azinphos Methyl**	**70**	**Miles**	**Medium**	**2015**
	Carbofuran/ Furadan	70	Miles	~~Medium~~ **Low**	~~12/11~~ **After 2015**
	Diazinon	**70**	**Miles**	**Medium**	**2015**
	Group A Pesticides	70	Miles	~~Medium~~ **Low**	~~12/11~~ **After 2015**
	Malathion	70	Miles	~~Medium~~ **Low**	~~12/11~~ **After 2015**
	Methyl Parathion	70	Miles	~~Medium~~ **Low**	~~12/11~~ **After 2015**
	Molinate	**70**	**Miles**	**Low**	**After 2015**
	Unknown Toxicity	70	Miles	~~Medium~~ **Low**	12/~~11~~ **After 2015**
Davis Creek Res	Mercury	290	Acres	~~Medium~~ **Low**	12/~~11~~ **After 2015**
Del Puerto Creek	**Chlorpyrifos**	**5**	**Miles**	**Low**	**After 2015**
	Diazinon	**5**	**Miles**	**Low**	**After 2015**
	Parathion	**5**	**Miles**	**Low**	**After 2015**
Delta Waterways	Chlorpyrifos	~~480,000~~ **48,000**	Acres	High	~~12/2005~~ **2004**
	DDT	~~480,000~~ **48,000**	Acres	Low	~~12/11~~ **After 2015**
	Diazinon	~~480,000~~ **48,000**	Acres	High	~~12/2005~~ **2004**
	Electrical Conductivity	16,000	Acres	Medium	~~12/11~~ **2015**
	Group A Pesticides	~~480,000~~ **48,000**	Acres	Low	~~12/11~~ **After 2015**
	Mercury	~~480,000~~ **48,000**	Acres	High	~~12/2005~~ **2004**
	Organic Enrichment/ Low DO	~~75~~ **1461**	Acres	High	~~12/11~~ **2005**

Waterbody	Pollutant/Stressor	Affected Size[1]	Units	Priority	TMDL End Date (Year)[2]
Delta Waterways	Unknown Toxicity	~~480,000~~ **48,000**	Acres	~~Medium~~ **Low**	~~12/11~~ **After 2015**
Dolly Creek	Copper	1	Miles	~~Medium~~ **High**	~~12/11~~ **2005**
	Zinc	1	Miles	~~Medium~~ **High**	~~12/11~~ **2005**
Don Pedro Lake	**Mercury**	**12,960**	**Acres**	**Low**	**After 2015**
Dunn Creek	Mercury	~~9~~ **1**	Miles	Low	~~12/11~~ **After 2015**
	Metals	~~9~~ **1**	Miles	Low	~~12/11~~ **After 2015**
Elder Creek	Chlorpyrifos	10	Miles	Medium	~~12/2005~~ **2003**
	Diazinon	10	Miles	Medium	~~12/2005~~ **2003**
Elk Grove Creek	Diazinon	5	Miles	Medium	~~12/2005~~ **2003**
Fall River (Pit)	Sedimentation/ Siltation	~~25~~ **9.5**	Miles	~~Medium~~ **Low**	~~12/11~~ **After 2015**
Feather River, Lower	Diazinon	60	Miles	High	~~12/2005~~ **2003**
	Group A Pesticides	60	Miles	Low	~~12/11~~ **After 2015**
	Mercury	60	Miles	Medium	12/2011
	Unknown Toxicity	60	Miles	~~Medium~~ **Low**	~~12/11~~ **After 2015**
Five Mile Slough	Chlorpyrifos	1	Miles	Medium	~~12/11~~ **2012**
	Diazinon	1	Miles	Medium	~~12/11~~ **2012**
	Dissolved Oxygen	**1**	**Miles**	**Low**	**After 2015**
	Pathogens	**5**	**Miles**	**Low**	**After 2015**
French Ravine	Bacteria	1	Miles	Low	~~12/11~~ **After 2015**
Grasslands	Electrical Conductivity	8,224	Acres	~~Medium~~ **Low**	~~12/11~~ **After 2015**
Marshes	~~Selenium~~	~~8,224~~	~~Acres~~	~~High~~	~~12/98~~

Waterbody	Pollutant/Stressor	Affected Size[1]	Units	Priority	TMDL End Date (Year)[2]
Harding Drain (Turlock Irr Dist Lateral #5)	Ammonia	7	Miles	Low	~~12/11~~ **After 2015**
	Chlorpyrifos	7	Miles	~~Medium~~ **Low**	~~12/11~~ **After 2015**
	Diazinon	7	Miles	~~Medium~~ **Low**	~~12/11~~ **After 2015**
	Unknown Toxicity	7	Miles	~~Medium~~ **Low**	~~12/11~~ **After 2015**
Harley Gulch	Mercury	8	Miles	~~Medium~~ **High**	~~12/11~~ **2005**
Horse Creek	Cadmium	~~2~~ **1**	Miles	Low	~~12/11~~ **After 2015**
	Copper	~~2~~ **1**	Miles	Low	~~12/11~~ **After 2015**
	Lead	~~2~~ **1**	Miles	Low	~~12/11~~ **After 2015**
	Zinc	~~2~~ **1**	Miles	Low	~~12/11~~ **After 2015**
Humbug Creek	Copper	~~9~~ **3**	Miles	Low	~~12/11~~ **After 2015**
	Mercury	~~9~~ **3**	Miles	Low	~~12/11~~ **After 2015**
	Sedimentation/ Siltation	~~9~~ **3**	Miles	Low	~~12/11~~ **After 2015**
	Zinc	~~9~~ **3**	Miles	Low	~~12/11~~ **After 2015**
Ingram/ Hospital Creek	**Chlropyrifos**	**2**	**Miles**	**Low**	**After 2015**
	Diazinon	**2**	**Miles**	**Low**	**After 2015**
	Parathion	**2**	**Miles**	**Low**	**After 2015**
Jack Slough	**Diazinon**	**13**	**Miles**	**Medium**	**2006**
James Creek	Mercury	~~6~~ **8.5**	Miles	Low	~~12/11~~ **After 2015**
	Nickel	~~6~~ **8.5**	Miles	Low	~~12/11~~ **After 2015**
Kanaka Creek	Arsenic	1	Miles	Low	~~12/11~~ **After 2015**

Waterbody	Pollutant/Stressor	Affected Size[1]	Units	Priority	TMDL End Date (Year)[2]
Keswick Res	Cadmium	200	Acres	~~Medium~~ **Low**	~~12/11~~ **After 2015**
	Copper	200	Acres	~~Medium~~ **Low**	~~12/11~~ **After 2015**
	Zinc	200	Acres	~~Medium~~ **Low**	~~12/11~~ **After 2015**
Kings River, Lower	Electrical Conductivity	30	Miles	Low	~~12/11~~ **After 2015**
	Molybdenum	30	Miles	Low	~~12/11~~ **After 2015**
	Toxaphene	30	Miles	Low	~~12/11~~ **After 2015**
Lake Combie	**Mercury**	**360**	**Acres**	**Medium**	**2012**
Lake Englebright	**Mercury**	**815**	**Acres**	**Medium**	**2011**
Little Backbone Creek	Acid Mine Drainage	1	Miles	~~Medium~~ **Low**	~~12/11~~ **After 2015**
	Cadmium	1	Miles	~~Medium~~ **Low**	~~12/11~~ **After 2015**
	Copper	1	Miles	~~Medium~~ **Low**	~~12/11~~ **After 2015**
	Zinc	1	Miles	~~Medium~~ **Low**	~~12/11~~ **After 2015**
Little Cow Creek	Cadmium	1	Miles	Low	~~12/11~~ **After 2015**
	Copper	1	Miles	Low	~~12/11~~ **After 2015**
	Zinc	1	Miles	Low	~~12/11~~ **After 2015**
Little Deer Creek	**Mercury**	**4**	**Miles**	**Low**	**After 2015**
Little Grizzly Creek	Copper	10	Miles	~~Medium~~ **High**	~~12/02~~ **2005**
	Zinc	10	Miles	~~Medium~~ **High**	~~12/02~~ **2005**
Lone Tree Creek	Ammonia	15	Miles	Low	~~12/11~~ **After 2015**
	Biological Oxygen Demand	15	Miles	Low	~~12/11~~ **After 2015**
	Electrical Conductivity	15	Miles	Low	~~12/11~~ **After 2015**

Waterbody	Pollutant/Stressor	Affected Size[1]	Units	Priority	TMDL End Date (Year)[2]
Marsh Creek	Mercury	~~24~~ **16.5**	Miles	Low	~~12/11~~ **After 2015**
	Metals	~~24~~ **8.5**	Miles	Low	~~12/11~~ **After 2015**
Marsh Creek Res	Mercury	375	Acres	~~Medium~~ **Low**	~~12/11~~ **After 2015**
Merced River, Lower	Chlorpyrifos	60	Miles	High	~~12/05~~ **2006**
	Diazinon	60	Miles	High	~~12/05~~ **2006**
	Group A Pesticides	60	Miles	Low	~~12/11~~ **After 2015**
Mokelumne River, Lower	**Aluminum**	**28**	**Miles**	**Low**	**After 2015**
	Copper	28	Miles	Low	~~12/11~~ **After 2015**
	Zinc	28	Miles	Low	~~12/11~~ **After 2015**
Morrison Creek	Diazinon	20	Miles	Medium	~~12/2005~~ **2003**
Mormon Slough	**Dissolved Oxygen**	**1**	**Mile**	**Low**	**After 2015**
	Pathogens	**4**	**Miles**	**Medium**	**2012**
Mosher Slough	Chlorpyrifos	2	Miles	Medium	~~12/11~~ **2012**
	Diazinon	2	Miles	Medium	~~12/11~~ **2012**
	Dissolved Oxygen	**2**	**Miles**	**Low**	**2030**
	Pathogens	**7**	**Miles**	**Low**	**After 2015**
Mud Slough	Boron	16	Miles	Low	~~12/11~~ **After 2005**
	Electrical Conductivity	16	Miles	Low	~~12/11~~ **After 2005**
	Pesticides	16	Miles	Low	~~12/11~~ **After 2005**
	Selenium	16	Miles	~~High~~ **Medium**	~~12/00~~ **2011**
	Unknown Toxicity	16	Miles	Low	~~12/11~~ **After 2015**
Natomas East Main Drain	Diazinon	5	Miles	Medium	~~12/11~~ **2015**
	PCBs4	12	Miles	Low	~~12/11~~ **After 2015**
Newman Wasteway	**Chlorpyrifos**	**9**	**Miles**	**Low**	**After 2005**
	Diazinon	**9**	**Miles**	**Low**	**After 2005**

Waterbody	Pollutant/Stressor	Affected Size[1]	Units	Priority	TMDL End Date (Year)[2]
Oak Run Creek	**Fecal Coliform**	**8**	**Miles**	**Low**	**After 2015**
Orestimba Creek	**Azinphos Methyl**	**10**	**Miles**	**Medium**	**2010**
	Chlorpyrifos	10	Miles	Medium	~~12/11~~ **2010**
	Diazinon	10	Miles	Medium	~~12/11~~ **2010**
	DDE	**10**	**Miles**	**Low**	**2030**
	Parathion	**10**	**Miles**	**Low**	**2025**
	Unknown Toxicity	3	Miles	~~Medium~~ **Low**	~~12/11~~ **After 2015**
Panoche Creek	Mercury	25	Miles	Low	~~12/11~~ **After 2015**
	Sedimentation/ Siltation	40	Miles	Low	~~12/11~~ **After 2015**
	Selenium	40	Miles	Low	~~12/11~~ **After 2015**
Pit River	Nutrients	100	Miles	Low	~~12/11~~ **After 2015**
	Organic Enrichment/ Low Dissolved Oxygen	100	Miles	Low	~~12/11~~ **After 2015**
	Temperature	100	Miles	Low	~~12/11~~ **After 2015**
Putah Creek, Lower	**Mercury**	**24**	**Miles**	**Low**	**After 2015**
	Unknown Toxicity	**30**	**Miles**	**Low**	**After 2015**
Putah Creek, Upper	**Unknown Toxicity**	**27**	**Miles**	**Low**	**After 2015**
Rollins Reservoir	**Mercury**	**840**	**Acres**	**Medium**	**2010**
Sacramento River (Red Bluff to Delta)	Diazinon	30	Miles	High	~~12/2005~~ **2003**
	Mercury	30	Miles	~~High~~ **Medium**	~~12/05~~ **2006**
	Unknown Toxicity	185	Miles	~~Medium~~ **Low**	~~12/11~~ **After 2015**
Sacramento River (Shasta Dam to Red Bluff)	Cadmium	40	Miles	High	12/01
	Copper	40	Miles	High	12/01
	Unknown Toxicity	50	Miles	~~Medium~~ **Low**	~~12/11~~ **After 2015**
	Zinc	40	Miles	High	12/01

Waterbody	Pollutant/Stressor	Affected Size[1]	Units	Priority	TMDL End Date (Year)[2]
Sacramento Slough	Diazinon	1	Miles	Medium	~~12/11~~ **2009**
	Mercury	1	Miles	~~Medium~~ **Low**	~~12/11~~ **After 2015**
Salt Slough	Boron	15	Miles	Low	~~12/11~~ **After 2005**
	Chlorpyrifos	15	Miles	Low	~~12/11~~ **After 2005**
	Diazinon	15	Miles	Low	~~12/11~~ **After 2005**
	Electrical Conductivity	15	Miles	Low	~~12/11~~ **After 2005**
	~~Selenium~~	~~15~~	~~Miles~~	~~High~~	~~12/98~~
	Unknown Toxicity	15	Miles	Low	~~12/11~~ **After 2015**
San Carlos Creek	Mercury	1	Miles	Low	~~12/11~~ **After 2015**
San Joaquin River	Boron	130	Miles	High	~~12/99~~ **2002**
	Chlorpyrifos	130	Miles	High	~~12/2005~~ **2003**
	DDT	130	Miles	Low	~~12/11~~ **After 2015**
	Diazinon	130	Miles	High	~~12/2005~~ **2003**
	Electrical Conductivity	130	Miles	High	~~12/99~~ **2002**
	Group A Pesticides	130	Miles	Low	~~12/11~~ **After 2015**
	Mercury	**60**	**Miles**	**Medium**	**2013**
	Selenium	50	Miles	High	~~12/00~~ **2001**
	Unknown Toxicity	130	Miles	~~Medium~~ **Low**	~~12/11~~ **After 2015**
San Luis Reservoir	**Copper**			**Low**	**After 2015**
Scott's Flat Reservoir	**Mercury**	**725**	**Acres**	**Medium**	**2012**
Shasta Lake	Cadmium	20	Acres	Low	~~12/11~~ **After 2015**
	Copper	20	Acres	Low	~~12/11~~ **After 2015**
	Zinc	20	Acres	Low	~~12/11~~ **After 2015**

Waterbody	Pollutant/Stressor	Affected Size[1]	Units	Priority	TMDL End Date (Year)[2]
Smith Canal	**Dissolved Oxygen**	**2.5**	**Miles**	**Low**	**After 2015**
	Organo-phosphorus Pesticides	**2.5**	**Miles**	**Medium**	**2015**
	Pathogens	**2.5**	**Miles**	**Low**	**After 2015**
South Cow Creek	**Fecal Coliform**	**6**	**Miles**	**Low**	**After 2015**
Spring Creek	Acid Mine Drainage	5	Miles	~~High~~ **Low**	~~12/11~~ **After 2015**
	Cadmium	5	Miles	~~High~~ **Low**	~~12/11~~ **After 2015**
	Copper	5	Miles	~~High~~ **Low**	~~12/11~~ **After 2015**
	Zinc	5	Miles	~~High~~ **Low**	~~12/11~~ **After 2015**
Stanislaus River, Lower	Diazinon	48	Miles	High	12/~~2000~~ **2004**
	Group A Pesticides	48	Miles	Low	~~12/11~~ **After 2015**
	Mercury	**58**	**Miles**	**Low**	**After 2015**
	Unknown Toxicity	48	Miles	~~Medium~~ **Low**	~~12/11~~ **After 2015**
Stockton Deep Water Channel	Dioxin	2	Miles	~~Medium~~ **Low**	**After 2015**
	Furans	2	Miles	~~Medium~~ **Low**	**After 2015**
	PCBs	2	Miles	~~Medium~~ **Low**	**After 2015**
	Pathogens	**3**	**Miles**	**Medium**	**2014**
Strong Ranch Slough	Chlorpyrifos	5	Miles	~~Medium~~ **High**	~~12/2005~~ **2003**
	Diazinon	5	Miles	~~Medium~~ **High**	12/~~2005~~ **2003**
Sulfur Creek	Mercury	7	Miles	High	2005
Sutter Bypass	**Diazinon**	**25**	**Miles**	**Medium**	**2012**
Temple Creek	Ammonia	10	Miles	Low	~~12/11~~ **After 2015**
	Electrical Conductivity	10	Miles	Low	~~12/11~~ **After 2015**

Waterbody	Pollutant/Stressor	Affected Size[1]	Units	Priority	TMDL End Date (Year)[2]
Town Creek	Cadmium	1	Miles	Low	~~12/11~~ **After 2015**
	Copper	1	Miles	Low	~~12/11~~ **After 2015**
	Lead	1	Miles	Low	~~12/11~~ **After 2015**
	Zinc	1	Miles	Low	~~12/11~~ **After 2015**
Tuolumne River, Lower	Diazinon	32	Miles	High	~~12/05~~ **2006**
	Group A Pesticides	32	Miles	Low	~~12/11~~ **After 2015**
	Unknown Toxicity	32	Miles	~~Medium~~ **Low**	~~12/11~~ **After 2015**
Walker Slough	**Diazinon**	**2**	**Miles**	**Medium**	**2012**
	Pathogens	**7**	**Miles**	**Medium**	**2014**
West Squaw Creek	Cadmium	2	Miles	~~Medium~~ **Low**	~~12/11~~ **After 2015**
	Copper	2	Miles	~~Medium~~ **Low**	~~12/11~~ **After 2015**
	Lead	2	Miles	~~Medium~~ **Low**	~~12/11~~ **After 2015**
	Zinc	2	Miles	~~Medium~~ **Low**	~~12/11~~ **After 2015**
Whiskeytown Res	High Coliform Count	100	Acres	Low	~~12/11~~ **After 2015**
Willow Creek (Whiskeytown)	Acid Mine Drainage	3	Miles	Low	~~12/11~~ **After 2015**
	Copper	3	Miles	Low	~~12/11~~ **After 2015**
	Zinc	3	Miles	Low	~~12/11~~ **After 2015**
Wolf Creek	**Pathogens**			**Low**	**After 2015**

[1]Affected Size = Portion of the waterbody not meeting water quality standards.
[2]TMDL End Date = the date by which the TMDL and associated program of implementation are expected to be considered by the Regional Board, generally as part of a Basin Plan Amendment. The end date is considered a maximum based on the funding assumptions described below.
[3]Group A pesticides = One or more of the Group A pesticides. The Group A pesticides include: aldrin, dieldrin, chlordane, endrin, heptachlor, heptachlor epoxide, hexachlorocyclohexane (including lindane), endosulfan and toxaphene.
[4]PCBs = Polychlorinated biphenyls.
[5] The listing for copper and zinc in Camanche Reservoir had previously been included as part of the lower Mokelumne River. The Regional Board determined that separate identification of the Camanche Reservoir and the lower Mokelumne River is appropriate for 303(d) list purposes.

Scheduling Assumptions - 1) available TMDL funds for TMDL development and implementation ($1.7 MM/year for staff in 2001 dollars); 2) TMDL development cost (per listed water body and pollutant equals $250,000 - includes implementation planning and Basin Planning); 3) after 2004, 1/2 of TMDL staff funds will be used for implementation of adopted TMDLs.

Note – TMDLs for selenium in Salt Slough and selenium in the Grassland Marshes were approved by U.S. EPA in 1999 and 2000, respectively.

Regional Board staff identified a number of water bodies and pollutants that should be assessed further prior to making a recommendation to list (or delist) those water bodies (see Table 2 below). In general, further assessment is needed under one or more of the following conditions: 1) the number of data points available or number of years of sample collection does not allow staff to determine whether a potential water quality problem is recurring; 2) recent and historic studies are not directly comparable due to different sampling protocols (e.g. the type of fish collected differ); 3) a sufficient historic data set exists with few exceedances, but more recent information does not indicate exceedances; or 4) control measures are in place that should result in reduction of the pollutant below criteria.

Table 2 – Suggested Sites and Parameters for Further Assessment

Water body	Pollutant
American River, Lower	Pathogens
Arcade Creek	Malathion
Butte Slough	Malathion
Butte Slough	Thiobencarb
Colusa Basin Drain	Chlorpyrifos
Colusa Basin Drain	Dicamba
Del Puerto Creek	Malathion
Delta (lower San Joaquin River)	Pathogens
Delta Waterways	DDT
Delta Waterways	Group A Pesticides
Feather River	Group A Pesticides
French Camp Slough	Pathogens
Fresno River	Nutrients/Pathogens
Hensley Lake	Nutrients/Pathogens
Ingram/Hospital Creek	Carbaryl
Kaweah River	Nutrients/Pathogens
Kern River	Nutrients/Pathogens
Lake Isabella	Nutrients/Pathogens
Lake Kaweah	Nutrients/Pathogens
Lake Success	Nutrients/Pathogens
Merced River	Mercury
Merced River	Parathion
Mormon Slough	Diazinon
Orestimba Creek	Methidathion
Salt Slough	Malathion
San Luis Reservoir	Copper
Ten Mile Creek (South Fork Kings River)	Nutrients/Pathogens
Tule River	Nutrients/Pathogens
Tuolumne River	Mercury
Yuba River	Pathogens

2 Public Solicitation and Documents Reviewed

Regional Board staff distributed a letter to the public requesting information for the update of the 303(d) list on 21 February 2001. Approximately 3,500 letters were distributed. The Regional Board's Basin Planning and NPDES mailing lists were used, along with the mailing list for the Sacramento River Watershed Program. The solicitation notice was also posted on the Regional Board's web site. The public was given until 15 May 2001 to provide information for the update of the 303(d) list.

During the public solicitation time period, three work shops were held: 1) on 21 March in Fresno; 2) on 28 March in Sacramento; and 3) on 6 April in Redding. There were 2 members of the public at the Fresno meeting, 8 at the Sacramento meeting, and 6 at the Redding meeting.

By the 15 May 2001 deadline, the Regional Board had received over 70 documents from 28 different individuals and organizations.

Regional Board staff also reviewed over 200 documents/data sources readily available within the Regional Board offices. Staff working in the NPDES permit program (for both storm water and non-storm water permits) provided information on potential problems in surface waters receiving NPDES permitted discharges.

The documents reviewed, from both the public solicitation and internally, are listed in Section 10.

3 Factors Considered in Recommending Changes to the 303(d) List

The factors below were generally considered in recommending changes to the 303(d) list. The specific application of these factors can be found in the appropriate Fact Sheets in the appendix.

3.1 Listing Factors

Water bodies and associated pollutants were generally recommended for addition to the 303(d) list if any one of these factors were met:

1. Effluent limitations or other pollution control requirements [e.g., Best Management Practices (BMPs)] are not stringent enough to assure protection of beneficial uses and attainment of SWRCB and RWQCB objectives, including those implementing SWRCB Resolution Number 68-16 "Statement of Policy with Respect to Maintaining High Quality of Waters in California" [see also 40 CFR 130.7(b)(1)]. This does not apply to non-attainment related solely to discharge in violation of existing WDR's or NPDES permit.

2. Fishing, drinking water, or swimming advisory currently in effect. This does not apply to advisories related to discharge in violation of existing WDR's or NPDES permit.

3. Beneficial uses are impaired or are expected to be impaired within the listing cycle (i.e. in next four years). Impairment is based upon evaluation of chemical, physical, or biological integrity. Impairment will be determined by

"qualitative assessment", physical/ chemical monitoring, bioassay tests, and/or other biological monitoring. Applicable Federal criteria and the Regional Board's Basin Plan water quality objectives determine the basis for impairment status.

4. The water body is on the previous 303(d) list and either: (a) monitoring continues to demonstrate a violation of objective(s) or (b) monitoring has not been performed.

5. Data indicate tissue concentrations in consumable body parts of fish or shellfish exceed applicable tissue criteria or guidelines. Criteria or guidelines related to protection of human and wildlife consumption include, but are not limited to, U.S. Food and Drug Administration Action Levels, National Academy of Sciences Guidelines, U.S. Environmental Protection Agency tissue criteria.

3.2 Delisting Factors

Water bodies were generally removed from the list for specific pollutants or stressors if any one of these factors was met:

1. Objectives were revised (for example, Site Specific Objectives), and the exceedence is thereby eliminated.

2. Faulty data led to the initial listing. Faulty data include, but are not limited to, typographical errors, improper quality assurance/quality control (QA/QC) procedures, or limitations related to the analytical methods that would lead to improper conclusions regarding the water quality status of the water body.

3. It has been documented that the objectives are being met and beneficial uses are not impaired based upon an evaluation of available monitoring data. This evaluation includes foreseeable changes in hydrology, land use, or product use and why such changes should not lead to future exceedance.

4. A TMDL has been approved by the U.S. Environmental Protection Agency for that specific water body and pollutant (see 40 CFR 130.7(b)(4)).

5. There are control measures in place which will result in protection of beneficial uses. Control measures include permits, clean up and abatement orders, and Basin Plan requirements which are enforceable and include a time schedule (see 40 CFR 130.7(b)(1)(iii)).

3.3 Other Changes

Other changes that have been recommended include:

1. Extent of impairment – a review of available data for existing listings may indicate that a change in the defined extent of impairment should be made. In some cases the miles (or area) of the impaired segment may be changed and in other cases the specific impacted segment is redefined.

2. Priority Ranking – a review of the Regional Board's priorities for TMDL development (based on the Regional Board's criteria discussed below) may result in a change to the existing priority ranking for a water body/pollutant combination.

4 Evaluation Criteria

Regional Board staff had a significant amount of information related to mercury, metals, pathogens, and pesticides. Fact sheets for each of the above categories of pollutant were prepared. The fact sheets describe the criteria used to evaluate the data and information and can be found in Appendix A.

For other pollutants not included in the above categories, Regional Board staff generally used the following hierarchy in evaluating data relative to applicable water quality objectives:

1. Applicable numeric water quality objectives (contained in the Basin Plan) or water quality standards (contained in the federal California and National Toxics Rules). Both the Basin Plan and federal rules governing a specific parameter were evaluated to determine any site specific applications or exceptions.

2. Criteria developed by the U.S. Environmental Protection Agency, California Department of Fish, and the California Department of Health Services and other applicable criteria developed by government agencies. Such criteria were used to interpret narrative water quality objectives. In those cases in which criteria were available from several agencies, preference was given to criteria developed for California or the most recently derived criteria. Toxicity test results and bioassay study results were also used to determine attainment of objectives.

3. Guidance or guidelines developed by agencies/entities such as the U.S. Food and Drug Administration, National Academy of Sciences, and the Agency for Toxic Substances and Disease Registry and the California Department of Health Services. Guidelines developed by other agencies

were thoroughly reviewed before applied, since the assumptions and risk factors considered may not be consistent with Regional Board water quality objectives.

4. Criteria or standards developed in other states, regions, or countries. Such criteria were evaluated to determine if the environmental setting, assumptions, and risk factors considered were consistent with Regional Board water quality objectives.

Other than described for the pollutant fact sheets in Appendix A, there were no specific minimum data requirements or a specific frequency of exceedance for making a finding that water quality objectives are not attained. In general, more data was needed to interpret environmental results that are very specific to time and geography. Less data were needed to make a determination based on environmental results that serve as integrators over space or time. For example, more water column chemistry data would generally be needed to determine impairment than fish tissue chemistry data. Also less water column chemistry data may be needed to make an impairment determination (or lack of impairment determination) if there is other information (e.g. correlations could be made between pesticide use patterns and the presence of pesticides in surface water).

Regional Board staff generally limited their consideration of environmental data to those organizations that conduct monitoring studies using documented quality assurance/quality control procedures. For data produced by citizen monitoring groups, Regional Board staff considered data from those groups whose sampling programs and protocols had been reviewed by the State Water Resource Control Board's citizen monitoring coordinators.

5 Priority Ranking

A priority ranking is required for listed waters to guide TMDL planning pursuant to 40 CFR 130.7. TMDLs were ranked into high (H), medium (M), and low (L) priority categories based on:

1. water body significance (such as importance and extent of beneficial uses, threatened and endangered species concerns and size of water body)

2. degree of impairment or threat (such as number of pollutants/stressors of concern, and number of beneficial uses impaired)

3. conformity with related activities in the watershed (such as existence of watershed assessment, planning, pollution control, and remediation, or restoration efforts in the area)

4. potential for beneficial use protection or recovery

5. degree of public concern and involvement
6. availability of funding and information to address the water quality problem
7. overall need for an adequate pace of TMDL development for all listed waters
8. other water bodies and pollutants have become a higher priority

The Regional Board identified water body/pollutant combinations as a high priority for TMDL development for those instances in which activities are currently underway to develop TMDLs. In most cases, the water bodies identified as high priority are significant waters of the State providing critical environmental, recreational, municipal, industrial, and agricultural uses. The degree of impairment is also significant with multiple stressors impacting the high priority waters. In general, the potential for beneficial use protection or recovery is high and there is a great deal of public involvement. In some cases, the overall need for an adequate pace of TMDL development is considered. A high priority is given to some water bodies that are less significant from a state-wide perspective, but are either well characterized or tributary streams to other high priority water bodies that will be addressed as a single water quality management strategy.

The Regional Board identified water body/pollutant combinations as a medium priority for TMDL development for water bodies that are tributary to, and/or have a similar impairment as, a high priority water body. The tributaries are often significant water bodies and have a greater degree of impairment, since they are often the primary source of pollutant loads. The Regional Board will be able to take advantage of information developed to address the high priority water bodies in developing TMDLs for medium priority water bodies and, in general, efforts will already be underway in the tributary water bodies to reduce pollutant loads to the main stem river or stream.

The Regional Board identified water body/pollutant combinations as a low priority for all other water body/pollutant combinations. In many cases, the water body may have a high priority for further assessment or regulatory activity through other Regional Board programs, which lessens the immediate need to begin TMDL development. For water bodies impaired by "Unknown Toxicity", a low priority is given since identification of the toxicant(s) causing impairment is expected prior to the initiation of the TMDL development process.

It should also be noted that for both medium and low priority water body/pollutant combinations, the priority (and schedule) might change during the next 303(d) list update.

6 Scheduling

As part of the preparation of the 303(d) list, Regional Board staff prepared a proposed schedule for the completion of TMDLs for all listed water bodies. For scheduling purposes, the completion date represents the date that Regional Board staff will present a Basin Plan Amendment for Regional Board consideration.

In most cases, the Basin Plan Amendment will describe a comprehensive water quality management strategy to correct the problems associated with the listed waters and pollutants. The comprehensive strategy will include a program of implementation, water quality objectives (if necessary), new or refined beneficial use designations (if necessary), and elements of the TMDL. The work load associated with a more comprehensive strategy, together with the administrative procedural requirements of basin planning, require a greater investment of time and resources than would be required to solely address federal Clean Water Act requirements for a TMDL.

The schedule provided is based on receiving a similar level of staff and contract resources as is currently available for both TMDL development and implementation of the adopted Basin Plan Amendment. The amount of funds currently available for TMDL development and implementation is $1.7 MM. For purposes of projecting TMDL timelines, it is assumed that those funds will be available primarily for TMDL development, implementation planning and Basin Planning through 2004. After 2004, it is assumed that half of the funds will be needed for implementation of the adopted Basin Plan Amendments. It is also assumed that the average cost of developing a water quality management strategy for each listed water body and pollutant is $250,000. Based on these funding and cost assumptions, the time to complete water quality management strategies for all listed waters and pollutants is approximately 50 years.

Federal regulations (40 CFR §130.7(b)(4)) require the identification of "...waters targeted for TMDL development in the next two years." All waterbody/pollutant combinations identified for completion by 2004 are targeted for TMDL development over the next two years.

Schedules for water bodies and pollutants that are to be completed after 2004 are tentative. Regional Board staff has not reviewed the data and information available for those water bodies, so the actual scope and timeline for completing the water quality management strategy is not known.

In general, Regional Board staff assigned a high priority (and near term schedule) to water bodies and pollutants for which TMDLs are currently being developed (i.e. information is being collected and analyzed for those water body/pollutant combinations-factors 1-7 from Section 5 apply). Medium priority was assigned (and schedules up to 2015) to those TMDLs that can most effectively build on the experience gained through development of the high priority TMDLs. In many cases, the medium priority TMDLs are tributaries to the water bodies that have been assigned a high priority for TMDL development.

Regional Board staff did not provide specific dates for low priority water bodies, which would be scheduled for completion after 2015. The 303(d) list will likely be revised several times between now and 2015, so providing dates for TMDL completion for currently listed water bodies would be highly speculative. Also Regional Board staff anticipates some gain in efficiency in completely both the technical and administrative aspects of TMDL development, but that efficiency improvement is difficult to gauge at this time.

It should be noted that a water body that is a low priority for TMDL development might be a high priority for the Regional Board for: further assessment, funding of watershed activities that can contribute to addressing the beneficial use impairment, or other regulatory action.

7 Documentation

A 303(d) update fact sheet was prepared for each discrete 303(d) listing or delisting recommendation. The fact sheets can be found in Appendix B.

Fact Sheets for Listing Decisions

Each fact sheet for decisions to add water bodies and pollutants to the 303(d) list includes the following information: Waterbody name, hydrologic unit number, total water body size, pollutant(s)/stressor(s) causing impairment, likely sources; the latitude and longitude of the upstream and downstream impaired stream segment and/or a specific narrative description of the impaired segment; a description of the characteristics of the watershed; the specific water quality objective(s) not being met; a summary of the data assessment that led to the decision to list; the criteria applied to the decision to list.

Fact Sheets for Delisting Decisions

Each fact sheet for decisions to delete water bodies and pollutants from the 303(d) list includes the following information: the water body name, pollutant(s)/stressor(s) previously identified as having caused an impairment; a summary of the data or information that lead to the decision to delist; and the criteria applied to the decision to delist.

Fact Sheets to Document Changes to Currently Listed Water bodies/Pollutants

Fact sheets were used to document changes to currently listed water body/pollutant combinations. A single fact sheet is used, in some cases, to document changes that are common to a group of water bodies.

8 Public Participation

Regional Board staff conducted 3 workshops during the time frame for solicitation of information. The workshops were in Fresno, Sacramento, and Redding. It is anticipated that there will be several more opportunities for public participation after staff has prepared its draft recommendations. Prior public participation and the anticipated schedule for Regional Board action on the 303(d) list are described below:

303(d) Update Step	Public Outreach
Solicitation of Information	Mailing to 3,500 people/groups on 21 February 2001
Solicitation of Information	Workshops held in Fresno, Sacramento, and Redding
Solicitation of Information	Receive data/information through 5/15/01
Draft 303(d) List Staff Report	Release mid-September
Draft 303(d) List Staff Report	Information Item at October Regional Bd. Meeting
Final 303(d) List	Release final staff report in December/January

9 Response to Comments Received During the Solicitation of Information

In addition to data and information, the Regional Board received some comments recommending additions to or deletions from the 303(d) list. The responses to those comments which recommended specific changes to the 303(d) list are given below.

Commenter 1: Julie Roth, Executive Director, Davis South Campus Superfund Oversight Committee

"We request that the CVRWQCB list Putah Creek as impaired because of excessive mercury concentrations in some of the fish that are used as food."

Response 1: Regional Board staff has reviewed the data in the reports submitted by the commenter. Based on this review, Regional Board staff recommends the addition of lower Putah Creek to California's 303(d) list for impairment due to elevated mercury levels in fish. The basis for this determination can be found in the "Lower Putah Creek, Mercury" fact sheet in Appendix B.

Commenter 2: Barbara Vlamis, Executive Director, Butte Environmental Council

The commenter recommended the addition of several waterbodies to the 303(d) list, including:

1. Butte Creek based on "one toxic reading" from NAWQA [the U.S. Geological Survey's National Water Quality Assessment];
2. Comanche Creek based on measurements by the local Isaac Walton League "exceeding State standards for copper, lead, and zinc";
3. Little Chico Creek based on monitoring conducted by Metcalf & Eddy in a storm drain system of total suspended solids, nutrients, total copper, and total zinc;
4. Dead Horse Slough based on elevated levels of lead in the sediment relative to Little Chico Creek to which it is tributary; and
5. Little Butte Creek based on a toxicity test result showing fathead minnow mortality.

Response 2:

1. Regional Board staff contacted U.S. Geological Survey NAWQA staff (Domagalski, Personal Communication, 2001) and found that Butte Creek was not sampled, although Butte Slough was sampled. Based on data available for Butte Slough, Regional Board staff are recommending the addition of Butte Slough to the 303(d) list due to elevated levels of diazinon, molinate, and thiobencarb.
2. No data was supplied to support the recommended listing and Regional Board staff are not aware of the availability of the referenced data in Regional Board files.
3. The Metcalf and Eddy study was referenced, but was not provided. The comment references the results from the study of a storm drainage system. Regional Board staff is not recommending listing drains constructed for the specific purpose of conveying storm water drainage.
4. Regional Board staff is currently investigating the Humboldt Road Burn Dump, the site that appears to be impacting Dead Horse Slough. The investigation is following the National Contingency Plan with the Regional Board as the Administering Agency. The Remedial Investigation Reports have been submitted and are being reviewed. Since the source of the lead is likely from the site under investigation, the Regional Board should have sufficient regulatory authority to oversee clean-up at that site and in the slough (should such clean-up be needed). Based on the above information, Regional Board staff believes, identification of Dead Horse Slough on the 303(d) list is not necessary.
5. Regional Board staff is following up on the issue of fathead minnow toxicity test results as a part of a CALFED funded study. The goal of the study is to determine the cause and significance of pathogen related toxicity that has been observed in fathead minnow toxicity tests. Until the CALFED study is completed, no recommendations for additions to the 303(d) list will be made based on pathogen-related fathead minnow toxicity test results.

Commenter 3: Stephan Orme, Data Specialist, Pesticide Action Network North America (PANNA)

"I am writing to submit the enclosed data from the Department of Pesticide Regulation's (DPR) Pesticide Surface Water Database for your consideration in updating the 303(d) list. Each of the records attached below documents an exceedence of a water quality guideline by a pesticide detection in California surface waters."

The documents provided by the commenter included records of exceedances as determined by the commenter as well as a description of the methodology as to how the U.S. EPA AQUIRE database was used to establish criteria.

Response 3: A description of how Regional Board staff considered water column pesticide data is included in the "Pesticide Numeric Criteria Fact Sheet" in Appendix A. That description identifies the criteria or guidelines used to interpret the Regional Board's narrative toxicity and pesticide water quality objectives. Regional Board staff used DPR's surface water database, as well as other data sources, to make a determination as to whether a water body and associated pesticide should be added to the 303(d) list. Regional Board staff review of the data resulted in the recommended addition of a number of water bodies to the 303(d) list as not attaining water quality objectives for certain pesticides (see Table 1). In general, PANNA identified exceedances did result in a recommended listing under the following conditions: 1) the exceedances identified were for water bodies not already currently listed; 2) the identified exceedances were not for storm drains specifically constructed to convey urban runoff or drainage canals specifically constructed to convey agricultural drainage; 3) greater than one exceedance was identified; 4) sufficient total sampling events were available to determine whether a potential water quality problem is recurring; and 5) criteria applied by the Regional Board to interpret exceedance of the narrative toxicity objective were exceeded.

Commenter 4: Phil Chang, Watershed Coordinator, Sierra Nevada Alliance

The commenter recommended that a number of Sierran watersheds be added to the "Priority Category I Watersheds" list. The commenter mentions some potential mercury and arsenic problems in the middle fork of the American River watershed and the south fork of the Feather River watershed. The commenter also states that the "surrounding watersheds in the Feather, Yuba, Bear, and American River basins have been listed in part for these same concerns." Based on a recommendation to create Aquatic Diversity Management Areas as part of the Sierra Nevada Ecosystem Project, the commenter recommends that "that the Middle Fork Feather, Upper Kern, Upper Merced, Upper Kings, Upper Merced, Upper Tuolumne, Upper Stanislaus, and Upper Mokelumne watersheds be prioritized in the 303(d) list development in 2001." Based on their importance as a drinking water source, the commenter recommends that "the upper Feather, American, Mokelumne, and Tuolumne watersheds should also be on the Priority Category I list."

Response 4: The commenter appears to be referring to the Unified Watershed Assessment process conducted in 1997 (see http://www.ca.nrcs.usda.gov/wps/cwap.html). The Federal government used the results of that process to prioritize funding of work related to watershed protection and restoration. Although the 303(d) list was used as a criteria to identify "Category I priority" watersheds, other criteria were also applied. Regional Board staff has reviewed the mercury information referred to by the commenter that is available for several Sierran streams and reservoirs. Based on that review, Regional Board staff are recommending the addition a number of waterbodies to the 303(d) list due to high levels of mercury in fish tissue. The recommended designation of Aquatic Diversity Management Areas does not appear to identify specific pollutants causing exceedances of water quality objectives, so Regional Board staff do not recommend adding the identified watersheds to the 303(d) list. The importance of a watershed as a drinking water source is not a sufficient basis for listing a waterbody, so Regional Board staff does not recommend adding to the 303(d) list those watersheds identified as important drinking water sources.

Commenter 5: Alexander R. Coate, Manager of Regulatory Compliance, East Bay Municipal Utility District (EBMUD)

"Data to recommend delisting of the Lower Mokelumne River for impairment due to copper and zinc and listing Rich Gulch as impaired for arsenic are provided for your consideration."

Response 5: Regional Board staff reviewed the data provided by EBMUD and are recommending that the Lower Mokelumne River remain on the 303(d) list for impairment due to copper and zinc. The 1998 303(d) list included Camanche Reservoir as part of the Lower Mokelumne River. The data does indicate that substantive improvements in water quality have occurred and that it is likely that water quality objectives are being attained for zinc in the Lower Mokelumne River and Camanche Reservoir as well as copper in Camanche Reservoir. The limited data set (1 year) available for Camanche Reservoir (post-remediation) is not sufficient to demonstrate that objectives are being met over a variety of water year types. Copper data for the Lower Mokelumne River still indicates that there are periodic exceedances. No recent data on zinc levels in the Lower Mokelumne River is available. A more detailed review of the data provided can be found in the Fact Sheets for the Lower Mokelumne River and Camanche Reservoir. Regional Board staff is not recommending the addition of Rich Gulch to the 303(d) list for impairment due to arsenic. The data provided was for a single storm event. Regional Board staff has learned that the Gwin Mine was the most likely source of the arsenic and that the mine portal was open for an exploratory survey in January 1997. The portal has since been closed, so storm water discharges from the mine are unlikely.

Commenter 6: William E. Teplin

"I am especially interested in any information that might help me understand the observations I have made for the past 2 years in early spring runoff (pre-peak) in the South Fork Kings River and Ten Mile Creek, both in the Sequoia National Forest, down stream of Sequoia-Kings Canyon National Park. We have observed major algal blooms and phosphate pillows (2 foot tall soap suds) in areas that would seem to be relatively pristine."

Response 6: No other data or information was provided, so no recommended changes to the 303(d) list are being made. Regional Board staff in Fresno will be conducting nutrient and pathogen monitoring in Ten Mile Creek (see Table 2). The comment has been forwarded to the Fresno office of the Regional Board for follow-up.

Commenter 7: Will Doleman, A Call for Water Sanity! Monitoring Group

The commenter provided information on issues in a number of creeks and ditches in Nevada County.

Response 7: No recommendations for changes to the 303(d) list were made based on the information provided in the letter. Based on the information in the report provided, Regional Board staff was not able to determine the quality assurance/quality control and sample collection procedures used. The commenter did provide some information that could indicate a potential water quality problem. Regional Board NPDES staff will follow-up and sample a number of the creeks identified by the commenter.

Commenter 8: Mary Berglund, President, Kern County Neighbors for Quality Air, Water and Growth

The commenter provided information and observations related to the Kern River, Buena Vista Lake, Caliente Creek, and Tehachapi Creek, as well as the EPC – Eastside Landfill. The commenter requests that the Regional Board investigate the sites mentioned.

Response 8: No recommendations for changes to the 303(d) list were made based on the information provided in the letter. The information was limited to a few observations, but no data was provided. The letter has been forwarded to the Fresno office for follow-up.

Commenter 9: Lynell Garfield, River Science Dir., South Yuba River Citizen's League (SYRCL)

The commenter recommends listing Shady Creek for excessive sediment. Information was also provided on E. coli levels in Humbug Creek and the Upper Yuba River.

Response 9: The commenter states that SYRCL has no data for the recommended listing of Shady Creek. Regional Board staff does not recommend listing water bodies based

solely on anecdotal information. Regional Board staff has reviewed the information provided on E. coli levels in Humbug Creek and the Upper Yuba River. Analytical results for total coliform and E. coli do not indicate exceedances of Department of Health Services criteria, therefore, Regional Board staff do not recommend listing Humbug Creek and the Upper Yuba River.

Commenter 10: Bill Jennings, DeltaKeeper

Response 10
The commenter recommended approximately 101 additions to California's 303(d) list for non-attainment of standards in Central Valley waters. In addition to the specific waterbodies and pollutants identified in the table below, DeltaKeeper recommended adding a number of specific waterbodies to the 303(d) List for temperature.

Staff recommends that waterbodies not be added to the 303(d) List for temperature. The Regional Board's Basin Plan includes the following temperature narrative objective "The natural receiving water temperature of intrastate waters shall not be altered unless it can be demonstrated to the satisfaction of the Regional Water Board that such alteration in temperature does not adversely affect beneficial uses. ....At no time or place shall the temperature of COLD or WARM intrastate waters be increased more than • °F above natural receiving water temperature. Temperature changes due to controllable factors shall be limited for the water bodies specified as described in Table III-4. To the extent of any conflict with the above, the more stringent objective applies. In determining compliance with the water quality objectives for temperature, appropriate averaging periods may be applied provided that beneficial uses will be fully protected."

As stated, the temperature objective would require the Regional Board to determine the "natural receiving water temperature" in order to determine whether the temperature has been altered in a manner that affects beneficial uses or to determine whether temperature has been increase by greater than • °F above natural receiving water temperature. The determination of the "natural receiving water temperature" for the Central Valley streams and rivers would require a scientific investigation and modeling effort that is beyond the scope of the 303(d) list update process. Staff, therefore, does not recommend the addition of any water bodies to the 303(d) list as impaired due to temperature.

Appendix A of this report describes how Regional Board staff evaluated available information for metals, mercury, pathogens, and pesticides. Based on information submitted by the commenter, other readily available information, and the procedures outlined in Appendix A, Regional Board staff determined whether water quality objectives were being attained for the recommended additions to the 303(d) list. Regional Board staff evaluation of recommended additions for other contaminants (other than metals, mercury, pathogens, and pesticides) is described below.

The commenter recommended addition of the Delta to the 303(d) list for impairment due to exotic species. Regional Board staff agree that exotic species are a problem in the Delta, but do not believe that exotic species are a "pollutant" as defined by the Clean

Water Act and therefore should not be included on the 303(d) list. Regional Board staff will consider identifying exotic species on the 305(b) report.

The commenter also recommended the addition of a number of parameters and water bodies to the 303(d) list based on exceedance of certain drinking water guidelines. Regional Board staff will be developing a proposed drinking water policy for Central Valley waters. That policy will identify both the relevant drinking water criteria as well as the appropriate point of application of those criteria. Regional Board staff believes that additions to the 303(d) list based on exceedance of criteria other than primary MCLs (maximum contaminant levels) would be premature.

The commenter recommended the addition of the Sacramento River to the 303(d) list as impaired by dieldrin. Dieldrin is an organo-chlorine pesticide that is considered to have an additive toxic effect with a number of other organo-chlorine pesticides (see footnote 3 to Table 1). This group of organo-chlorine pesticides is referred to as Group A pesticides. Regional Board staff applied the National Academy of Sciences (NAS, 1973) guidelines for Group A pesticides and the Food and Drug Administration guidelines (USFDA, 1984) of 100 ng/g and 300 ng/g respectively in evaluating the available information. Based on those guidelines and the available information, Regional Board staff does not recommend adding the Sacramento River to the 303(d) list for impairment by dieldrin.

The commenter recommended the addition of the Sacramento River, North Delta, South Delta and Smith Canal to the 303(d) list for impairment by PCBs. Regional Board staff applied the National Academy of Sciences (NAS, 1973) guidelines and the Food and Drug Administration guidelines (USDA-FDA, 1984) of 500 ng/g and 2000 ng/g respectively in evaluating the available information. Based on those guidelines and the available information, Regional Board staff does not recommend adding the Sacramento River, North Delta, South Delta and Smith Canal to the 303(d) list for impairment by PCBs.

The commenter recommended the addition of Mosher Slough, Five-Mile Slough, the Calaveras River, Smith Canal, Mormon Slough, and French Camp Slough to the 303(d) list as impaired by low dissolved oxygen. Regional Board staff recommends adding Mosher Slough, Five-Mile Slough, the Calaveras River, Smith Canal, and Mormon Slough to the 303(d) list as impaired by dissolved oxygen. The limited data set for French Camp Slough did not indicate the potential for a recurring dissolved oxygen problem.

The commenter recommended adding the Colusa Basin Drain to the 303(d) list as impaired by high electrical conductivity. The commenter states that the 90th percentile of the available data is above an agricultural water quality goal of 700 • mhos/cm. Electrical conductivity is an indicator of pollutants (e.g. sodium, chloride) that can impact salt sensitive crops at high enough levels. Regional Board staff are not aware of any information from users of the Colusa Basin Drain that the salinity levels are impacting

crops, therefore, Regional Board staff do not recommend adding the Colusa Basin Drain to the 303(d) list as impaired by high electrical conductivity.

The commenter recommended adding the San Joaquin River to the 303(d) list for impairment due to high ammonia levels. Regional Board staff believe that ammonia issues will be addressed by NPDES permits that are currently in place and, therefore, do not recommend adding the San Joaquin River to the 303(d) list for impairment due to high ammonia levels.

10 References

10.1 Documents and References Used to Support Recommended Changes to the 303(d) List

Alpers, C.N., and M.P. Hunerlach. 2000. *Mercury Contamination from Historic Gold Mining in California.* U.S. Geological Survey. Fact Sheet FS-061-00. May 2000.

Bailey, H.C., L. Deanovic, E. Reyes, T. Kimball, K. Larsen, K. Cortwright, V. Connor, and D. Hinton. 2000. *Diazinon and Chlorpyrifos in Urban Waterways in Northern California.* USA. Environmental Toxicology and Chemistry (19) 82-87.

Bailey, H.C., J.L. Miller, M.J. Miller, L.C. Wiborg, L. Deanovic, and T. Shed. 1997. *Joint Acute Toxicity of Diazinon and Chlorpyrifos to Ceriodaphnia dubia.* Environmental Toxicology and Chemistry (16) 2304-2308.

Brodberg, R. K., and G. A. Pollock. 1999. *Prevalence of Selected Target Chemical Contaminants in Sport Fish from Two California Lakes: Public Health Designed Screening Study.* California Environmental Protection Agency, Office of Environmental Health Hazard Assessment.

Buer, S.M., S.R. Phillippe, and T.R. Pinkos. 1979. *Inventory and Assessment of Water Quality Problems related to Abandoned and Inactive Mines in the Central Valley Region of California.* CRWQCB-CVR (California Regional Water Quality Control Board, Central Valley Region).

California Rice Commission. 2001. *CA Rice.* www.calrice.org/environment/balance-cheet/chap3.html

CDM (Camp Dresser & McKee Inc). 1999. *Assessment of Water Quality Data from Smith Canal.* July 27, 1999. (Appendix B-2 to City of Stockton & San Joaquin County Storm Water Management Program).

CCR (California Code of Regulations). Title 17 §7958 *Bacteriological Standards.*

CDFG (California Department of Fish and Game). 1991. *Lower Mokelumne River Fisheries Plan.* The Resources Agency, Department of Fish and Game, Streamflow Requirements Program. November 1991.

CDHS (California Department of Health Services). 2000. *Draft Guidance for Fresh Water Beaches.* July 27, 2000.

CDPR (California Department of Pesticide Regulation). 2000a. *DPR Surface Water Database (SWDB),* as of July 15, 2000.

CDPR. 2000b. *Pesticide Use Report (PUR) Database.* Preliminary 2000 Pesticide Use Data.

CDWR (California Department of Water Resources). 1993. *Dams within Jurisdiction of the State of California.* DWR Bulletin 17, as presented by the Berkeley Digital Library Project. Accessed on August 23, 2001. Accessed: (http://elib.cs.berkeley.edu/dams/about.html).

CDWR. 1998. *Aquatic Monitoring and Assessment for the Upper Fall River, Memorandum Report.* May 1998.

Chen C. Tsai W. 1999. *Application of Stockton's Water Quality Model to Evaluate Stormwater Impact on Smith Canal.* February 23, 1999. (Attachment to March 17, 1999 letter from City of Stockton, G. Birdzell)

Chilcott, J. 1992. *Agenda Item #11 for Meeting of California Regional Water Quality Control Board, Central Valley Region.* September 25, 1992. Fresno, CA. Staff Report on Consideration of Water Body Designations to Comply with Provisions of the Water Quality Control Plan for Inland Surface Waters of California. Appendix B.

CH2MHILL. 2000a. *Closure Report: Penn Mine Environmental Restoration Project.* Prepared for: East Bay Municipal Utility District and Regional Water Quality Control Board-Central Valley Region. Oakland, California. December 2000.

CH2MHILL. 2000b. *(Draft) Post-Restoration Final Effectiveness Report: Penn Mine Environmental Restoration Project.* Prepared for: East Bay Municipal Utility District and Regional Water Quality Control Board-Central Valley Region. Oakland, California. September 2000.

City of Grass Valley. 2000. *Discharger self-monitoring reports (DSMRs) for Grass Valley Waste Water Treatment Plant.*

City of Grass Valley. 2001. *Discharger self-monitoring reports (DSMRs) for Grass Valley Waste Water Treatment Plant.*

Cortright, K., L. Deanovic, H. Bailey, and D. Hinton. 1995. *Stockton Urban Runoff April 1995-June 1995* Report- *Prepared for: Central Valley Regional Water Quality Control Board.*

CRWQCB- CVR (California Regional Water Quality Control Board, Central Valley Region). 1978. *Waste Discharge Requirements for Mount Diablo Quicksilver Mine, Contra Costa County.* Sacramento, Ca: CRWQCB.

CRWQCB-CVR. 1995. *Futures Foundation, New Idria Mine File.* 1971-1995 Electronic database of all water sampling results for San Carlos Creek and New Idria Mine drainage. Mercury data for water samples collected June 1971 to December 1995.

CRWQCB-CVR. 1998. *The Water Quality Control Plan (Basin Plan) for the California Regional Water Quality Control Board, Central Valley Region — The Sacramento River Basin and the San Joaquin River Basin.* Fourth Edition. CRWQCB-CVR, Sacramento, Ca.
http://www.swrcb.ca.gov/~rwqcb5/bsnplnab.pdf

CRWQCB-CVR. 1999a. (Enclosure 5) *Waste Discharge Requirements (WDRs) Order No. 99-052, Madera County Maintenance District 22A, Oakhurst Wastewater Treatment Facility, Madera County,* (with Supporting Data and Analyses). 30 April 1999 (Rescinded on 17 April 2000).

CRWQCB-CVR. 1999b. (Enclosure 6), January 1996-January 2000, *Fresno River Water Quality Data from Self-Monitoring Reports, Madera County Maintenance District 22A, Oakhurst Wastewater Treatment Facility, Madera County.*

CRWQCB-CVR. 2001a. *Avena Drain File.* File Containing Regional Board Staff Field notes and lab results from Avena Drain and surrounding dairies.

CRWQCB-CVR. 2001b. Letter dated 21 February 2001. *Public Solicitation of Water Quality Information.*

CRWQCB-SFB (San Francisco Bay), State Water Resources Control Board, and California Department of Fish and Game. 1995. *Contaminant Levels in Fish Tissue from San Francisco Bay: Final Report.* San Francisco Regional Water Quality Control Board, Oakland, CA.

CRWQCB-SFB (San Francisco Bay Regional Water Quality Control Board), State Water Resources Control Board, and California Department of Fish and Game. 1995. *Contaminant Levels in Fish Tissue from San Francisco Bay: Final Report.* San Francisco Regional Water Quality Control Board, Oakland, CA.

Davis, J.A., and M.D. May. 2000. *Contaminant Concentrations in Fish from the Sacramento-San Joaquin Delta and Lower San Joaquin River – 1998.* San Francisco Estuary Institute report. Richmond, California. September 2000.

Davis, J.A., M.D. May, G. Ichikawa, and D. Crane. 2000. *Contaminant Concentrations in Fish from the Sacramento-San Joaquin Delta and Lower San Joaquin River, 1998.* San Francisco Estuary Institute, Richmond, CA.

DeLorme. 1998. *Northern California Atlas and Gazetteer- Detailed Topographic Maps.* 1:150,000 Scale. Fourth Edition. (http://www.delorme.com.)

Dileanis, P.D., and J.L. Domagalski. 2000. *Occurrence and Transport of Diazinon in the Sacramento River and its Tributaries During Three Winter Storms, January-February 2000.* Draft, 3-3-01.

Dileanis, P.D., J.L. Domagalski, and K.P. Bennett. 2000. *Occurrence and Transport of Diazinon in the Sacramento River and its Tributaries During Three Winter Storms, January-February 2000.* Water-Resources Investigations Draft Report. U.S. Geological Survey. Sacramento, CA., as presented in CDPR, 2001.

Dileanis, P.D., J.L. Domagalski, and K.P. Bennett. 2001. *Occurrence and Transport of Diazinon in the Sacramento River and its Tributaries During Three Winter Storms, January-February 2000.* U.S. Geological Survey Water Resources Investigations Report, Draft. Sacramento, CA

Domagalski, J.L. 2000. *Pesticide Monitoring in the Sacramento River Basin, Ca. 2/96-9/98,* report in prep. USGS. July 2000.

Domagalski, J.L., 2001. Telephone conversation between Joe Domagalski (Sacramento River Basin NAWQA Study Unit, Chief, U.S. Geological Survey) and Joe Karkoski (Sacramento River Watershed TMDL Unit, Chief, California Regional Water Quality Control Board, Central Valley Region) on 4 September 2001, regarding sampling sites included in NAWQA studies.

EBMUD (East Bay Municipal Utility District). 2000. *All About EBMUD.* EBMUD Public Affairs Office publication. http://www.ebmud.com/pubs/annual/allaboutebmud_2000.pdf. Last accessed: August 2, 2001.

EBMUD (East Bay Municipal Utility District). 2001. Unpublished dissolved copper concentration data for the lower Mokelumne River downstream of Camanche Dam, generated as part of EBMUD's NPDES requirements. Provided electronically by Alexander R. Coate (Manger of Regulatory Compliance, EBMUD) to Michelle L. Wood (Environmental Specialist, Central Valley Regional Water Quality Control Board) on August 2, 2001.

EDAW, Inc. 1992. *Draft EIS/EIR for the Updated Water Supply Management Program, Volume III, Technical Appendices B1 and B2.* Prepared for: East Bay Municipal Utility District. Oakland, California. December 1992.

Foe, C. 1995. *Insecticide Concentrations and Invertebrate Bioassay Mortality in Agricultural Return Water from the San Joaquin Basin.* Central Valley Regional Water Quality Control Board. Sacramento, CA December 1995.

Foe, C. and W. Croyle. 1998. *Mercury Concentrations and Loads from the Sacramento River and from Cache Creek to the Sacramento-San Joaquin Delta Estuary.* California Regional Water Quality Control Board, Central Valley Region Report. Sacramento, Ca. June 1998.

Fujimura, R. 1993a. *Chemical Analyses and Bioassay Test Results for Samples Collected from December 29 to February 25,, 1993.* Memorandum to Brian Finlayson, Pesticide Investigations Unit, California Department of Fish and Game. Rancho Cordova, CA. March 26, 1993. As presented in CDPR, 2001.

Fujimura, R. 1993b. *Chemical Analyses and Bioassay Test Results for Samples Collected from July 9 to September 9, 1992.* Memorandum to Brian Finlayson, Pesticide Investigations Unit, California Department of Fish and Game. Rancho Cordova, CA. March 23, 1993. As presented in CDPR, 2000.

Fujimura, R. 1993c. *Chemical Analyses and Bioassay Test Results for Samples Collected from March 16 to April 30, 1992.* Memorandum to Brian Finlayson, Pesticide Investigations Unit, California Department of Fish and Game. Rancho Cordova, CA. March 22, 1993. As presented in CDPR, 2000.

Fujimura, R. 1993d. *Chemical Analyses and Bioassay Test Results for Samples Collected from December 23, 1991 to February 27, 1992.* Memorandum to Brian Finlayson, Pesticide Investigations Unit, California Department of Fish and Game. Rancho Cordova, CA. February 23, 1993. As presented in CDPR, 2000.

Fujimura, R. 1991a. *Chemical and Toxicity Test Results from the San Joaquin River at Three Sites from July 2 to September 13, 1991.* Memorandum to Lisa Ross, Department of Pesticide Regulation. Sacramento, CA. November 6, 1991. As presented in CDPR, 2000.

Fujimura, R. 1991b. *Chemical and Toxicity Test Results from the San Joaquin River and Tributaries During March 4 to April 26, 1991.* Memorandum to Lisa Ross, Department of Pesticide Regulation. Sacramento, CA. November 6, 1991. As presented in CDPR, 2000.

Gregorio, D. 2000 *Field Report, Kings River Sampling*, State Water Resources Control Board, Division of Water Quality.

Gorder, N.K.N., J.M. Lee, and K. Newhart. 1995. *Information on rice pesticides submitted to the California Regional Water Quality Control Board Central Valley Region.* Environmental Monitoring and Pest Management Branch, Department of Pesticide Regulation, Sacramento, CA. December 28, 1995. As presented in CDPR, 2000.

Gorder, N.K.N., J.M. Lee, and K. Newhart. 1996. *Information on rice pesticides submitted to the California Regional Water Quality Control Board Central Valley Region.* Environmental Monitoring and Pest Management Branch, Department of Pesticide Regulation, Sacramento, CA. December 31, 1996. As presented in CDPR, 2000.

Gorder, N.K.N., J.M. Lee, and K. Newhart. 1997. *Information on rice pesticides submitted to the California Regional Water Quality Control Board Central Valley Region.* Environmental Monitoring and Pest Management Branch, Department of Pesticide Regulation, Sacramento, CA. December 31, 1997. As presented in CDPR, 2000.

Gorder, N.K.N., J.M. Lee, and K. Newhart. 1998. *Information on rice pesticides submitted to the*

California Regional Water Quality Control Board Central Valley Region. Environmental Monitoring and Pest Management Branch, Department of Pesticide Regulation, Sacramento, CA. December 31, 1998. As presented in CDPR, 2000.

Hannaford M.J., and North State Institute for Sustainable Communities. 2000. Preliminary Water Quality Assessment of Cow Creek Tributaries. Department of Fish and Game. May 15, 2000. (http://www.delta.dfg.ca.gov/afrp/documents/cowcrk.rpt.pdf).

Harrington, J.M. 1990. *Hazard Assessment of the Rice Insecticides Molinate and Thiobencarb to Aquatic Life in the Sacramento River System.* California Department of Fish and Game. Environmental Services Division. Administrative Report 90-1. Sacramento, CA

Holmes, R. 2001. Personal Communication with C. Spector. CVRWQCB. August 28, 2001.

Holmes, R., C. Foe, and V. de Vlaming. 2000. *Sources and Concentrations of Diazinon in the Sacramento Watershed During the 1994 Orchard Dormant Spray Season.* California Regional Water Quality Control Board – Central Valley Region. Sacramento, CA., as presented in CDPR, 2000.

Horizons Technology, Inc. 1997. Sure! MAPS® RASTER Map Sets (U.S. Geological Survey 7.5' Topographic Quadrangles), Version 2.1.2.

Horning, W.B., and C.I. Weber, eds. 1985. *Short-term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organism*; second edition. US EPA (Environmental Protection Agency) document #: 600/4-85/014. US EPA, Office of Research and Development, Cincinnati, OH.

Iovenitti, J.L., Weiss Associates, and J. Wessman. 1989. *Mount Diablo Mine: Surface Impoundment Technical Report.* Pleasant Hill, Ca.

Jennings, B. 2001. *Letter from Bill Jennings (DeltaKeeper A Project of San Francisco BayKeeper) to Mr. Jerry Bruns and Mr. Joe Karkoski (California Regional Water Quality Control Board, Central Valley Region) dated May 14, 2001, regarding DeltaKeeper comments on section 303(d) list update.* May 14, 2001.

Larry Walker Associates, 2001A. SRWP 99-00 Database. Unpublished Data.

Larry Walker Associates, 2001B. *Sacramento River Watershed Program Annual Monitoring Report: 1999-2000.* Prepared for the Sacramento River Watershed Program by Larry Walker Associates, Davis, California.

Larsen K., K.A. Cortright., P.Young, V. Connor, L.A.Deanovic, D.E. Hinton. 1998. *Stockton Fish Kills Associated With Urban Storm Runoff: The Role of Low Dissolved Oxygen.* CVRWQCB. June 1998.

Larsen K., M. McGraw, V. Connor, L. Deanovic, T. Kimball, and D. Hinton. 2000. *Cache Creek and Smith Canal Watersheds Toxicity Monitoring Results: 1998-1999* Final Report. November 2000.

Lee G.F, and A. Jones-Lee. 2000a. *Dissolved Oxygen Depletion in the Stockton Sloughs.* August 2000. (Prepared for DeltaKeeper)

Lee G.F, and A. Jones-Lee. 2000b. *Issues in Developing the San Joaquin River Deep Water Ship Channel DO TMDL.* Report to San Joaquin River Dissolved Oxygen Total Maximum Daily Load Steering Committee and the CVRWQCB. August 17, 2000.

Lee, G.F., and A. Jones-Lee. 2001. *Review of the City of Stockton Urban Stormwater Runoff Aquatic Life Toxicity Studies Conducted by the Central Valley Regional Water Quality Control Board, DeltaKeeper,*

and the University of California, Davis, Aquatic Toxicology Laboratory between 1994 and 1999. G. Fred Lee & Associates. El Macero, CA. (Prepared for DeltaKeeper).

Marshack, J.B. 2000. *A Compilation of Water Quality Goals.* California Regional Water Quality Control Board, Central Valley Region Report. August 2000, updated October 11, 2000; December 5, 2000; February 8, 2001; April 18, 2001; and July 26, 2001.

May, J.T., R.L. Hothem, C.N. Alpers, and M.A. Law. 2000. *Mercury Bioaccumulation in Fish in a Region Affected by Historic Gold Mining: The South Yuba River, Deer Creek, and Bear River Watersheds, California, 1999.* U.S. Geological Survey. Sacramento, CA. 2000.

McKee and Wolf. 1971. *Water Quality Criteria.* Publication 3-A. California State Water Control Board. Sacramento, California.

Menconi, M., and S. Gray. 1992. *Hazard Assessment of the Insecticide Carbofuran to Aquatic Organisms in the Sacramento River System.* California Department of Fish and Game, Environmental Services Division. Administrative Report 92-3. Sacramento, CA.

Menconi, M., and J. M. Harrington. 1992. *Hazard Assessment of the Insecticide Methyl Parathion to Aquatic Life in the Sacramento River System.* California Department of Fish and Game. Environmental Services Division. Administrative Report 92-1. Sacramento, CA

Montoya, B, and X Pan. 1992. *Inactive Mine Drainage in the Sacramento Valley, California.* California Regional Water Quality Control Board, Central Valley Region Report. July 1992.

NAS (National Academy of Science). 1973. *A Report of the Committee on Water Quality: Water Quality Criteria, 1972.* U.S. Environmental Protection Agency, National Academy of Science-National Academy of Engineers (NAS). EPA R3-73-033.

NCWA (Northern California Water Association). 2001.*The Lower Butte Creek Project.* (http://norcalwater.org/lower_butte_creek_project.htm). Last updated Sept 4, 2001.

Nevada County. 2000. *Press Release, Three County Environmental Health Agencies Issue Interim Public Health Notification on Mercury in Fish.* Nevada County, Department of Environmental Health. (http://www.co.nevada.ca.us/ehealth/hg/press_release_10-03-00.htm)

Newhart, K., D. Jones, and S. Ceesay. 2000. *Information on Rice Pesticides-Submitted to the California Regional Water Quality Control Board.* California Environmental Protection Agency, Department of Pesticide Regulation. Environmental Monitoring and Pest Management Branch. Environmental Hazards Assessment Program. December 31, 2000.

Nordmark, C. 2000, In prep. *Preliminary Results of Acute and Chronic Toxicity Testing of Surface Water Monitored in the Sacramento River Watershed, Winter 1999-00.* Memorandum to Don Weaver, Environmental Monitoring and Pest Management, Department of Pesticide Regulation. Sacramento, CA., as presented in CDPR, 2001.

Nordmark, C. 1999. *Preliminary Results of Acute and Chronic Toxicity Testing of Surface Water Monitored in the Sacramento River Watershed, Winter 1998-99.* Memorandum to Don Weaver, Environmental Monitoring and Pest Management, Department of Pesticide Regulation, Sacramento, CA. May 26, 1999., as presented in CDPR, 2000.

Nordmark, C. 1998. *Preliminary Results of Acute and Chronic Toxicity Testing of Surface Water Monitored in the Sacramento River Watershed, Winter 1998-99.* Memorandum to Don Weaver, Environmental Monitoring and Pest Management, Department of Pesticide Regulation. Sacramento, CA. July 31, 1998, as presented in CDPR, 2000.

Nordmark, C.E., K.P. Bennett, H. Feng, J. Hernandez, and P. Lee. 1998. *Occurrence of aquatic toxicity and dormant spray pesticide detections in the Sacramento River watershed.* Winter 1996-97. Environmental Hazards Assessment Program, Environmental Monitoring and Pest Management Branch. Department of Pesticide Regulation. Sacramento, CA. Report EH98-01. February, 1998. as presented in CDPR, 2000.

North State Resources and T Holmes (prepared for the Fall River Resource Conservation District). *A study of the Habitat Characteristics of the Aquatic Vegitation of the Upper Fall River: Final Report.* Redding, Ca. December 8, 1997.

Nichols, J., S. Bradbury, and J. Swartout. 1999. *Derivation of wildlife values for mercury* in *Journal of Toxicology and Environmental Health*: 325-355.

OEHHA (Office of Environmental Health Hazard Assessment). 1987. *Methyl Mercury In Northern Coastal Mountain Lakes: Guidelines for Sport Fish Consumption For Clear Lake (Lake County), Lake Berryessa (Napa County), And Lake Herman (Solano County).* James W. Stratton, Daniel Smith, Anna M. Fan, and Steven Book. Hazard Evaluation Section and the Epidemiological Studies and Surveillance Section, Berkeley, California.

OEHHA (Office of Environmental Health Hazard Assessment). 2000. *Draft Evaluation of Potential Health Effects of Eating Fish From Black Butte Reservoir (Glenn and Tehama Counties): Guidelines for Sport Fish Consumption*, Pesticide and Environmental Toxicology Section, California Environmental Protection Agency, Office of Environmental Health Hazard Assessment.

OEHHA (Office of Environmental Health Hazard Assessment). 1999. *Health Risk Categories and Cancer Risk. Values for Chemicals without California Public Health Goals*: molinate. www.oehha.ca.gov/risk/ChemicalDB/withoutPHG.asp?name=molinate&number=221267

OMR. 2000. *California's Abandoned Mines – A Report on the Magnitude and Scope of the Issue in the State.* California Department of Conservation, Office of Mine Reclamation, Abandoned Mine Lands Unit (OMR). Sacramento, CA. June 2000.

PANNA. 2000. *DPR surface water database with exceedances indicated.* 9/24/00. PANNA

PANNA. 2001. *DPR surface water database with exceedances indicated.* 6/29/01. PANNA

Panshin, S.Y., N.M. Dubrovsky, J.M. Gronberg and J.L. Domagalski. 1998. *Occurrence and distribution of dissolved pesticides in the San Joaquin River Basin, California.* U.S. Geological Survey. Water Resources Investigations Report 98-4032. National Water Quality Assessment Program., as presented in CDPR, 2000.

Ross, L. 1992. *Preliminary Results of the San Joaquin River Study; Summer, 1991.* Memorandum to Kean Goh. Environmental Hazards Assessment Program, Environmental Monitoring and Pest Management Branch. California Department of Pesticide Regulation. Sacramento, CA. May 21, 1992.

Ross, L. 1993. *Preliminary Results of the San Joaquin River Study; Summer, 1992.* Memorandum to Kean Goh. Environmental Hazards Assessment Program, Environmental Monitoring and Pest Management Branch. California Department of Pesticide Regulation. Sacramento, CA. September 22, 1993. As presented in CDPR, 2000.

Ross, L., J. Stein, J. Hsu, J. White, and K. Hefner. 1996. *Distribution and Mass Loading of Insecticides in the San Joaquin River, California: Winter 1991-92 and 1992-93.* Environmental Hazards Assessment Program, Environmental Monitoring and Pest Management Branch. California Department of Pesticide Regulation. Sacramento, CA. Report EH 96-02. November, 1996., as presented in CDPR, 2000.

Ross, L., J. Stein, J. Hsu, J. White, and K. Hefner. 1999. *Distribution and Mass Loading of Insecticides in the San Joaquin River, California: Spring 1991 and 1992.* Environmental Hazards Assessment Program, Environmental Monitoring and Pest Management Branch. California Department of Pesticide Regulation. Sacramento, CA. Report EH 99-01. April, 1999, as presented in CDPR, 2000.

Russick, K. 2001. *Characterization of OP Pesticides in Sacramento Urban Runoff and Receiving Waters.* Unpublished Draft CALFED Repot. Russik Environmental Consultant, Elk Grove, California.

SCH EIR. 1996. *Draft EIR for The Penn Mine Site, Long-Term Solution Project.* Prepared for: East Bay Municipal Utility District and Regional Water Quality Control Board-Central Valley Region. SCH EIR No. 95103036. May 1996.

Siepmann, S., and Finlayson, B.J. 2000. *Water Quality Criteria for Diazinon and Chlorpyrifos.* California Department of Fish and Game. Office of Spill Prevention and Response. Administrative Report 00-3. Sacramento, CA

Siepmann, S., and M.J. Jones. 1998a. *Hazard Assessment of the Insecticide Carbanyl to Aquatic Life in the Sacramento-San Joaquin River System.* California Department of Fish and Game. Office of Spill Prevention and Response. Administrative Report 98-1. Sacramento, CA.

Siepmann, S., and S.B. Slater. 1998b. *Hazard Assessment of the Insecticide Malathion to Aquatic Life in the Sacramento-San Joaquin River System.* California Department of Fish and Game. Office of Spill Prevention and Response. Administrative Report 98-2. Sacramento, CA.

Slotton, D.G., S.M. Ayers, J.E. Reuter, and C.R. Goldman. 1995. *Gold mining impacts on food chain mercury in northwestern Sierra Nevada streams.* Technical Completion Report for the University of California Resources Center, Project W-816. University of California, Davis, Division of Environmental Studies, August 1995.

Slotton, D.G., S.M. Ayers, and J.E. Reuter. 1996a. *Marsh Creek Watershed: 1995 Mercury Assessment Project—Final Report March 1996.* Report Prepared for Contra Costa County, March 1996.

Slotton, D.G., S.M. Ayers, J.E. Reuter, and C.R. Goldman. 1996b. *Gold Mining Impacts on Food Chain Mercury in Northwestern Sierra Nevada Streams (1996 Revision).* Division of Environmental Studies, University of California, Davis. December 1996.

Slotton, D.G., S.M. Ayers, J.E. Reuter, and C.R. Goldman. 1997. *Cache Creek Watershed Preliminary Mercury Assessment, Using Benthic Macro-Invertebrates – Final Report, June 1997.* University of California, Davis, Division of Environmental Studies, June 1997.

Slotton, D.G., S.M. Ayers, J.E. Reuter, C.R. Goldman. 1999. *Lower Putah Creek 1997-1998 Mercury Biological Distribution Study. February 1999.* Dept. of Environmental Science and Policy, University of California, Davis. February 1999.

Slotton, D.G., T.H. Suchanek, and S.M. Ayers. 2000. *Delta Wetlands Restoration and the Mercury Question: Year 2 Findings of the CALFED UC Davis Mercury Study. IEP Newsletter.* 13(4): 34-44.

SWRCB (State Water Resources Control Board). 1990. *Water Quality Problems Associated with Operation of Pardee and Camanche Reservoir.* State Water Resources Control Board, Division of Water Quality staff report.

SWRCB (State Water Resources Control Board). 1999. *1998 California 303(d) List and Priority Schedule.* Approved by U.S. Environmental Protection Agency, Region 9. May 12, 1999. (http://www.swrcb.ca.gov/tmdl/docs/303d98.pdf).

SWRCB. 2001. Undated memorandum from Stan Martinson, Chief, Division of Water Quality. *Solicitation of Water Quality Information.* E-mail sent 14 February 2001.

SWRCB-DWQ (State Water Resources Control Board, Division of Water Quality). 1995. *Toxic Substances Monitoring Program: Freshwater Bioaccumulation Monitoring Program: Data Base (Metals_Wet).*

Templin, B. 2000, *Photo-documentation of Ten Mile Creek*, Friends of the South Fork Kings River, April 28, 2000. (http://www.fix.net/sfkings.com)

Tetra Tech, Inc (for the Fall River Resource Conservation District). 1998. *Analysis of Sedimentation and Action Plan Development for the Upper Fall River, Shasta County, California.* San Francisco, Ca. May 20, 1998.

USBR (U.S. Bureau of Reclamation). 2001. *U.S. Bureau of Reclamation DataWeb: Power Plants, Dams & Reservoirs.* Accessed on August 22, 2001 (http://dataweb.usbr.gov/).

USACOE (US Army Corps of Engineers) October 1996, *Sanitary Survey of The Hensley Lake Watershed,* Sacramento District

USACOE (US Army Corps of Engineers) 1997, 1998, 1999, 2000, *Annual Water Quality Report, Lake Monitoring Program,* Sacramento District (Enclosures 1, 2, 3, and 4)(Also accessible on the internet at http://www.spk.usace.army.mil/cespk-ed/env)

USACOE (US Army Corps of Engineers) 8 May 2001, Armbruester, Edward, Park Manager Hensley Lake. Verbal communication with Jack Yamauchi, CRWQCB-CVR.

USDA (United States Depatment of Agriculture), River Basin Planning Staff, in cooperation with Fall River Resource Conservation District. 1983. *Fall River Watershed Area Study, Summary Report.* Davis, Ca. June 1983.

USDHHS-ATSDR (US Department of Health and Human Services, Agency for Toxic Substances and Disease Registry). 1994. *Public Health Statement for DDT, DDE, and DDD.* May 1994. (http://www.atsdr.cdc.gov/ToxProfiles/phs8908.html)

USDHHS-ATSDR (US Department of Health and Human Services, Agency for Toxic Substances and Disease Registry). 1995. *ToxFAQs - DDT, DDE, and DDD.* September 1995. (http://www.atsdr.cdc.gov/tfacts35.html)

USDHHS-ATSDR (US Department of Health and Human Services, Agency for Toxic Substances and Disease Registry). 1997. *Fish Sampling in Putah Creek, 1996, Laboratory for Energy Related Health Research, Davis, Yolo County California, Cerclis No. CA2890190000.* Agency for Toxic Substance and Disease Registry (ATSDR). April 1997.

USDHHS-ATSDR. 1998. *Health Consolation, Fish Sampling in Putah Creek (Phase II), Laboratory for Energy Related Health Research, Davis, Yolo County California, Cerclis No. CA2890190000.* Agency for Toxic Substance and Disease Registry. September 1998.

USEPA (Environmental Protection Agency). 1976. *Quality Criteria for Water (The Red Book).*

USEPA. 1986a. Ambient Water Quality Criteria for Bacteria. EPA # 44015-84-002.

USEPA. 1986b. *Ambient Aquatic Life Water Quality Criteria: Chlorpyrifos - 1986.* EPA# 440/5-86-005

USEPA. 1991. *Technical Support Document for Water Quality-based Toxics Control*; second edition. US EPA document #: 505/2-90/001. US EPA, Office of Water, Washington DC.

USEPA. 1995. *Great Lakes Water Quality Initiative Technical Support Document for Wildlife Criteria.* EPA-820-B-95-009. U.S. Environmental Protection Agency, Office of Water. March 1995.

USEPA. 1997a. *Mercury Study Report to Congress, Vol. 6. An Ecological Assessment for Anthropogenic Mercury Emissions in the United States.* U.S. Environmental Protection Agency, Office of Air Quality Planning & Standards and Office of Research and Development. Washington, DC.

USEPA (Office of Water). 1997b. *National Clarifying Guidance For 1998 State and Territory Clean Water Act Section 303(d) Listing Decisions.* August 17, 1997. (http://www.epa.gov/owow/tmdl/lisgid.html)

USEPA. 1998a. *Bacterial Water Quality Standards Status Report.* EPA-823-R-98-003. U.S. Environmental Protection Agency, Office of Water Report. May 1998.

USEPA. 1998b. *Ambient Aquatic Life Water Quality Criteria: Diazinon.* Office of Water Draft Document. September 1998.

USEPA. 1999. *National Recommended Water Quality Criteria – Correction.* EPA 822-Z-99-001. April 1999. U.S. Environmental Protection Agency, Office of Water. Washington, DC. (http://www.epa.gov/ost/pc/revcom.pdf).

USEPA. 2000a. *Water Quality Standards; Establishment of Numeric Criteria for Priority Toxic Pollutants for the State of California; Rule.* U.S. Environmental Protection Agency, 40 CFR, Part 131, *in* Federal Register, Volume 65, No. 97. Thursday, May 18, 2000.

USEPA. 2000b. *Guidance for Assessing Chemical Contaminant Data for Use in Fish Advisories. Volume 1, Fish Sampling and Analysis, Third Edition.* U.S. Environmental Protection Agency, Office of Water. EPA 823-B-00-007. November, 2000.

USEPA. 2001a. *Protocol for Developing Pathogen TMDLs.* EPA 841-R-00-002. U.S. Environmental Protection Agency, Office of Water Report. January 2001.

USEPA. 2001b. *Water Quality Criterion for Protection of Human Health: Methylmercury.* EPA-823-R-01-001. U.S. Environmental Protection Agency, Office of Science and Technology. January 2001.

USFDA (U.S. Food and Drug Administration). 1984. *Shellfish Sanitation Interpretation: Action Levels for Chemical and Poisonous Substances.* USFDA, Shellfish Sanitation Branch. Washington, DC. June 1984.

USFWS (U.S. Fish & Wildlife Service). 1992. *Before the State Water Resources Control: In the Matter of the Water Rights Hearing for the Lower Mokelumne River – Closing Statement, Enclosure 2 (EBMUD Data – Aluminum, Cadmium, Zinc, Iron and Zinc).* Prepared by J.W. Burke, III (Regional Solicitor, USFWS Pacific Southwest Region) and Lynn Cox (Assistant Regional Solicitor, USFWS Pacific Southwest Region).

USGS (United States Geological Survey). 2001. *National Water Information System.* http://water.usgs.gov/nwis/ (August 28, 2001)

USGS. 1958-2000. California 7.5' Topographic Quadrangle, as presented by TopoZone.com (© 2000 Maps a la carte, Inc.). Accessed on March 13, 2001 (http://www.topozone.com/default.asp) *Ciervo Mountain* (1969), *Idria* (1969), *San Benito Mountain* (1981), and *Tumey Hills* (1971), La Grange (1987), Westley (1991), and Brush Lake (1969), *Chiles Valley*(1980), *Aetna Springs* (1987), *Walter Springs* (1987b.), *Desert Reservoir* (1997).

Weber, C.I., W.H. Peltier, *et al.* 1989. *Short-term Methods for estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms*, second edition. US EPA (Environmental Protection Agency) document #: 600/4-89/001. US EPA, Office of Research and Development, Cincinnati, OH.

Westcot, D.W., C.A. Enos, and P.A. Lowry, 1991. Preliminary Estimate of Salt and Trace Element Loading to the San Joaquin River by Ephemeral Streams Draining the Eastern Slope of the Coast Range (Diablo Range). Central Valley Regional Water Quality Control Board.

WHO (World Health Organization). 1993. *Guidelines for Drinking Water Quality*, 2nd edition. Geneva, WHO. www.who.int/water_sanitation_health/GDWQ/Chemicals/molinatesum.htm

Woodward-Clyde. 1992. *Source Identification and Control Report, December 1, 1992.* Report prepared for the Santa Clara Valley Nonpoint Source Pollution Control Program by Woodward-Clyde Consultants, Oakland, California

Wyels, W. 1987. *Regional Mercury Assessment.* California Regional Water Quality Control Board, Central Valley Region. March 1987.

10.2 Documents and References Reviewed that Did Not Provide Information to Support Changes to the 303(d) List

Alpers, Anweiler, Howard. 1998. *Metals Transport in the Sacramento River, California, 1996-97*: Vol 2 Interpretation of Metals Loads. USGS

Alpers C.N., H.E. Taylor, and J.L. Domagalski. 2000. *Metals Transport in the Sacramento River, California, 1996-1997*, Volume 1: Methods and Data. USGS.

Alpers C.N., Antweiler, H.E. Taylor, P.D. Dileanis, and J.L. Domagalski. 2000. *Metals Transport in the Sacramento River, California, 1996-1997*, Volume 2: Interpretation of Metal Loads. USGS.

Ames, M. 001. *Cover letter from M. Ames to Joe Karkoski.* Redding, City of. 5/14/01.

Amy, G., R. Bull, K. Kerri, and S. Regli. 1998. *Bay Delta Driking Water Quality Bromide Ion (Br) and Formation of Brominated Disinfections By-Products (DBPs).* CALFED

Archibald & Wallberg Consultants. 1997. *Sacramento Stormwater Management Program: 1996 / 1997 Annual Monitoring Report.* Sacramento Stormwater Management Program

Archibald & Wallberg Consultants, Montgomery Watson. 1998. *American River Watershed Sanitary Survey: 1998 Update.* City of Sacramento

Austin, S.A. 1999. *Update on the Tradable Loads Program in the Grasslands Drainage Area, To all interested parties, Re: Econimic Incentives Project to Improve Water Quality in the Grasslands.* San Luis & Delta-Mendota Water Authority. 25-Aug-99.

Azimi-Gaylon, S. 2000. *Quality Assurance Project Plan: Monitoring Organophosphorus Pesticides in the Lower San Joaquin Basin.* RWQCB. 1-Feb-00.

Barry, T. 1999. *Ecological Risk Assessment: Key Concepts/California Examples.* DPR

Bennett K.P., N. Singhasemanon, N. Miller, and R. Gal. 1998. *Rice Pesticides Monitoring in the Sacramento Valley, 1995.* DPR

Bennett, K. P., C. E. Nordmark, J. Schuette, H. Feng, J. Hernandez, and P. Lee. *Occurrence of aquatic toxicity and dormant-spray pesticide detections in the San Joaquin River watershed, Winter 1996-97.*

Bialy, H. 1998. *Data Report: Acute Copper Toxicity to Salmonids in Surface Waters in the Vicinity of the Iron Mountain Mine, California* - Vol 1. California office of the Attorney General

Block Environmental Services (BES). Grasslands Bypass Project (GBP). *Toxicity Program laboratory toxicity testing program.* (www. blockenviron. com/gbp/)

Brodberg, R. K., G. A Pollock. 1999. *Prevalence of Selected Target Chemical Contaminants in Sport Fish from Two California Lakes: Public Health Designed Screening Study.* Office of Environmental Health Hazard Assessment, Pesticide and Environmental Toxicology Section. June 1999.

Brown, L. R. 1997. *Concentrations of Chlorinated Organic Compounds in Biota and Bed Sediment in Streams of the San Joaquin Valley, California* in Archives of Environmental Contamination and Toxicology. USGS. May-97.

Brown, L. R. 1998. *Assemblage of Fishes and Their Associations with Environmental Variables, Lower San Joaquin River Drainage, California*: USGS Open File Report 98-77. USGS

Brown, L. R. 1998. *Concentrations of Chlorinated Organic Compounds in Biota and Bed Sediment in Streams of the Lower San Joaquin River Drainage, California.* USGS

Brown L. and J. May. 1999. *Macroinvertebrate Assemblages On Woody Debris and their Relationships with Environmental Variables In the Lower Sacramento and San Joaquin River Drainages, California.* USGS

Brown L. and J. May. 2000. *Benthic Macroinvertebrate Assemblages and their Relationships with Environmental Variables In the Lower Sacramento and San Joaquin River Drainages, California.* USGS

Brunetti J. 1999. *Pesticide Use Report Data For 1990 Through 1998.* DPR Dec, 1999.

Burke, J.W. and L. Cox. *In the Matter of the Water Rights Hearing for the Lower Mokelumne River, Closing Statement US FWS for the SWR Controls.* USFWS

Cain D.J., J.L. Cater, S.V. Fend, Sa. *Metal Exposure to a Benthic Invertebrate, Hydrpsyche californica, in the Sacramento River Downstream of Keswick Reservoir, California.* 1998. USGS

Cal EPA, Department of Toxic Substances Control. Abandoned Mine Lands Preliminary Assessment Handbook. 1998. Cal EPA, Department of Toxic Substances Control

CALFED. 1999. *Watershed Program Plan: Draft Programmatic EIS/EIR Technical Appendix.* CALFED Bay-Delta Program. June, 1999.

CALFED. 2000. *Science Conference 2000: Abstracts.* CALFED

CALFED. 2000. *Sources And Magnitudes Of Water Quality Constituents Of Concern In Drinking Water Supplies Taken From The Sacramento - San Joaquin Delta.* Sept 2000. CALFED

CALFED. 2000. *Water Quality Program Plan: Final Programmatic EIS/EIR Technical Appendix.* CALFED. Jul-00.

CCME (Canadian Council of Ministers of the Environment). 1991. Appendix IX- A protocol for the derivation of water quality guidelines for the protection of aquatic life (April 1991). In: Canadian water quality guidelines, Canadian Council of Resource and Environment Ministers, 1987. Prepared by the Task

Force on Water Quality Guidelines. [Updated and reprinted with minor revisions and editorial changes in Canadian environmental quality guidelines, Chapter 4, Canadian Council of Ministers of the Environment, 1999, Winnipeg.]

CDFG (California Department of Fish and Game). 1998. *Test 132: 96-hour acute Ceriodaphnia dubia test for diazinon.* Aquatic Toxicology Laboratory, Elk Grove.

CDFG. 1999. *Identification and Control of Pollution Sources in the Upper Sacramento River.* Feb, 1999. CVRWQCB

CDFG. 2000. *Biological Assessment Of Auburn Ravine, Placer County, California.*

CDHS. 1997. *Health Consultation: McCormick and Baxter Creosoting Company, Stockton, San Joaquin County, California, Cerclis No. CAD009106527.* 15-Jan-97.

CDPR. 1997. *Memo dated 6 June 1997.*

CDPR. 1997. *Toxicity Testing of Surface Water Monitored in the San Joaquin River and Sacramento River Watersheds, Winter 1996-97.* CDPR. Jun-97.

CDPR. 1998. *SWDB Study 32.* Environmental Hazards Assessment Program, Environmental Monitoring and Pest Management Branch, Department of Pesticide Regulation, Sa. February-98.

CDPR. *Preliminary Results of Acute and Chronic Toxicity Testing of Surface Water Monitored in the Sacramento River Watershed.* Memorandum, *Winter 1998-1999.*

CDPR. *Surface Water Monitoring in San Joaquin River Watershed.* 1996-1997.

CDPR. 2000. *Surface Water Database* (CD-Rom). July, 2000. CalEPA, Department of Pesticide Regulation.

CDPR. 2001. *Memo to RWQCB,* with a series of web sites to visit. Apr-01.

CDPR. *Preliminary Results of Acute and Chronic Toxicity Testing of Surface Water Monitored in the Sacramento River Watershed.* Memorandum.

CDWR (Department of Water Resources). 1998. *Municipal Water Quality Investigation Program. Aquatic Monitoring and Assessment for the Upper Fall River,* Memorandum Report. CDWR. May-98.

CDWR. *Clear Lake Sampling data* (core sampling). Submitted by: County of Lake.

CDWR. 2000. *Impacts of the South Delta Temporary Barriers Project, Year 2000 Operations on Steelhead, Spring- and Winter-run Chinook Salmon.* CDWR. Jan-00.

Chen, C. W. and Tsai, W. *Evaluation of Alternatives to Meet the Dissolved Oxygen Objectives of the Lower San Joaquin River.* San Ramon, CA

Chen, C. W., and Tsai, W. 2000. *Rough Loading Calculation for Dissolved Oxygen Sinks in Lower San Joaquin River.* RWQCB. Jan-00.

Chilcott, J. 2000. *Review of Selenium Concentrations in Wetland Water Supply Channels in the Grassland Watershed.* RWQCB. May-00.

Chilcott J.E., L.F. Grober, J.L. Eppinger, and A. Ramirez. 1998. *Water Quality of the Lower San Joaquin Rivers: Lander Avenue to Vernalis October 1995 - September 1997 (Water Years 1996-1997).* RWQCB. Dec-98.

Chilcott, J.E., L.F. Grober, J.L. Eppinger, and A. Ramirez. 1998. *Agricultural Drainage Contribution to Water Quality in the Grassland Watershed of Western Merced County, California: October 1995 - September 1997. (Water Years 1996 and 1997).* RWQCB. Dec-98.

Chilcott, J.E., L.F. Grober, A. Vargas, and J.L. Eppinger. 2000. *Agricultural Drainage Contribution to Water Quality in the Grassland Watershed of Western Merced County, California: October 1997 - September 1999.* RWQCB. May-00.

Chilcott, J.E., L.F. Grober, A. Vargas, and J.L. Eppinger. 2000. *Water Quality of the Lower San Joaquin Rivers: Lander Avenue to Vernalis October 1997 - September 1998.* RWQCB. May-00.

Clark, S.L., J. Bruns, V. Connor, and Jan. 1998. Metal Concentrations, Loads, and Toxicity Assessment in the Sacramento/San Joaquin Delta: 1993 - 1995. CVRWQCB

Coate, A.R. 2001. *Cover letter to Mr Karkoski, from Coate, AR.* East Bay Municipal Utility District. Apr-01.

Colusa Co Resource Conservation District. 2000. *Sand and Salt Creek Watershed Project: Final Report.* Colusa Co Resource Conservation District. Feb. 2000.

Colusa, City of. 2001. *Powell Slough Water Sample Data, 1993-1997.* City of Colusa. Mar-01.

Colusa, City of. 2001. *Report of Waste Discharge Application for the City of Colusa (Submitted to Kyle Erickson, CRWQCB).* City of Colusa. Mar-01.

Commandatore A.M., Herren, Main, Santillan, Connor, Grovhoug, and Horford. 1998. 1997 *Compendium of Water Quality Investigations in the Sacramento River Watershed, Sacramento-SJ Delta, and SFBay Area.* CDWR

Connor, V. *Diazinon and Chlorpyrifos in Urban Creeks and Sloughs.* In prep.

Contra Costa Water District. 1997. *Salinity Survey of the Contra Costa Canal, Report to DHS.* Contra Costa Water District. 5/30/97.

Contra Costa Water District. 1997. *Your Drinking Water, Annual Water Quality Report 1997.* Contra Costa Water District.

Contra Costa Water District. 1998. *Your Drinking Water, A Report on the Quality of Your Tap Water, Annual Water Quality Report 1998.* Contra Costa Water District

Contra Costa Water District. 1999. *Your Drinking Water, Annual Water Quality Report 1999.* Contra Costa Water District

Contra Costa Water District. 2001. *Adverse impacts to CCWD caused by increased salinity and concentrations of organic carbon and other constituents of concern at CCWD's intakes.* Contra Costa Water District. 5/15/01.

Contra Costa Water District. 2001. *Municipal water quality investigation, independent data at a variety of CCWD locations.* Contra Costa Water District. 5/15/01.

Cooke, J., and V. Connor. 1998. *Toxicants in Surface Waters of the Sacramento River Watershed.* CVRWQCD

Cortright, K.; L. Deanovic, and D. Hilton. 1998. *Sacramento River Watershed Program Toxicity Testing Results: Quarterly Report October 1997 - December 1997.* CVRWQCB, UC Davis Aquatic Toxicology Laboratory.

Cortright, K., L. Deanovic, and D. Hilton. 1998. *Sacramento River Watershed Program Toxicity Testing Results: Quarterly Report January - February 1998.* CVRWQCB, UC Davis Aquatic Toxicology Laboratory.

Coulston, P.J. 1997. *Interagency Ecological Program for the Sacramento-San Joaquin Estuary: 1993 Annual Report.* DWR

CRA (California Resources Agency). 1998. *California Watershed Information Technical System – A Project of CERES: Geographic Information by Hydrologic Region, Watershed Data and Information for the lower Feather River Basin.* August 21, 1998 (Copyright © 1997).

CRMP (Panoche/Silver Creek Coordinated Resource Management Plan) TRC (Technical Review Committee). 1996. *Draft Water Quality Report.* . February 29, 1996.

CRWQCB- CVR (California Regional Water Quality Control Board, Central Valley Region). 1997. *Upper Fall River Water Quality Monitoring* . RWQCB. Summer 1997.

CRWQCB- CVR. 1997. Memo: Metal Toxicity To EPA Bioassey Species In Water Samples Collected Downstream From Keswick Reservoir (1988 - 93). CRWQCB- CVR. Jan 1997.

CRWQCB- CVR. 2000. *Clear Lake TMDL for Mercury Numeric Target Report- Preliminary Draft.* CRWQCB- CVR. Aug-00.

CRWQCB- CVR. 2000. *Selenium TMDL for Grasslands Marshes.* RWQCB

Davis, J.A., M.D. May, G. Ichikawa, and D. Crane. 1998. *Contaminant Concentrations in Fish from the Sacramento-San Joaquin Delta and Lower San Joaquin River, 1998.* San Francisco Estuary Institute, Richmond, CA. Sep-98.

de Vlaming, V., V. Connor, DiGiorgio, Bailey, L. Deanovic, and Hinton. 2000. Journal In Environmental Toxicology and Chemistry, vol. 19: pp 42-62.

Deanovic, L. 1997. *Sacramento-San Joaquin Delta bioassay monitoring report. 1994-1995.* Aquatic toxicity Laboratory, UC Davis.

Deanovic, L. 1998. *Sacramento- San Joquin Delta Bioassay Monitoring Report 1994-1995,* In Prep.

Deanovic L, K. Cortright, K. Larsen, E. Reyes, H. Bailey, and D. Hinton. 1998. *Sacramento-San Joaquin Delta, Bioassey Monitoring Report: 1994-1995, Second Annual Report to the Central Valley Regional Water Quality Control Board.*

Deanovic L, K. Larson, V. Connor, and D. Hinton. 1998. *Sacramento River Watershed Program Toxicity Testing Results: Quarterly Report January-February 1998.* CVRWQCB, UC Davis Aquatic Toxicology Laboratory

Deanovic L, K. Cortright, K. Larsen, and E. Reyes, Bailey, and Hinton. 1998. *Sacramento-San Joaquin Delta Bioassay Monitoring Report 1994-1995 (Draft).* UC Davis Aquatic Toxicology Laboratory

Deanovic L, K. Cortright, K. Larsen, and Da. 1998. *Stockton Fish Kills Associated with Urban Storm Runoff: The Role of Low Dissolved Oxygen (Draft) June 1998.* CVRWQCD, UC Davis Aquatic Toxicology Laboratory

Deanovic L,, D. Hilton, and K. Larson. 1998. *Sacramento River Watershed Program Toxicity Testing Results: Quarterly Report March - May 1998.* CVRWQCB, UC Davis Aquatic Toxicology Laboratory

DeltaKeeper. *Appendix F: Summary Statistics for Monitoring Data: SRWP, USGS NAWQA, Sacramento River CMP, and City of Redding .*

DeltaKeeper. 1998. *Pollution Alert, to Louis Pratt, Dairy Discharge- high EC reading.* Delta Keeper. 1-Jun-98.

Doleman, W. 2001. *Letter from Doleman, W to Joe Karkoski.* Will Doleman, ACFWS monitoring. May-01.

Doleman, W. 2001. Various reports in paper form. May-01.

Domagalski, J.L. 1997. *Results of a Prototype Surface Water Network Design for Pesticides Developed for the San Joaquin River Basin, California* in Journal of Hydrology. USGS

Domagalski, J.L. 1998. *Occurrence of Transport of Total Mercury and Methyl Mercury in the Sacramento River Basin, California* in Journal of Geochemical Exploration. Jun-98.

Domagalski, J.L. 2000. *Pesticides in Surface Water Measured at Selected Sites in the Sacramento River Basin, California, 1996-1998.* USGS, NAWWA

Domagalski J.L., and L. Brown. 1998. *National Water Quality Assessment Program-The Sacramento River Basin.* USGS

Domagalski, J.L., and P.D. Dileanis. *Water-Quality Assessment of the Sacramento River Basin, California- - Water Quality of Fixes Sites, 1996-1998.* USGS

Domagalski, J.L., P.D. Dileanis, D.L. Knifong, C.M. Munday, J.T. May, B. J. Dawson, J.L. Shelton, and C.N. Alpers. 2000. *National Water-Quality Assessment: Water-Quality, Sediment and Tissue Chemistry, and Biological Data, 1995-1998.* U. S. Geological Survey Open-File Report 00-391. http://ceres. ca. gov/watershed/geographic/sacramento. html

Domagalski, J.L., P.D. Dileanis, D.L. Knifong, C.M. Munday, J.T. May, B.J. Dawson, J.L. Shelton, and C.N. Alpers. 2000. *Water-Quality Assessment of the Sacramento River Basin, Water-Quality, Sediment and Tissue Chemistry and Biological Data*, 1995-1998. USGS- water.wr.usgs.gov/sac_nawqa/waterindex.html

Domagalski, J.L., N.M. Dubrovski, and C.R. Kratzer. 1997. *Pesticides in the San Joaquin River, CA: Inputs from Dormant Sprayed Orchards.* J. of Environ. Quality, 26:454-465.

Domagalski, J.L., D.L. Knifong, P.D. Dileanis, L.R. Brown, J.T. May, V. Connor, and C.N. Alpers. 2000. *Water Quality in the Sacramento River Basin, California, 1994–98*: Circular 1215. USGS

Domagalski, J.L., Knifong, D.L., MacCoy, D.E., Dileanis, P.D., Dawson, B.J., and M.S. Majewski,. 1998. *Water Quality Assessment of the Sacramento River Basin, California - Environmental Setting and Study Design.* USGS

Dubrovski, N.M., C.R. Kratzer, L. Brown, J. Gronberg, and K. Burow. 1998. *Water Quality in the San Joaquin-Tulare Basins, California, 1992-95.* USGS: Circular 1159.

Foe, C. 2000. *Progress report for CALFED Task 1A: Methyl mercury budget for the freshwater side of the Sacramento-San Joaquin Delta Estuary.* In *Mid-Project Meeting of the Scientific Review Committee for the CALFED Project: An Assessment of Ecological and Human Health I.* December 2000.

Foe C., L. Deanovic, and D. Hilton. 1998. *Toxicity Identification Evaluations of Orchard Dormant Spray Storm Runoff.* CVRWCB. Dec-98.

Fox Environmental Management, Archibald & Wallberg. 1997. *Aquatic Toxicity and Pesticides in Surface Waters of the Central Valley: Final Report.* California Urban Water Agencies

Friends of Deer Creek. 2001. *Deer Creek Monitorin Program, Dec 2000- April 2001.* Friends of Deer Creek.

Friends of Deer Creek. 2001. *Letter in response to RWQCB request for information.*

Fuji, Ranalli, Aiken, and Bergamaschi. 1998. *Dissolved Organic Carbon Concentrations and Compositions, and Trihalomethane Formation Potentials* in *Waters from Agricultural Peat Soils, Sac-SJ Delta, Ca: Implications for Drinking-Water Quality* (Report 98-4147). UGSG, DWR

Ganapathy, C. 1999. *Preliminary Results of Acute and Chronic Toxicity Testing of Surface Water Monitored in the Sacramento River Watershed, Winter 1997-98.* DPR. 5-Jan-99.

Ganapathy, C. 1999. *Preliminary results of acute and chronic toxicity testing of surface water monitored in the San Joaquin River watershed, winter 1997-98.* Memorandum to Don Weaver, Environmental Monitoring and Pest Management, Department of Pesticide Regulation, Sacramento. January 5, 1999.

Ganapathy, C. 1999. *Preliminary results of acute and chronic toxicity testing of surface water monitored in the San Joaquin River watershed, winter 1998-99.* Memorandum to Don Weaver, Environmental Monitoring and Pest Management, Department of Pesticide Regulation, Sacramento. July 20, 1999.

Ganapathy, C., C. Nordmark, K. Bennett, A. Bradley, H. Feng, J. Hernandez, and J. White. 1997. *Temporal distribution of insecticide residues in four California Rivers.* Report EH97-06. Environmental Hazards Assessment Program, Environmental Monitoring and Pest Management Branch, California Department of Pesticide Regulation, Sacramento, CA.

Ganguli, P., R.P. Mason, K.E. Abu-saba, R.S. Anderson, and R. Flegal. 2000. *Mercury speciation in mine drainage from the New Idria Quicksilver Mine, California* in *Environmental Science and Technology.*

Goodbred, S. L.,R.J. Gilliom, T.S. Gross, N.P. Denslow, W.L. Bryant, and T.R. Schoeb. 1997. *Reconnaissance of 17b-Estradiol, 11-Ketotesterone, Vitellogenin, and Gonad Histopathology in Common Carp of United States Streams: Potential for Contaminant-Induced Endocrine Disruption.*

Grassland Bypass Project Oversight Committee. 1998. *Grassland Bypass Project Annual Report.* Grassland Bypass Project Oversight Committee. 12-May-98.

Grassland Bypass Project Oversight Committee. 1999. *Project Description and Update.* 1-Mar-99.

Grassland Bypass Project Oversight Committee. 1999. *Grassland Bypass Project.* 1-Jun-99.

Grasslands Basin Steering Committee. 1999. *Rule Enforcing Selenium Load Allocation and Establishing a Tradeable Loads Program for Water Year 1999* DRAFT. 6-Jan-99. RWQCB, Grasslands Basin Steering Committee

Gronberg, J.M., N.M. Dubrovski, Brown, and Burow. 1998. *Environmental Setting of the San Joaquin-Tulare Basins, California.* USGS

Grover, J. 2000. *Dormant Spray Project Quarterly Report Data Appendix: December 1999 - February 2000.* UC Davis Aquatic Toxicology Laboratory. Jun, 2000.

Harrington J.M., P. Ode, A. Montalvo, D. Post, and C. *A Water Quality Inventory Series: Biological and Physical/Habitat Assessment of California Water Bodies; Russian River Index of Biological Integrity (RRIBI) for First to Third Order Tributary Streams.* May 1999.

Hilton D.E. 1998. *Multiple Stressors in the Sacramento River Watershed.* UC Davis Aquatic Toxicology Laboratory.

Holmes R., V. De Vlaming, and C. Foe. 2000. Sources And Concentrations Of Diazinon In The Sacramento Watershed During The 1994 Orchard Dormant Spray Season. July 2000. CVRWQCB

Holmes, T., and North State Resources, Inc. 1997. *A Study of the Habitat Characteristics of the Aquatic Vegetation of the Upper Fall River, Final Report.* Dec-97.

Hunt J.W., B.S. Anderson, B.M. Phillips, and R.S. Tjee. *Agriculture, Ecosystems and Environment: Patterns of Aquatic Toxicity in an Agriculturally Dominated Coastal Watershed in California.* Institute of Marine Sciences, UC Santa Cruz; Calif. Mar, 1999.

IEP. IEP *Newsletter*, VOL 13, NO 3. 2000.

IEP. IEP *Newsletter*, VOL 13, NO 4. 2000.

Jardini R., and L. Deanovic. 1999. *SRWP Toxicity Monitoring & CALFED Fathead Minnow Mortality And Algae Toxicity Investigation: Sept - Nov 1999.* UC Davis Aquatic Toxicity Laboratory. Nov 1999.

Jardini R., and L. Deanovic. 2000. Sacramento River Watershed Program Toxicity Monitoring and CALFED Fathead Minnow Mortality and Algae Toxicity Investigation. Mar. 2000. UC Davis - Aquatic Toxicology Laboratory

Jones, D. 2000. *Preliminary results of acute and chronic toxicity testing of surface water monitored in the San Joaquin River watershed, winter 1999-00.* Memorandum to Don Weaver, Environmental Monitoring and Pest Management, Department of Pesticide Regulation, Sacramento.

Jones & Stokes Associates. 2000. *Submission of Stockton Regional Water Control Facility Data Collected for Fall 1999.* Jan-00.

Kern County Neighbors for Quality Aire, Water and Growth. 2001. *Public comments on water quality information.* Kern County Neighbors for Quality Aire, Water and Growth. May-01.

Kern County Water Agency. *LETTER and DISK with information in response to the RWQCBs request for information.* Apr-01. Kern County Water Agency

Kratzer, C. R. 1997. *Transport of Diazinon in the San Joaquin River Basin, California.* USGS National Water-Quality Assessment Program, open-file report 97-411.

Kratzer, C. R. 1998. *Pesticides in storm runoff from agricultural and urban areas in the Tuolumne River basin in the vicinity of Modesto, California.* USGS National Water-Quality Assessment Program, water-resources investigations report 98-4017.

Kratzer, C. R. 1999. *Transport of Sediment-Bound Organochlorine Pesticides to the San Joaquin River, California in Journal of the American Water Resources Association.* USGS. Aug-99.

Kratzer, C. R. 1999. *Transport of diazinon in the San Joaquin River Basin, California* in Journal of the American Water Resources Association 35(2): 379-395.

Kratzer, C.R., and Jennifer L. Shelton. 1998. *Water Quality Assessment of the San Joaquin - Tulare Basins, California: Analysis of Availability Data on Nutrients and Suspended Sediment in Surface Water, 1972 - 1990.* USGS

Lake, County of. 1997. *Scotts Creek Watershed Project (319h)* (not enclosed).

Lake, County of. 1999. *Clear Lake Watershed Analysis (205j)* (not enclosed).

Lake, County of. 1999. *Clear Lake Watershed Assurance (QA) Plan for the Clear Lake Basin Watershed Assessment (205j) Project* (not enclosed).

Lake, County of. *Clear Lake Core Data from DWR Clear Lake Sampling Sites.*

Lake, County of. *Creek Water Quality Samples/Stream Sampling Data for Lake County, Ca.*

Lake, County of. *Lake County 303(d) information: D:\water\lakedata\lakedata. mdb.*

Lake, County of. *Methods and Information about the County Clear Lake Database : D:\water\lakedata\lakedata. mdb Access 97.*

Lake, County of, and Mendocino National Forest. *Watershed Analysis Report, Upper Lake Watershed* (only part included).

Larry Walker Associates. 1997. *Sacramento River Mercury Control Planning Project: Final Project Report.* Sacramento Regional County Sanitation District

Larry Walker Associates. 1997. *Sacramento River Mercury Control Planning Project.* March 1997.

Larry Walker Associates. 2000. *Sacramento River Watershed Program Annual Monitoring Report: 1998-1999.* June 23, 2000.

Larry Walker Associates. 2000. *Annual Monitoring Report: 1998 - 1999* (Final). SRWP, Larry Walker Associates. JUN 2000.

Larry Walker Associates. 2000. *Sacramento River Coordinated Monitoring Program, 1999-2000 Annual Report.* SRWP, Larry Walker Associates. Nov 2000.

Larsen, K. 1998. *Sacramento River Watershed Project Toxicity Monitoring Results: 1997-98. Final Report.* Prepared for the Sacramento Regional County Sanitation District. November 1998.

Larsen, K. 1998. *Sacramento River Watershed Program Toxicity Testing Results: 1997-1998.* CVRWQCB, UC Davis Aquatic Toxicology Laboratory

Larsen K, and V. Connor. 1998. *SRWP: Toxicity Monitoring Results: 1996 - 1997.* UC Davis Aquatic Toxicology Laboratory, CVRWQCB

Larsen K., and L. Deanovic. 1999. *Deltakeeper Project Quarterly Report Data Appendix: March - May 1999.* UC Davis Aquatic Toxicology Laboratory

Larsen K., L. Deanovic, and D.E. Hinton. 1999. *Cache Creek and Putah Creek Project Quarterly Report Reference Toxicant Data and Data Appendix: January - March 1999.* UC Davis Aquatic Toxicology Laboratory

Larsen K., and J. Perez. 2000. *Sacramento River Watershed Program Toxicity Testing Data Results Summary: 1998-99.* CVRWQCB. Feb, 2000.

Larsen, S. J., Capal, and Majewski. 1997. *Pesticides in Surface Waters: Distribution, Trends, and Governing factors.* Chelsea, Michigan

Lawrence Livermore National Laboratory. Report and DISK with information, mailed in response to the RWQCBs request for information for the 303(d) list.

Lee G.F., and A. Jones-Lee. 1997. *Comments on Follow up Sampling and Analysis Guidelines for Fish, Sediment, and Water Sampling from the Putah Creek Adjacent to the Former Laboratory for Energy-Related Health Research, Davis, CA, Draft 2, dated September 17,1997.* Prepared by B Lloyd and ??. G. F. Lee & Assoc. Oct. 1997.

Lee G.F., and A. Jones - Lee. 1998. *Comments on US Department of Health and Human Services Public Health Service, Agency for Toxic Substance and Disease Registry, Draft Health Consultation, Fish Sampling of Putah Creek (Phase II) for the LEHR National Superfund Site.* G. FRED LEE & ASSOC. 16-Sep-98.

Lee G.F., and A. Jones-Lee. 1998. *Letter to Gary Carlton, Executive Director, CVRWQCB from G. Fred Lee.* G. G. F. Lee & ASSOC. Oct, 1998.

Lee, G.F. and A. Jones-Lee. 1999. *Preliminary report: Conclusions from review of the City of Stockton Urban Stormwater Runoff Aquatic Life Toxicity Studies Conducted by the Central Valley Regional Water Quality Control Board, DeltaKeeper, City of Stockton and UCD Aquatic Toxicology Lab.* G. FRED LEE & ASSOC. June 4, 1999.

Lee G.F., and A. Jones-Lee. 1999. "*To individuals interested in hazardous chemical bioassumulation in Putah Creek fish*". G. FRED LEE & ASSOC. April, 1999.

Lee G.F., and A. Jones-Lee. 2000. G. Fred Lee & Assoc Publications On Drinking Water (Various Studies). G. F. Lee & ASSOC

Litton, G.M. 2000. *Summary Report for: Sediment Oxygen Demand, Sediment Deposition Rates, Biochemical Oxygen Demand Kinetics.* Jan-00. UOP

Lucas, R. 2000. *Report of Dissolved Oxygen Steering Committee to the Central Valley Regional Water Quality Board.* Aug-00. RWQCB

Maccoy, D.E. and J.L. Domagalski. 1999. *Trace Elements and Organic Compounds in Streambed Sediment and Aquatic Biota for the Sacramento River Basin, California, October and November 1995.* National Water-Quality Assessment Program.

Majewski, M. 2000. *Atmospheric Transport of Pesticides into and from an Urban Environment: Project Update for 1996.* Draft Report to the California Department of Pesticide Regulation. 23-Aug-00.

Malacha Hydro Limited Partnership. 2000. *Much Valley Hydroelectric Project: Water Surfacec Records, Monthly Summary, Pit River/Afterbay H2O quality Averages for 1994-1995 to 1997 to 1998. Jun-99.* Malacha Hydro Limited Partnership, provided to the RWQCB in 2000.

Miller J., and M. Miller. 2000. *Identification Of Diazinon And Chlorpyrifos Toxicity To Ceriodrapnia In Samples Of Surface Water Using Antibody – Mediated Chemical – Specific Removal Processes: VOL. 1 OF 3: Report And Appendacies.* Sept 2000. SWRCB, CALEPA, Aqua – Sciences

Montoya, B.L. 1999. *Water Quality Assessment of the State Water Project, 1996-1997.* DWR

Montoya, B.L. 2000. *Water Quality Assessment of the State Water Project, 1998-99.* DWR

Municipal Water Quality Investigations Program. 1999. *Compendium of Water Quality Investigations in the Sacramento River Watershed, Sacramento-San Joaquin Delta, and San Francisco Bay Area. California Department of Water Resources.* August 1999.

MWD. 2000. *MTBE Survery Results* (Data and Memo to Mike Paulucci). MWD. May-00.

Nordmark, C. 1997. *Preliminary Results of Acute and Chronic Toxicity Testing of Surface Water Monitored in the San Joaquin River Watershed, Winter 1996-97.* CDPR. 6-Jun-97.

Nordmark, C. 1998. *Preliminary results of acute and chronic toxicity testing of surface water monitored in the Sacramento River watershed, winter 1997-98.* Memorandum to Don Weaver, Environmental Monitoring and Pest Management, Department of Pesticide Regulation, Sacramento. July 31, 1998.

Nordmark, C. 1999. *Preliminary Results of Acute and Chronic Toxicity Testing of Surface Water Monitored in the Sacramento River Watershed, Winter 1998-99.* CDPR. 26-May-99.

Nordmark, C., K.P. Bennett, H. Feng, J. Hernandez, P. Lee. 1998. *Occurrence of Aquatic Toxicity and Dormant-Spray Pesticide Detections in the Sacramento River Watershed, Winter 1996-97.* CDPR. Feb-98.

Nordmark C.E., K.P. Bennett, H. Feng, and J.Hernandez. 1999. *Memorandum to Don Weaver, Preliminary Results of Acute and Chronic Toxicity Testing of Surface Water Monitored in The Sacramento River Watershed, Winter 1998-99.* CDPR. May-99.

Novartis Crop Protection, Inc. 1997. *An Ecological Risk Assessment of Diazinon in the Sacramento and San Joaquin River Basins.* Novartis Crop Protection, Inc. , Greensboro, NC, Environmental and Public Affairs Department. Oct-97.

Oakhurst WWTF. 1999. *WDR Order No. 99-052*, Madera County Maintenance District No 22A, Oakhurst WWFT, Madera County. RWQCB

Poletika, N.N., and Robb, C.K. 1998. *Monitoring Study to Charactorize Chlorpyrifos Concentration Patterns and Ecological Risk in an Agriculturally Dominated Tributary of the San Joaquin River.* Dow AgroSciences. Nov-98.

Poletika, N.N., and Robb, C.K. 1999. *A Monitoring Study to Characterize Chlorpyrifos Concentration Patterns and Ecological Risk in an Agriculturally Dominated Tributary of the San Joaquin River: Part 2.* Dow AgroSciences LLC. Dec-99.

Redding, City of. 2001. *Data Set: Ca, Cu, and Zn in Sacramento River (graphs and data).* City of Redding. 5/14/01.

Reuter, J.E. , D.G. Slotton, S. M. Ayers, and C.R. Goldman. 2000. *Mercury Distribution in the Sediment and Biota of Davis Creek and Davis Creek Reservoir – McLaughlin Gold Mine Project, Yolo County, CA..* Aug-00.

Reyes E., H. Bailey, D. Hinton, V. Connor. 1998. The Role Of Microorganisms and Zinc In the Cerodaphnia Morality Observed in Sacramento River Bioassay in VM Medicine and Epidemiology

Ross L., R. Stein, J. Hsu, J. White, and K. Hefner. 2000. *Insecticide Concetrations in the San Joaquin River Watershed, California Summer 1991 and 1992.* DPR. AUG 2000.

Roth, J. 1997. *Letter to Gary Carlton from Julie Roth.* Oct. 1997. DSCSOC

Roth, J. 1998. *Letter to William Taylor, PhD, Agency for Toxic Substance and Disease Registry, from Julie Roth.* Sept. 1998. DSCSOC

Roth, J. 2000. *Letter to Mr. and Mrs. Corsella from Julie Roth.* Feb. 2000. DSCSOC

Roth, J. 2001. *Cover letter to Joe Karkoski from Julie Roth.* April 2001. DSCSOC

Roth D.A., H.E. Taylor, J. Domagalski, and P. Dileanis. 1998. *Distribution of Inorganic Mercury in Sacramento River Water and Sediment.*

Sacramento, City of. 2000. *Toxicity of Arcade Creek Stormwater to Ceriodaphnia dubia.*

San Joaquin River Exchange, Contractors Water Authority. *Special Issue Exchange Perspective: Unreasonable Water Quality Standards Proposed* (and letter preface).

SFEI. 1997. *San Francisco Estuary Regional Monitoring Program for Trace Substances: 1996 Annual Report. San Francisco Estuary Institute, Richmond, CA.* December-97.

SFEI. 1999. *San Francisco Estuary Regional Monitoring Program for Trace Substances: 1997 Annual Report.* San Francisco Estuary Institute, Richmond, CA. June-99.

SFEI. 1999. *Annual Monitoring Report: San Francisco Estuary Regional Monitoring Program for Toxic Substances. Report, Chapter 8.* http://www.sfei.org/rmp/1997/

SFEI. 2000. *Contaminant Concentrations in Fish from the Sac-SJ Delta and Lower SJR, 1998.* Sep-00.

SFEI. *Grassland Bypass Project, monthly monitoring report from October 1996 to February 2001.* http://www.sfei.org/grassland/reports/gbppdfs.htm.

SFEP (SF Estuary Project)/CALFED. 2000. *State of the Estuary 2000, Restoration Primer, SF Bay-Sac-SJ Delta Estuary.*

Sierra Nevada Alliance. 2001. *Disk/letter of information in response to the RWQCBs request for information for the 303(d) list.*

South Yuba River Citizens' League. 2001. Letter of recommendations from SYRCL *in response to the RWQCBs request for information for the 303(d) list.* Aug-00. South Yuba River Citizens' League

South Yuba River Citizens' League. *Water Monitoring Quality Assurance Project Plan (and letter summary).* Aug-00. South Yuba River Citizens' League

State Water Resources Control Board (SWRCB). *Consolidated Toxic Hot Spots Cleanup Plan.* Volume II: Regional Cleanup Plans. 1999.

Steensen, Chilcott, Grober, Eppinger, and Ranirez. 1998. *Compilation of Electrical Conductivity, Boron, and Selenium Water Quality Data for the Grassland Watershed and SJR, May 1985- September 1995.* RWQCB. Feb, 1998.

Stockton, City of. 1997. *NPDES, Ambient Water Quality Monitoring Program: Results of sampling Sutter Basin agricultural drain for suspected phenoxy compounds.* City of Stockton, Sutter County Department of Agriculture. Sutter County Department of Agriculture (personal communication). June 26, 1997.

Tetra Tech, Inc. 1998. *Analysis of Sedimentation and Action Plan Development for the Upper Fall River, Shasta County, California* (for Fall River Resources Conservation District). May 1998.

Thibeau, D. 1997. *Quality Assurance Project Plan (Category III) Clear Lake Basin Watershed Assessment.*

Thomas, C., and T. Maurer. 1999. *Contaminant Concentrations in Water Samples from Selected Sites on the San Joaquine River National Wildlife Refuge.* USFW. Nov-99.

Thompson B., R. Hoenicke, J. Davis, and A. Gunther. 2000. *An Overview Of Contaminant-Related Issues Identified by Monitoring in San Francisco Bay.* San Francisxo Estuary Regional Monitoring Program.

Tierney D., J. Giddings, L. Hall, Ke. *An Ecological Risk Assessment of Diazinon in the Sacramento and San Joaquin River Basins.* Novartis Crop Production, Inc.

Tomko, J. J. and K.M. Russick. 2000. *Evaluation of Effects of Existing Diazinon and Chlorpyrifos Levels Within Arcade Creek in Sacramento, CA.* Report to the Sacramento Area Stormwater Permittees. September 2000

Truong P., and S. Dabney. 2000. *Cache Creek Pollution Solution Forum.* Agricultural Research Service of USDA. May 2000.

UC Davis (UCD), Division of Environmental Studies. 1997. *Cache Creek Watershed Preliminary Mercury Assessment, Using Benthic Macro-Invertebrates.* CVRWQCB

UCD, Aquatic Toxicology Laboratory. 1999. *Toxicity of urban runoff in Modesto, California.* May 25, 1999. SWDB study 49

USDHHS-ATSDR (US Department of Health and Human Services, Agency for Toxic Substances and Disease Registry). 1997. *Health Consultation, Fish Sampling in Putah Creek 1996, Laboratory for Energy-Related Health Research, Davis, California* dated April 4, 1997. Agency for Toxic Substance and Disease Registry. April, 1997.

USDHHS-ATSDR. 1998. *Health Consultation, Fish Sampling in Putah Creek 1996, Laboratory for Energy-Related Health Research, Davis, California* dated September 17, 1998. Agency for Toxic Substance and Disease Registry. Sept. 1998.

USEPA (US Environmental Protection Agency (Office of Standards and Permits)). 1997. *Chlorpyrifos and Diazinon Contamination of Surface Waters to EPA Region IX.* EPA Office of Standards and Permits. July 1997.

USEPA (Office of Water, Office of Science and Technology). 1999. *1999 Update of Ambient Water Quality Criteria for Ammonia.* Dec, 1999. USEPA

USGS. 1998. *Occurrence and Distribution of Dissolved Pesticides in the San Joaquin River Basin, California.*

USGS. 1998. *Water Quality in the San Joaquin-Tulare Basins: California 1992-95.*

USGS. 2000. *Pesticides in Surface Water Measured at Select Sites in the Sacramento River Basin, California, 1996-1998.* Water-Resources Investigations Report 00-4203.

USGS. 2000. *Metals Transport in the Scramento River, CA, 1996 - 97, Vol 1: Interpretation of Metals Loads.*

USGS-NAWQA (National Water Quality Association). *Water-Quality Assessment of the Sacramento River Basin, California: Water-Quality, Sediment and Tissue Chemistry, and Biological Data, 1995-1998, Sacramento River Trace Metals Study.* (http://ca.water.usgs.gov/sac_nawqa/sacmetals.html)

vanderVeen, J. *Report of Storm Drain Data Fall/Winter of 99/00.* Friends of Deer Creek.

Vorster, A. 1990. *Water Quality Problems Associated with Operation of Pardee and Camanche Reservoir.* July 1990 (faxed). SWRCB.

Walker, W.J. 1997. *Notice of Emergency Remediation Measures Preliminary Report.* SECOR Internation, Inc. Jan-97.

William Abbott and Assoc. 1997. *Letter to Greg Vaughn, CVRWQCB, Re; Notice of Emergency Remediation Measures Gwin Mine, Calaveras County, California.* Jan-97.

Yuba City, City of. 2001. *Report Prepared for Water Treatment Plant.* 5/7/01.

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Appendix A

Numeric Criteria Fact Sheets

California Regional Water Quality Control Board, Central Valley Region
Draft Staff Report on Recommended Changes to California's Clean Water Act Section 303(d) List – Appendix A

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A Appendix - Numeric Criteria Fact Sheets

Regional Board staff developed "Fact Sheets" to describe the criteria used to interpret data for certain categories of pollutants. The Numeric Criteria Fact Sheets were developed for pollutants for which the Regional Board had a significant amount of information. For a category of pollutant, the Numeric Criteria Fact Sheets identify the beneficial uses that are likely impacted, the water quality objectives that are relevant to that pollutant, the criteria used to assess attainment of the water quality objectives, and a general description of how data were interpreted. Numeric Criteria Fact Sheets were developed for mercury, metals, pathogens, and pesticides.

A.1 Mercury Numeric Criteria Fact Sheet

A.1.1 Introduction

This fact sheet describes the basis for the Regional Board staff's evaluation of mercury information available for surface waters within the Central Valley region. The applicable beneficial uses and water quality objectives are described (as identified in the Regional Board's Basin Plan), the criteria used to interpret narrative water quality objectives are identified, and a summary of how data are generally evaluated relative to those criteria is provided.

A.1.2 Applicable Beneficial Uses

The following beneficial uses will most often apply in the evaluation of potential mercury impacts in surface waters (from pages II-1 and II-2 of the Basin Plan).

> **Cold Freshwater Habitat (COLD)** - Uses of water that support cold water ecosystems including, but not limited to, preservation or enhancement of aquatic habitats, vegetation, fish, or wildlife, including invertebrates.
>
> **Commercial and Sport Fishing (COMM)** – Uses of water for commercial or recreational collection of fish, shellfish, or other organisms including, but not limited to, uses involving organisms intended for human consumption or bait purposes.
>
> **Municipal and Domestic Supply (MUN)** - Uses of water for community, military, or individual water supply systems including, but not limited to, drinking water supply.
>
> **Warm Freshwater Habitat (WARM)** - Uses of water that support warm water ecosystems including, but not limited to, preservation or enhancement of aquatic habitats, vegetation, fish, or wildlife, including invertebrates.

Water Contact Recreation (REC-1) – Uses of water for recreational activities involving body contact with water, where ingestion of water is reasonably possible. These uses include, but are not limited to, swimming, wading, water-skiing, skin and scuba diving, surfing, white water activities, fishing, or use of natural hot springs.

Wildlife Habitat (WILD) – Uses of water that support terrestrial or wetland ecosystems including, but not limited to, preservation and enhancement of terrestrial habitats or wetlands, vegetation, wildlife (e.g., mammals, birds, reptiles, amphibians, invertebrates), or wildlife water and food sources.

A.1.3 Applicable Water Quality Objectives

The following narrative objectives potentially apply in the evaluation of mercury impacts in surface waters under the heading of toxicity from Section III of the Basin Plan:

Under the heading of **Chemical Constituents:**

> Waters shall not contain chemical constituents in concentrations that adversely affect beneficial uses. At a minimum, water designated for use as domestic or municipal supply (MUN) shall not contain concentrations of chemical constituents in excess of the maximum contaminant levels (MCLs) specified in the following provisions of Title 22 of the California Code of Regulations, which are incorporated by reference into this plan: Tables 64431-A (Inorganic Chemicals) and 64431-B (Fluoride) of Section 64431, Table 64444-A (Organic Chemicals) of Section 64444, and Tables 64449-A (Secondary Maximum Contaminant Levels-Consumer Acceptance Limits) and 64449-B (Secondary Maximum Contaminant Levels-Ranges) of Section 64449. This incorporation-by-reference is prospective, including future changes to the incorporated provisions as the changes take effect.

Under the heading of **Toxicity:**

> The narrative water quality objective for toxicity in the Basin Plan states, in part, "All waters shall be maintained free of toxic substances in concentrations that produce detrimental physiological responses in human, plant, animal, or aquatic life." The narrative toxicity objective further states that "The Regional Water Board will also consider ... numerical criteria and guidelines for toxic substances developed by the State Water Board, the California Office of Environmental Health Hazard Assessment, the California Department of Health Services, the U.S. Food and Drug Administration, the National Academy of Sciences, the USEPA, and other appropriate organizations to evaluate compliance with this objective." (CVRWQCB, 1998)

In addition to the narrative toxicity objective, the USEPA promulgated numeric water quality standards as part of the California Toxic Rule (CTR) in April 2000 (USEPA, 2000b). The CTR criterion of 0.05 µg/L (50 ng/L) total recoverable mercury protects humans from exposure to mercury in drinking water and contaminated fish. The standard is enforceable for all waters with a municipal and domestic water supply and/or any aquatic beneficial use designation. The federal rule did not specify duration or frequency terms; however, researchers have previously employed a 30-day averaging interval with an allowable exceedance frequency of once every three years for protection of human health, which is recommended for this effort (Marshack, personal communication).

A.1.4 Numeric Criteria Used

Various government entities have developed numeric criteria for mercury in fish tissue and water for both human health and wildlife protection. The following describes some of the criteria that could be used to interpret the Regional Board's narrative toxicity water quality objective.

Mercury in Fish Tissue

The National Academy of Sciences (NAS) numeric mercury guideline of 0.5 µg/g (parts per million [ppm]) (NAS, 1973) applies to whole, freshwater fish and marine shellfish. The NAS criterion was developed for the purpose of wildlife protection. The USEPA has also established wildlife criteria for the Great Lakes Water Quality Initiative (USEPA, 1995) and the Mercury Study Report to Congress (USEPA, 1997a). These USEPA criteria suggest that a range of mercury in fish tissue of 0.08 ppm (trophic level 3 [TL3] fish) to 0.35 ppm (trophic level 4 [TL4] fish) should be protective of wildlife. Because wildlife generally consume lower trophic level (and smaller) fish, the human health and wildlife criteria are not directly comparable.

The United States Food and Drug Administration (USFDA) action level for fish tissue of 1.0 ppm (USFDA, 1984) applies to the edible portion of commercially caught freshwater and marine fish for the protection of human health. Action levels are health-based advisory levels for chemicals for which primary maximum contaminant levels (MCLs) have not been adopted.

The USEPA recently established a criterion of 0.3 ppm methylmercury in the edible portions of fish for protection of human health (USEPA, 2001). For 303(d) fact sheet development, USEPA's criterion of 0.3 ppm is applied. This criterion is the most conservative and the most recently established.

Mercury in Surface Water

The USEPA and the California Department of Health Services determined that a MCL of 2.0 micrograms per liter (µg/L) (2,000 ng/L) be established for mercury in drinking water (Marshack, 2000). The CTR criterion, which also applies to mercury in surface waters, is discussed above.

All available criteria are summarized in Table A-1.

Table A-1. Mercury Criteria		
Agency	**Hg in fish tissue (mg/kg)**	**Hg in Surface Water (µg/L)**
USEPA Criterion, Methyl Mercury	0.3	
NAS Guideline for Wildlife Protection	0.5	
USFDA Action Level for Human Consumption	1.0	
CDHS & USEPA Primary MCL (inorganic Hg)		2
USEPA CTR Human Health – (Drinking Water & Aquatic Organism Consumption-inorganic mercury)		0.05

A.1.5 Data Interpretation

Mercury in Fish Tissue

The mercury criterion for fish tissue derived by USEPA is based on an average allowable intake of mercury by humans per day and an average consumption rate. The criterion is based on human consumption and accumulation of mercury over time. Mercury tends to accumulate in fish that are at top trophic levels and concentrations typically increase with fish age and size. When evaluating mercury fish tissue data, staff compared the average mercury concentrations in fish tissue samples of top trophic level fish (trophic level 4 fish – including mostly bass and catfish) to the USEPA human health criterion of 0.3 mg/kg (ppm). Average concentrations of mercury in trophic level 3 fish (e.g., trout, suckers, carp, and pikeminnow) were evaluated when there were limited data for trophic level 4 fish.

This approach may be conservative because people may eat a mix of trophic level 3 and 4 fish. In contrast to the potentially conservative approach of considering only trophic level 4 fish, the USEPA default consumption rate may not be representative of fishing populations in Central Valley waters (i.e consumption rates may be higher in the Central Valley). Staff calculated a weighted average based on the number of fish in the composite sample analyzed.

Exceptions to the general approach for evaluating mercury in fish tissue are described in the specific fact sheets.

Mercury in Surface Water

In contrast to fish tissue data, data from water samples are location and time specific. An initial screening of available water quality data was performed by determining whether a minimum of ten water samples was available and whether there was a minimum of two exceedances of the CTR criterion of 0.05 µg/L. If the minimum amount of data were available, staff then performed a more intensive review of the available data to determine whether the CTR criterion was being attained. Staff considered the CTR exceedance frequency of once every three years when evaluating the data.

A.2 Metals Numeric Criteria Fact Sheet

A.2.1 Introduction

This fact sheet describes the Regional Board staff's evaluation of metals information available for surface waters within the Central Valley Region. The applicable beneficial uses and water quality objectives are described (as identified in the Regional Board's Basin Plan), the criteria used to interpret narrative water quality objectives are identified, and a summary of how data are generally evaluated relative to those criteria given.

A.2.2 Applicable Beneficial Uses

The following beneficial uses will most often apply in the evaluation of potential metals impact in surface waters (from pages II-1 and II-2 of the Basin Plan).

Agricultural Supply (AGR) - Uses of water for farming, horticulture, or ranching including, but not limited to, irrigation (including leaching of salts), stock watering, or support of vegetation for range grazing.

Cold Freshwater Habitat (COLD) - Uses of water that support cold water ecosystems including, but not limited to, preservation or enhancement of aquatic habitats, vegetation, fish, or wildlife, including invertebrates.

Commercial and Sport Fishing (COMM) – Uses of water for commercial or recreational collection of fish, shellfish, or other organisms including, but not limited to, uses involving organisms intended for human consumption or bait purposes.

Municipal and Domestic Supply (MUN) - Uses of water for community, military, or individual water supply systems including, but not limited to, drinking water supply.

Warm Freshwater Habitat (WARM) - Uses of water that support warm water ecosystems including, but not limited to, preservation or enhancement of aquatic habitats, vegetation, fish, or wildlife, including invertebrates.

Water Contact Recreation (REC-1) – Uses of water for recreational activities involving body contact with water, where ingestion of water is reasonably possible. These uses include, but are not limited to, swimming, wading, water-skiing, skin and scuba diving, surfing, white water activities, fishing, or use of natural hot springs.

Wildlife Habitat (WILD) – Uses of water that support terrestrial or wetland ecosystems including, but not limited to, preservation and enhancement of terrestrial habitats or wetlands, vegetation, wildlife (e.g., mammals, birds, reptiles, amphibians, invertebrates), or wildlife water and food sources.

A.2.3 Applicable Water Quality Objectives

The following narrative objectives potentially apply in the evaluation of metals impact in surface waters under the heading of toxicity from Section III of the Basin Plan:

Under the heading of **Chemical Constituents:**

> Waters shall not contain chemical constituents in concentrations that adversely affect beneficial uses. At a minimum, water designated for use as domestic or municipal supply (MUN) shall not contain concentrations of chemical constituents in excess of the maximum contaminant levels (MCLs) specified in the following provisions of Title 22 of the California Code of Regulations, which are incorporated by reference into this plan: Tables 64431-A (Inorganic Chemicals) and 64431-B (Fluoride) of Section 64431, Table 64444-A (Organic Chemicals) of Section 64444, and Tables 64449-A (Secondary Maximum Contaminant Levels-Consumer Acceptance Limits) and 64449-B (Secondary Maximum Contaminant Levels-Ranges) of Section 64449. This incorporation-by-reference is prospective, including future changes to the incorporated provisions as the changes take effect.

Under the heading of **Toxicity**:

> The narrative water quality objective for toxicity in the Basin Plan states, in part, "All waters shall be maintained free of toxic substances in concentrations that produce detrimental physiological responses in human, plant, animal, or aquatic life." The narrative toxicity objective further states that "The Regional Water Board will also consider ... numerical criteria and guidelines for toxic substances developed by the State Water Board, the California Office of Environmental Health Hazard Assessment, the California Department of Health Services, the U.S. Food and Drug Administration, the National Academy of Sciences, the USEPA, and

other appropriate organizations to evaluate compliance with this objective." (CVRWQCB, 1998)

In addition to the narrative toxicity objective, the USEPA promulgated numeric water quality standards as part of the California Toxic Rule (CTR) in April 2000 (USEPA, 2000b). The applicable CTR criteria are described in Table A-2 below.

A.2.4 Numeric Criteria Used

Several numeric criteria have been developed by state and federal agencies to assess surface water impairment by metals toxicity. The following describes some of the criteria that could be used to interpret the Regional Board's narrative water quality objectives. For waters with both drinking water and aquatic life beneficial uses, the most stringent criterion was applied.

Department of Health Services (DHS) and United States Environmental Protection Agency (USEPA) develop Maximum Contaminant Levels (MCLs) as part of their drinking water standards. Primary MCLs are derived from health-based criteria (e.g., cancer risk) and secondary MCLs are derived from human welfare considerations (e.g., taste, odor, and laundry staining). Primary and secondary MCLs can be applied to both surface and groundwater and may be used to interpret narrative objectives to prohibit toxicity in drinking water.

The Food and Agriculture Organization of the United Nations published *Water Quality for Agriculture* in 1985, which contains criteria protective of agricultural uses of water.

The California Water Code and Section 303 of the Clean Water Act requires the preparation and adoption of a Basin Plan. The Basin Plan identifies the beneficial uses of navigable waters and provides water quality objectives based on those uses. Since federal law defines the combination of beneficial uses and water quality objectives as water quality standards, the Basin Plan is a regulatory reference for meeting the state and federal requirements for water quality control. Metals objectives provided in the Basin Plan are based on a water hardness of 40 mg/L (as $CaCO_3$). The Basin Plan also contains equations to derive objectives for hardness other than 40 mg/L.

The California Toxics Rule (CTR) was promulgated in April 2000 when USEPA developed water quality criteria for priority toxic pollutants in California's inland surface waters (USEPA, 2000). Together the CTR criteria and the Basin Plan beneficial uses are applied to water quality standards. All CTR metals criteria presented in Table A-2 are based on 40 mg/L hardness (as $CaCO_3$). Since the continuous and maximum criteria vary with hardness, the CTR provides equations to derive the adjusted criteria for water samples with a hardness other than 40 mg/L.

Regional Board staff did not use the aluminum 4-day average recommended criterion published by USEPA. In a recent document that included corrections to a number of criteria developed by USEPA, the following footnote was included for the aluminum 4-day average criterion:

"There are three major reasons why the use of Water-Effect Ratios might be appropriate. (1) The value of 87 µg/l is based on a toxicity test with the striped bass in water with pH= 6.5-6.6 and hardness <10 mg/L. Data in "Aluminum Water-Effect Ratio for the 3M Plant Effluent Discharge, Middleway, West Virginia" (May 1994) indicate that aluminum is substantially less toxic at higher pH and hardness, but the effects of pH and hardness are not well quantified at this time. (2) In tests with the brook trout at low pH and hardness, effects increased with increasing concentrations of total aluminum even though the concentration of dissolved aluminum was constant, indicating that total recoverable is a more appropriate measurement than dissolved, at least when particulate aluminum is primarily aluminum hydroxide particles. In surface waters, however, the total recoverable procedure might measure aluminum associated with clay particles, which might be less toxic than aluminum associated with aluminum hydroxide. (3) EPA is aware of field data indicating that many high quality waters in the U.S. contain more than 87 µg aluminum/L, when either total recoverable or dissolved is measured."

Based on the significant qualifications associated with the aluminum 4-day average criteria, Regional Board staff believes that site specific evaluation of potential chronic effects of aluminum are necessary prior to making a determination to add waters to the 303(d) list based on chronic aluminum impairment. Central Valley waters in general do not have the combination of low pH and hardness that the toxicity test had, upon which the criterion was based. Additionally, a portion of the aluminum observed in Central Valley waters is likely to be associated with clay particles, which, as stated by USEPA, may be less toxic than aluminum associated with aluminum hydroxide. Regional Board staff did apply the acute aluminum criterion, because USEPA did not make a similar qualification regarding the applicability of the acute criterion.

Regional Board staff did not apply the secondary MCL for iron in its evaluation of iron water quality data. Regional Board staff will be developing a proposed drinking water policy for Central Valley waters. That policy will identify both the relevant drinking water criteria as well as the appropriate point of application of those criteria. For this reason, Regional Board staff believes that additions to the 303(d) list based on exceedance of the iron secondary MCL would be premature. Regional Board staff did apply the site-specific iron water quality objective identified in the Basin Plan in the evaluation of iron water quality data.

All applicable water quality objectives and numeric criteria are summarized in Table A-2.

Table A-2. Metals Criteria (µg/L)

	Chemical Constituents				CTR Criteria		
Metal	Primary MCL	Secondary MCL	Ag Water Quality Goals	Numeric Objective (Basin Plan)	Freshwater Aquatic Life 4-Day Avg Concentration (Dissolved)	Freshwater Aquatic Life 1-Hr Avg Concentration (Dissolved)	Human Health – (Drinking Water & Aquatic Organism Consumption)
Al	1000[a]	200[a]	5000		87[f,h]	750[f]	
As	50[a,b]		100	10[c]	150	340	
Cd	5[b]		10	0.22[d]	1.1	1.6	
Cu	1300[a,b]	1000[a]	200	5.6[d], 10[c]	4.1	5.7	1300
Fe		300[a,i]	5000	300[c]		1000[f,g]	
Pb	15[a,b]		5000		0.92	24	
Mn		50[a]	200	50[c]			
Ni	100[a]		200		24	220	610
Zn		5000[a]	2000	100[c], 16[d]	54	54	9100[f]
pH		6.5-8.5[b]		6.5-8.5[e]		6.5-9.0[g]	

a California Department of Health Services criterion
b U.S. Environmental Protection Agency criterion
c Applies only to Sacramento River from Keswick Dam to the I Street Bridge at City of Sacramento; American River from Folsom Dam to the Sacramento River; Folsom Lake; and the Sacramento-San Joaquin Delta expressed as a dissolved concentration.
d Applies only to Sacramento River and its tributaries above State Hwy 32 bridge at Hamilton City
e Or a change of 0.5, Goose Lake criteria range 7.5-9.5
f Total recoverable concentration. USEPA National Recommended Ambient Water Quality Criteria; CTR and NTR values have not been promulgated.
g Instantaneous maximum. National Ambient Water Quality Criteria, not CTR value.
h Not used in evaluation of aluminum data. See discussion in main text above.
i Not used in evaluation of iron data. See discussion main text above.

A.2.5 Data Interpretation – METALS

Data from water samples are both location and time specific. In recognition of the discrete nature of water quality sample results, Regional Board staff considered the following factors in reviewing available data: 1) total number of samples collected; 2) total number of exceedances of criteria; 3) magnitude of exceedances of criteria; and 4) frequency of exceedance of criteria. An initial screening of available water quality data was performed by determining whether a minimum of ten water samples was available and whether there was a minimum of two exceedances. If the minimum amount of data were available, staff then performed a more intensive review of the available data to determine whether the applicable criteria were being attained. Staff considered the CTR exceedance frequency of once every three years when evaluating the data.

METALS

If exceedances appeared to occur infrequently (e.g., less than once every three years), then no recommendation for listing was made. In evaluating exceedances of chronic water quality criteria (often expressed as a four-day average), data over consecutive days were often not available. Regional Board staff evaluated the available data to determine whether exceedance of the chronic criteria could be inferred based on the magnitude of the exceedance or based on data collected prior to and after the data point being evaluated. A significant exceedance of a chronic criterion on a single day (e.g. by a factor of 4) would imply exceedance of the 4-day average criterion. Exceedance of the

chronic criteria over successive (although non-consecutive) sampling events would also imply exceedance of the criteria.

In general, waters were listed as impaired due to a particular metal when the available information indicated that the criteria would likely be exceeded on a periodic basis (i.e., the exceedance is not a unique event). A few data points with consistent (and/or substantial) exceedances could provide evidence of impairment in one case, whereas, more data points would be needed in another instance in which infrequent exceedances occurred. A specific description of how data were interpreted is contained in the fact sheets for each 303(d) list recommendation.

If available water quality data did not indicate exceedances of criteria, if few data points were available (e.g., less than 10 sampling events), or if an exceedance appeared to be a unique event, no recommendation for adding the water and pollutant to the 303(d) list was made. In some cases, the information available indicated that there may be an impairment, but not enough data were available to indicate that the exceedances occurred on a periodic basis. For those waters, a recommendation for further assessment is made.

The extent of impairment is based on the location of samples and evidence of relevant metal sources. The extent of impairment would be minimally defined as the distance between sampling points at which exceedances of criteria were found. Land use information, and the relative location of potential dilution flows were also considered in identifying the extent of impairment.

A.3 Pathogen Numeric Criteria Fact Sheet

A.3.1 Introduction

This fact sheet describes the basis for the Regional Board's evaluation of pathogen information available for surface waters within the Central Valley Region. The applicable beneficial uses and water quality objectives are described (as identified in the Regional Board's Basin Plan), the criteria used to interpret narrative water quality objectives are identified, and a summary of how data is generally evaluated relative to those criteria is given.

A.3.2 Applicable Beneficial Uses

The following beneficial uses will most often apply in the evaluation of potential pathogen impacts in surface waters (from pages II-1 and II-2 of the Basin Plan):

> **Agricultural Supply (AGR)** - Uses of water for farming, horticulture, or ranching including, but not limited to, irrigation (including leaching of salts), stock watering, or support of vegetation for range grazing.

Municipal and Domestic Supply (MUN) - Uses of water for community, military, or individual water supply systems including, but not limited to, drinking water supply.

Shellfish Harvesting (SHELL) - Uses of water that support habitats suitable for the collection of filter-feeding shellfish (e.g., clams, oysters, and mussels) for human consumption, commercial, or sports purposes.

Water Contact Recreation (REC-1) - Uses of water for recreational activities involving body contact with water, where ingestion of water is reasonably possible. These uses include, but are not limited to, swimming, wading, water-skiing, skin and scuba diving, surfing, white water activities, fishing, or use of natural hot springs.

A.3.3 Applicable Water Quality Objectives

The most sensitive beneficial use for pathogen impairment is contact recreation. The Basin Plan contains a specific objective for fecal coliform bacteria. (CRWQCB-CVR, 1998; http://www.swrcb.ca.gov/rwqcb5/bsnplnab.pdf). The Basin Plan states, "In waters designated for contact recreation (REC-1), the fecal coliform concentration based on a minimum of not less than five samples for any 30-day period shall not exceed a geometric mean of 200/100 ml, nor shall more than ten percent of the total number of samples taken during any 30-day period exceed 400/100 ml.

For Folsom Lake (50), the fecal coliform concentration based on a minimum of not less than five samples for any 30-day period, shall not exceed a geometric mean of 100/100 ml, nor shall more than ten percent of the total number of samples taken during any 30-day period exceed 200/100 ml."

In addition to the specific Basin Plan objective for bacteria the narrative toxicity objective also is applicable. The narrative toxicity objective in the Basin Plan states, in part, "All waters shall be maintained free of toxic substances in concentrations that produce detrimental physiological responses in human, plant, animal, or aquatic life." The narrative toxicity objective further states the " the Regional Water Board will also consider...numerical criteria and guidelines developed by the State Water Board, the California Office of Environmental Health Hazard Assessment, the California Department of Health Services...the U.S. Environmental Protection Agency, and other organizations to evaluate compliance with this objective."

A.3.4 Numeric Criteria Used

Pathogen guidelines and criteria have been developed for the protection of human health by the California Department of Health Services (DHS) (Title 17 California Code of Regulation section 7958). DHS has also published draft guidelines for posting/closure of freshwater beaches DHS, July 2000 http://www.dhs.ca.gov/ps/ddwem/beaches/freshwater.htm) . USEPA has also issued criteria for bacteria (*Ambient Water Quality Criteria for Bacteria* (USEPA, 1986)). USEPA has requested that states adopt E. coli and enterococci indicators, rather than total or fecal coliforms by federal fiscal year 2003. The recommendation is based on studies that indicate that *E. coli* and enterococci show a strong correlation between swimming-associated illness and the microbiological quality of the waters used by recreational bathers (USEPA, 1986).

Table A-3. Bacteria Water Quality Standards

California Department of Health Services Standards Criteria are expressed as Most Probable Number (MPN) per 100 milliliters					
	Total Coliform	**Fecal Coliform**	**enterococcus**		***E. coli***
30 day log mean[1]	1,000	200	35		126[2]
Single Sample	10,000	400	104	61[2]	235[2]
USEPA Standards Criteria are expressed as Most Probable Number (MPN) per 100 milliliters					
	Total Coliform	**Fecal Coliform**	**enterococcus**		***E. coli***
30 day geometric mean[1]			33		126
Single Sample[3]			61		235
CVRWQCB Basin Plan Criteria Criteria are expressed as Most Probable Number (MPN) per 100 milliliters					
30 day		200			
10% of the samples shall not exceed		400			

1. The geometric mean and the log mean statistical methods are equivalent for non-zero, positive data sets.
2. Draft guidelines for posting/closure of freshwater beaches DHS, July 2000.
3. Single sample values for posting/closing beaches are statistically derived. The values presented in the tables are for "designated bathing beach" areas. Less restrictive numbers may be calculated for areas with lower frequency of contact recreational use. (USEPA 1986)

A.3.5 Data Interpretation

Pathogen criteria differ from other pollutant types in that the pollutant is not measured directly but uses indicator organisms to assess the likelihood of a water body being impaired. The criteria, adopted by U.S.EPA, used a risk level value of no more than eight illnesses per 1,000 swimmers for fresh waters, and no more than 19 illnesses per 1,000 swimmers for marine waters (USEPA 2001). The numerical values are "steady state" geometric mean values. U.S. EPA recommends a sampling protocol of a minimum of not less than five samples taken over not more than a 30-day period (USEPA 1986). DHS standards and recommended criteria are similar to EPA's and are also based on a statistically significant sample sizes. The primary difference between DHS and USEPA is the statistical methods used to derive the steady state number. USEPA uses a geometric mean calculation and DHS uses a log-mean calculation. The statistical methods are equivalent with non-zero positive data sets.

Monitoring studies of the indicator organisms for pathogens outside of designated swimming areas are variable in scope and frequently contain a limited number of samples. Data sets that include multiple sampling events per month (weekly or bi-weekly for example) and that span multiple months will be statistically evaluated and compared to the EPA standards. If the geometric means exceed the criteria a recommendation for listing for impairment by pathogens will be made. Single samples that exceed the recommendations for beach closure may not, in the absence of additional monitoring, be evidence of an ongoing, or seasonal, problem that would justify the listing of the water body.

A.4 Pesticide Numeric Criteria Fact Sheet

A.4.1 Introduction

This fact sheet describes the basis for the Regional Board's evaluation of pesticide information available for surface waters within the Central Valley Region. The applicable beneficial uses and water quality objectives are described (as identified in the Regional Board's Basin Plan), the criteria used to interpret narrative water quality objectives are identified, and a summary of how data is generally evaluated relative to those criteria is given.

A.4.2 Applicable Beneficial Uses

The following beneficial uses will most often apply in the evaluation of potential pesticide impacts in surface waters (from pages II-1 and II-2 of the Basin Plan):

> **Water Contact Recreation (REC-1)** - Uses of water for recreational activities involving body contact with water, where ingestion of water is reasonably possible. These uses include, but are not limited to, swimming, wading, water-

skiing, skin and scuba diving, surfing, white water activities, fishing, or use of natural hot springs.

Warm Freshwater Habitat (WARM) - Uses of water that support warm water ecosystems including, but not limited to, preservation or enhancement of aquatic habitats, vegetation, fish, or wildlife, including invertebrates.

Cold Freshwater Habitat (COLD) - Uses of water that support cold water ecosystems including, but not limited to, preservation or enhancement of aquatic habitats, vegetation, fish, or wildlife, including invertebrates.

Municipal and Domestic Supply (MUN) - Uses of water for community, military, or individual water supply systems including, but not limited to, drinking water supply.

A.4.3 Applicable Water Quality Objectives

The following narrative objectives potentially apply in the evaluation of potential pesticide impacts in surface waters (from Section III of the Basin Plan).

Under the heading of **Chemical Constituents:**

> Waters shall not contain chemical constituents in concentrations that adversely affect beneficial uses. At a minimum, water designated for use as domestic or municipal supply (MUN) shall not contain concentrations of chemical constituents in excess of the maximum contaminant levels (MCLs) specified in the following provisions of Title 22 of the California Code of Regulations, which are incorporated by reference into this plan: Tables 64431-A (Inorganic Chemicals) and 64431-B (Fluoride) of Section 64431, Table 64444-A (Organic Chemicals) of Section 64444, and Tables 64449-A (Secondary Maximum Contaminant Levels-Consumer Acceptance Limits) and 64449-B (Secondary Maximum Contaminant Levels-Ranges) of Section 64449. This incorporation-by-reference is prospective, including future changes to the incorporated provisions as the changes take effect.

Under the heading of **Pesticides:**

- No individual pesticide or combination of pesticides shall be present in concentrations that adversely affect beneficial uses.
- Discharges shall not result in pesticide concentrations in bottom sediments or aquatic life that adversely affect beneficial uses.
- Total identifiable persistent chlorinated hydrocarbon pesticides shall not be present in the water column at concentrations detectable within the accuracy of analytical methods approved by the Environmental Protection Agency or the Executive Officer.

- Pesticide concentrations shall not exceed those allowable by applicable antidegradation policies(see State Water Resources Control Board Resolution No. 68-16 and 40 C.F.R. Section 131.12.).
- Pesticide concentrations shall not exceed the lowest levels technically and economically achievable.
- Waters designated for use as domestic or municipal supply (MUN) shall not contain concentrations of pesticides in excess of the Maximum Contaminant Levels set forth in California Code of Regulations, Title 22, Division 4, Chapter 15.
- Waters designated for use as domestic or municipal supply (MUN) shall not contain concentrations of thiobencarb in excess of 1.0 mg/l.

Where more than one objective may be applicable, the most stringent objective applies. For the purposes of this objective, the term pesticide shall include: (1) any substance, or mixture of substances which is intended to be used for defoliating plants, regulating plant growth, or for preventing, destroying, repelling, or mitigating any pest, which may infest or be detrimental to vegetation, man, animals, or households, or be present in any agricultural or nonagricultural environment whatsoever, or (2) any spray adjuvant, or (3) any breakdown products of these materials that threaten beneficial uses. Note that discharges of "inert" ingredients included in pesticide formulations must comply with all applicable water quality objectives.

Under the heading of **Toxicity:**

All waters shall be maintained free of toxic substances in concentrations that produce detrimental physiological responses in human, plant, animal, or aquatic life. This objective applies regardless of whether the toxicity is caused by a single substance or the interactive effect of multiple substances. Compliance with this objective will be determined by analyses of indicator organisms, species diversity, population density, growth anomalies, and biotoxicity tests of appropriate duration or other methods as specified by the Regional Water Board. The Regional Water Board will also consider all material and relevant information submitted by the discharger and other interested parties and numerical criteria and guidelines for toxic substances developed by the State Water Board, the California Office of Environmental Health Hazard Assessment, the California Department of Health Services, the U.S. Food and Drug Administration, the National Academy of Sciences, the U.S. Environmental Protection Agency, and other appropriate organizations to evaluate compliance with this objective.

The survival of aquatic life in surface waters subjected to a waste discharge or other controllable water quality factors shall not be less than that for the same water body in areas unaffected by the waste discharge, or, when necessary, for

other control water that is consistent with the requirements for "experimental water" as described in *Standard Methods for the Examination of Water and Wastewater*, latest edition. As a minimum, compliance with this objective as stated in the previous sentence shall be evaluated with a 96-hour bioassay.

Further explanation of the interpretation of surface water monitoring information can be found in section IV (Implementation) of the Basin Plan, as follows:

Under *Policy for Application of Water Quality Objectives*

Where multiple toxic pollutants exist together in water, the potential for toxicologic interactions exists. On a case by case basis, the Regional Water Board will evaluate available receiving water and effluent data to determine whether there is a reasonable potential for interactive toxicity. Pollutants which are carcinogens or which manifest their toxic effects on the same organ systems or through similar mechanisms will generally be considered to have potentially additive toxicity. The following formula will be used to assist the Regional Water Board in making determinations:

$$\sum_{i=1}^{n} \frac{[\text{Concentration of Toxic Substance}]_i}{[\text{Toxicologic Limit for Substance in Water}]_i} < 1.0$$

The concentration of each toxic substance is divided by its toxicologic limit. The resulting ratios are added for substances having similar toxicologic effects and, separately, for carcinogens. If such a sum of ratios is less than one, an additive toxicity problem is assumed not to exist. If the summation is equal to or greater than one, the combination of chemicals is assumed to present an unacceptable level of toxicologic risk.

Under the heading of **Pesticide Discharges from Nonpoint Sources**

In conducting a review of pesticide monitoring data, the Board will consider the cumulative impact if more than one pesticide is present in the water body. This will be done by initially assuming that the toxicities of pesticides are additive. This will be evaluated separately for each beneficial use using the following formula:

$$\frac{C1}{O1} + \frac{C2}{O2} + \ldots + \frac{Ci}{Oi} = S$$

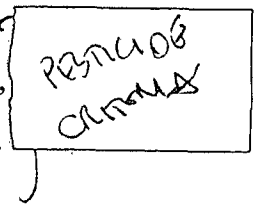
Where:

C = The concentration of each pesticide.

O = The water quality objective or criterion for the specific beneficial use for each pesticide present, based on the best available information. Note that the

numbers must be acceptable to the Board and performance goals are not to be used in this equation.
S = The sum. A sum exceeding one (1.0) indicates that the beneficial use may be impacted.

For most pesticides, numerical water quality objectives have not been adopted. USEPA criteria and other guidance are also extremely limited. Since this situation is not likely to change in the near future, the Board will use the best available technical information to evaluate compliance with the narrative objectives. Where valid testing has developed 96 hour LC50 values for aquatic organisms (the concentration that kills one half of the test organisms in 96 hours), the Board will consider one tenth of this value for the most sensitive species tested as the upper limit (daily maximum) for the protection of aquatic life. Other available technical information on the pesticide (such as Lowest Observed Effect Concentrations and No Observed Effect Levels), the water bodies and the organisms involved will be evaluated to determine if lower concentrations are required to meet the narrative objectives.



In addition to the narrative toxicity objective, the USEPA promulgated numeric water quality standards as part of the California Toxic Rule (CTR) in April 2000 (USEPA, 2000b). The applicable CTR criteria are described in Table A-5 below.

A.4.4 Numeric Criteria Used

Regional Board staff used the following hierarchy to determine the applicable criteria for use in evaluating potential impacts on aquatic life: 1) Regional Board adopted performance goals (numeric performance goals are described for some rice pesticides); 2) the most recently developed USEPA/Department of Fish & Game criteria; and 3) Canadian water quality guidelines.

Regional Board staff used the following hierarchy to determine the applicable criteria for use in evaluating potential drinking water impacts: 1) Regional Board adopted performance goals (a numeric water quality objective for thiobencarb has been established for MUN uses); 2) the most recently developed USEPA/Department of Health Services criteria; and 3) Canadian drinking water quality guidelines.

For waters with both drinking water and aquatic life beneficial uses, the most stringent criterion was applied.

The table below describes some of the criteria that could be used to interpret the Regional Board's narrative water quality objectives. The numbers in **bold** are the criteria used to evaluate available data on pesticide levels in surface waters for the purpose of providing recommendations to the State Board on changes to the 303(d) list. The DDT and DDE criteria were adopted by the USEPA as part of the California Toxics Rule and therefore

are the applicable standards where fishing (i.e.. REC 1) is a beneficial use of water. The thiobencarb water quality objective is identified in the Regional Board's Basin Plan for use where drinking water (i.e. MUN) is a designated use.

In general, the criteria presented are contained in the report and associated database *A Compilation of Water Quality Goals* (Marshack, 2000). The report includes criteria developed by the USEPA, California Department of Fish and Game, California Department of Health Services, and California Office of Environmental Health Hazard Assessment. In general, the criteria were developed either to protect human health through consumption of drinking water or to protect aquatic life. The criteria for DDT and DDE, although water column criteria, were derived in part to protect humans from consumption of contaminated fish.

Regional Board staff also used water quality guidelines from the Canadian Council of Environmental Ministers, the Canadian national environmental agency, when criteria derived in the U.S. were not available. The Canadian protocol for derivation of water quality guidelines to protect aquatic life includes a minimum toxicological data set for fish, invertebrates, and plants. (CCME, 1991). The guideline for a given pollutant is preferably derived based on the lowest-observable-effect level (LOEL) of the most sensitive stage of the most sensitive organism. The LOEL is multiplied by a safety factor of 0.1 to derive the guideline value. Alternatively, the guideline can be derived from studies of acute toxicity. In this case, the acute/chronic (i.e. LC50/ no-observed-effect concentration) ratio is applied by dividing the most sensitive LC50 by the acute to chronic ratio (ACR). If an ACR is not available universal application factors are applied for non persistent (0.05) vs. persistent (0.01) pollutants. The Canadian protocol is comparable to the methodology employed by the USEPA and California Department of Fish and Game.

Regional Board staff also considered criteria derived by the Pesticide Action Network from the AQUIRE database (Pesticide Action Network (PAN), 2001a, 2001b). The AQUIRE database is managed by USEPA and provides results from tens of thousands of toxicity tests. From the AQUIRE database, PAN derived an acute value by calculating the average LC50 (lethal concentration to 50% of the organisms) for the most sensitive species. PAN derived a chronic value by calculating the average concentration of the most sensitive non-lethal endpoint for the most sensitive species. For example, if reproduction for a particular invertebrate species was most sensitive to a pesticide, PAN averaged the toxicity endpoints of all the studies for that particular species and effect.

Regional Board staff is not recommending the use of the PAN criteria. The quality control and quality assurance (QA/QC) procedures for studies contained in the AQUIRE database are not consistent. The experimental conditions of the various studies may also vary. It is beyond the scope of the update of the 303(d) list to make a determination as to adequacy of the studies upon which the PAN criteria are based. The PAN criteria are displayed for comparative purposes only.

Table A-4. Aquatic Life Protection - Criteria are in µg/L					
Pesticide	**EPA Criteria**	**DFG Criteria**	**Canadian**	**PAN**	**Regional Board**
2,4-D				1.0	
Alachlor	**76**[a]			5.0	
Atrazine	12[b]		**1.8**	2.0	
Azinphos	**0.01**			0.024	
Bromacil			**5**	97	
Carbaryl		**2.53** (CCC & CMC)	0.20	1.0	
Carbofuran		0.5 (max)	1.8	2.0	**0.4**
Chlorpyrifos	0.041/0.083 (CCC/CMC)	**0.014/0.020** (CCC/CMC)	0.0035	0.003	
Cyanazine			**2.0**	0.1	
DDE				0.0018	
DDT	**0.01/1.1**[c] (CCC/CMC)			0.0055	
Diazinon	0.09 (draft CMC)	**0.05/0.08** (CCC/ CMC)		0.0018	
Diazoxon				8.9	
Dicamba	200		**0.06** (Irrigation water)		
Dieldrin	**0.056/0.24**[c] (CCC/CMC)			0.01	
Dimethoate			**6.2**	1.0	
Diuron				7.03	
Endosulfan II Beta	**0.056/0.22** (CCC/CMC)		0.02	0.1	
Endosulfan Sulfate	**0.056/0.22** (CCC/CMC)		0.02	212	
Fonofos				0.08	
Malathion	0.1	0.43 (CMC)		0.001	**0.1**
MCPA, dimethylamine salt			**2.6**	6.0	
Methidathion				0.3	
Methyl Parathion		0.08 (max)		0.0003	**0.13**
Molinate		13 (max)		3.0	**10**
Parathion	**0.013/0.065** (CCC/CMC)			0.0006	
Prometryn				0.75	
Propanil				0.5	

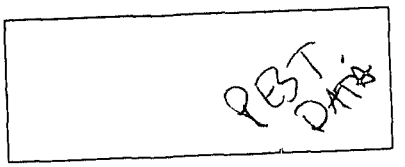
Table A-4. Aquatic Life Protection - Criteria are in µg/L					
Pesticide	**EPA Criteria**	**DFG Criteria**	**Canadian**	**PAN**	**Regional Board**
Simazine	**10**		10	0.6140	
Thiobencarb		3.1 (max)		6.2	**1.5**

Bold – are the criteria used to evaluate available data on pesticide levels in surface waters for the purpose of providing recommendations to the State Board on changes to the 303(d) list.
EPA Criteria – Criteria are from criteria documents published by the U.S. Environmental Protection Agency as described in Marshack, 2000.
DFG Criteria – Criteria are from hazard assessment criteria documents published by the California Department of Fish and Game (Harrington, 1990;Menconi an Gray, 1992; Menconi and Harrington, 1992; Siepmann and Slater, 1998; Siepmann and Jones, 1998; Siepmann and Finlayson, 2000)
Canadian - Criteria are from guidelines published by the Canadian Council of Ministers of the Environment (CCME, 1991).
PAN – Criteria are contained in the Pesticide Action Network's 303(d) list submittal to the Central Valley Regional Board (PAN, 2001).
Regional Board – Criteria come from performance goals contained in the Central Valley Regional Board's Basin Plan (CRWQCB-CVR, 1998).
[a] USEPA Water Quality Advisory
[b] Draft criterion
[c] California Toxics Rule (CTR) or National Toxics Rule (NTR) criterion

Table A-5. Drinking Water Protection - Criteria are in µg/L				
Pesticide	**EPA Criteria**	**Regional Board**	**OEHHA/DHS**	**Canadian**
2,4-D	**70** (MCL), 100[a]		**70** (MCL)	
Alachlor	**2** (MCL)		**2** (MCL)/ 4(PHG)	
Atrazine	3 (MCL)		**0.15** (OEHHA)/ 3 (MCL)	0.005
Azinphos	87.5 (NAS)			**0.02**
Bromacil	**90** (HA)			
Carbaryl	700 (IRIS)		700 (DHS AL)	
Carbofuran	40 (MCL)/ 35 (IRIS)		18 (MCL)/ **1.7 (PHG)**	
Chlorpyrifos	21 (IRIS)			
Cyanazine	**1** (HA)			
DDE	**0.00059**[b] (drinking water/ consumption)		0.1 (OEHHA)	
DDT	**0.00059**[b] (drinking water/ consumption)		0.1 (OEHHA)	
Diazinon	0.6 (HA)		6 (DHS AL)	
Diazoxon				
Dicamba	**210** (IRIS)			
Dieldrin	**0.00014** (drinking water/ consumption)		0.002 (DHS AL)	
Dimethoate	1.4 (IRIS)		**1.0** (DHS AL)	
Diuron	**14** (IRIS)			
Endosulfan II Beta	110[b] (drinking water/ consumption)			
Endosulfan Sulfate	110[b] (drinking water/ consumption)			
Fonofos	**14** (IRIS)			
Malathion	160 (IRIS)		**160** (DHS AL)	
MCPA, dimethylamine salt	**11** (IRIS)			
Methidathion	**0.7** (IRIS)			
Methyl Parathion	1.8 (IRIS)		**2** (DHS AL)	
Molinate	14 (IRIS)		**20** (MCL)	
Parathion	4.2 (IRIS)		**40** (DHS AL)	
Prometryn	**28** (IRIS)			
Propanil	**35** (IRIS)			
Simazine	3.5 (IRIS)		**0.4** (OEHHA PHG)/ 4 (MCL)	

Table A-5. Drinking Water Protection - Criteria are in μg/L				
Pesticide	**EPA Criteria**	**Regional Board**	**OEHHA/DHS**	**Canadian**
Thiobencarb	1 (secondary MCL)/ 70 (primary MCL)	**1.0**		

Bold – are the criteria used to evaluate available data on pesticide levels in surface waters for the purpose of providing recommendations to the State Board on changes to the 303(d) list.
DHS AL – California Department of Health Services Action Level for drinking water.
EPA Criteria – Criteria are from criteria documents published by the U.S. Environmental Protection Agency as described in Marshack, 2000.
HA – Health Advisory for drinking water.
IRIS – USEPA Integrated Risk Information System.
NAS – National Academy of Sciences recommended level for protection of health for drinking water.
OEHHA/DHS – Criteria are from guidelines and criteria published by the California Office of Environmental Health Hazard Assessment and California Department of Health Services as described in Marshack, 2000.
Canadian - Criteria are from guidelines published by the Canadian Council of Ministers of the Environment (CCME, 1991).
PAN – Criteria are contained in the Pesticide Action Network's 303(d) list submittal to the Central Valley Regional Board (PAN, 2001).
PHG – Public Health Goal for drinking water (OEHHA).
Regional Board – Criteria come from performance goals contained in the Central Valley Regional Board's Basin Plan (CRWQCB-CVR, 1998).
[a] USEPA National Recommended Ambient Water Quality criterion to protect human health from water and fish/shellfish consumption.
[b] California Toxics Rule criterion for protection for drinking water and consumption of fish/shellfish.



A.4.5 Data Interpretation

Data from water samples are both location and time specific. In recognition of the discrete nature of water quality sample results, Regional Board staff considered the following factors in reviewing available data: 1) total number of samples collected; 2) total number of exceedances of criteria; 3) magnitude of exceedance of criteria; and 4) frequency of exceedance of criteria. An initial screening of available water quality data was performed by determining whether a minimum of ten water samples was available and whether there was a minimum of two exceedances. If the minimum amount of data were available, staff then performed a more intensive review of the available data to determine whether the applicable criteria was being attained.

In addition, Regional Board staff also considered factors such as the season of sample collection, the likely pesticide use patterns, and when the studies were conducted (e.g. comparisons were made between past studies and recent studies). When data were evaluated, sampling events conducted at different sites for the same water body were considered together.

In evaluating exceedance of chronic water quality criteria (often expressed as a four-day average), data over consecutive days was often not available. Regional Board staff evaluated the available data to determine whether exceedance of the chronic criteria could be inferred based on the magnitude of the exceedance or based on data collected prior to and after the data point being evaluated. A significant exceedance of a chronic criteria on a single day (e.g. by a factor of 4) would imply exceedance of the 4-day average criteria. Exceedance of the chronic criteria over successive (although non-consecutive) sampling events would also imply exceedance of the criteria.

In general, waters were listed as impaired due to a particular pesticide when the available information indicated that the criteria would likely be exceeded on a periodic basis (i.e. the exceedance is not a unique event). Few data with consistent (and/or significant) exceedances could provide evidence of impairment in one case, whereas, more data would be needed in another instance in which infrequent exceedances occurred.

If available water quality data did not indicate exceedances of criteria, if little data were available (e.g. less than 10 sampling events), or if the exceedance appeared to be a unique event, no recommendation for adding the water and pollutant to the 303(d) list was made.

In some cases, the information available indicated that there may be an impairment, but not enough data were available to indicate that the exceedances occurred on a periodic basis. For those waters, a recommendation for further assessment is made.

The extent of impairment is based on the location of samples and evidence of relevant sources. The extent of impairment would be minimally defined as the distance between sampling points at which exceedances of criteria were found. Land use information, as well as the relative location of potential dilution flows, was also considered in identifying the extent of impairment.

A specific description of how data were interpreted is contained in the fact sheets for each 303(d) list recommendation.

Draft Staff Report on Recommended Changes to California's Clean Water Act Section 303(d) List

Appendix B

Fact Sheets for Recommended Changes to the 303(d) List

Pollutant/Stressor	Waterbody	Hydro Unit[1]	Total Size[2]	Affected Size[3]	Units	TMDL End Date (Mo/Yr)[4]
Acid Mine Drainage	Little Backbone Creek	506.20	3	1	Miles	12/11
	Spring Creek	524.40	8	5	Miles	12/11
	Willow Creek (Whiskeytown)	524.63	15	3	Miles	12/11
Ammonia	Harding Drain (Turlock Irr Dist Lateral #5)	535.50	7	7	Miles	12/11
	Lone Tree Creek	531.40	15	15	Miles	12/11
	Temple Creek	531.40	10	10	Miles	12/11
Arsenic	Kanaka Creek	517.42	1	1	Miles	12/11
Bacteria	French Ravine	516.32	1	1	Miles	12/11
Biological Oxygen Demand	Lone Tree Creek	531.40	15	15	Miles	12/11
Boron	Mud Slough	541.20	16	16	Miles	12/11
	Salt Slough	541.20	21	15	Miles	12/11
	San Joaquin River	544.00	330	130	Miles	12/99
Cadmium	Horse Creek	526.20	2	2	Miles	12/11
	Little Backbone Creek	506.20	3	1	Miles	12/11
	Little Cow Creek	507.33	33	1	Miles	12/11
	Keswick Res	524.40	650	200	Acres	12/11
	Sacramento River (Shasta Dam to Red Bluff)	508.10	50	40	Miles	12/01
	Shasta Lake	506.10	29,500	20	Acres	12/11
	Spring Creek	524.40	8	5	Miles	12/11
	Town Creek	526.20	3	1	Miles	12/11
	West Squaw Creek	505.10	5	2	Miles	12/11
Carbofuran/Furadan	Colusa Drain	520.21	70	70	Miles	12/11
Chlorpyrifos	Arcade Creek	519.21	10	10	Miles	12/11
	Chicken Ranch Slough	519.21	5	5	Miles	12/11
	Delta Waterways	544.00	480,000	480,000	Acres	12/05
	Elder Creek	519.12	10	10	Miles	12/11
	Five Mile Slough	544.00	2	1	Miles	12/11
	Harding Drain (Turlock Irr Dist Lateral #5)	535.50	7	7	Miles	12/11
	Merced River, Lower	535.00	60	60	Miles	12/05
	Mosher Slough	544.00	3	2	Miles	12/11
	Orestimba Creek	541.00	30	10	Miles	12/11
	Salt Slough	541.20	21	15	Miles	12/11
	San Joaquin River	544.00	330	130	Miles	12/05
	Strong Ranch Slough	519.21	5	5	Miles	12/11
Copper	Dolly Creek	518.54	1	1	Miles	12/11
	Horse Creek	526.20	2	2	Miles	12/11
	Humbug Creek	517.32	9	9	Miles	12/11
	Keswick Reservoir	524.40	650	200	Acres	12/11
	Little Backbone Creek	506.20	3	1	Miles	12/11
	Little Cow Creek	507.33	33	1	Miles	12/11
	Little Grizzly Creek	518.54	10	10	Miles	12/02
	Mokelumne River, Lower	531.20	28	28	Miles	12/11
	Sacramento River (Shasta Dam to Red Bluff)	508.10	50	40	Miles	12/01
	Shasta Lake	506.10	29,500	20	Acres	12/11
	Spring Creek	524.40	8	5	Miles	12/11
	Town Creek	526.20	3	1	Miles	12/11
	West Squaw Creek	505.10	5	2	Miles	12/11
	Willow Creek (Whiskeytown)	524.63	15	3	Miles	12/11
DDT	Delta Waterways	544.00	480,000	480,000	Acres	12/11
	San Joaquin River	544.00	330	130	Miles	12/11

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Pollutant/Stressor	Waterbody	Hydro Unit[1]	Total Size[2]	Affected Size[3]	Units	TMDL End Date (Mo/Yr)[4]
Diazinon	Arcade Creek	519.21	10	10	Miles	12/11
	Chicken Ranch Slough	519.21	5	5	Miles	12/11
	Delta Waterways	544.00	480,000	480,000	Acres	12/05
	Elder Creek	519.12	10	10	Miles	12/11
	Elk Grove Creek	519.11	5	5	Miles	12/11
	Feather River, Lower	519.22	60	60	Miles	12/11
	Five Mile Slough	544.00	2	1	Miles	12/11
	Harding Drain (Turlock Irr Dist Lateral #5)	535.50	7	7	Miles	12/11
	Merced River, Lower	535.00	60	60	Miles	12/05
	Morrison Creek	519.12	20	20	Miles	12/11
	Mosher Slough	544.00	3	2	Miles	12/11
	Natomas East Main Drain	519.22	12	5	Miles	12/11
	Orestimba Creek	541.00	30	10	Miles	12/11
	Sacramento River (Red Bluff to Delta)	500.00	185	30	Miles	12/05
	Sacramento Slough	520.10	1	1	Miles	12/11
	Salt Slough	541.20	21	15	Miles	12/11
	San Joaquin River	544.00	330	130	Miles	12/05
	Stanislaus River, Lower	535.30	48	48	Miles	12/00
	Strong Ranch Slough	519.21	5	5	Miles	12/11
	Tuolumne River, Lower	535.50	32	32	Miles	12/05
Dioxin	Stockton Deep Water Channel	544.00		2	Miles	
Electrical Conductivity	Delta Waterways	544.00	480,000	16,000	Acres	12/11
	Grasslands Marshes	541.20	8,224	8,224	Acres	12/11
	Kings River, Lower	551.90	95	30	Miles	12/11
	Lone Tree Creek	531.40	15	15	Miles	12/11
	Mud Slough	541.20	16	16	Miles	12/11
	Salt Slough	541.20	21	15	Miles	12/11
	San Joaquin River	544.00	330	130	Miles	12/99
	Temple Creek	531.40	10	10	Miles	12/11
Furans	Stockton Deep Water Channel	544.00		2	Miles	
Group A Pesticides[5]	Delta Waterways	544.00	480,000	480,000	Acres	12/11
	American River, Lower	519.21	30	23	Miles	12/11
	Colusa Drain	520.21	70	70	Miles	12/11
	Feather River, Lower	519.22	60	60	Miles	12/11
	Merced River, Lower	535.00	60	60	Miles	12/11
	San Joaquin River	544.00	330	130	Miles	12/11
	Stanislaus River, Lower	535.30	48	48	Miles	12/11
	Tuolumne River, Lower	535.50	32	32	Miles	12/11
High Coliform Count	Whiskeytown Res	524.61	32,351	100	Acres	12/11
Lead	Horse Creek	526.20	2	2	Miles	12/11
	Town Creek	526.20	3	1	Miles	12/11
	West Squaw Creek	505.10	5	2	Miles	12/11
Malathion	Colusa Drain	520.21	70	70	Miles	12/11
Mercury	American River, Lower	519.21	30	23	Miles	12/11
	Berryessa Lake	512.21	20,700	20,700	Acres	12/05
	Cache Creek	511.30	60	35	Miles	12/05
	Clear Lake	513.52	43,000	43,000	Acres	12/05
	Davis Creek Res	513.32	290	290	Acres	12/11
	Delta Waterways	544.00	480,000	480,000	Acres	12/05
	Dunn Creek	543.00	9	9	Miles	12/11
	Feather River, Lower	519.22	60	60	Miles	12/11
	Harley Gulch	513.51	8	8	Miles	12/11
	Humbug Creek	517.32	9	9	Miles	12/11
	James Creek	512.24	6	6	Miles	12/11
	Marsh Creek	543.00	24	24	Miles	12/11
	Marsh Creek Res	543.00	375	375	Acres	12/11
	Panoche Creek	542.40	50	25	Miles	12/11
	Sacramento River (Red Bluff to Delta)	500.00	185	30	Miles	12/05
	Sacramento Slough	520.10	1	1	Miles	12/11
	San Carlos Creek	542.20	1	1	Miles	12/11
	Sulfur Creek	513.51	7	7	Miles	12/05

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[redacted]

Pollutant/Stressor	Waterbody	Hydro Unit[1]	Total Size[2]	Affected Size[3]	Units	TMDL End Date (Mo/Yr)[4]
Metals	Dunn Creek	543.00	9	9	Miles	12/11
	Marsh Creek	543.00	24	24	Miles	12/11
Methyl Parathion	Colusa Drain	520.21	70	70	Miles	12/11
Molybdenum	Kings River, Lower	551.90	95	30	Miles	12/11
Nickel	James Creek	512.24	6	6	Miles	12/11
Nutrients	Clear Lake	513.52	43,000	43,000	Acres	12/11
	Pit River	506.00	200	100	Miles	12/11
Organic Enrichment/Low Dissolved Oxygen	Delta Waterways	544.00	480,000	75	Acres	12/11
	Pit River	506.00	200	100	Miles	12/11
PCBs[6]	Natomas East Main Drain	519.22	12	12	Miles	12/11
	Stockton Deep Water Channel	544.00		2	Miles	
Pesticides	Mud Slough	541.20	16	16	Miles	12/11
Sedimentation/Siltation	Fall River (Pit)	526.40	25	25	Miles	12/11
	Humbug Creek	517.32	9	9	Miles	12/11
	Panoche Creek	542.40	50	40	Miles	12/11
Selenium	Grasslands Marshes	541.20	8,224	8,224	Acres	12/98
	Mud Slough	541.20	16	16	Miles	12/00
	Panoche Creek	542.40	50	40	Miles	12/11
	Salt Slough	541.20	21	15	Miles	12/98
	San Joaquin River	544.00	330	50	Miles	12/00
Temperature	Pit River	506.00	200	100	Miles	12/11
Toxaphene	Kings River, Lower	551.90	95	30	Miles	12/11
Unknown Toxicity	American River, Lower	519.21	30	23	Miles	12/11
	Cache Creek	511.30	60	35	Miles	12/11
	Colusa Drain	520.21	70	70	Miles	12/11
	Delta Waterways	544.00	480,000	480,000	Acres	12/11
	Feather River, Lower	519.22	60	60	Miles	12/11
	Harding Drain (Turlock Irr Dist Lateral #5)	535.50	7	7	Miles	12/11
	Mud Slough	541.20	16	16	Miles	12/11
	Orestimba Creek	541.00	30	3	Miles	12/11
	Sacramento River (Red Bluff to Delta)	500.00	185	185	Miles	12/11
	Sacramento River (Shasta Dam to Red Bluff)	508.10	50	50	Miles	12/11
	Salt Slough	541.20	21	15	Miles	12/11
	San Joaquin River	544.00	330	130	Miles	12/11
	Stanislaus River, Lower	535.30	48	48	Miles	12/11
	Tuolumne River, Lower	535.50	32	32	Miles	12/11

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Pollutant/Stressor	Waterbody	Hydro Unit[1]	Total Size[2]	Affected Size[3]	Units	TMDL End Date (Mo/Yr)[4]
Zinc	Dolly Creek	518.54	1	1	Miles	12/11
	Horse Creek	526.20	2	2	Miles	12/11
	Humbug Creek	517.32	9	9	Miles	12/11
	Keswick Res	524.40	650	200	Acres	12/11
	Little Backbone Creek	506.20	3	1	Miles	12/11
	Little Cow Creek	507.33	33	1	Miles	12/11
	Little Grizzly Creek	518.54	10	10	Miles	12/02
	Mokelumne River, Lower	531.20	28	28	Miles	12/11
	Sacramento River (Shasta Dam to Red Bluff)	508.10	50	40	Miles	12/01
	Shasta Lake	506.10	29,500	20	Acres	12/11
	Spring Creek	524.40	8	5	Miles	12/11
	Town Creek	526.20	3	1	Miles	12/11
	West Squaw Creek	505.10	5	2	Miles	12/11
	Willow Creek (Whiskeytown)	524.63	15	3	Miles	12/11

[1]Hydro Unit = Hydrologic unit, area, and subarea boundary numbers defined on the California Watershed Map (CALWATER v2.2).

[2]Total Size = Total size of the identified waterbody.

[3]Affected Size = Portion of the waterbody not meeting water quality standards.

[4]TMDL End Date = Schedule for "completing and submitting" TMDLs [see 1998 Clean Water Listing Guidelines for California (August 11, 1997)].

[5]Group A pesticides = One or more of the Group A pesticides. The Group A pesticides include: aldrin, dieldrin, chlordane, endrin, heptachlor, heptachlor epoxide, hexachlorocyclohexane (including lindane), endosulfan and toxaphene.

[6]PCBs = Polychlorinated biphenyls.

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Pollutant/Stressor	Waterbody	Hydro Unit[1]	Total Size[2]	Affected Size[3]	Units	TMDL End Date (Mo/Yr)[4]
Acid Mine Drainage	Little Backbone Creek	506.20	3	1	Miles	12/11
	Spring Creek	524.40	8	5	Miles	12/11
	Willow Creek (Whiskeytown)	524.63	15	3	Miles	12/11
Ammonia	Harding Drain (Turlock Irr Dist Lateral #5)	535.50	7	7	Miles	12/11
	Lone Tree Creek	531.40	15	15	Miles	12/11
	Temple Creek	531.40	10	10	Miles	12/11
Arsenic	Kanaka Creek	517.42	1	1	Miles	12/11
Bacteria	French Ravine	516.32	1	1	Miles	12/11
Biological Oxygen Demand	Lone Tree Creek	531.40	15	15	Miles	12/11
Boron	Mud Slough	541.20	16	16	Miles	12/11
	Salt Slough	541.20	21	15	Miles	12/11
	San Joaquin River	544.00	330	130	Miles	12/99
Cadmium	Horse Creek	526.20	2	2	Miles	12/11
	Little Backbone Creek	506.20	3	1	Miles	12/11
	Little Cow Creek	507.33	33	1	Miles	12/11
	Keswick Res	524.40	650	200	Acres	12/11
	Sacramento River (Shasta Dam to Red Bluff)	508.10	50	40	Miles	12/01
	Shasta Lake	506.10	29,500	20	Acres	12/11
	Spring Creek	524.40	8	5	Miles	12/11
	Town Creek	526.20	3	1	Miles	12/11
	West Squaw Creek	505.10	5	2	Miles	12/11
Carbofuran/Furadan	Colusa Drain	520.21	70	70	Miles	12/11
Chlorpyrifos	Arcade Creek	519.21	10	10	Miles	12/11
	Chicken Ranch Slough	519.21	5	5	Miles	12/11
	Delta Waterways	544.00	480,000	480,000	Acres	12/05
	Elder Creek	519.12	10	10	Miles	12/11
	Five Mile Slough	544.00	2	1	Miles	12/11
	Harding Drain (Turlock Irr Dist Lateral #5)	535.50	7	7	Miles	12/11
	Merced River, Lower	535.00	60	60	Miles	12/05
	Mosher Slough	544.00	3	2	Miles	12/11
	Orestimba Creek	541.00	30	10	Miles	12/11
	Salt Slough	541.20	21	15	Miles	12/11
	San Joaquin River	544.00	330	130	Miles	12/05
	Strong Ranch Slough	519.21	5	5	Miles	12/11
Copper	Dolly Creek	518.54	1	1	Miles	12/11
	Horse Creek	526.20	2	2	Miles	12/11
	Humbug Creek	517.32	9	9	Miles	12/11
	Keswick Reservoir	524.40	650	200	Acres	12/11
	Little Backbone Creek	506.20	3	1	Miles	12/11
	Little Cow Creek	507.33	33	1	Miles	12/11
	Little Grizzly Creek	518.54	10	10	Miles	12/02
	Mokelumne River, Lower	531.20	28	28	Miles	12/11
	Sacramento River (Shasta Dam to Red Bluff)	508.10	50	40	Miles	12/01
	Shasta Lake	506.10	29,500	20	Acres	12/11
	Spring Creek	524.40	8	5	Miles	12/11
	Town Creek	526.20	3	1	Miles	12/11
	West Squaw Creek	505.10	5	2	Miles	12/11
	Willow Creek (Whiskeytown)	524.63	15	3	Miles	12/11
DDT	Delta Waterways	544.00	480,000	480,000	Acres	12/11
	San Joaquin River	544.00	330	130	Miles	12/11

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Pollutant/Stressor	Waterbody	Hydro Unit[1]	Total Size[2]	Affected Size[3]	Units	TMDL End Date (Mo/Yr)[4]
Diazinon	Arcade Creek	519.21	10	10	Miles	12/11
	Chicken Ranch Slough	519.21	5	5	Miles	12/11
	Delta Waterways	544.00	480,000	480,000	Acres	12/05
	Elder Creek	519.12	10	10	Miles	12/11
	Elk Grove Creek	519.11	5	5	Miles	12/11
	Feather River, Lower	519.22	60	60	Miles	12/11
	Five Mile Slough	544.00	2	1	Miles	12/11
	Harding Drain (Turlock Irr Dist Lateral #5)	535.50	7	7	Miles	12/11
	Merced River, Lower	535.00	60	60	Miles	12/05
	Morrison Creek	519.12	20	20	Miles	12/11
	Mosher Slough	544.00	3	2	Miles	12/11
	Natomas East Main Drain	519.22	12	5	Miles	12/11
	Orestimba Creek	541.00	30	10	Miles	12/11
	Sacramento River (Red Bluff to Delta)	500.00	185	30	Miles	12/05
	Sacramento Slough	520.10	1	1	Miles	12/11
	Salt Slough	541.20	21	15	Miles	12/11
	San Joaquin River	544.00	330	130	Miles	12/05
	Stanislaus River, Lower	535.30	48	48	Miles	12/00
	Strong Ranch Slough	519.21	5	5	Miles	12/11
	Tuolumne River, Lower	535.50	32	32	Miles	12/05
Dioxin	Stockton Deep Water Channel	544.00		2	Miles	
Electrical Conductivity	Delta Waterways	544.00	480,000	16,000	Acres	12/11
	Grasslands Marshes	541.20	8,224	8,224	Acres	12/11
	Kings River, Lower	551.90	95	30	Miles	12/11
	Lone Tree Creek	531.40	15	15	Miles	12/11
	Mud Slough	541.20	16	16	Miles	12/11
	Salt Slough	541.20	21	15	Miles	12/11
	San Joaquin River	544.00	330	130	Miles	12/99
	Temple Creek	531.40	10	10	Miles	12/11
Furans	Stockton Deep Water Channel	544.00		2	Miles	
Group A Pesticides[5]	Delta Waterways	544.00	480,000	480,000	Acres	12/11
	American River, Lower	519.21	30	23	Miles	12/11
	Colusa Drain	520.21	70	70	Miles	12/11
	Feather River, Lower	519.22	60	60	Miles	12/11
	Merced River, Lower	535.00	60	60	Miles	12/11
	San Joaquin River	544.00	330	130	Miles	12/11
	Stanislaus River, Lower	535.30	48	48	Miles	12/11
	Tuolumne River, Lower	535.50	32	32	Miles	12/11
High Coliform Count	Whiskeytown Res	524.61	32,351	100	Acres	12/11
Lead	Horse Creek	526.20	2	2	Miles	12/11
	Town Creek	526.20	3	1	Miles	12/11
	West Squaw Creek	505.10	5	2	Miles	12/11
Malathion	Colusa Drain	520.21	70	70	Miles	12/11
Mercury	American River, Lower	519.21	30	23	Miles	12/11
	Berryessa Lake	512.21	20,700	20,700	Acres	12/05
	Cache Creek	511.30	60	35	Miles	12/05
	Clear Lake	513.52	43,000	43,000	Acres	12/05
	Davis Creek Res	513.32	290	290	Acres	12/11
	Delta Waterways	544.00	480,000	480,000	Acres	12/05
	Dunn Creek	543.00	9	9	Miles	12/11
	Feather River, Lower	519.22	60	60	Miles	12/11
	Harley Gulch	513.51	8	8	Miles	12/11
	Humbug Creek	517.32	9	9	Miles	12/11
	James Creek	512.24	6	6	Miles	12/11
	Marsh Creek	543.00	24	24	Miles	12/11
	Marsh Creek Res	543.00	375	375	Acres	12/11
	Panoche Creek	542.40	50	25	Miles	12/11
	Sacramento River (Red Bluff to Delta)	500.00	185	30	Miles	12/05
	Sacramento Slough	520.10	1	1	Miles	12/11
	San Carlos Creek	542.20	1	1	Miles	12/11
	Sulfur Creek	513.51	7	7	Miles	12/05

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Pollutant/Stressor	Waterbody	Hydro Unit[1]	Total Size[2]	Affected Size[3]	Units	TMDL End Date (Mo/Yr)[4]
Metals	Dunn Creek	543.00	9	9	Miles	12/11
	Marsh Creek	543.00	24	24	Miles	12/11
Methyl Parathion	Colusa Drain	520.21	70	70	Miles	12/11
Molybdenum	Kings River, Lower	551.90	95	30	Miles	12/11
Nickel	James Creek	512.24	6	6	Miles	12/11
Nutrients	Clear Lake	513.52	43,000	43,000	Acres	12/11
	Pit River	506.00	200	100	Miles	12/11
Organic Enrichment/Low Dissolved Oxygen	Delta Waterways	544.00	480,000	75	Acres	12/11
	Pit River	506.00	200	100	Miles	12/11
PCBs[6]	Natomas East Main Drain	519.22	12	12	Miles	12/11
	Stockton Deep Water Channel	544.00		2	Miles	
Pesticides	Mud Slough	541.20	16	16	Miles	12/11
Sedimentation/Siltation	Fall River (Pit)	526.40	25	25	Miles	12/11
	Humbug Creek	517.32	9	9	Miles	12/11
	Panoche Creek	542.40	50	40	Miles	12/11
Selenium	Grasslands Marshes	541.20	8,224	8,224	Acres	12/98
	Mud Slough	541.20	16	16	Miles	12/00
	Panoche Creek	542.40	50	40	Miles	12/11
	Salt Slough	541.20	21	15	Miles	12/98
	San Joaquin River	544.00	330	50	Miles	12/00
Temperature	Pit River	506.00	200	100	Miles	12/11
Toxaphene	Kings River, Lower	551.90	95	30	Miles	12/11
Unknown Toxicity	American River, Lower	519.21	30	23	Miles	12/11
	Cache Creek	511.30	60	35	Miles	12/11
	Colusa Drain	520.21	70	70	Miles	12/11
	Delta Waterways	544.00	480,000	480,000	Acres	12/11
	Feather River, Lower	519.22	60	60	Miles	12/11
	Harding Drain (Turlock Irr Dist Lateral #5)	535.50	7	7	Miles	12/11
	Mud Slough	541.20	16	16	Miles	12/11
	Orestimba Creek	541.00	30	3	Miles	12/11
	Sacramento River (Red Bluff to Delta)	500.00	185	185	Miles	12/11
	Sacramento River (Shasta Dam to Red Bluff)	508.10	50	50	Miles	12/11
	Salt Slough	541.20	21	15	Miles	12/11
	San Joaquin River	544.00	330	130	Miles	12/11
	Stanislaus River, Lower	535.30	48	48	Miles	12/11
	Tuolumne River, Lower	535.50	32	32	Miles	12/11

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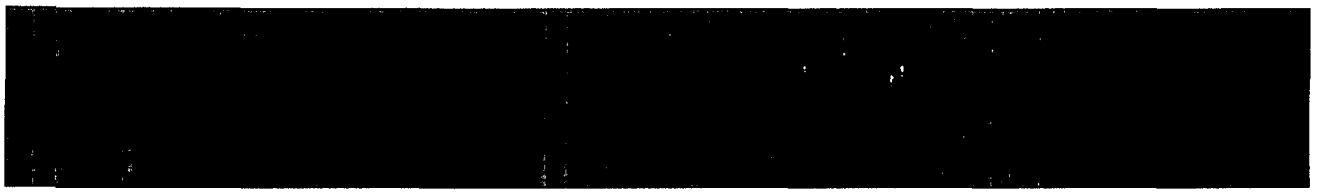

Pollutant/Stressor	Waterbody	Hydro Unit[1]	Total Size[2]	Affected Size[3]	Units	TMDL End Date (Mo/Yr)[4]
Zinc	Dolly Creek	518.54	1	1	Miles	12/11
	Horse Creek	526.20	2	2	Miles	12/11
	Humbug Creek	517.32	9	9	Miles	12/11
	Keswick Res	524.40	650	200	Acres	12/11
	Little Backbone Creek	506.20	3	1	Miles	12/11
	Little Cow Creek	507.33	33	1	Miles	12/11
	Little Grizzly Creek	518.54	10	10	Miles	12/02
	Mokelumne River, Lower	531.20	28	28	Miles	12/11
	Sacramento River (Shasta Dam to Red Bluff)	508.10	50	40	Miles	12/01
	Shasta Lake	506.10	29,500	20	Acres	12/11
	Spring Creek	524.40	8	5	Miles	12/11
	Town Creek	526.20	3	1	Miles	12/11
	West Squaw Creek	505.10	5	2	Miles	12/11
	Willow Creek (Whiskeytown)	524.63	15	3	Miles	12/11

[1]Hydro Unit = Hydrologic unit, area, and subarea boundary numbers defined on the California Watershed Map (CALWATER v2.2).

[2]Total Size = Total size of the identified waterbody.

[3]Affected Size = Portion of the waterbody not meeting water quality standards.

[4]TMDL End Date = Schedule for "completing and submitting" TMDLs [see 1998 Clean Water Listing Guidelines for California (August 11, 1997)].

[5]Group A pesticides = One or more of the Group A pesticides. The Group A pesticides include: aldrin, dieldrin, chlordane, endrin, heptachlor, heptachlor epoxide, hexachlorocyclohexane (including lindane), endosulfan and toxaphene.

[6]PCBs = Polychlorinated biphenyls.

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Waterbody	Pollutant/Stressor	Hydro Unit[1]	Total Size[2]	Affected Size[3]	Units	TMDL End Date (Mo/Yr)[4]
American River, Lower	Group A Pesticides[5]	519.21	30	23	Miles	12/11
	Mercury	519.21	30	23	Miles	12/11
	Unknown Toxicity	519.21	30	23	Miles	12/11
Arcade Creek	Chlorpyrifos	519.21	10	10	Miles	12/11
	Diazinon	519.21	10	10	Miles	12/11
Berryessa Lake	Mercury	512.21	20,700	20,700	Acres	12/05
Cache Creek	Mercury	511.30	60	35	Miles	12/05
	Unknown Toxicity	511.30	60	35	Miles	12/11
Chicken Ranch Slough	Chlorpyrifos	519.21	5	5	Miles	12/11
	Diazinon	519.21	5	5	Miles	12/11
Clear Lake	Mercury	513.52	43,000	43,000	Acres	12/05
	Nutrients	513.52	43,000	43,000	Acres	12/11
Colusa Drain	Carbofuran/Furadan	520.21	70	70	Miles	12/11
	Group A Pesticides	520.21	70	70	Miles	12/11
	Malathion	520.21	70	70	Miles	12/11
	Methyl Parathion	520.21	70	70	Miles	12/11
	Unknown Toxicity	520.21	70	70	Miles	12/11
Davis Creek Res	Mercury	513.32	290	290	Acres	12/11
Delta Waterways	Chlorpyrifos	544.00	480,000	480,000	Acres	12/05
	DDT	544.00	480,000	480,000	Acres	12/11
	Diazinon	544.00	480,000	480,000	Acres	12/05
	Electrical Conductivity	544.00	480,000	16,000	Acres	12/11
	Group A Pesticides	544.00	480,000	480,000	Acres	12/11
	Mercury	544.00	480,000	480,000	Acres	12/05
	Organic Enrichment/Low Dissolved Oxygen	544.00	480,000	75	Acres	12/11
	Unknown Toxicity	544.00	480,000	480,000	Acres	12/11
Dolly Creek	Copper	518.54	1	1	Miles	12/11
	Zinc	518.54	1	1	Miles	12/11
Dunn Creek	Mercury	543.00	9	9	Miles	12/11
	Metals	543.00	9	9	Miles	12/11
Elder Creek	Chlorpyrifos	519.12	10	10	Miles	12/11
	Diazinon	519.12	10	10	Miles	12/11
Elk Grove Creek	Diazinon	519.11	5	5	Miles	12/11
Fall River (Pit)	Sedimentation/Siltation	526.40	25	25	Miles	12/11
Feather River, Lower	Diazinon	519.22	60	60	Miles	12/11
	Group A Pesticides	519.22	60	60	Miles	12/11
	Mercury	519.22	60	60	Miles	12/11
	Unknown Toxicity	519.22	60	60	Miles	12/11
Five Mile Slough	Chlorpyrifos	544.00	2	1	Miles	12/11
	Diazinon	544.00	2	1	Miles	12/11
French Ravine	Bacteria	516.32	1	1	Miles	12/11
Grasslands Marshes	Electrical Conductivity	541.20	8,224	8,224	Acres	12/11
	Selenium	541.20	8,224	8,224	Acres	12/98
Harding Drain (Turlock Irr Dist Lateral #5)	Ammonia	535.50	7	7	Miles	12/11
	Chlorpyrifos	535.50	7	7	Miles	12/11
	Diazinon	535.50	7	7	Miles	12/11
	Unknown Toxicity	535.50	7	7	Miles	12/11
Harley Gulch	Mercury	513.51	8	8	Miles	12/11
Horse Creek	Cadmium	526.20	2	2	Miles	12/11
	Copper	526.20	2	2	Miles	12/11
	Lead	526.20	2	2	Miles	12/11
	Zinc	526.20	2	2	Miles	12/11
Humbug Creek	Copper	517.32	9	9	Miles	12/11
	Mercury	517.32	9	9	Miles	12/11
	Sedimentation/Siltation	517.32	9	9	Miles	12/11
	Zinc	517.32	9	9	Miles	12/11
James Creek	Mercury	512.24	6	6	Miles	12/11
	Nickel	512.24	6	6	Miles	12/11
Kanaka Creek	Arsenic	517.42	1	1	Miles	12/11
Keswick Res	Cadmium	524.40	650	200	Acres	12/11
	Copper	524.40	650	200	Acres	12/11
	Zinc	524.40	650	200	Acres	12/11
Kings River, Lower	Electrical Conductivity	551.90	95	30	Miles	12/11
	Molybdenum	551.90	95	30	Miles	12/11
	Toxaphene	551.90	95	30	Miles	12/11

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Waterbody	Pollutant/Stressor	Hydro Unit[1]	Total Size[2]	Affected Size[3]	Units	TMDL End Date (Mo/Yr)[4]
Little Backbone Creek	Acid Mine Drainage	506.20	3	1	Miles	12/11
	Cadmium	506.20	3	1	Miles	12/11
	Copper	506.20	3	1	Miles	12/11
	Zinc	506.20	3	1	Miles	12/11
Little Cow Creek	Cadmium	507.33	33	1	Miles	12/11
	Copper	507.33	33	1	Miles	12/11
	Zinc	507.33	33	1	Miles	12/11
Little Grizzly Creek	Copper	518.54	10	10	Miles	12/02
	Zinc	518.54	10	10	Miles	12/02
Lone Tree Creek	Ammonia	531.40	15	15	Miles	12/11
	Biological Oxygen Demand	531.40	15	15	Miles	12/11
	Electrical Conductivity	531.40	15	15	Miles	12/11
Marsh Creek	Mercury	543.00	24	24	Miles	12/11
	Metals	543.00	24	24	Miles	12/11
Marsh Creek Res	Mercury	543.00	375	375	Acres	12/11
Merced River, Lower	Chlorpyrifos	535.00	60	60	Miles	12/05
	Diazinon	535.00	60	60	Miles	12/05
	Group A Pesticides	535.00	60	60	Miles	12/11
Mokelumne River, Lower	Copper	531.20	28	28	Miles	12/11
	Zinc	531.20	28	28	Miles	12/11
Morrison Creek	Diazinon	519.12	20	20	Miles	12/11
Mosher Slough	Chlorpyrifos	544.00	3	2	Miles	12/11
	Diazinon	544.00	3	2	Miles	12/11
Mud Slough	Boron	541.20	16	16	Miles	12/11
	Electrical Conductivity	541.20	16	16	Miles	12/11
	Pesticides	541.20	16	16	Miles	12/11
	Selenium	541.20	16	16	Miles	12/00
	Unknown Toxicity	541.20	16	16	Miles	12/11
Natomas East Main Drain	Diazinon	519.22	12	5	Miles	12/11
	PCBs[6]	519.22	12	12	Miles	12/11
Orestimba Creek	Chlorpyrifos	541.00	30	10	Miles	12/11
	Diazinon	541.00	30	10	Miles	12/11
	Unknown Toxicity	541.00	30	3	Miles	12/11
Panoche Creek	Mercury	542.40	50	25	Miles	12/11
	Sedimentation/Siltation	542.40	50	40	Miles	12/11
	Selenium	542.40	50	40	Miles	12/11
Pit River	Nutrients	506.00	200	100	Miles	12/11
	Organic Enrichment/Low Dissolved Oxygen	506.00	200	100	Miles	12/11
	Temperature	506.00	200	100	Miles	12/11
Sacramento River (Red Bluff to Delta)	Diazinon	500.00	185	30	Miles	12/05
	Mercury	500.00	185	30	Miles	12/05
	Unknown Toxicity	500.00	185	185	Miles	12/11
Sacramento River (Shasta Dam to Red Bluff)	Cadmium	508.10	50	40	Miles	12/01
	Copper	508.10	50	40	Miles	12/01
	Unknown Toxicity	508.10	50	50	Miles	12/11
	Zinc	508.10	50	40	Miles	12/01
Sacramento Slough	Diazinon	520.10	1	1	Miles	12/11
	Mercury	520.10	1	1	Miles	12/11
Salt Slough	Boron	541.20	21	15	Miles	12/11
	Chlorpyrifos	541.20	21	15	Miles	12/11
	Diazinon	541.20	21	15	Miles	12/11
	Electrical Conductivity	541.20	21	15	Miles	12/11
	Selenium	541.20	21	15	Miles	12/98
	Unknown Toxicity	541.20	21	15	Miles	12/11
San Carlos Creek	Mercury	542.20	1	1	Miles	12/11
San Joaquin River	Boron	544.00	330	130	Miles	12/99
	Chlorpyrifos	544.00	330	130	Miles	12/05
	DDT	544.00	330	130	Miles	12/11
	Diazinon	544.00	330	130	Miles	12/05
	Electrical Conductivity	544.00	330	130	Miles	12/99
	Group A Pesticides	544.00	330	130	Miles	12/11
	Selenium	544.00	330	50	Miles	12/00
	Unknown Toxicity	544.00	330	130	Miles	12/11

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Waterbody	Pollutant/Stressor	Hydro Unit[1]	Total Size[2]	Affected Size[3]	Units	TMDL End Date (Mo/Yr)[4]
Shasta Lake	Cadmium	506.10	29,500	20	Acres	12/11
	Copper	506.10	29,500	20	Acres	12/11
	Zinc	506.10	29,500	20	Acres	12/11
Spring Creek	Acid Mine Drainage	524.40	8	5	Miles	12/11
	Cadmium	524.40	8	5	Miles	12/11
	Copper	524.40	8	5	Miles	12/11
	Zinc	524.40	8	5	Miles	12/11
Stanislaus River, Lower	Diazinon	535.30	48	48	Miles	12/00
	Group A Pesticides	535.30	48	48	Miles	12/11
	Unknown Toxicity	535.30	48	48	Miles	12/11
Stockton Deep Water Channel	Dioxin	544.00		2	Miles	
	Furans	544.00		2	Miles	
	PCBs	544.00		2	Miles	
Strong Ranch Slough	Chlorpyrifos	519.21	5	5	Miles	12/11
	Diazinon	519.21	5	5	Miles	12/11
Sulfur Creek	Mercury	513.51	7	7	Miles	12/05
Temple Creek	Ammonia	531.40	10	10	Miles	12/11
	Electrical Conductivity	531.40	10	10	Miles	12/11
Town Creek	Cadmium	526.20	3	1	Miles	12/11
	Copper	526.20	3	1	Miles	12/11
	Lead	526.20	3	1	Miles	12/11
	Zinc	526.20	3	1	Miles	12/11
Tuolumne River, Lower	Diazinon	535.50	32	32	Miles	12/05
	Group A Pesticides	535.50	32	32	Miles	12/11
	Unknown Toxicity	535.50	32	32	Miles	12/11
West Squaw Creek	Cadmium	505.10	5	2	Miles	12/11
	Copper	505.10	5	2	Miles	12/11
	Lead	505.10	5	2	Miles	12/11
	Zinc	505.10	5	2	Miles	12/11
Whiskeytown Res	High Coliform Count	524.61	32,351	100	Acres	12/11
Willow Creek (Whiskeytown)	Acid Mine Drainage	524.63	15	3	Miles	12/11
	Copper	524.63	15	3	Miles	12/11
	Zinc	524.63	15	3	Miles	12/11

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