CALFED Ecosystem Water Quality Objectives

	Suggested Ranges		
Parameter	**Sacramento River**	**San Joaquin River**	**Delta**
Cadmium	Water: River and Tributaries from above State Hwy 32 bridge at Hamilton City: **0.22 µg/l** [a,c,d] Below Hamilton City: **2.2 µg/l** (4 day average) [a,e] **4.3 µg/l** (1 hour average) [a,e] Sediment: [z] **5.0 ppm** (dry weight)	Water: **2.2 µg/l** (4 day average) [a,e] **4.3 µg/l** (1 hour average) [a,e] Sediment: [z] 5.0 ppm (dry weight)	Water: East of Antioch Bridge: **2.2 µg/l** (4 day average) [a,e] **4.3 mg/l** (1 hour average) [a,e] West of Antioch Bridge: **1.1 µg/l** (4 day average) [x] **3.9 µg/l** (1 hour average) [x] Sediment: [z] 1.2 ppm (dry weight)
Copper	Water: River and Tributaries from above State Hwy 32 bridge at Hamilton City: **5.6 µg/l** [a,c,d] Below Hamilton City: **10 µg/l** (no hardness connection) [a,d,f] Sediment: [z] **70.0 ppm** (dry weight)	Water: **9.0 µg/l** (4 day average) [a,e] **13 µg/l** (1 hour average) [a,e] Sediment: [z] **70.0 ppm** (dry weight)	Water: East of Antioch Bridge: **10 µg/l** (no hardness connection) [a,d,f] West of Antioch Bridge: **6.5 µg/l** (4 day average) [x] **9.2 µg/l** (1 hour average) [x] Sediment: [z] **34.0 ppm** (dry weight)
Mercury (inorganic)	Water: **0.012 µg/l** (4 day average) [b,e] **2.1 µg/l** (1 hour maximum) [a,e] Sediment: [z] **0.15 ppm** (dry weight) Tissue: [i,y] **0.5 µg/gm** (whole fish, wet weight)	Water: **0.012 µg/l** (4 day average) [b,e] **2.1 µg/l** (1 hour maximum) [a,e] Sediment: [z] **0.15 ppm** (dry weight) Tissue: [i,y] **0.5 µg/gm** (whole fish, wet weight)	Water: East of Antioch Bridge: **0.012 µg/l** (4 day average) [b,e] **2.1 µg/l** (1 hour maximum) [a,e] West of Antioch Bridge: **0.025 µg/l** (4 day average) [x] **2.4 µg/l** (1 hour average) [x] Sediment: [z] **0.15 ppm** (dry weight) Tissue: [i,y] **0.5 µg/gm** (whole fish, wet weight)

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Parameter	**Sacramento River**	**San Joaquin River**	**Delta**
Selenium	Water: **20 µg/l** (1 hour maximum) [b,e] **5.0 µg/l** (4 day average) [b,e] Tissue: * **4-12 ppm** (fish, whole body, dry weight) **3-7 ppm** (fish food items, food chain, dry weight)	Water:[j] South of Merced River: **20 µg/l** (1 hour maximum) [b,e] **5.0 µg/l** (4 day average) [b,e] North of Merced River: **12 mg/l** (maximum)[b,e] **5.0 µg/l** (4 day average)[b,e] Tissue: * **4-12 ppm** (fish, whole body, dry weight) **3-7 ppm** (fish food items, food chain, dry weight)	Water: East of Antioch Bridge: **20 µg/l** (1 hour maximum) [b,e] **5.0 µg/l** (4 day average) [b,e] West of Antioch Bridge: **20 µg/l** (1 hour average) [b,e] **5.0 µg/l** (4 day average) [b,e] Tissue: * **4-12 ppm** (fish, whole body, dry weight) **3-7 ppm** (fish food items, food chain, dry weight)
Zinc	Water: River and Tributaries from above State Hwy 32 bridge at Hamilton City: **16 µg/l** [a,c,d] Below Hamilton City: **100 µg/l** (no hardness connection) [a,d,g] Sediment: [z] **120.0 ppm** (dry weight)	Water: **120 µg/l** (4 day average) [a,e] **120 µg/l** (1 hour average) [a,e] Sediment: [z] **120.0 ppm** (dry weight)	Water: East of Antioch Bridge: **100 µg/l** (no hardness connection) [a,d] West of Antioch Bridge: **106µg/l** (4 day average) [x] **117 µg/l** (1 hour average) [x] Sediment: [z] **150.0 ppm** (dry weight)
Carbofuran	Water:[k] **0.4 µg/l** (daily max. and total pesticide) [h]	Water: **0.4 µg/l** (daily max. and total pesticide) [h]	Water: **0.4 µg/l** (daily max. and total pesticide) [h]
Chlordane	Water: **2.4 µg/l** (instantaneous max.) [e] **0.0043 µg/l** (4 day average, total pesticide) [e] Sediment: [z] **7.1 ppm** (dry weight)	Water: **2.4 µg/l** (instantaneous max.) [e] **0.0043 µg/l** (4 day average, total pesticide) [e] Sediment: [z] **7.1 ppm** (dry weight)	Water: **2.4 µg/l** (instantaneous max.) [e] **0.0043 µg/l** (4 day average, total pesticide) [e] Sediment: [z] **7.1 ppm** (dry weight)
Chlorpyrifos	Water:[m] **0.02 µg/l** (4 day average, total pesticide) [l,g]	Water:[m] **0.02 µg/l** (4 day average,total pesticide) [l,g]	Water:[m] **0.02 µg/l** (4 day average,total pesticide) [l,g]
Diazinon	Water:[n] **0.08 µg/l** (1 hour average,total pesticide)[l] **0.04 µg/l** (4 day average, total pesticide)[l]	Water:[n] **0.08 µg/l** (1 hour average,total pesticide)[l] **0.04 µg/l** (4 day average, total pesticide)[l]	Water:[n] **0.08 µg/l** (1 hour average,total pesticide)[l] **0.04 µg/l** (4 day average, total pesticide)[l]

CALFED Ecosystem Water Quality Objectives

	Suggested Ranges		
Parameter	**Sacramento River**	**San Joaquin River**	**Delta**
DDT	Water: **1.1 µg/l** (instantaneous max., total pesticide) [e] **0.001 µg/l** (4 day average, ,total pesticide) [e] Tissue: [y] **1 µg/l** (whole fish, wet weight)	Water: **1.1 µg/l** (instantaneous max., total pesticide) [e] **0.001 µg/l** (4 day average, ,total pesticide) [e] Tissue: [o,y] **1 µg/l** (whole fish, wet weight)	Water: East of Antioch Bridge: **1.1 µg/l** (instantaneous max., total pesticide) [e] **0.001 µg/l** (4 day average, ,total pesticide) [e] West of Antioch Bridge: **1.1 µg/l** (instantaneous maximum) **0.001 µg/l** (24 hour average) Tissue: [y] **1 µg/l** (whole fish, wet weight)
PCB's	Water: **0.014 µg/l** (4 day average) [e] (each of 7 congeners) Sediment: [z] **50 ppm** (dry weight, total) Tissue: [y] **0.5 µg/l** (whole fish, wet weight, total)	Water: **0.014 µg/l** (4 day average) [e] (each of 7 congeners) Sediment: [z] **50 ppm** (dry weight, total) Tissue: [y] **0.5 µg/l** (whole fish, wet weight, total)	Water: East of Antioch Bridge: **0.014 µg/l** (4 day average) [e] (each of 7 congeners) West of Antioch Bridge: **0.014 µg/l** (24 hour average) Sediment: [z] **50 ppm** (dry weight, total) Tissue: [y] **0.5 µg/l** (whole fish, wet weight, total)
Toxaphene	Water: **0.73 µg/l** (1 hour average) [e] **0.0002 µg/l** (4 day average) [e] Tissue: [y] **0.1 µg/l** (whole fish, wet weight) (sum of 9 organochlorine insecticides)	Water: **0.73 µg/l** (1 hour average) [e] **0.0002 µg/l** (4 day average) [e] Tissue: [y] **0.1 µg/l** (whole fish, wet weight) (sum of 9 organochlorine insecticides)	Water: East of Antioch Bridge: **0.73 µg/l** (1 hour average) [e] **0.0002 µg/l** (4 day average) [e] West of Antioch Bridge: **0.0002 µg/l** (4 day average) [e] Tissue: [y] **0.1 µg/l** (whole fish, wet weight) (sum of 9 organochlorine insecticides)

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CALFED Ecosystem Water Quality Objectives

Suggested Ranges			
Parameter	**Sacramento River**	**San Joaquin River**	**Delta**
Ammonia	Water: **0.08 - 2.5 µg/l** (4 day average) [e,p] **0.58 - 35 µg/l** (1 hour average) [e,p]	Water: **0.08 - 2.5 µg/l** (4 day average) [e,p] **0.58 - 35 µg/l** (1 hour average) [e,p]	Water: East of Antioch Bridge: **0.08 - 2.5 µg/l** (4 day average) [e,p] **0.58 - 35 µg/l** (1 hour average) [e,p] West of Antioch Bridge: **0.025 µg/l** (annual median) **0.16 µg/l** (maximum)
Dissolved Oxygen	Water: Keswick Dam to Hamilton City, June 1 to August 31: **9000 µg/l** [d,q] Below I Street Bridge: **7000 µg/l** [d]	Water: Between Turner Cut and Stockton, September 1 through November 30: **6000 µg/l** [d]	Water: [s] All Delta waters west of Antioch Bridge: **7000 µg/l** (minimum) [d,x] All Delta waters: **5000 µg/l** [d,r]
Temperature	Water: Keswick Dam to Hamilton City: **< 56° F** [d,u] Hamilton City to I Street Bridge: **< 68°F** [d,u] I Street Bridge to Freeport: **< 68°F** [d,v] I Street Bridge to Freeport, January 1 through March 31: **< 66°F** [d,w]	Water: At Vernalis: **< 68°F** [d,v]	Water: West of Antioch Bridge: **< 5°C** increase above for receiving water designated as cold or warm freshwater habitat. [x] Alteration of temperature shall not adversely affect beneficial uses. [x]
Turbidity			Water: West of Antioch Bridge: No adverse effect or > 10 % change
Unknown Toxicity [t]			Water: West of Antioch Bridge: Acute- A median of not less than 90% survival and a 90 percentile of not less than 70% survival Chronic - no chronic toxicity in ambient waters

[a] dissolved form

[b] total recoverable form

[c] The effects of these concentrations were measured by exposing test organisms to dissolved aqueous solutions of 40 mg/l hardness that had been filtered through a 0.45 micron membrane filter. Where deviations from 40 mg/l of water hardness occur, the objectives, in mg/l shall be determined using the following formulas:

$Cu = e^{(0.905)(\ln \text{hardness})} - 1.612 \times 10^3$

$Zn = e^{(0.830)(\ln \text{hardness})} - 0.289 \times 10^3$

$Cd = e^{(1.160)(\ln \text{hardness})} - 5.777 \times 10^3$

[d] Central Valley Regional Water Quality Control Plan

[e] General EPA 304(a) guideline

[f] Within the next year the State Water Resources Control Board or EPA will promulgate/adopt objectives which are hardness dependent. The adoption language is likely to contain a clause saying that the most stringent objective applies. Sometimes the 10 µg/l objective will be more stringent and at other times the new rule will be more stringent.

[g] Similar to the objectives for copper, we expect the State Water Resources Control Board or EPA to promulgate new objectives within the next year which will be more stringent than current objectives.

[h] The Central Valley Regional Water Quality Control Board expects to adopt an objective for carbofuran within the next year. The objective will probably be very similar to the performance goal.

[i] Water quality limited segments for mercury in fish tissue occur in the Sacramento River and Delta.

[j] Water quality limited segments for selenium in the water column from Salt Slough to Vernalis on the San Joaquin River.

[k] Lower Sacramento River is a water quality limited segment for carbofuran.

[l] California Department of Fish and Game acute (1 hour) and chronic (4 day) hazard assessment criteria.

[m] Sacramento River, San Joaquin River, and Delta water quality limited segments for chlorpyrifos.

[n] Sacramento River, San Joaquin River, and Delta water quality limited segments for diazinon.

[o] San Joaquin River water quality limited segment for DDT in tissue.

[p] Values are a function of pH, temperature, and designation of water body as cold or warm water beneficial use.

[q] When natural conditions lower dissolved oxygen below this level, the concentrations shall be maintained at or above 95% of saturation.

[r] Except those water bodies which are constructed for special purposes and from which fish have been excluded or where the fishery is not important and a beneficial use.

[s] Southern Delta around Stockton is a water quality limited segment for dissolved oxygen.

[t] Bioassay results or other special studies demonstrate toxicity. Sacramento River, San Joaquin River, and Delta are water quality limited segments for "unknown toxicity".

[u] The temperature shall not be elevated above 56°F in the reach form Keswick Dam to Hamilton City nor above 68°F in the reach from Hamilton City to I Street Bridge during periods when temperature increases will be detrimental to the fishery.

[v] The daily average water temperature shall not be elevated by controllable factors above 68°F from the I Street Bridge to Freeport on the Sacramento River, and at Vernalis on the San Joaquin River between April 1 through June 30 and September 1 through November 30 in all water year types.

[w] The daily average water temperature shall not be elevated by controllable factors above 66°F from the I Street Bridge to Freeport on the Sacramento River between January 1 through March 31.

x San Francisco Regional Water Quality Control Board objectives at 100 mg/l hardness. Formulas for calculating objectives for varying hardness levels are as follows:

$Cd = e^{(0.7852H - 3.490)}$ (4 day average)

$= e^{(1.128H - 3.828)}$ (1 hour average)

$Cu = e^{(0.8545H - 1.465)}$ (4 day average)

$e^{(0.9422H - 1.464)}$ (1 hour average)

$Zn = e^{(0.8473H + 0.7614)}$ (4 day average)

$= e^{(0.8473H + 0.8604)}$ (1 hour average)

[y] National Academy of Sciences (NAS)-National Academy of Engineering 1973

[z] Effect range-low (ERLs) concentrations

* San Luis Drain Reuse, Technical Advisory Committee Selenium ecological risk guidelines