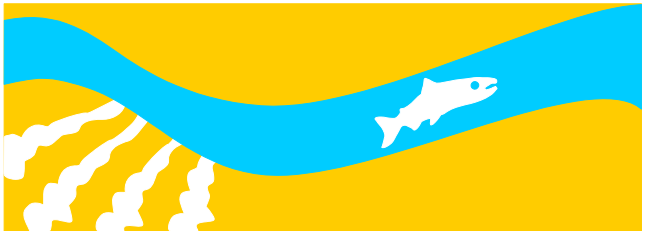
Exhibit B

Water Quality Criteria

Fisheries Management Plan: A Framework for Adaptive Management in the San Joaquin River Restoration Program

SAN JOAQUIN RIVER RESTORATION PROGRAM



November 2010

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Abbreviations and Acronyms

µg/L	micrograms per liter
Central Valley Water Board	Central Valley Regional Water Quality Control Board
CWA	Clean Water Act
DFG	California Department of Fish and Game
DO	dissolved oxygen
DPA	Drainage Project Area
EPA	U.S. Environmental Protection Agency
GBP	Grassland Bypass Project
MCL	maximum contaminant level
mg/L	milligrams per liter
MOA	Memorandum of Agreement
NPDES	National Pollutant Discharge Elimination System
OP	organophosphate pesticide
SJRRP	San Joaquin river Restoration Program
SWQCP	State water quality control program
SWRCB	State Water Resources Control Board
TDS	total dissolved solids
TMDL	total maximum daily load

To meet the San Joaquin River Restoration Program (SJRRP) Restoration Goals, water quality should meet minimum standards for protection of aquatic resources. Due to the lack of information on the effects of many water quality constituents on Chinook salmon and other fish, the water-quality objectives for beneficial uses defined by the Central Valley Regional Water Quality Control Board (Central Valley Water Board formerly CVRWQCB) are used to establish water-quality goals. The main beneficial uses for the enhancement of fisheries resources within the Restoration Area are: (1) cold freshwater habitat, (2) fish migration, and (3) spawning, reproduction and/or early development.

Water-quality objectives are "the limits or levels of water quality constituents or characteristics established for the reasonable protection of beneficial uses of the water or the prevention of a nuisance in a specific area" (California Water Code Section 13050(h)). Water-quality standards consist of the designated beneficial uses and water quality objectives of the State Water Resources Control Board (SWRCB) and Central Valley Water Board. For the San Joaquin River system, including the Restoration Area, SWRCB has set a goal to be free of toxic substances in surface water. In addition, beneficial uses and water quality criteria are identified in the Water Quality Control Plan (CVRWQCB 2007).

The temperature objectives are based on a California Department of Fish and Game (DFG) proposal to assess temperature impairment (DFG 2007), U.S. Environmental Protection Agency (EPA) guidelines (EPA 2003), and a report on temperature impacts on fall-run Chinook salmon and steelhead (Rich and Associates 2007).

Section 303(d) of the Clean Water Act (CWA) requires the states to develop a list of impaired water bodies and to describe a priority ranking for addressing impairments. The most recent 303(d) list of impaired water bodies presented by the Central Valley Water Board identifies Reaches 3, 4, and 5, and Mud and Salt sloughs as impaired water bodies due to pesticides and "unknown toxicity." Total maximum daily loads (TMDLs) are developed to allocate loads from point and nonpoint pollution sources to their impaired water bodies and describe required measures, actions, and responsibilities to meet water-quality standards.

The stringency of water quality objectives specified by a TMDL can be adjusted to protect beneficial uses. Typically, a least stringent approach that can successfully protect water quality for the fisheries is preferred to manage nonpoint source contamination problems (CVRWQCB 2007), but a measure of higher stringency should be employed if it is determined that the initial management approach does not protect the fisheries. The Central Valley Water Board could apply limits more stringent than defined maximum contaminant levels (MCL) when they represent a benefit to sustainable fisheries in the Restoration Area. Implementation of the most stringent objectives will provide the maximum protection of water quality for the beneficial uses of the San Joaquin River waters for fishes.

The Central Valley Water Board and the SWRCB mandates and objectives are used by, and in conjunction with, water quality monitoring elements of the SJRRP. The following sections describe the various water quality constituents and the objectives used to evaluate water quality conditions in the Restoration Area.

Water Temperature

Water quality could be degraded as a result of high water temperatures. High water temperatures promote poor water quality conditions and compromise fish survival (DFG 1998). Unsuitable temperature conditions contribute to limiting the production of juvenile salmonids and may account for some of the variability in the number of adult Chinook salmon returning to the San Joaquin River.

Changes in the water temperature profile in the Restoration Area are expected to affect movement, reproduction, growth, and/or survival of local fish populations. Specifically, Chinook salmon exposed to seasonally elevated temperatures show alterations in adult migration patterns, holding, spawning, egg incubation, juvenile rearing, or survival of migrating juveniles. Moreover, existing temperature conditions in Reach 2A are likely to be lethal to migrating adults and outmigrating juveniles. Hence, physiological tolerance of elevated temperatures during migration maximizes the probability of successful reintroduction and establishment of a new self-sustaining Chinook salmon run in the San Joaquin River.

Salinity and Boron

Salt and boron occur naturally in soils adjacent to the San Joaquin River and can be mobilized from soils by rain and applied irrigation water. Lands on the west side of the San Joaquin River are a major source of salt loads into the river. In 1969, the former Central Valley RWQCB signed a Memorandum of Agreement (MOA) with the U.S. Department of the Interior, Bureau of Reclamation, to not exceed a mean monthly total dissolved solids (TDS) concentration of 500 milligrams per liter (mg/L) in the San Joaquin River immediately below the confluence with the Stanislaus River (CVRWQCB 2007). Salinity and boron TMDLs were completed for the San Joaquin River, and the Central Valley Water Board is committed to refining and updating these guidelines with the best scientific information available (Tables B-1 and B-2).

Trace Elements: Selenium and Mercury

The presence of selenium and mercury in the San Joaquin River Basin affects fishes, their predators, and their food base (CVRWQCB 2001). The major source of selenium is subsurface agricultural return flows (tile drainage) from an area called the Drainage Project Area (DPA) that is currently under regulations to reduce selenium loading. Based on load allocation, waste discharge requirements are assigned to the DPA's drainage system, the Grassland Bypass Project (GBP). The purpose of the GBP is to reduce

selenium discharges. Load allocations for agricultural discharges were developed to meet water quality objectives for selenium in the San Joaquin River downstream from the Restoration Area. TMDLs have been completed for selenium in Salt Slough, the Grassland Marshes, and the San Joaquin River (CVRWQCB 2005) (Table B-2) and should be implemented by the SWRCB after public review (CVRWQCB 2007).

The lower San Joaquin River is federally listed under the CWA 303(d) list as impaired for selenium. The U.S. EPA aquatic life criterion of 5 micrograms per liter (µg/L) was adopted as the San Joaquin River objective (CVRWQCB 2001). A 5-µg/L objective must be met for the San Joaquin River for Reaches 4 and 5 – from Sack Dam to the Merced River confluence – starting in October 2010 (Table B-2). The selenium water quality objective for the entire San Joaquin River downstream from the Merced River will be attained when the water quality objective is also attained at a point just downstream from the Merced River confluence (CVRWQCB 2001).

The presence of mercury in the San Joaquin River Basin and its bioaccumulation potential can reach harmful levels in fishes and their predators. Piscivorous birds sampled at different locations within the Sacramento River and San Joaquin river basins have mercury concentrations within a toxic range (CVRWQCB 2007). High mercury concentrations in fish tissue result from drainage, runoff, and erosion from old mines during mineral exploration and extraction activities. Thus, ore exploration and extraction activities are discharges of great concern in the San Joaquin River Basin (CVRWQCB 2007).

Dissolved Oxygen

The Central Valley Water Board uses a number of tools to regulate discharges of waste that could impact dissolved oxygen (DO) concentration in receiving waters, including but not limited to, waivers of waste discharge requirements or National Pollutant Discharge Elimination System (NPDES) permits. Alternatively, prohibitions should help manage the low DO problem in the lower San Joaquin River. DO levels below 5.0 mg/L create an oxygen barrier, also known as “oxygen block,” which impedes upstream migration of adult Chinook salmon (SWRCB 2000). Levels as low as 1.5mg/L DO have been recorded in the lower San Joaquin River, and levels as low as 0 mg/L have been recorded in the Stockton Deep Water Ship Channel (SWRCB 2000). Table B-3 identifies the DO water quality objectives as defined by the Central Valley Water Board (2007).

Pesticides and Herbicides

Pesticide contamination of surface waters can affect fish and aquatic wildlife. For most pesticides, numerical water quality objectives have not been adopted, but a number of narrative water quality objectives (e.g., no adverse effects) for pesticides and toxicity are listed in Table B-4 through Table B-6 (CVRWQCB 2007). A goal to be free of toxic substances in surface water is established for the San Joaquin River system. This goal is intended to protect the beneficial uses of recreation, warm freshwater habitat, cold

freshwater habitat, and municipal and domestic supply from potential pesticide impacts. Maximum allowable levels for two organophosphate pesticides (OP) found in the San Joaquin River, diazinon and chlorpyrifos, have been defined by the Central Valley Water Board in the form of water quality objectives (Table B-5), waste load, and load allocations (CVRWQCB 2007). High and variable concentrations of diazinon and chlorpyrifos are found in winter runoff (Kratzer and Shelton 1998). During winter, dormant-spray pesticides, such as diazinon and chlorpyrifos, are applied to fruit orchards and alfalfa fields in the San Joaquin River Basin and Delta islands (Kuivila 1995, 2000). In combination, OPs from contaminated watersheds can have additive effects on the neurobehavior of salmon (Scholz et al. 2006). In addition, bottom sediment toxicity from pyrethroids and some herbicides can impact sediment dwelling organisms (i.e., lower tropic level). Therefore, reductions to the maximum allowable levels could be mandated to account for potential additive or synergistic toxicity impacts on reintroduced salmonids.

Groundwater Quality

Groundwater quality in the San Joaquin River Basin is considered to be poor. Groundwater has little or no assimilative capacity for wastes. Preventive measures, such as overdraft prevention, are required to avoid groundwater contamination. Prevention is significantly more cost effective than designing cleanup plans when groundwater quality issues arise. For example, groundwater contamination from the use of nitrogen fertilizer on irrigation crops leads to nitrate-polluted base flows reaching the San Joaquin River creates a critical condition for both fish and municipal water users.

State water quality control programs (SWQCP) establish standards for groundwater in addition to surface waters (Table B-5) (CVRWQCB 2007). Therefore, SWQCPs approved by SWRCB are the regulatory references to meet groundwater quality requirements during management actions to restore the San Joaquin fisheries.

Regular groundwater quality monitoring is recommended at selected wells, including areas of the lower reaches of the San Joaquin River adjacent to agricultural lands (CH2M Hill 2007). A groundwater quality monitoring program could help measure salinity loads, trace elements, and heavy metals in the Restoration Area and recommend mitigation measures to protect immigrating adults and outmigrating juvenile salmon. Mitigation or avoidance measures could be developed and implemented to minimize the impact of reach-specific restoration actions on different aspects of water quality.

Other Water Quality Constituents

Other water quality constituents of concern include nutrients, suspended sediment and turbidity, as well as ammonia exports from local wastewater treatment plants and from septic leaching and animal facilities. Narrative objectives have been established for these constituents (Tables B-6 and B-7).

Ammonia, nitrates, and bacterial contamination (e.g., fecal coliforms) within the Restoration Area are a result of wastewater and stormwater inputs. Wastewater inputs can become a water quality issue when animal facilities do not comply with waste discharge requirements. Many of these animal facilities are not regulated by waste discharge requirements (CVRWQCB 2007). To prevent similar mortalities of Chinook salmon and other fishes in the San Joaquin River, numerical water quality objectives for ammonia would be derived for the protection of beneficial uses for fishes (Table B-7).

Sedimentation due to surface runoff from agricultural, roads, driveways, construction sites, etc., can impair fisheries in receiving waters and high levels has actually changed the fish community composition in some rivers (e.g., Missouri River). Sediment loading and suspension in the river increase turbidity, which may be compounded by the distribution and circulation of toxic substances bound to suspended particles. Turbidity is a measure of light transmittance in water that could be affected by different factors besides suspended solids, including algal communities and water coloration. In general, discerning individual effects may be easier than discerning population-level effects (Newcombe and Jensen 1996). Potential adverse effects of increased turbidity on fishes downstream from Friant Dam could range from a reduction in visibility that could affect feeding efficiency to gill clogging and abrasion under high sediment concentrations. Such adverse suspended sediment conditions can affect salmonid homing and cause physiological stress (Entrix 2008). Alternately, increased turbidity caused by suspended solids can have a protective impact against predation of outmigrating juveniles.

Table B-1.
Salinity Objectives for SJRRP Water Quality and/or Beneficial Uses Based on the State Water Resources Control Board Water Quality Standards

Salinity		
Season	**Electrical Conductivity, EC (mS/cm)**	**Total Dissolved Solids (ppm)**
Irrigation (April-August)	0.7	455
NonIrrigation (September-March)	1.0	650
Chloride (Cl^-)[a]		
Location (Beneficial Use)*	**Water Year Type**	**No. of Days ea. Calendar Year <150 mg/L Cl^- / (%)**
San Joaquin River at Antioch Water Works Intake (Municipal and Industrial Uses)	Wet	240 (66%)
	Above Normal	190 (52%)
	Below Normal	175 (48%)
	Dry	165 (45%)
	Critical Dry	155 (42%)
Agricultural Water Quality Limits	106 mg/L	
Freshwater Aquatic Life Protection (U.S. EPA)	Continuous concentration (4-day Average) = 230,000µg/L; Maximum concentration (1-hour Average) = 860,000µg/L	
Electrical Conductivity, EC[b]		
Location (Beneficial Use)*	**Water Year Type**	**Dates (Values, µmhos)**
San Joaquin River at Jersey Point (Agricultural Use)	Wet	April 1-Aug.15 (0.45)
	Above Normal	April 1-Aug.15 (0.45)
	Below Normal	April 1-June 20 (0.45); June 20-Aug.15 (0.74)
	Dry	April 1-June 15 (0.45); June 15-Aug.15 (1.35)
	Critical Dry	April 1-Aug.15 (2.20)
San Joaquin River at San Andreas Landing (Agricultural Use)	Wet	April 1-Aug. 15 (0.45)
	Above Normal	April 1-Aug. 15 (0.45)
	Below Normal	April 1-Aug. 15 (0.45)
	Dry	April 1-June 25 (0.45); June 25-Aug. 15 (0.58)
	Critical Dry	April 1-Aug. 15 (0.87)
San Joaquin River at Antioch Water Works Intake (Striped Bass Spawning) This is a beneficial use.	All	April 15-May 31 (or until spawning has ended) (1.5)
San Joaquin River at Antioch Water Works Intake (Striped Bass Spawning - Relaxation Provision[d])	Dry	April 1-May 31 (1.5-1.8)
	Critical	April 1-May 31 (1.5-3.7)
San Joaquin River at Prisoners Point (Striped Bass Spawning) This is a beneficial use.	All	April 1-May 31 (or until spawning has ended) (0.44)
San Joaquin River at Prisoners Point (Striped Bass Spawning - Relaxation Provision[d]) Refer to footnote d below.	Dry and Critical	April 1-May 31(or until spawning has ended) (0.55)

Table B-1.
Salinity Objectives for SJRRP Water Quality and/or Beneficial Uses Based on the State Water Resources Control Board Water Quality Standards (contd.)

Electrical Conductivity, EC[c]		
Location (Beneficial Use)*	**Water Year Type**	**Dates (Values, µmhos)**
San Joaquin River at Airport Way Bridge, Vernalis (Agricultural Use)	All	April 1-Aug. 31 (0.7); Sep. 1-Mar. 31 (1.0)
San Joaquin River at Brandt Bridge (Agricultural Use)	All	April 1-Aug. 31 (0.7); Sep. 1-Mar. 31 (1.0)
Secondary Maximum Contaminant Level (MCL)	900 µmhos/cm (at 25°C) (CDPH)	
Agricultural Water Quality Limits	700 µmhos/cm (at 25°C)	

Sources: Central Valley Water Quality Control Board 2008, SWRCB Water Rights Decision (D-1641) 2000, Basin Plan 2007.

Notes:

The water year classification will be established using the best available estimate of the 60-20-20 San Joaquin Valley water year hydrologic classification

[a] Maximum mean daily 150 mg/L chloride for at least the number of days shown during the Calendar Year. Must be provided in intervals of not less than 2 weeks duration (Percentage of Calendar Year shown in parenthesis)

[b] Maximum 14-day running average of mean daily, in µmhos/cm

[c] Maximum 30-day running average of mean daily, in µmhos

[d] Relaxation provisions replace standards whenever water projects impose deficiencies in firm supplies.

Key:

µg/L= micrograms per liter

µmhos = micromhos. The Siemens (S), a measure of electric conductance, is also referred to as mho since it is equal to inverse ohm.

CDPH = California Department of Public Health

cm = centimeter

MCL = Maximum Contaminant Level

mg/L = milligrams per liter

mS = millisiemens

ppm = parts per million or mg/L

Table B-2.
Trace Element Objectives for the SJRRP Water Quality and/or Beneficial Uses

Constituent	Maximum Concentration	Applicable Water Bodies and/or Standards
Boron[1]	2.0 mg/L (15 March through 15 September)	San Joaquin River, mouth of the Merced River to Vernalis
	0.8 mg/L (monthly mean, 15 March through 15 September)	
	2.6 mg/L (16 September through 14 March)	
	1.0 mg/L (monthly mean, 16 September through 14 mg/L March) 1.3 mg/L (monthly mean, critical year[2])	
	100 / 10,000 µg/L	California State Notification Level and Response Level for Drinking Water (DPH)
	700 /750 µg/L	Agricultural Water Limits
	1400 µg/L	U.S. EPA Integrated Risk Information System (IRIS) Reference Dose as a Drinking Water Level
	1000 µg/L	Suggested No-Adverse-Response Level (SNARL)
Molybdenum[1]	0.015 mg/L	San Joaquin River, mouth of the Merced River to Vernalis
	0.010 mg/L (monthly mean)	
	0.050 mg/L	Salt Slough, Mud Slough (north), San Joaquin River from Sack Dam to the mouth of Merced River
	0.019 mg/L (monthly mean)	
Selenium[1]	0.012 mg/L	San Joaquin River, mouth of the Merced River to Vernalis
	0.005 mg/L (4-day average)	San Joaquin River below the Merced River; Critical, Dry and Below Normal Water Year Types (1 October 2010)
	0.005 mg/L (4-day average)	Mud Slough (north), and the San Joaquin River from Sack Dam to the mouth of the Merced River (1 October 2010)
	50 µg/L	Drinking Water Standards (California & Federal) Maximum Contaminant Levels (MCL)
	20 µg/L	Agricultural Water Quality Limits
	35 µg/L	U.S. EPA Integrated Risk Information System (IRIS) Reference Dose as a Drinking Water Level
	50 µg/L	Suggested No-Adverse-Response Level (SNARL) for toxicity other than cancer risk
	5 µg/L	U.S. EPA National Recommended Ambient Water Quality Criteria for Freshwater Aquatic Life Protection - Continuous Concentration (4-day Average)
	20 µg/L	U.S. EPA National Recommended Ambient Water Quality Criteria for Freshwater Aquatic Life Protection - Maximum Concentration (1-hour Average)
	258 µg/L	U.S. EPA National Recommended Ambient Water Quality Criteria for Freshwater Aquatic Life Protection - 24-hour Average
	170 µg/L	Non-Cancer Health Effects: Sources of Drinking Water (water + organisms)
	4200 µg/L	Other Waters (aquatic organism consumption only)

Table B-2.
Trace Element Objectives for the SJRRP Water Quality and/or Beneficial Uses (contd.)

Constituent	Maximum Concentration	Applicable Water Bodies and/or Standards
Mercury (inorganic)	2 µg/L	Drinking Water Standards (California & Federal) - Primary Maximum Contaminant Level (MCL)
	1.2 µg/L	(DPH, U.S. EPA); California Public Health Goal
	2 µg/L	Suggested No-Adverse-Response Level (SNARL) for toxicity other than cancer risk
Mercury (organic and inorganic)	0.77 µg/L	U.S. EPA National Recommended Ambient Water Quality Criteria for Freshwater Aquatic Life Protection - Continuous Concentration (4-day Average)
	1.4 µg/L	U.S. EPA National Recommended Ambient Water Quality Criteria for Freshwater Aquatic Life Protection - Maximum Concentration (1-hour Average)
Methylmercury	0.07 µg/L	U.S. EPA Integrated Risk Information System (IRIS) Reference Dose as a Drinking Water Level
	0.15 µg/L	Maximum Allowable Dose Level for Reproductive Toxicity
	0.3 mg/kg	U.S. EPA National Recommended Ambient Water Quality Criteria for Human Health and Welfare Protection - Non-Cancer Health Effects

Source: Central Valley Regional Water Quality Control Board 2008.

Notes:

[1] Boron, molybdenum, and boron objectives are total concentrations.

[2] A critical year has a water index equal or less than 5.4.

Key:

µg/L = micrograms per liter
DPH = California Department of Public Health
MCL = maximum containment level
mg/kg = milligrams per kilogram
mg/L = milligrams per liter
OEHHA = Office of Environmental Health Hazard Assessment
U.S. EPA = United States Environmental Protection Agency

Table B-3.
Dissolved Oxygen Objectives for the SJRRP

Dissolved Oxygen Water Quality Objectives			
Season	**Region**	**Values**	**Beneficial use**
1 September- 30 November	Lower San Joaquin River (Stockton to Turner Cut)	6.0 mg/L[a]	Fall-run Chinook salmon protection
1 September- 30 November	Restoration Area	6.0 mg/L[b]	Salmonid migration, spawning and rearing
All Year	Delta region	5.0 mg/L[c]	Warm Freshwater Habitat (WARM)

Sources:
[a] *SWRCB (1991)*
[b] *Fisheries Management Work Group recommendation for dissolved oxygen concentrations within the Restoration Area.*
[c] *Central Valley Regional Water Quality Control Board Basin Plan (2007)*
Key:
mg/L = milligrams per liter

Table B-4.
Narrative Water Quality Objectives for the SJRRP

Category	Description	Applicable Water Bodies
Bacteria	• Mean concentration of fecal coliforms: 200/100 ml (n>5 samples; 30-d period) • Maximum concentration of fecal coliforms: 400/100 ml (<10% of samples; 30-d period)	Waters designated for contact recreation
Biostimulatory Substances	• Will not promote aquatic growths in concentrations that cause nuisance or adversely affect beneficial uses	Inland surface waters, including the SJRB
Color	• Water will be free of discoloration that causes nuisance or adversely affects beneficial uses	Inland surface waters, including the SJRB
Floating Material	• Water will not contain floating material in amounts that cause nuisance or adversely affect beneficial uses	Inland surface waters, including the SJRB
Methylmercury	• Less than 0.09 (trophic level 3) and 0.19 (trophic level 4) mg methyl mercury/kg wet weight of fish tissue • Average concentration less than 0.12 (trophic level 3) and 0.23 (trophic level 4) mg methylmercury/kg wet weight, muscle tissue • Average concentration less than 0.05 (trophic level 2 and 3 fish) mg methylmercury/kg wet weight, whole fish	Clear Lake* Cache, North Fork Cache, and Bear Creeks*
Oil and Grease	• Waters will not contain oils, greases, waxes, or other materials in concentrations that adversely affect beneficial uses	Inland surface waters, including the SJRB

Table B-4.
Narrative Water Quality Objectives for the SJRRP (contd.)

Category	Description	Applicable Water Bodies
pH	• 6.5-8.5; Changes in normal pH levels will not exceed 0.5 in fresh waters with designated COLD or WARM beneficial uses • Drinking Water Standards (California & Federal) Secondary Maximum Contaminant Levels (MCL) = 6.5 / 8.5 units (U.S. EPA) • Agricultural Water Quality Limits = 6.5 / 8.4 units • U.S. EPA National Recommended Ambient Water Quality Criteria: Taste & Odor or Welfare = 5 / 9 units • Recommended Criteria for Freshwater and Aquatic Life Protection (Instantaneous Maximum) = 6.5 / 9 units	Inland surface waters, including the SJRB
Pesticides (in general)	• No individual pesticide or combination of pesticides will be present in concentrations that adversely affect beneficial uses • Discharges will not result in pesticide concentrations in bottom sediments or aquatic life that adversely affect beneficial uses • Total chlorinated hydrocarbon pesticides will not be present at detectable concentrations (approved by EPA) in the water column • Concentrations will not exceed those allowable by applicable antidegradation policies • Concentrations will not exceed the lowest levels technically and economically achievable • Concentrations in MUN waters will not exceed MCLs set forth in the California Code of Regulations, Title 22, Division 4, Chapter 15 • Concentrations of thiobencarb in MUN waters will not exceed 1.0 µg/L	Inland surface waters, including the SJRB
Radioactivity	• Radionucleotides will not be present in concentrations that are harmful to human, plant, animal or aquatic life • Radionucleotide concentrations will not lead to their accumulation in the food web to an extent that presents a hazard • Radionucleotide concentrations will not exceed MCLs specified in Section 64443 of Title 22 of the California Code of Regulations	Inland surface waters, including the SJRB

Table B-4.
Narrative Water Quality Objectives for the SJRRP (contd.)

Category	Description	Applicable Water Bodies
Sediment	• The suspended sediment load and suspended sediment discharge rate of surface waters will not be altered in such a manner as to cause nuisance or adversely affect beneficial uses	Inland surface waters, including the SJRB
Settleable Material	• Waters will not contain substances in concentrations that result in the deposition of material that causes nuisance or adversely affects beneficial uses.	Inland surface waters, including the SJRB
Suspended Material	• Waters will not contain suspended material in concentrations that cause nuisance or adversely affect beneficial uses.	Inland surface waters, including the SJRB
Tastes and Odors	• "Water shall not contain taste- or odor-producing substances in concentrations that impart undesirable tastes or odors to domestic or municipal water supplies or to fish flesh or other edible products of aquatic origin, or that cause nuisance, or otherwise adversely affect beneficial uses."	Inland surface waters, including the SJRB
Temperature	• The natural receiving water temperature of intrastate waters will not be altered unless it does not adversely affect beneficial uses. • "At no time or place shall the temperature of COLD or WARM intrastate waters be increased more than 5°F above natural receiving water temperature." • Reference: Water Quality Control Plan for Control of Temperature in the Coastal and Interstate Waters and Enclosed Bays of California. State Water Resources Control Board. http://www.swrcb.ca.gov/water_issues/programs/ocean/docs/wqplans/thermpln.pdf • The CA Thermal Plan defines natural receiving water temperature as "the temperature of the receiving water at locations, depths, and times which represent conditions unaffected by any elevated temperature waste discharge or irrigation return waters." • In other words, this narrative objective states that the temperatures of the receiving waters of cold or warm freshwater habitat in California, including the San Joaquin River Restoration Area, should not increase more than 5°F above existing conditions (This criteria is not based on biological needs). • "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 3 in all water year types." [a] Note this temperature can be too high to meet the needs of salmon.	Inland surface waters, including the SJRB San Joaquin River at Airport Way Bridge, Vernalis*
Toxicity	• All "waters shall be maintained free of toxic substances in concentrations that produce detrimental physiological responses (or toxicity due to single or interacting substances) in human, plant, animal, or aquatic life…" Survival of aquatic life in surface waters subjected to a waste discharge shall not be less than that for the same water body in unaffected areas or other control water.	Inland surface waters, including the SJRB

Table B-4.
Narrative Water Quality Objectives for the SJRRP (contd.)

Category	Description	Applicable Water Bodies
Turbidity	• Waters will be free of changes in turbidity that cause nuisance or adversely affect beneficial uses. • Increases in turbidity (measured by NTUs) attributable to controllable water quality factors will not exceed the following limits: Where natural turbidity = 0-5 NTUs; increases will not exceed 1 NTU Where natural turbidity = 5-50 NTUs; increases will not exceed 20 percent Where natural turbidity = 50-100 NTUs; increases will not exceed 10 NTUs Where natural turbidity > 100 NTUs; increases will not exceed 10 percent Drinking water standards (California & Federal) MCL: Primary MCL = 1 / 5 NTU (DPH, U.S. EPA); Secondary MCL = 5 NTU (DPH)	Inland surface waters, including the SJRB

Source: Modified from CVRWCB (2007) Basin Plan.

Notes:

[a] Taken from the State Water Board's "Water Quality Control Plan For Salinity," May 1991.

[b] Control water should be consistent with the requirements for "experimental water" as described in Standard Methods for the Examination of Water and Wastewater, latest edition

[c] Controllable water quality factors "are those actions, conditions, or circumstances resulting from human activities that may influence the quality of the waters of the State, that are subject to the authority of the State Water Board or the Regional Water Board, and that may be reasonably controlled." (Central Valley RWQCB Basin Plan 2007)

[*] Water bodies outside the Restoration Area.

Key:

°F = degrees Fahrenheit
µg/L = micrograms per liter
COLD = cold freshwater habitat beneficial use
DPH = California Department of Public Health
kg = kilogram
MCL = maximum contaminant levels
mg = milligram
ml = milliliter
MUN = municipal and domestic supply beneficial use
NTU = Nephelometric Turbidity Units
SJRB = San Joaquin River Basin
U.S. EPA = U.S. Environmental Protection Agency
WARM = warm freshwater habitat beneficial use

Table B-5.
Narrative Objectives for Groundwater Quality in the San Joaquin River Basin

Narrative Water Quality Objectives for the San Joaquin River Basin Groundwaters	
Category	**Description[a]**
Bacteria	• In MUN groundwaters, the most probable number of coliform organisms over any 7-day period shall be less than 2.2/100 ml.
Chemical Constituents	• Groundwaters shall not contain chemical constituents in concentrations that adversely affect beneficial uses. • At a minimum, MUN groundwaters shall not exceed MCLs for chemical constituents as specified in Title 22 of the California Code of Regulations. In addition, MUN waters shall not contain lead in excess of 0.015 mg/L.
Radioactivity	• At a minimum, MUN groundwaters shall not contain concentrations of radionucleotides in excess of the MCLs specified in Section 64443 of Title 22 of the California Code of Regulations.
Tastes and Odors	• Groundwaters shall not contain taste- or odor-producing substances in concentrations that cause nuisance or adversely affect beneficial uses.
Toxicity	• Groundwaters shall be maintained free of toxic substances in concentrations that produce detrimental physiological responses in human, plant, animal, or aquatic life associated with designated beneficial use(s). This objective applies regardless of whether the toxicity is caused by a single substance or the interactive effect of multiple substances.

Source: Modified from CVRWCB (2007) Basin Plan.

Note:
[a] These objectives are applicable to all groundwaters of the Sacramento and San Joaquin River Basins.

Key:
MCL = Maximum Contaminant Level
mg/L = milligrams per liter
ml = milliliter
MUN = Municipal and Domestic Supply beneficial use

Table B-6.
Diazinon and Chlorpyrifos Water Quality Objectives for the Protection of the San Joaquin River

Specific Pesticide Water Quality Objectives for the San Joaquin River		
Pesticide	**Maximum Concentration (µg/L) and Averaging Period**	**Applicable Water Bodies**
Chlorpyrifos	• 0.025 µg/L; 1-hour average (acute) • 0.015 µg/L; 4-day average (chronic) • Not to be exceeded more than once in a 3-year period • Continuous Concentration (4-day Average) = 0.014 / 0.041 µg/L • Maximum Concentration (1-hour Average) = 0.02 / 0.083 µg/L	• San Joaquin River from Mendota Dam to Vernalis (Mendota Dam to Sack Dam; Sack Dam to Mouth of Merced River)[a] • Mouth of Merced River to Vernalis* • Delta Waterways*
Diazinon	• 0.16 µg/L; 1-hour average (acute) • 0.10 µg/L; 4-day average (chronic) • Not to be exceeded more than once in a 3-year period. • Continuous Concentration (4-day Average) = 0.05 / 0.17 µg/L • Maximum Concentration (1-hour Average) = 0.08 / 0.17 µg/L	• As noted above for Chlorpyrifos

Notes:

* Water bodies outside the Restoration Area

[a] "Waste Load Allocations (WLA) for permitted dischargers, Load Allocations (LA) for nonpoint source discharges, and the Loading Capacity (LC) of the San Joaquin River from the Mendota Dam to Vernalis shall not exceed the sum (S) of one (1.0) (Basin Plan 2007)": $S = CD/WQOD + CC/WQOC \leq 1.0$, where:

CD = diazinon concentration (µg/L) of point source discharge for the WLA; nonpoint source discharge for the LA; or San Joaquin River for the LC.

CC = chlorpyrifos concentration (µg/L) of point source discharge for the WLA; nonpoint source discharge for the LA; or San Joaquin River for the LC.

NAS = National Academy of Sciences Delete. You don't need to include this abbreviation if the associated changes were not incorporated in the latest version of the table.

WQOD = acute or chronic diazinon water quality objective in µg/L.

WQOC = acute or chronic chlorpyrifos water quality objective in µg/L.

"nondetectable" concentrations in analytical studies = 0.0 µg/L

Key:

µg/L = microgram per liter

LA = Load Allocations

LC = Loading Capacity

WLA = Waste Load Allocations

Table B-7.
Recommended Numerical Objective for Ammonia for the SJRRP

Category	Suggested Numerical Water Quality Limit
Ammonia (total ammonia nitrogen)	U.S. EPA National Recommended Water Quality Criteria to Protect Freshwater Aquatic Life If the following conditions are met: • Minimum Target Temperature for fish = 55°F (13°C) • Mean daily pH in the lower San Joaquin > 8.0 Total Ammonia should not exceed: • Continuous Concentration, 30-day Average (mg N/L) < 2.43; when early life stages are present • Maximum Concentration, 1-hour average (mg N/L) < 5.62; when salmonids are present

Sources:
Central Valley Regional Water Quality Control Board 2007
Appendix A
Key:
< = less than
> = greater than
°C = degrees Celsius
°F = degrees Fahrenheit
mg N/L = milligrams of nitrogen per liter
U.S. EPA = U.S. Environmental Protection Agency

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