Evaluation of Municipal and Domestic Supply (MUN) Beneficial Use in Agricultural Drains

Sacramento Valley Archetypes

Draft Monitoring Plan

12 March 2012

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I. Introduction

This plan documents the monitoring aspects of the MUN Beneficial Use Evaluation in Agricultural Drains 2012 study. This study is sponsored by the Central Valley Regional Water Quality Control Board (Central Valley Water Board) in conjunction with the Central Valley Salinity Alternatives for Long-Term Sustainability (CV-SALTS) initiative. The purpose of this study is to evaluate appropriate application of MUN Beneficial Use designations within agriculturally dominated water bodies downstream of Publicly Owned Treatment Works (POTW) discharges in the Sacramento River Basin.

Sampling sites consist of:

- Sites utilized by POTWs for compliance for the National Pollutant Discharge Elimination System (NPDES) program (specifically, sites upstream and downstream of effluent discharge, defined as treated wastewater); and
- Downstream locations that evaluate progressive water quality at confluences with additional agriculturally dominated water bodies.

Parameters analyzed include flow, electrical conductivity and constituents encompassed by Maximum Contaminant Levels (MCLs) specified in provisions of Title 22 of the California Code of Regulations as documented in the Central Valley Basin Plans. Additional constituents will be analyzed against human health-based standards in the California Toxics Rule (CTR).

It is anticipated that an 18-month sampling period will be needed to ensure that seasonal changes in water quality and hydrology are documented. The design allows for adaptive review and changes on a quarterly schedule. If it is determined that the MUN designated use is not existing and the water body meets the exceptions in the Drinking Water policy, adjustments to the monitoring design will be discussed at quarterly reviews.

To leverage resources, provide access and insure transparency, the project has been coordinated with the CV-SALTS initiative, Irrigated Lands Regulatory Program coalitions, local POTWs and other local, state and federal stakeholders.

II. Background

Via the Sources of Drinking Water Policy (88-63), the Central Valley Regional Water Quality Control Board Basin Plans (Basin Plans) designate MUN beneficial use to all water bodies unless they are specifically listed as water bodies that are not designated with MUN. The Basin Plan states that waters designated for MUN must not exceed MCLs for chemical constituents, pesticides, and radionuclides. While 88-63 does contain exceptions for the MUN designation, to utilize the

exception, the Basin Plans require *". . . a formal Basin Plan amendment and public hearing, followed by approval of such an amendment by the State Water Board and the Office of Administrative Law."*

During permit adoptions for the National Pollution Discharge Elimination System (NPDES) program, there have been challenges to protecting the MUN beneficial use designation in agricultural drains due to the stated exception in 88-63. The cost for POTWs to comply with protecting the MUN beneficial use has been estimated at $3 - $7 million (City of Willows, case example). The POTWs have been provided the option of pursuing a basin plan amendment as part of their permit compliance.

Concurrently, the CV-SALTS initiative has identified the protection of MUN beneficial uses in agriculturally dominated water bodies as potentially over restrictive and in need of evaluation. CV-SALTS identified receiving waters of four POTWs as potential archetypes for evaluating appropriateness of a MUN designation. These same archetypes have challenged the MUN designation during NPDES permit renewals.

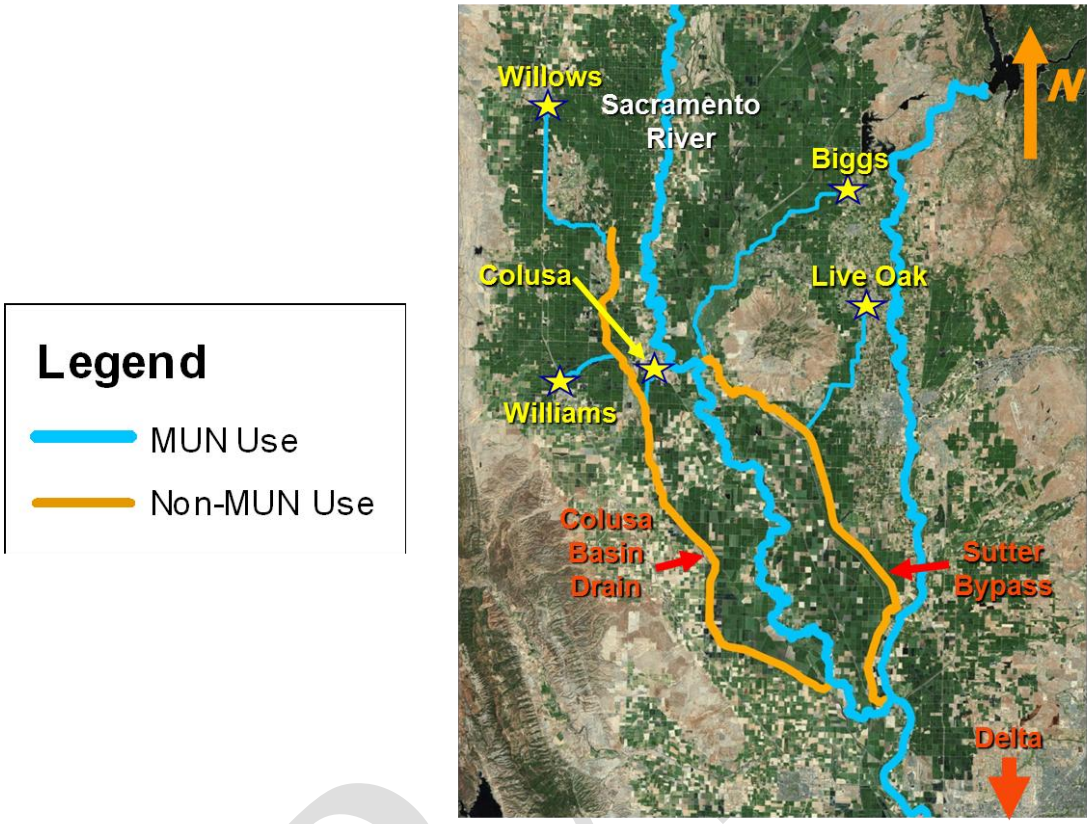
In May 2011, a draft Central Valley Water Board staff report evaluated the appropriateness of the MUN beneficial use in a water body (agricultural drain) receiving effluent. The report found that more data needs to be collected before determining if a basin plan amendment is needed. The data needs noted included: characterization of the receiving waters, water quality data for the effluent and all receiving waters, flow data for all of the receiving waters, an antidegradation analysis, and an environmental analysis.

This project attempts to combine and leverage the work desired by four POTWs (the cities of Willows, Colusa, Live Oak, and Biggs) and the archetypes identified by CV-SALTS. The findings from this study may change how compliance for MUN will be enforced in new NPDES permits.

III. Study Design Overview

This Monitoring Plan has been formatted to reflect California's Surface Water Ambient Monitoring Program's (SWAMP's) template. The following sections provide details of the plan, including questions to be answered, constituents to be analyzed, sampling sites and frequency. Figure 1 displays where the study area.

Figure 1: Study Area



III.a Monitoring Design

III.a.1 Questions to be Answered

This monitoring effort will provide information within the designated area of the Sacramento River Basin to evaluate appropriate implementation of the MUN beneficial use in agriculturally dominated water bodies (Figure 1). This project will primarily investigate appropriate application of the Sources of Drinking Water Policy (#88-63) and Antidegradation Policy (#68-16). Questions being asked by this study are:

Key Factors

- Is the designated use occurring? (Perform physical survey of the area)
- Is the water source predominantly recycled water, urban storm drainage, treated or untreated wastewater or agricultural return water? (California Department of Public Health policy memorandum

97-005: Recommends against the use of drinking water supplies from “Water that is predominantly recycled water, urban storm drainage, treated or untreated wastewater, or is agricultural return water”

- Is there a significant change in hydrology due to seasonality and/or water management?

88-63: Sources of Drinking Water

- Do the exceptions of the Drinking Water policy apply?
    - Does water source provide an average sustained yield of 200 gallons per day?
    - Is the water source in a system designed or modified to collect or treat municipal or industrial wastewaters, process waters, mining wastewaters, or storm water runoff?
    - Is the water source in a system designed or modified for the primary purpose of conveying or holding agricultural drainage waters?
    - Does the water body have a contamination, either by natural processes or by human activity that cannot reasonably be treated for domestic use using either Best Management Practices or best economically achievable treatment practices?
- If an exception is applicable, will the discharge (from the system designed to treat wastewater or conveying agricultural water) be monitored to assure compliance with all relevant water quality objectives as required by the Regional Boards?

68-16: Maintaining High Quality of Waters in California

- *Is the anti-degradation analysis for NPDES permit complete?*
    - *If not, what additional information is needed?*
- Is water quality sufficient to attaining the beneficial use? (What is the quality of the background water?)
    - If not:
        - At what point downstream is MUN achievable?
        - Do any of the 40CFR131.10(g) Factors occur?
            - Naturally occurring pollutant concentrations prevent attainment of use
            - Natural, ephemeral, intermittent or low flow conditions or water levels prevent the attainment of the use, unless these conditions may be compensated for by the

discharge of sufficient volume of effluent discharges without violating State water conservation requirements to enable uses to be met
- Human caused conditions or sources of pollution prevent the attainment of the use and cannot be remedied or would cause more environmental damage to correct than to leave in place
- Dams, diversions or other types of hydrologic modification preclude the attainment of the use, and it is not feasible to restore the water body to its original condition or to operate such modification in a way that would result in the attainment of the use
- Controls more stringent than those required by sections 301 (b) and 306 of the Act would result in substantial and widespread economic and social impact

- What are the appropriate constituents to monitor?

The primary objectives of this monitoring project are:

- Characterize Receiving Waters
- Determine spatial and temporal extent of potential degradation and/or impairment

III.a.2 Answering Key Factors

- *Is the designated use occurring?*

- *Is the water source predominantly wastewater or agricultural return water?*

Review existing water rights permits and conduct a physical survey of the water bodies surrounding the effluent discharges from the POTWs. The physical survey would include evaluation of discharge points and diversions and associated use. .

Interview the POTWs and Irrigation Districts to characterize the water source. Confirm with physical survey.

- *Is there a significant change in hydrology due to seasonality and/or water management?*

Interview irrigation districts and POTWs to document hydrologic changes due to seasonality and/or water management. Identify any continuous flow data within the study area and compile information. Collect flow information for a minimum of 1-year with the option to extend 6-months depending on initial findings. Flow measurements should be conducted weekly with photographs to complement the findings. Locations for flow measurements should be upstream and downstream

of the effluent discharge, the effluent discharge, as well as upstream and downstream of the last water body that receive the effluent discharge and are tributary to the Sutter Bypass or Colusa Basin Drain which are both designated as non-MUN.

III.a.3 Answering the Sources of Drinking Water Policy

- *Do the exceptions of the Drinking Water policy apply?*
    - *Does water source provide an average sustained yield of 200 gallons per day?*

Conduct weekly flow measurements at key monitoring locations. Include photo documentation.

- *Is the water source in a system designed or modified to collect or treat municipal or industrial wastewaters, process waters, mining wastewaters, or storm water runoff?*
- *Is the water source in a system designed or modified for the primary purpose of conveying or holding agricultural drainage waters?*

Utilize a combination of physical surveys and interviews with POTWs, Irrigation Districts and local water users/purveyors to determine origin of the water body and dominant use.

- *Does the water body have a contamination, either by natural processes or by human activity that cannot reasonably be treated for domestic use using either Best Management Practices or best economically achievable treatment practices?*

Evaluate the water quality data collected for the antidegradation analyses to determine if the water body has a contamination. If a contamination is found in the water body, then interview the POTWs, the agricultural community, and other interested stakeholders to evaluate whether reasonable treatment can be economically achieved.

- *If an exception is applicable, will the discharge (from the system designed to treat wastewater or conveying agricultural water) be monitored to assure compliance with all relevant water quality objectives as required by the Regional Boards?*

Sites downstream of the effluent discharge will be monitored to evaluate progressive water quality at confluences with additional agriculturally dominated water bodies. Current long-term monitoring efforts, primarily the Irrigated Lands Regulatory Program, Surface Water Ambient Monitoring Program and

Department of Water Resources Water Quality Investigations, will be evaluated to determine whether appropriate compliance points and adequate monitoring are established.

III.a.4 Answering the Anti-degradation Policy

- *Is the anti-degradation analysis for NPDES permit complete?*
    - *If not, what additional information is needed?*

Antidegradation analyses were conducted on all of the permitted discharges when they were re-adopted with a provision to protect the MUN beneficial use. Analysis of the results would provide valuable background information including identifying key constituents of concern and data gaps.

- *Is water quality sufficient to attaining the beneficial use?*
    - *What is the quality of the background water?*
    - *At what point downstream is MUN achievable?*
    - *What are the appropriate constituents to monitor?*

The Basin Plans specify using the Maximum Contaminant Levels (MCLs) specified in provisions of Title 22 of the California Code of Regulations to evaluate protection of MUN. In addition, the California Toxics Rule (CTR) provides human health-based standards for additional constituents. The constituents identified by the regulations are listed in Appendix A. To determine background concentrations and changing water quality moving through the system, water quality analyses will be conducted upstream and downstream of each major inflow. To account for anticipated seasonality, full scans of all constituents will be conducted during 4-key seasons: storm runoff; spring snowmelt; irrigation; and dry season. Monthly scans will be conducted for key constituents identified in previous NPDES evaluations: nitrate; arsenic; total trihalomethanes (THMs); aluminum; iron; manganese; methylene blue active substances (MBAS). Continuation of monthly analyses will be re-evaluated after each seasonal full scan.

- *Do any of the 40CFR131.10(g) Factors occur?*

The 40CFR131.10(G) Factors include naturally occurring pollutant contamination; natural, ephemeral, intermittent or low flow conditions or water levels; irreparable human caused conditions; hydrologic modifications and/or widespread economic impact that would prevent attainment of use. A combination of physical surveys, interviews with POTWs and Irrigation Districts, analysis of past and current water quality data would determine if any of the 40CFR131.10(G) Factors occur. The appropriate constituents to monitor have numerical criteria related to MUN. This includes constituents in the California Maximum Contaminant Levels, human-health based standards in the California Toxics Rule, and flow. The spatial and

temporal aspects of the flow and water quality sampling have been described above and are linked to key inflows and seasonal periods where natural and managed hydrology are anticipated to have distinct patterns.
Table 1 summarizes the general types of activities that will occur to answer the monitoring questions addressed by this study.

The monitoring will be conducted for eighteen months (March 2012 – August 2013) in order to span anticipated hydrologic changes due to seasons (irrigation, non-irrigation, dry, etc.) with the option to review and adapt the effort at quarterly intervals. Final design was reviewed by the CV-SALTS Technical Committee.

Table 1. Summary of Methods Used to Evaluate MUN Beneficial Use

	Method of Evaluation					
		Site Selection			Parameter Selection	
Monitoring Questions	Background Survey Watershed (Includes looking for intake pipes and interviews with POTWs and Irrigation Districts)	Monitor at Upstream Receiving Water Sites	Monitor at Downstream Receiving Water Sites	Monitor at Effluent Sites	Monitor Flow	Monitor MUN Constituents listed in: MCLs, CTR, Public Health Goal, Notification Level for drinking water, Odor Threshold
Key Factors						
Is the MUN use occurring?	X					
What is the characterization of the water source?	X					
Is there a change in Hydrology?	X	X	X		X	
68-16: Antidegradation Policy						
Is the Antidegradation analysis complete for NPDES permit?		X	X	X		X
Is water quality sufficient to attaining MUN?		X	X	X		X
If not, at what point downstream is MUN achievable?			X	X	X	X
Do any of the 40CFR131.10(G) Factors occur?	X	X	X	X	X	X
What are the appropriate constituents to monitor?					X	X
88-63: Sources of Drinking Water Policy						
Does the water source provide an average sustained yield of 200 gallons per day?	X	X	X	X	X	
Is the water source in a system designed to treat industrial wastewaters?	X					
Is the water source in a system modified for the primary purpose of holding or conveying agricultural drainage waters?	X					
If an exception is applicable, will the discharge be monitored to assure compliance with all relevant water quality objectives as required by the Regional Boards?			X			X

III.b. Sampling Locations

The sampling locations were selected to characterize the receiving waters and determine background quality as well as spatial and temporal extent of potential degradation and/or impairment.

Thirty-one sites have been selected to help characterize the water bodies (Table 2). Sites were selected after field reconnaissance and discussions with local stakeholders and water managers.

For all sites, safety and all-weather access are priorities for sampling activities. Based on field and weather conditions, the sampling plan may be modified by the project team during the sampling event to provide for field safety and make the collection accurate and thorough. Any changes will be documented on the field sheets. Figure 2 displays the monitoring sites on a map.

Table 2. Monitoring Sites (Water bodies are in **Bold**)

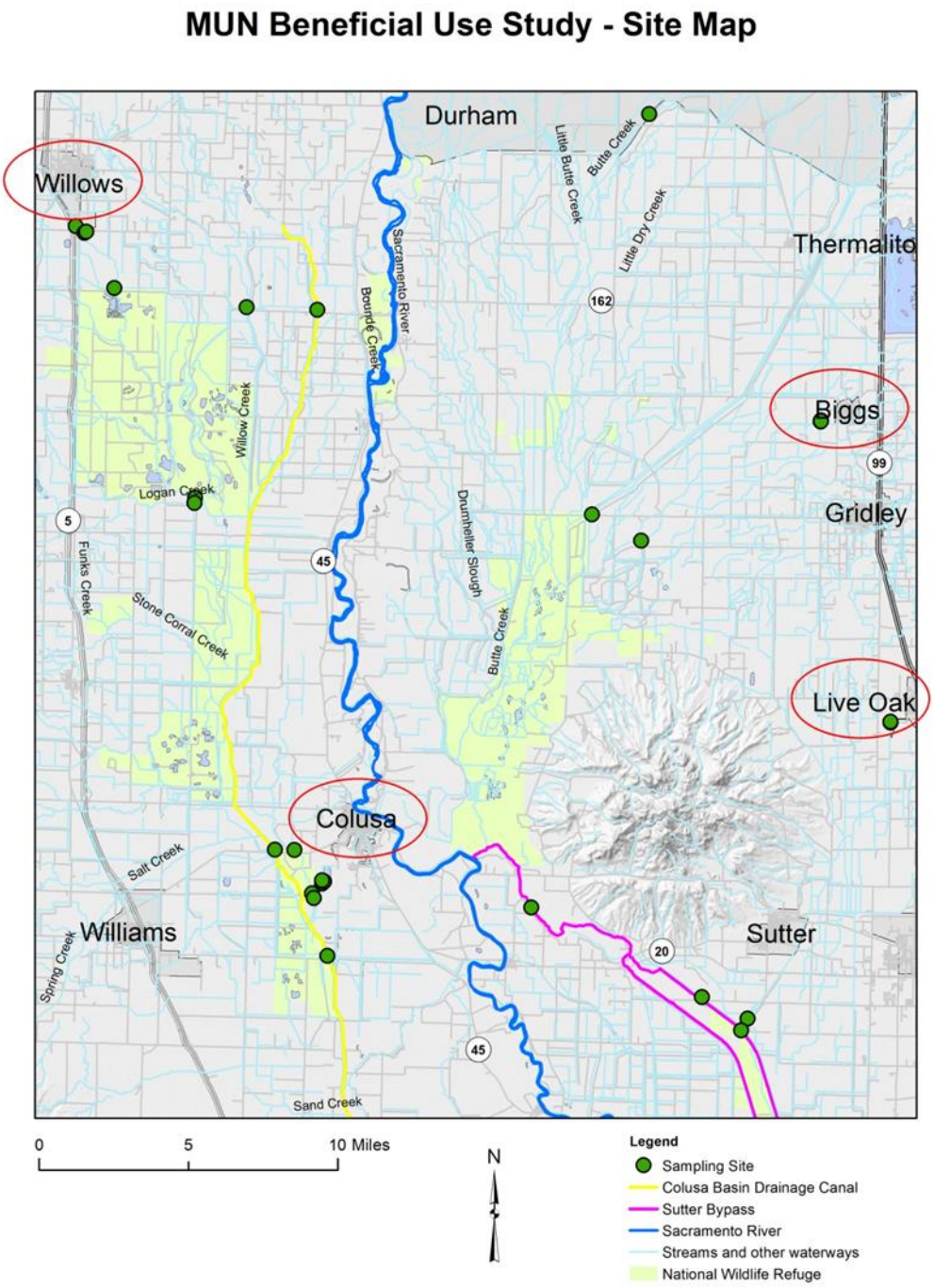
Note: GPS coordinates and "New Sites" are estimated using Google Maps and are subject to change after site reconnaissance.

No.	Station Number	Site Description	Latitude	Longitude
City of Colusa – Colusa County				
1	RSW-001U	**Unnamed tributary to Powell Slough**, below the first upstream agricultural discharge (up to 50 feet upstream)	39.180662	-122.031417
2	RSW-001D	**Unnamed tributary to Powell Slough**, above the first downstream agricultural discharge (up to 200 feet downstream)	39.179521	-122.031402
3	RSW-002U	**Powell Slough** (250 feet upstream from the confluence of the unnamed tributary to Powell Slough with Powell Slough)	39.174674	-122.037452
4	RSW-002D	**Powell Slough**, 400 feet downstream from the confluence of the unnamed tributary to Powell Slough with Powell Slough)	39.172442	-122.036265
5		**New Ditch,** upstream of effluent pump station	39.17427	-122.03125
6	EFF-001	Effluent Pump Station		
7		**Colusa Basin Drain**, upstream of effluent discharge at Highway 20	39.19550	-122.06083
8		**Colusa Basin Drain**, downstream of effluent discharge at Abel Road	39.14463	-122.02734

No.	Station Number	Site Description	Latitude	Longitude
9		**Powell Slough**, upstream of effluent discharge at Highway 20	39.19545	-122.04893
City of Willows – Glenn County				
10	RSW-001	**Ag Drain C**, Upstream Receiving Water – 1500 feet upstream from D-001	39.495456	-122.194655
11	RSW-002	**Ag Drain C**, Downstream Receiving Water – 100 feet downstream from D-001	39.492235	-122.189014
12		**Ag Drain C**, downstream of effluent discharge before effluent enters Wildlife Refuge at Road 60	39.46569	-122.16961
13		**Willow Creek,** upstream of effleunt discharge into Colusa Basin Drain at Road 61	39.45747	-122.08609
14		**Hunters Creek**, upstream of effluent discharge	39.36260	-122.11622
15		**Logan Creek**, downstream of effluent discharge	39.36520	-122.11597
16	EFF-001	Downstream of the last connection through which wastes can be admitted to the outfall		
17		**Colusa Basin Drain,** upstream of effluent discharge	39.45750	-122.04198
City of Live Oak – Sutter County				
18	RSW-001	**Lateral Drain #1**, Approximately 50 feet upstream of Discharge Point No. 001 to the receiving water	39.25983	-121.678742
19	RSW-002	**Lateral Drain #1**, Approximately 200 feet downstream of Discharge Point No. 001 to the receiving water or upstream of the next ag drain	39.258875	-121.678732
20	EFF-001	Location where a representative sample of the facility's effluent can be obtained prior to discharge into the receiving water		
21		**Wadsworth Canal,** downstream of effluent discharge	39.11893	-121.76402
22		**Sutter Bypass**, upstream of effluent discharge	39.128036	-121.79546
23		**Sutter Bypass**, downstream of effluent discharge	39.11250	-121.76814
City of Biggs – Butte County				

No.	Station Number	Site Description	Latitude	Longitude
24	R-001	**Lateral K** – Upstream receiving water sample – 100 feet upstream of Discharge Point D-001	39.408727	-121.725319
25	R-002	**Lateral K** – Downstream receiving water sample – 100 feet downstream of Discharge Point D-001	39.408213	-121.725319
26	M-001	Effluent sample point – last connection through which wastes can be admitted into the outfall		
27		**C Main Drain**, upstream of effluent discharge at dam before Cherokee Canal	39.34880	-121.83657
28		**Cherokee Canal**, upstream of effluent discharge	39.36247	-121.86745
39		**Butte Creek,** upstream of effluent discharge	39.55569	-121.83652
30a		**Butte Creek,** downstream of effluent discharge in Duck Club	New Site	
30b		**Butte Slough,** downstream of effluent discharge at Meridian	New Site	

Figure 2: MUN Beneficial Use Study – Site Map



III.c. Parameters

Parameters for this study were selected based on the potential to address the primary objectives and questions listed in section III.a. Study parameters include: field parameters (including flow, EC, pH, temperature and dissolved oxygen); and chemical parameters (including those with MCLs and those contained within the CTR). A draft Central Valley Water Board staff report released in May 2011 indicated that seven constituents currently in POTW effluent may not meet the water quality based effluent limitations designed to protect the MUN beneficial use. The seven constituents are: nitrate, arsenic, total trihalomethanes, aluminum, iron, manganese, and methylene blue active substances (MBAs).

The draft staff report used the permit findings which referred to the use of Primary and Secondary MCLs to protect the MUN beneficial use. Primary MCLs are enforceable drinking water standards which are established to protect the public against consumption of drinking water contaminants that present a risk to human health. Secondary MCLs are non-mandatory water quality standards established as guidelines to assist public water systems in managing their drinking water for aesthetic considerations, such as taste, color, and odor. While all the MCL and CTR constituents will be monitored seasonally, the seven constituents along with specific conductivity, dissolved boron and sodium will be monitored monthly in order to determine potential impact of the discharge to the water body and downstream. Specific constituents and assessment concentrations are listed in Appendix A.

III.c.1 Field Parameters

Field parameters will include flow, temperature, dissolved oxygen, pH, specific conductivity and turbidity. Field parameters will help characterize the water bodies because they provide general hydrology and water quality information.

III.c.2 Key Constituents

During the POTWs' NPDES permit renewal process, the following constituents were identified in the effluent at concentrations that may exceed guidelines and/or criteria for protecting drinking water supplies:

- Nitrate
- Arsenic
- Total Trihalomethanes (THMs)
- Aluminum
- Iron
- Manganese
- Methylene Blue Active Substances (MBAS)

Table 3. Water Quality Criteria for Key Constituents

Parameter	Drinking Water	Impact of exceeding criteria
Flow	"Sources of Drinking Water" Policy - exception if water source does not provide an average sustained yield of 200 gallons per day	
Specific Conductivity	California Secondary Maximum Contaminant Level – 900 µmhos/cm	
Turbidity	California Secondary Maximum Contaminant Level – 5 NTU	
pH	Basin Plan Objective -6.5 – 8.5	
Boron	CDPH Notification Level for drinking water – 1 mg/L	
Sodium	USEPA Drinking Water Advisory – 20 mg/L	
Nitrate	California Primary Maximum Contaminant Level - 10 mg/L	The concern with nitrate is for infants below the age of six months who drink water containing nitrate in excess of the MCL could become seriously ill and, if untreated, may die. Symptoms include shortness of breath and blue-baby syndrome.
Arsenic	California Primary Maximum Contaminant Level - 0.01 mg/L	The concern with arsenic is skin damage or problems with circulatory systems, and may have increased risk of getting cancer. Arsenic is a priority pollutant covered by the CTR but no criteria to protect human health was promulgated.
Total Trihalomethanes	California Primary Maximum Contaminant Level - 80 µg/L	THMs are made up of bromoform, chloroform, dibromochloromethane, and dichlorobromomethane. THM compounds are formed in the wastewater during the disinfection process with chlorine. The California Primary MCL for total THMs is 80 µg/L. The California Toxics Rule (CTR) includes a criterion of 4.3 µg/L for bromoform, 0.41 µg/L for dibromochloromethane, and 0.56 µg/L for dichlorobromomethane for the protection

Parameter	Drinking Water	Impact of exceeding criteria
		of human health for waters from which both water and organisms are consumed. Chloroform is a priority pollutant covered by the CTR but no criteria to protect human health was promulgated. Bromoform, dibromochloromethane and dichlorobromomethane are carcinogens. The CTR critera for these constituents protect at the 10^{-6} risk level, which is the risk of up to one additional cancer in one million people based on an average water consumption level of 2.0 Liters/day and assuming lifetime exposure of 70 years.
Aluminum	California Secondary Maximum Contaminant Level - 0.2 mg/L	The concern with aluminum is chronic toxicity due to gastrointestinal effects. The California Secondary MCL is 0.2 mg/L. The Secondary MCL level protects against colored water. Effluent limitation that are causing compliance issues are based on the Secondary MCL.
Iron	California Secondary Maximum Contaminant Level - 0.3 mg/L	The secondary MCL protects against colored water, staining and metallic taste.
Manganese	California Secondary Maximum Contaminant Level - 0.05 mg/L	The secondary MCL protects against colored water and metallic taste.
Methylene blue Active Substances (MBAs)	California Secondary Maximum Contaminant Level - 0.5 mg/L	The secondary MCL protects against froth, cloudy water, bitter taste and odor.

III.d. Frequency of Sampling

All chemical parameters listed under the MCLs and CTR will be monitored seasonally at all twenty-eight sites. Key constituents will be monitored monthly at all twenty-eight sites and will be re-evaluated after each seasonal full scan. Flow and field parameters will be monitored weekly.

Frequency of sampling is summarized in Table 4:

Table 4. Sampling Frequency (W= Weekly, M=Monthly, S=Seasonally)

Location	Sites	Flow and Field Parameters	Key Constituents of Concern	Inorganic Chemical Scan	Non-volatile Synthetic Organic Chemical Scan
City of Colusa	**Unnamed tributary to Powell Slough**, below the first upstream agricultural discharge (up to 50 feet upstream)	W	M	S	S
	Unnamed tributary to Powell Slough, above the first downstream agricultural discharge (up to 200 feet downstream)	W	M	S	S
	Powell Slough, 250 feet **upstream** from the confluence of the unnamed tributary to Powell Slough with Powell Slough)	W	M	S	S
	Powell Slough, 400 feet **downstream** from the confluence of the unnamed tributary to Powell Slough with Powell Slough)	W	M	S	S
	Powell Slough, Upstream of WWTP at Hwy 20	W	M	S	S
	Colusa Basin Drain, **upstream** of WWTP at Hwy 20	W	M	S	S
	Colusa Basin Drain, downstream of effluent discharge at Abel Rd	W	M	S	S
	New Ditch, upstream of effluent discharge	W	M	S	S
	Effluent Pump Station	W	M	S	S
City of Willows	**Upstream** Receiving Water – 1500 feet upstream from D-001 when discharging to **Ag Drain C**	W	M	S	S
	Downstream Receiving Water – 100 feet downstream from D-001 when discharging to **Ag Drain C**	W	M	S	S
	Willow Creek, upstream of effluent discharge into Colusa Basin Drain at Road 61	W	M	S	S
	Colusa Basin Drain, upstream of effluent discharge at Road 61	W	M	S	S
	Ag Drain C – Downstream, This site is the point before it enters the Sacramento Wildlife Refuge	W	M	S	S
	Logan Creek, Downstream of effluent discharge	W	M	S	S
	Hunters Creek, upstream of effluent discharge	W	M	S	S
	Effluent - Downstream of the last connection through which wastes can be admitted to the outfall	W	M	S	S
City of Live Oak	**Reclamation District 777 Lateral Drain No. 2,** Approximately 50 feet upstream of Discharge Point to the receiving water	W	M	S	S

Location	Sites	Flow and Field Parameters	Key Constituents of Concern	Inorganic Chemical Scan	Non-volatile Synthetic Organic Chemical Scan
	Reclamation District 777 Lateral Drain No. 2, Approximately 200 feet downstream of Discharge Point No. 001 to the receiving water or upstream of the next ag drain	W	M	S	S
	Effluent	W	M	S	S
	Wadsworth Canal, Last point before effluent discharge from treatment plant flows into the Sutter Bypass	W	M	S	S
	Sutter Bypass, Upstream of effluent discharge from Live Oak	W	M	S	S
	Sutter Bypass, Downstream of effluent discharge from Live Oak	W	M	S	S
City of Biggs	**Lateral K**, Upstream receiving water sample – 100 feet upstream of Discharge Point D-001	W	M	S	S
	Lateral K, Downstream receiving water sample – 100 feet downstream of Discharge Point D-001	W	M	S	S
	Effluent, last connection through which wastes can be admitted into the outfall	W	M	S	S
	Cherokee Canal, upstream of effluent discharge	W	M	S	S
	C Main Drain, upstream before Cherokee Canal	W	M	S	S
	Butte Creek, Upstream of WWTP near Nelson Road	W	M	S	S
	Butte Creek or Butte Slough, If accessible-will sample Butte Creek in Duck Club. Alternate is Butte Slough at Meridian	W	M	S	S

III.e. Data Management

All data from this study will be managed in accordance with the California Environmental Data Exchange Network (CEDEN) templates provided by the Central Valley Regional Data Center. The Central Valley Water Board will load field sheet, field parameters, flow, and chemical parameters data into the templates provided from the Regional Data Center. The time period to enter all

data from this study into the templates will be determined when more resources become available.

When the data is entered into the CEDEN Database, the data can then be accessed by the public through the CEDEN website. Information on CEDEN is available at www.ceden.org.

IV. Review Strategy

In addition to the review by SWAMP, ILRP and CV-SALTS program staff from the Central Valley Water Board, this document and the draft and final study reports will be provided to the CV-SALTS technical committee for review.

V. Quality Assurance

All aspects of this study will be conducted in accordance with the 2008 SWAMP Quality Assurance Program Plan (QAPrP) for the State of California's Surface Water Ambient Monitoring Program (State Water Board, 2008) and the Procedures Manual for the San Joaquin River Water Quality Monitoring Program (Central Valley Water Board, 2010).

All samples and field measurements collected will comply with the 2008 SWAMP Quality Assurance Program Plan (QAPrP) for the State of California's Surface Water Ambient Monitoring Program (State Water Board, 2008) and the Procedures Manual for the San Joaquin River Water Quality Monitoring Program (Central Valley Water Board, 2010).

Blind field and laboratory replicates will be collected at 5% of sites sampled. Sample bottles will be provided by Excel Chem Laboratories. Water samples will be bottled appropriately based on whether they come pre-preserved or need to be held at <10°C. Field and laboratory blanks will be used for each batch of bottles collected and processed. Chain-of-custody documentation will be maintained for all samples.

Sampling protocols will comply with the 2008 SWAMP Quality Assurance Management Plan (QAMP) for the State of California's Surface Water Ambient Monitoring Program (State Water Board, 2008) and the Procedures Manual for the San Joaquin River Water Quality Monitoring Program (Central Valley Water Board, 2010).

V.a. Field Equipment

A YSI multiparameter water quality monitor will be used to collect data for temperature, dissolved oxygen, pH and specific conductivity. Turbidity measurements will be collected with a Hach turbidimeter. The field equipment are calibrated using certified calibration standards and manufacturer specifications prior to each sampling event and the calibration is checked for accuracy following each sampling event. Calibration records are maintained at the Central Valley Water Board offices and are used to determine instrument accuracy. Specific model numbers and calibration dates for the field equipment will be noted on the field sheets and in the final report.

Photo documentation will be used to document when flows are dry. Stagnant flow will be notated on field sheets.

V.b. Laboratory Methods and Costs

Most lab analysis will be conducted by Excelchem Environmental Labs (Rocklin, CA) through June 2013 and estimated analytical costs are summarized in Table 5. Excelchem Environmental Labs will analyze all key constituents from April and May. June samples will be split between Excelchem Environemental Labs and Moore Twining Associates (Fresno, CA) in order to fit within laboratory contract budgets. Excelchem will analyze for Nitrate as Nitrogen, Nitrite as Nitrogen, and MBAs because these constituents have a very short holding time (48 hours). Moore Twining Associates will analyze for boron, sodium, total: iron, aluminum, arsenic, manganese, and volatile organic compounds. Table 6 is a summary of estimated analytical costs by POTW Study Area. Table 7 is a list of constituents that are contained within the scans. Radionuclides, Bentazon, Diquat, Endothall, Glyphosate, Molinate, Asbestos, and Thiobencarb costs are to be determined because they were not part of the Central Valley Water Board FY11/12 Analytical Contract. The Volatile Organic Compound & Oxygenated Additive Scan is being sampled monthly because analyzing for Total Trihalomethanes separately will still cost the same as the scan. Cost estimates include QA samples.

Table 5. Laboratory Costs for Key Constituents and All Scans (Excelchem Only)

Constituent	Test Method	Cost
Key Constituents (Monthly sampling)		
Boron	200.8	$ 5.00
Sodium	200.8	$ 5.00
Nitrate	300	$ 7.00
Arsenic	1639	$ 8.00
Volatile Organic Compound & Oxygenated Additive Scan (This scan includes Total Trihalomethanes)	8260B	$ 60.00
Aluminum	200.8	$ 5.00
Iron	200.8	$ 5.00
Manganese	200.8	$ 5.00
MBAs	5540C	$ 20.00
Total per Site:		$ 120.00
Total per Month (28 Sites):		$ 3,360.00
QA Samples per Month (10%):		$ 336.00
Total per Month (28 Sites + QA):		$ 3,696.00
Total for 28 Sites for 18 months:		$ 66,528.00
Inorganic Chemical Scan (Seasonal sampling - Once every 3 months) *Note: Asbestos Cost is being determined because it was not part of the Lab Contract*		
Antimony, Barium, Beryllium, Cadmium, Chromium, Nickel, Thallium, Copper, Silver, Zinc	200.8	$ 50.00
Lead	1638	$ 35.00
Total Dissolved Solids	2540C	$ 7.00
Ammonia	4500-NH3	$ 25.00
Nitrite	300	$ 7.00
Chloride	300	$ 7.00
Sulfate	300	$ 10.00
Cyanide	335.4	$ 22.00
Fluoride	300	$ 10.00
Mercury	1669/1631	$ 100.00
Perchlorate	314.1	$ 50.00
Selenium	200.9/1639	$ 8.00
Total per Site:		$ 331.00
Total per Season (28 Sites):		$ 9,268.00
QA Samples per Season (10%):		$ 926.80
Total per Season (28 Sites + QA):		$ 10,194.80
Total for 6 seasons:		$ 61,168.80
Organic (Non-Volatile Synthetic Organic Chemicals) Chemical Scan (Seasonal sampling - Once every 3 months) *Note: Bentazon, Diquat, Endothall, Glyphosate, Molinate, and Thiobencarb Costs are being determined because they were not part of the Lab Contract*		
Organo-Chlorinated Pesticide	8081A	$ 60.00
Gas Chromatography/Mass Spectrometer (GC/MS) Semivolatiles	8270C	$ 95.00
Chlorinated Herbicide	8151A	$ 60.00
Organo-Phosphorus Pesticide	8141A	$ 60.00
Polychlorinated Biphenyls (PCB's)	8082A	$ 60.00
Poly-Chlorinated-Dibenzo-p-Dioxin/Furan High Resolution Mass Spectrometer (HRMS)	8290	$ 500.00
Carbamate Pesticide	8318	$ 125.00
Total per Site:		$ 960.00
Total per Season (28 Sites):		$ 26,880.00
QA Samples per Month (10%):		$ 2,688.00
Total per Season (28 Sites + QA):		$ 29,568.00
Total for 6 seasons:		$ 177,408.00
Grand Total for Key Constituents and All Scans:		$ 305,104.80

Table 6. Estimated Analytical Cost by POTW Study Area

POTW	# Sites	Estimated Analytical Cost**			
		Each Month	Each Season	1-Year	18-Months
Willows	9	$1,181	$12,734.90	$65,164	$97,793
Colusa	8	$961	$11,005.80	$56,668	$85,043
Live Oak	6	$714	$8,201.60	$42,650	$63,466
Biggs	5	$653	$7,054.50	$34,687	$54,207
Total:	28	$3,509	$38,996.80	$199,169.00	$300,509.00

Monthly = $132/site (Includes 10% for QA)
Seasonal = $1420.10/site (Includes 10% for QA)
1-year = 12-monthly + 4-seasonal
18-months = 18-monthly + 6-seasonal
**Costs Based on Central Valley Water Board FY11/12 Analytical Contract
**When applicable, costs have been adjusted when POTW is monitoring the same constituent as part of their NPDES permit

Table 7. List of Constituents within Each Scan

Scan	Test Method	Constituent
Volatile Organic Compound & Oxygenated Additive	8260B	1,1-Dichloroethane, 1,1-Dichloroethene, 1,1,1-Trichloroethane, 1,1,2,2-Tetrachloroethane, 1,2-Dichlorobenzene, 1,2-Dichloroethane, cis-1,2-Dichloroethene, 1,2-Dichloropropane, 1,2,4-Trichlorobenzene, 1,3-Dichlorobenzene, 1,3-Dichloropropene, 1,4-Dichlorobenzene, Acrolein, Acrylonitrile, Benzene, Bromoform, Bromomethane, Carbon tetrachloride, Chlorobenzene (mono chlorobenzene), Chloroethane, 2-Chloroethyl vinyl ether, Chloroform, Chloromethane, Dibromochloromethane, Dichlorobromomethane, Dichloromethane, Ethylbenzene, Hexachlorobenzene, Hexachlorobutadiene, Hexachloroethane, Naphthalene, Tetrachloroethene, Toluene, trans-1,2-Dichloroethylene, Trichloroethene, Vinyl chloride, Methyl-tert-butyl ether (MTBE), Trichlorofluoromethane, 1,1,2-Trichloro-1,2,2-Trifluoroethane, Styrene, Xylenes, 1,2-Dibromo-3-chloropropane (DBCP), Ethylene Dibromide
Organo-Chlorinated Pesticide	8081A	4,4'-DDD, 4,4'-DDE, 4,4'-DDT, alpha-Endosulfan, alpha-Hexachlorocyclohexane (BHC), Alachlor, Aldrin, beta-Endosulfan, beta-Hexachlorocyclohexane, Chlordane, Dieldrin, Endosulfan sulfate, Endrin, Endrin Aldehyde, Heptachlor, Heptachlor Epoxide, Lindane (gamma-Hexachlorocyclohexane), Toxaphene
Gas Chromatography/Mass Spectrometer (GC/MS) Semivolatiles	8270C	1,2-Benzanthracene, 1,2-Diphenylhydrazine, 2-Chlorophenol, 2,4-Dichlorophenol, 2,4-Dimethylphenol, 2,4-Dinitrophenol, 2,4-Dinitrotoluene, 2,4,6-Trichlorophenol, 2,6-Dinitrotoluene, 2-Nitrophenol, 2-Chloronaphthalene, 3,3'-Dichlorobenzidine, 3,4-Benzofluoranthene, 4-Chloro-3-methylphenol, 4,6-Dinitro-2-methylphenol, 4-Nitrophenol, 4-Bromophenyl phenyl ether, 4-Chlorophenyl phenyl ether, Acenaphthene, Acenapthylene, Anthracene, Benzidine, Benzo(a)pyrene (3,4-benzopyrene), Benzo(g,h,i)perylene, Benzo(k)fluoranthene, Bis(2-chloroethoxy) methane, Bis(2-chloroethyl) ether, Bis(2-chloroisopropyl) ether, Bis(2-ethylhexyl) phthalate, Butyl benzyl phthalate, Chrysene, Di-n-butylphthalate, Di-n-octylphthalate, Dibenzo(a,h)-anthracene, Diethyl phthalate, Dimethyl phthalate, Fluoranthene, Fluorene, Hexachlorocyclopentadiene, Indeno(1,2,3-c,d)pyrene, Isophorone, N-Nitrosodiphenylamine, N-Nitrosodimethylamine, N-Nitrosodi-n-propylamine, Nitrobenzene, Pentachlorophenol, Phenanthrene, Phenol, Pyrene
Chlorinated Herbicide	8151A	2,4-D, Dalapon, Dinoseb, Picloram, 2,4,5-TP (Silvex)
Organo-Phosphorus Pesticide	8141A	Atrazine, Simazine (Princep), Diazinon, Chlorpyrifos
Polychlorinated Biphenyls (PCB's)	8082A	PCB-1016, PCB-1221, PCB-1232, PCB-1242, PCB-1248, PCB-1254, PCB-1260
Poly-Chlorinated-Dibenzo-p-Dioxin/Furan High Resolution Mass Spectrometer (HRMS)	8290	2,3,7,8-TCDD (Dioxin)
Carbamate Pesticide	8318	Carbofuran, Oxamyl

APPENDIX A: List of potential parameters of concern including from MCLs and CTR

Analyte	Primary MCL	Secondary MCL	California Toxics Rule (CTR)
Dissolved Nitrate+Nitrite (sum as nitrogen)	**10 mg/L**		
Total Arsenic	**0.010 mg/L**		
Total Triahlomethanes	**0.080 mg/L**		
Total Aluminum	1.0 mg/L	**0.2 mg/L**	
Total Iron		**0.3 mg/L**	
Total Manganese		**0.05 mg/L**	
Foaming Agents (MBAS)		**0.5 mg/L**	
Antimony	**0.006 mg/L**		.0014 mg/L
Asbestos	**7 Million Fibers per Liter**		**7 Million Fibers/Liter**
Barium	**1.0 mg/L**		
Beryllium	**0.004 mg/L**		
Total Cadmium	**0.005 mg/L**		
Total Chromium	**0.05 mg/L**		
Cyanide	**0.15 mg/L**		0.700 mg/L
Fluoride	**2.0 mg/L**		
Mercury	0.002 mg/L		**0.000050 mg/L**
Total Nickel	**0.1 mg/L**		0.610 mg/L
Nitrate (as NO3)	**45 mg/L**		
Nitrite (as Nitrogen)	**1.0 mg/L**		
Perchlorate	**0.006 mg/L**		
Total Selenium	**0.05 mg/L**		
Thallium	0.002 mg/L		**.0017 mg/L**
Total Copper		**1.0 mg/L**	1.300 mg/L
Total Silver		**0.1 mg/L**	
Total Zinc		**5.0 mg/L**	

Dissolved Chloride		**250 mg/L**	
Dissolved Sulfate		**250 mg/L**	
1,2-Dibromo-3chloropropane (DBCP)	0.0017 µg/L [CA Public Health Goal OEHHA]		
Dissolved Boron	1 mg/L [CA DPH Notification Level for drinking water]		
Total Lead	0.2 µg/L [CA Public Health Goal OEHHA]		
Total Ammonia	1.5 mg/L [Odor threshold (Amoore and Hautala)]		
Dissolved Sodium	20 mg/L [USEPA Drinking Water Advisory]		
Diazinon	1.2 µg/L [CA DPH Notification Level for drinking water]		
Chlorpyrifos	2 µg/L [USEPA, OPP Drinking Water Health Advisory - non-cancer]		
Chloroform	1.1 µg/L [Cal/EPA Cancer Potency Factor as a drinking water level (b)]		
Benzene	**0.001 mg/L**		0.0012 mg/L
Carbon Tetrachloride	0.0005 mg/L		**0.00025 mg/L**
1,2-Dichlorobenzene	**0.6 mg/L**		
1,4-Dichlorobenzene	**0.005 mg/L**		
1,1-Dichloroethane	**0.005 mg/L**		
1,2-Dichloroethane	0.005 mg/L		**0.00038 mg/L**
1,1-Dichloroethylene	0.006 mg/L		**0.000057 mg/L**
Cis1,2-Dichloroethylene	**0.006 mg/L**		
Trans-1,2-Dichloroethylene	**0.01 mg/L**		
Dichloromethane	**0.005 mg/L**		
1,2-Dichloropropane	0.005 mg/L		**0.00052 mg/L**
1,3-Dichloropropene	**0.0005 mg/L**		
Ethylbenzene	**0.3 mg/L**		3.100 mg/L
Methyl-tert-butyl ether	0.013 mg/L	**0.005 mg/L**	
Monochlorobenzene	**0.07 mg/L**		
Styrene	**0.1 mg/L**		
1,1,2,2-Tetrachloroethane	0.001 mg/L		**0.00017 mg/L**
Tetrachloroethylene	0.005 mg/L		**0.0008 mg/L**
Toluene	**0.15 mg/L**		6.800 mg/L

1,2,4-Trichlorobenzene	**0.005 mg/L**		
1,1,1-Trichloroethane	**0.200 mg/L**		
1,1,2-Trichloroethane	**0.005 mg/L**		
Trichloroethylene	0.005 mg/L		**0.0027 mg/L**
Trichlorofluoromethane	0.15 mg/L		
1,1,2,Trichloro-1,2,2-Trifluoroethane	1.2 mg/L		
Vinyl Chloride	**0.0005 mg/L**		0.002 mg/L
Xylenes	1.750 mg/L		
Alachlor	0.002 mg/L		
Atrazine	0.001 mg/L		
Bentazon	0.018 mg/L		
Benzo(a)pyrene	0.0002 mg/L		
Carbofuran	0.018 mg/L		
Chlordane	0.0001 mg/L		
2,4-D	0.07 mg/L		
Dalapon	0.2 mg/L		
Dibromochloropropane (DBCP)	0.0002 mg/L		
Di(2-ethylhexyl)adipate	0.4 mg/L		
Di(2-ethylhexyl)phthalate (DEHP)	0.004 mg/L		
Dinoseb	0.007 mg/L		
Diquat	0.02 mg/L		
Endothall	0.1 mg/L		
Endrin	0.002 mg/L		**0.00076 mg/L**
Ethylene Dibromide	0.00005 mg/L		
Glyphosphate	0.7 mg/L		
Heptachlor	0.00001 mg/L		**0.00000021 mg/L**
Heptachlor Epoxide	0.00001 mg/L		**0.00000010 mg/L**
Hexachlorobenzene	0.001 mg/L		**0.00000075 mg/L**

Hexachlorocyclopentadiene	0.05 mg/L		
Lindane	0.0002 mg/L		
Methoxychlor	0.03 mg/L		
Molinate	0.02 mg/L		
Oxamyl	0.05 mg/L		
Pentachlorophenol	0.001 mg/L		**0.00028 mg/L**
Picloram	0.5 mg/L		
Polychlorinated Biphenyls	0.0005 mg/L		**0.00000017 mg/L**
Simazine	0.004 mg/L		
Thiobencarb	0.07 mg/L	0.001 mg/L	
Toxaphene	0.003 mg/L		**0.00000073 mg/L**
2,3,7,8-TCDD (Dioxin)	3 x 10-8 mg/L		
2,4,5-TP (Silvex)	0.05 mg/L		
Color		15 Units	
Odor		Threshold 3 Units	
Turbidity		5 NTU [§64653.Filtration - CDPH]	
Total Dissolved Solids		500 mg/L	
Specific Conductance		900 µS/cm	
pH	6.5 - 8.5 [USEPA Secondary MCL]		
Acrolein			**0.320 mg/L**
Acrylonitrile			**0.000059 mg/L**
Bromoform			**0.0043 mg/L**
Chlorobenzene			**0.680 mg/L**
Chlorodibromomethane			**0.000401 mg/L**
Dichlorobromomethane			**0.00056 mg/L**
1,3-Dichloropropylene			**0.010 mg/L**
Methyl Bromide (Bromomethane)			**0.048 mg/L**
Methylene Chloride (Dichloromethane)			**0.0047 mg/L**

1,2-Trans-Dichloroethylene			**0.700 mg/L**
1,1,2,2-Trichloroethane			**0.00060 mg/L**
2-Chlorophenol			**0.120 mg/L**
2,4-Dichlorophenol			**0.093 mg/L**
2,4-Dimethylphenol			**0.540 mg/L**
2-Methyl-4,6-Dinitrophenol			**0.0134 mg/L**
2,4-Dinitrophenol			**0.070 mg/L**
Pentachlorophenol	0.001 mg/L		**0.00028 mg/L**
Phenol			**21.0 mg/L**
2,4,6-Trichlorophenol			**0.0021 mg/L**
Acenaphthene			**1.2 mg/L**
Anthracene			**9.6 mg/L**
Benzidine			**0.00000012 mg/L**
Benzo(a)Anthracene [1,2-Benzanthracene]			**0.0000044 mg/L**
Benzo(a)Pyrene			**0.0000044 mg/L**
Benzo(b)Fluoranthene [3,4-Benzofluoranthene]			**0.0000044 mg/L**
Benzo(k)Fluoranthene			**0.0000044 mg/L**
Bis(2-Chloroethyl)Ether			**0.000031 mg/L**
Bis(2-Chloroisopropyl)Ether			**1.400 mg/L**
Bis(2-Ethylhexyl)Phthalate			**0.0018 mg/L**
Butylbenzyl Phthalate			**3.0 mg/L**
2-Chloronaphthalene			**1.7 mg/L**
Chrysene			**0.0000044 mg/L**
Dibenzo(ah)Anthracene			**0.0000044 mg/L**
1,2 Dichlorobenzene			**2.7 mg/L**
1,3 Dichlorobenzene			**0.400 mg/L**
1,4 Dichlorobenzene			**0.400 mg/L**
3,3'-Dichlorobenzidine			**0.00004 mg/L**
Diethyl Phthalate			**23 mg/L**
Dimethyl Phthalate			**313 mg/L**

Di-n-Butyl Phthalate			**2.7 mg/L**
2,4-Dinitrotoluene			**0.00011 mg/L**
1,2-Diphenylhydrazine			**0.000040 mg/L**
Fluoranthene			**0.3 mg/L**
Fluorene			**1.3 mg/L**
Hexachlorobutadiene			**0.00044 mg/L**
Hexachlorocyclopentadiene			**0.240 mg/L**
Hexachloroethane			**0.0019 mg/L**
Indeno(1,2,3-cd) Pyrene			**0.0000044 mg/L**
Isophorone			**0.0084 mg/L**
Nitrobenzene			**0.017 mg/L**
N-Nitrosodimethylamine			**0.00000069 mg/L**
N-Nitrosodi-n-Propylamine			**0.000005 mg/L**
N-Nitrosodiphenylamine			**0.005 mg/L**
Pyrene			**0.960 mg/L**
Aldrin			**0.00000013 mg/L**
Alpha-BHC			**0.0000039 mg/L**
Beta-BHC [beta-Hexachlorocyclohexane]			**0.000014 mg/L**
Gamma-BHC [Lindane]			**0.000019 mg/L**
Chlordane			**0.00000057 mg/L**
4,4'-DDT			**0.00000059 mg/L**
4,4'-DDD			**0.00000059 mg/L**
4,4'-DDE			**0.00000083 mg/L**
Dieldrin			**0.00000014 mg/L**
Alpha-Endosulfan			**0.110 mg/L**
Beta-Endosulfan			**0.110 mg/L**
Endosulfan Sulfate			**0.110 mg/L**
Endrin Aldehyde			**0.00076 mg/L**
Radium-226	5 pCi/L (combined radium-226 & -228)		
Radium-228	5 pCi/L (combined radium-226 & -228)		
Gross Alpha particle activity (excluding radon and uranium)	15 pCi/L		
Uranium	20 pCi/L		
Beta/photon emitters	4 millirem/year annual dose equivalent to the total body or any internal organ		
Strontium-90	8 pCi/L (=4 millirem/yr dose to bone marrow)		
Tritium	20000 pCi/L (=4 millirem/yr dose to total body)		

APPENDIX B: List of Stakeholders

- CV-SALTS
- City of Willows
- City of Colusa
- City of Biggs
- City of Live Oak
- California Rice Commission
- Sacramento Valley Coalition
- Central Valley Regional Water Quality Control Board
- US EPA
- State Water Resources Control Board