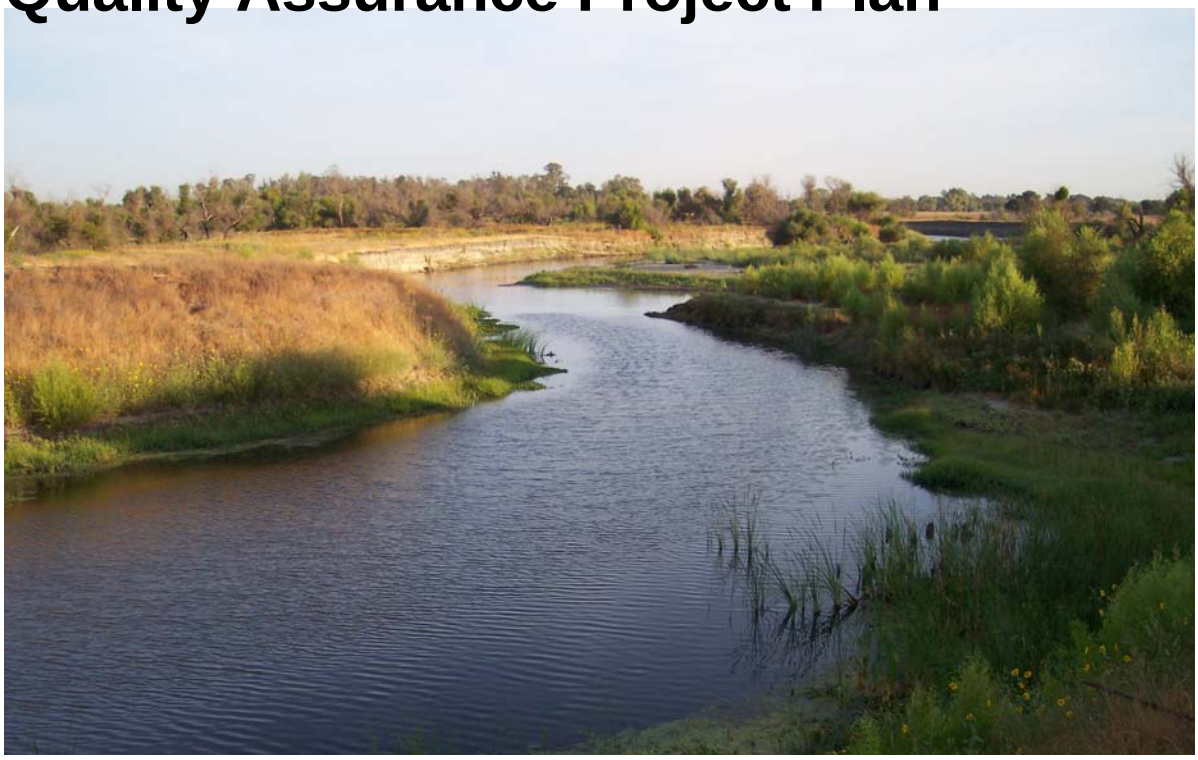
RECLAMATION
Managing Water in the West

Delta Mendota Canal Recirculation Pilot Study
Water Quality Monitoring Program - 2008

Quality Assurance Project Plan



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San Joaquin River Recirculation Study Water Quality Monitoring Program - 2008

Quality Assurance Project Plan

_____	_____
Environmental Monitoring Team Project Manager	Date
_____	_____
Quality Assurance Team Project Manager	Date
_____	_____
Data Management Team Project Manager	Date

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Project Management

I. Project/Task Organization

Personnel from URS will maintain and review this Quality Assurance Project Plan (QAPP). Additionally, personnel from URS will collect the samples, incorporate external quality assurance (QA) samples, validate the analytical data, write QA summary reports, enter data into the Environmental Monitoring Branch database, generate data tables, and provide a final data assessment report, containing the data, to the project manager. Individuals from the URS responsible for these tasks are:

Name	Phone Number	Function
Terry Cooke	510 874-1736 415 269-7659	Project Manager
Lisa Hunt	510 874-1795 415 505-4139	Assistant Project Manager
Jody Edmunds	510 874-3009 415 830-7244	Pilot Study Task Lead
Jeremy Bricker	510 874-1718 707 694-7566	Flow Measurements
Michelle Turner	510 874-1746 408 505-5095	Sampling and Analysis QA/QC
Raul Farre	510 874-3270 510 219-0725	Field Coordinator

Chemical laboratory analyses will be performed by Caltest Analytical Laboratory in Napa, California. The lab contact is Mike Hamilton and his phone number is 707 258-4000. Acute toxicity tests will be performed by Pacific EcoRisk in Fairfield, California. The lab contact is Stephen Clark and his phone number is 707 207-7760.

II. Problem Definition/Background

This water quality monitoring study will help determine the potential water quality impact to the San Joaquin River (SJR) from the initial flush of water through the Newman Wasteway (NW). This monitoring program is tied to a Pilot Recirculation study where a volume of water from the Delta-Mendota Canal (DMC) is directed to the SJR via the NW. This wasteway flows from west to east with its head gate on the DMC just upstream of Check 10 at milepost 54.38. The terminus of the wasteway is at the SJR 1.24 miles upstream of the Merced River confluence.

The wasteway is 8.2 miles long with the upper 1.5 miles concrete lined and the remainder unlined. The capacity of the wasteway is 4300 cfs but on average, there usually is only 50 to 75 cfs of flow from agricultural drainage. Twice a

month, a five minute pulse flow of 500 cfs is sent down the wasteway to clear sediment loads from the headgates. During this study, additional flows through the wasteway are estimated to be 50-250 cfs.

The study objective is to monitor how water quality is affected as DMC water moves through the NW to the SJR. There are questions regarding water quality impacts from possible mobilization of sediments and contaminants as a result of past and current agricultural drainage in the wasteway.

The proposed water quality monitoring program is designed to obtain information on the "first flush" of water from the DMC into the NW. The frequency of monitoring will be more intensive during the first few days of the initial flush and will then taper off for the duration of the study.

Reclamation plans to maintain to release the following flow rates from DMC to NW:

Flow Releases From the DMC Into the Newman Wasteway

Date	**Time**	**CFS**	**hours**
Tuesday, July 29, 2008	0600	0	
Tuesday, July 29, 2008	0601	50	**2**
Tuesday, July 29, 2008	0800	100	**2**
Tuesday, July 29, 2008	1000	150	**2**
Tuesday, July 29, 2008	1200	200	**2**
Tuesday, July 29, 2008	1400	250	**40**
Thursday, July 31, 2008	0600	100	
Flows will be adaptively managed by CVO from this point forward			
Tentative end date Monday, September 15, 2008	0800	0	

The plan is subject to change based on water quality and water supply conditions. Changes to this operations plan will come at the direction of CVO and will be coordinated with members of the 2008 pilot study team.

III. Project/Task Description

Water flow, water quality and sediment toxicity will be measured at key locations in the system to determine how characteristics change as water is released into the San Joaquin River from the DMC.

Water Sampling
Six sample locations will be utilized in this study. DMC water will be tracked and sampled in the DMC above the NW headgates and at two sites in the NW and three sites on the SJR. Sample locations are described below:

Site Name	Description
DMC at NW	DMC above the Newman Wasteway Headgates
NW upstream	NW immediately downstream of headgates at DMC
NW downstream	NW ~100 yards upstream of discharge point to SJR, in the wasteway
SJR upstream	SJR 500 ft upstream of NW discharge point
SJR downstream	SJR downstream of NW discharge point before the confluence of Merced River
SJR @ Crows Landing	San Joaquin River at Crows Landing Gage

Water samples from each of the six sample locations will be collected according to the schedule presented in Tables 1 and 2. When water is initially released into the NW, water samples will be collected in the DMC at the NW headgate to measure background water quality before it is affected by possible contaminants in the wasteway. In addition, daily measurements will be taken in the first three days and weekly thereafter.

Physical measurements will also be measured continuously at most stations using water quality meters. Meters will record turbidity, water temperature, electrical conductivity, and dissolved oxygen will be used as water quality indicators to determine when the front end of the flushed water has reached the NW terminus.

Flow Measurements
Flow rates will also be determined in the NW to estimate the travel time from the DMC to the SJR. Flow measurements will be made in the NW at mile marker 1.14 (NW upstream) (MM1.14) and at mile marker 6.88 (MM6.88). Flow and salinity of water in the SJR will be derived from US Geological Survey measurements at Mud Slough near Gustine and the SJR at Fremont Ford (Hwy 140).

Table 1. Sample Schedule Overview for Laboratory Analytes

Time	Frequency	Number of samples
Days 1 – 3	• A minimum of one grab sample every six hours at NW upstream, NW downstream, SJR upstream and SJR downstream, starting with time 0 as background • Samples every 24 hours at DMC and SJR Crows Landing starting with time 0 • More frequently as turbidity changes significantly	minimum of 67
Day 5 or 6	• One sample at all six sites	6
Weeks 2, 3, 4, 5, and 6	• One sample each week at all six sites	30
--	--	Total: 103

Continuous logging meters (YSI 6920) will be installed at three locations; NW d/s, SJR u/s, and SJR d/s; and used to collect the following physical parameters.

- Temperature
- Electrical Conductivity
- pH
- Dissolved Oxygen
- Turbidity

A water quality data recorder (troll) will be installed at NW u/s that will record flow (pressure), temperature, conductivity, and pH. We may also install an additional YSI 6920 meter at Crow's Landing if available. Data will be uploaded into laptap computers at every sampling event during the initial three day period and weekly thereafter. This information will allow us to better characterize turbidity in the Newman Wasteway and the San Joaquin River as flows are altered by the recirculation releases. This real time data will be used to make decisions about sample collection timing for constituents that must be analyzed in a laboratory.

Meters will be calibrated before installation and every 12 hours during the first three days. Meters will be calibrated at every site visit thereafter. All calibrations will be done in accordance with manufacturer's instructions.

Table 2. Sample Schedule Detail

Time	DMC @ NW	NW upstream	NW downstream	SJR upstream	SJR downstream	SJR Crows Landing
Continuous meters						
		Flow, Temp, EC	Flow, Temp, EC, DO, Turbidity	Temp, EC, DO, Turbidity	Temp, EC, DO, Turbidity	Temp, EC, DO, Turbidity
Grab Sampling						
0 hours **day 1**	Physicals Inorganics *E. coli*	Turbidity Inorganics *E. coli*	Turbidity *E. coli*, Water Toxicity, Sediment Toxicity	Turbidity Inorganics *E. coli*	Turbidity Inorganics *E. coli* Water Toxicity (+2 hours from NW)	Turbidity Inorganics
6 hours		Turbidity Inorganics	Turbidity Inorganics	Turbidity Inorganics	Turbidity Inorganics	
12 hours		Turbidity Inorganics	Turbidity Inorganics Water Toxicity (100 cfs)	Turbidity Inorganics	Turbidity Inorganics Water Toxicity (+2 hours from NW)	
18 hours		Turbidity Inorganics	Turbidity Inorganics	Turbidity Inorganics	Turbidity Inorganics	
0 hours **day 2**	Physicals Inorganics *E. coli*	Turbidity Inorganics *E. coli*	Turbidity Inorganics *E. coli* Water Toxicty (200 cfs)	Turbidity Inorganics *E. coli*	Turbidity Inorganics *E. coli* Water Toxicity (+2 hours from NW)	Turbidity Inorganics
6 hours		Turbidity Inorganics	Turbidity, Inorganics	Turbidity Inorganics	Turbidity Inorganics	
12 hrs		Turbidity Inorganics	Turbidity, Inorganics	Turbidity Inorganics	Turbidity Inorganics	
18 hrs		Turbidity Inorganics	Turbidity, Inorganics	Turbidity Inorganics	Turbidity Inorganics	
0 hours **day 3**	Physicals inorganics	Turbidity Inorganics	Turbidity, Inorganics Water Toxicty (100 cfs)	Turbidity Inorganics	Turbidity Inorganics	Turbidity Inorganics
6 hrs		Turbidity Inorganics	Turbidity, Inorganics	Turbidity, Inorganics	Turbidity Inorganics	
12 hrs		Turbidity Inorganics	Turbidity, Inorganics	Turbidity Inorganics	Turbidity Inorganics	
18 hrs		Turbidity Inorganics	Turbidity, Inorganics	Turbidity, Inorganics	Turbidity Inorganics	
Day 5 or 6	Physicals inorganics	Turbidity, Inorganics	Turbidity Inorganics Water Toxicity	Turbidity Inorganics	Turbidity Inorganics Water Toxicity (+2 hours from NW)	Turbidity Inorganics
Weeks 2-7	Physicals inorganics	Turbidity Inorganics	Turbidity Inorganics	Turbidity Inorganics	Turbidity Inorganics	Turbidity Inorganics

Parameters of Concern:

Physical Parameters

- Flow
- Temperature
- Electrical Conductivity
- Dissolved Oxygen
- Turbidity

Inorganic Parameters

- Total Suspended Solids
- Total Organic Carbon
- Metals (see Table 4)
- Hardness
- Nutrients
- BOD

E. coli

Table 3. Sample Information Table

Parameter	**Bottle**	**Preservative**	**Hold Time**	**Method***
TSS	250 ml HDPE	None	7 days	EPA 160.2 or ASTM D-3977-97
Total and Dissolved Mercury	500ml glass	None	28 days	EPA 1631
Dissolved Metals	1000ml HDPE	None	6 months	EPA 200.8
Se	125ml HDPE	HNO_3	6 months	ICP-DRC-MS
B	500 ml	HNO_3	6 months	EPA 200.7
TOC	3x 40ml VOAs	HCL	28 days	SM 5310B
BOD	500 ml HDPE	None	48 hours	EPA 405.1
Nutrients (ammonia, TKN)	500 ml HDPE	H_2SO_4	28 days	EPA350.2; EPA 351.3;
E. coli	100 ml plastic coliform bottle	None	24 hours	SM18; 9221B+E

* A comparable method with an acceptable reporting limit may be used in place of the methods listed.

In addition, the following data will be collected to evaluate sediment transport in the Newman Wasteway and the San Joaquin River.

- Physical parameters (flow, temperature, electrical conductivity, and dissolved oxygen) will be measured with a handheld YSI 6920 for three transects in the San Joaquin River – immediately downstream of the Newman Wasteway (SJR/NW), at SJR d/s, and downstream of the Merced River (SJR/MR). Measurements and GPS coordinates will be recorded approximately every 10 feet across the river cross-sections. Data will be collected once recirculation flow has stabilized at 250 cfs (the

2nd day of recirculation), and again once the flow has been reduced to 100 cfs and stabilized. Grab samples for TSS will also be collected at some locations to establish a relationship between TSS and turbidity in the SJR.

- Bathymetric cross sections will be conducted at several locations in the NW before and after the pilot study.

IV. Quality Objectives and Criteria

The project requires the analytical laboratory to analyze water samples for the parameters identified in Table 4. In addition, the laboratory methods utilized must also meet the reporting limits and acceptance criteria summarized in this table.

Table 4: Data Quality Objectives for Inorganic Parameters

Parameters	Reporting Limit* (mg/L)	Accuracy (% Recovery)	Precision (% RPD)	Completeness (%)	Corrective Actions
TKN	0.1	80%-120%	[>5x RL] = 0%-20%, [< 5x RL] difference within + RL	90%	Reanalyze sample and if not confirmed, reanalyze the batch
Ammonia	0.1	80%-120%	[>5x RL] = 0%-20%, [< 5x RL] difference within + RL	90%	Reanalyze sample and if not confirmed, reanalyze the batch
E. coli	1MPN per 100ml	Within certified range	Refer to method	90%	Qualify data or resample
TSS	3	80%-120%	[>5x RL] = 0%-20%, [< 5x RL] difference within + RL	90%	Reanalyze sample and if not confirmed, reanalyze the batch
TOC	0.5	80%-120%	[>5x RL] = 0%-20%, [< 5x RL] difference within + RL	90%	Reanalyze sample and if not confirmed, reanalyze the batch
Boron	0.01	80%-120%	[>5x RL] = 0%-20%, [< 5x RL] difference within + RL	90%	Reanalyze sample and if not confirmed, reanalyze the batch
Selenium	0.001	80%-120%	[>5x RL] = 0%-20%, [< 5x RL] difference within + RL	90%	Reanalyze sample and if not confirmed, reanalyze the batch
Aluminum	0.010	80%-120%	[>5x RL] = 0%-20%, [< 5x RL] difference within + RL	90%	Reanalyze sample and if not confirmed, reanalyze the batch
Arsenic	0.001	80%-120%	[>5x RL] = 0%-20%, [< 5x RL] difference within + RL	90%	Reanalyze sample and if not confirmed, reanalyze the batch
Copper	0.005	80%-120%	[>5x RL] = 0%-20%, [< 5x RL] difference within + RL	90%	Reanalyze sample and if not confirmed, reanalyze the batch
Mercury	0.0000005	80%-120%	[>5x RL] = 0%-20%, [< 5x RL] difference within + RL	90%	Reanalyze sample and if not confirmed, reanalyze the batch
BOD	5		Refer to method	90%	Qualify data or resample

* RLs are subject to change due to: dilutions, Method Detection Limit (MDL) studies, or different laboratories analyzing the samples.

Table 5 identifies acceptance criteria for field measurements relative to reporting limits, accuracy, completeness, and resolution.

Table 5: Data Quality Objectives for Field Monitoring

Parameter	Equipment/Range	Units	Detection Limit	Accuracy	Resolution	Completeness
Temperature	YSI 6920/-5 to 50C	Degrees C	NA	± 0.5ºC	0.01ºC	NA
Turbidity	YSI 6920 /0-1000 NTU	NTU	0.01	± 2% or 0.3 NTU whichever is greater	0.1 NTU	90%
Electrical Conductivity	YSI 6920/0-100 mS/cm	µS/cm	10	± 0.5% + 0.001 m/s/cm	0.001-0.1 range dependent	90%
Dissolved Oxygen	YSI 6920/0-50 mg/L	mg/L	0.1	± 0.5	0.1	90%
pH	YSI 6920/0-14 s.u.	s.u.	NA	± 0.2	0.01	90%

V. Special Training/Certifications

None required.

VI. Documentation and Records

Sample Collection Record

At the time of sample collection, field logbook entries are made. The field logbook documents: site name, date of sample collection, start and end time of sample collection, QA samples collected, sample IDs, method of sampling, parameters and matrices collected, and any unusual conditions that might affect the samples. After entering the required information, the field sampler must sign the field logbook entry.

Chain of Custody

The field sampler generates a chain of custody (COC) form. The COC documents legal custody of the samples from the time of collection to the time of delivery to the laboratory. Information provided on the COC can include the project name, project manager, title and signature of sample collector, name of the laboratory performing the analyses, list of samples by sample ID, date and time the samples were collected, sample matrix type, number of containers per sample ID, parameters and analyses requested, point of contact phone number, and the date, time, and signatures of all parties responsible for receiving and relinquishing the samples from the time of collection to the time of delivery to the laboratory.

Analytical Report

The laboratory produces the analytical report which contains laboratory data results. The analytical report documents the analytical results for each parameter analyzed on each sample submitted. The analytical report generally includes the case narrative, analytical results, RLs for parameters, methods used to analyze the sample, date sample was collected, prepared, and analyzed, and the laboratory's quality control (QC) results.

Data Assessment / Data Tables

The Data Management Team (DMT) will generate tables from the Environmental Monitoring Database. The Environmental Monitoring Team (EMT) will utilize the tables to make an assessment of the water quality impacts due to the release of water through the wasteway.

Quality Assurance Summary Report

The QA specialist will create a QA summary report that discusses the results of the external QA samples, the results of the laboratory's QC samples, historical outliers, completeness, and holding times. The QA summary report will accompany the data tables.

Data Generation and Acquisition

VII. Sampling Process Design

Inorganic sample collection

Water will be collected at each site to be analyzed for inorganic parameters. Grab samples will be collected at each site for every sampling event, \ Inorganic analyses will include: total suspended solids or suspended sediment concentration, total organic carbon, biological oxygen demand, metals, hardness, and nutrients (a complete list of inorganic analyses is presented as table 4).

Biological sample collection

Escherichia coli (E. coli)

For day 1, 2, and 3 water samples for *E. Coli* analysis will be collected at the downstream sites, and SJR upstream site only. Samples for *E. coli* will be collected directly from the source at approximately hours 0, 6 and 18.

Acute Toxicity

Water for acute toxicity tests will be collected on day 1 from the downstream sites only. At NW downstream, water will be collected at time zero, and when the flows are calculated at 100, and 200 cfs. The last sample will be collected on Day 5 or 6, once recirculation flows have stabilized at 100 cfs. . At SJR downstream, water will be collected approximately 2 hours after samples are collected at NW downstream. Water will be used to conduct survival, growth and

reproduction toxicity tests on three species: *Ceriodaphnia dubia, Pimephales promelas, and Selenastrum capricornutum.* An additional 12 gallons of water for each sample will be collected for potential use in a TIE in the event the bioassay reveals adverse impacts.For this initial water screening, an acute definitive test with five dilutions shall be run over 96 hours. If, during the initial toxicity screening, a 50% or greater difference in test organism mortality is detected at any time between an ambient sample (i.e., from a stream site) and the laboratory control during an acceptable *Ceriodaphnia dubia* or *Pimephales promelas* test, or a 50% or greater difference in test organism growth is detected between an ambient sample (i.e., from a stream site) and the laboratory control at the end of an acceptable *Selenastrum capricornutum* test, then a Toxicity Identification Evaluation (TIE) and chemical monitoring shall be conducted on that same sample.

At a minimum, a Phase I TIE should be conducted to determine the general class (i.e., metals, non-polar organics such as pesticides, surfactants, etc.) of the chemical causing toxicity. This minimum TIE effort will determine the type of chemical monitoring necessary to identify the specific agents causing toxicity. Phase II TIEs may also be utilized to identify specific toxic agents.

Physical Measurements

Physical measurements of flow, temperature, electrical conductivity, dissolved oxygen, pH, and turbidity will be collected on-site for every sampling event. Physical measurements will be used to determine when the first flush has subsided. If the readings are stable after day 1, the intense sampling of the downstream sites will be discontinued.

Flow measurements will be conducted by URS personnel using continuous flow meters. At MM1.14 flow rate will be collected using a pressure transducer using the rating curve established by San Luis Delta Mendota Water Authority for this site to convert the pressure reading to flow rate. This data will be used to verify the flow releases from the DMC into the wasteway. At Newman d/s (mile marker 6.88) a Flowdair System will be installed under the ag bridge to provide continous flow data. These data will be used to evaluate the flow gains and losses in the wasteway and to guide the grab sampling program.

In addition, a staff gauge will be located at the terminus of the wasteway (upstream of any anticipated influence from the SJR). This staff gauge will be set to zero at the current elevation of the wasteway discharge and used only as a reference to change, and as an indicator to high stable flow.

VIII. Sampling Methods

Sample Collection

Decontamination
All equipment used for sample collection must be pre-cleaned before use. Equipment should be scrubbed with Alkanox™ (soap) rinsed three times with DI water and three times with environmental water.

Grab Samples
Grab sampling is conducted by either using non-reactive buckets for sample collection or collecting samples directly into an unpreserved sample container. Individual sample bottles with preservative will then be filled directly from the non-reactive bucket.

Physical Measurements

Physical measurements will be conducted on-site by field personnel. Turbidity , electrical conductivity, dissolved oxygen, and temperature will be measured at locations indicated using a continuous logging YSI 6920. All meters will be calibrated twice a day for days 1-3, and once before sampling for day 5/6 and weeks 2-6.

Quality Assurance (QA) Sample Collection

Duplicate samples should be collected in the field from a single volume of water from the non-reactive bucket. Blank samples should also be collected in the field.

IX. Sample Handling and Custody

Inorganic Samples

Samples will be placed in zip lock bags and stored on ice in coolers until couriered to the laboratory. The laboratory receives the samples and stores them in refrigerators. Refrigeration keeps the samples between 2 and 6 degrees Celsius to prevent degradation.

Samples are collected, processed, and shipped to the laboratory in a timely manner to ensure the holding times are not exceeded. The holding times are detailed in table 3.

Microbiological Samples

Microbiological samples will be shipped from the field each day. The samples are shipped to the laboratory on ice in coolers URS will relinquish the samples to the laboratory on the COC, which accompanies the samples during shipment. The laboratory receives the samples and stores them in refrigerators.

Refrigeration keeps the samples between 2-6 degrees Celsius to prevent degradation.

Samples are collected, processed, and shipped to the laboratory in a timely manner to ensure the holding times are not exceeded. The holding times are detailed in the table 3.

Toxicity Samples

Toxicity samples will be shipped from the field each day. The samples are shipped to the laboratory on ice in coolers. URS will relinquish the samples to the laboratory on the COC, which accompanies the samples during shipment. The laboratory receives the samples and stores them in refrigerators. Refrigeration keeps the samples between 2-6 degrees Celsius to prevent degradation.

Samples are collected, processed, and shipped to the laboratory in a timely manner to ensure the holding times are not exceeded. The holding times are detailed in the table 3.

X. Analytical Methods

Monitoring personnel will measure dissolved oxygen, temperature, pH, turbidity, and electrical conductivity using a YSI 6920 continuous logging meter.

The laboratories follow the protocols for preparation, analysis, and corrective actions stated in the analytical methods and the laboratory Standard Operating Procedures (SOP). Approximate turn around times for analysis is 3 weeks. Analytical methods to be used are listed in Table 3.

XI. Quality Control

Following is a brief summary of the QA activities that pertain to this project.

Field QA

Field QA/QC will consist of blanks and duplicate samples.

Blank Samples

Equipment blanks are used to check for contamination from sampling equipment. To generate an equipment blank the non-reactive bucket will be cleaned as per normal procedure. DI water will then be used to fill the bucket and transferred into the sample bottles. The equipment blank will be then submitted to the laboratory blind for analysis.

Field blanks are used to check the cleanliness of the sampling bottles, bottle handling, and shipping procedures. Field blanks are prepared by filling a sample

bottle in the field with DI water and shipping the sample to the laboratory for analysis.

Field Duplicates

Field duplicates are samples collected at the same place and time and are used to represent the precision of the entire sampling and analysis system. For this study filed duplicated will be collected at a frequency of greater than 5%.

Laboratory Quality Control Samples

The laboratory will incorporate QC samples at the frequency specified in the analytical method and the laboratory SOP. The results for the QC samples will be assessed based on the acceptance criteria in the analytical method and the laboratory SOP. If any laboratory QC samples do not meet the established acceptance criteria, the laboratory will follow the corrective action protocol detailed in the analytical methods or the laboratory SOP.

Laboratory QA samples will be used to check accuracy, precision, and contamination will be incorporated for Hg (low level), TSS, TOC, Se, NH_3 as N, TKN, dissolved metals, and total B. Some parameters do not allow for a complete set of QA to be incorporated. For *E. coli*, a precision check will not be incorporated.

Accuracy

Matrix spike, blank spike, and certified reference samples are incorporated to assess accuracy. They are incorporated at a rate of 5% of the production samples. If less than 20 production samples are collected, at least one spike/reference sample is incorporated. Accuracy is assessed using percent recovery (PR):

The PR for a spike sample is calculated as follows:

$$PR = \frac{(S - R)}{A}(100)$$

PR	=	Percent Recovery
S	=	Spiked Sample Result
R	=	Regular Sample Result
A	=	Amount of Spike Added

The PR for a reference sample is calculated as follows:

$$PR = \left(\frac{F}{MPVorMPN} \right)(100)$$

PR	=	Percent Recovery
F	=	Reference Sample Result
MPV	=	Most Probable Value
MPN	=	Most Probable Number

Precision

Duplicate samples are incorporated to assess precision. They are incorporated at a rate of 10% of the production samples. If less than 10 production samples are collected, at least one duplicate sample is incorporated. Precision is assessed using relative percent difference (RPD):

$$RPD = \frac{|R - D|}{\left((R + D) / 2 \right)} (100)$$

RPD	=	Relative Percent Difference
R	=	Regular Sample Result
D	=	Duplicate Sample Result

Contamination

Blank samples (DI water) are incorporated to assess laboratory contamination. They are incorporated at a rate of 5% of the production samples. If less than 20 production samples are collected, at least one blank sample is incorporated.

Holding Times

The date of the sample analysis will be compared to the date the sample was collected to ensure the sample was analyzed within the holding time. If the holding times are exceeded, the program manager will determine if re-sampling is required. If re-sampling is not required, the QA specialist will qualify the data as necessary.

Historical Outliers

When the analytical report is received, the inorganic results for the production samples for each site will be entered into an Excel spreadsheet. The Excel spreadsheets have been developed to flag any result that is an outlier. If a result is flagged, the QAT will use the guidelines in the QASOP to determine if the sample needs to be reanalyzed for the parameter.

XII. Instrument/Equipment Testing, Calibration, Inspection, and Maintenance

Field

Each YSI instrument will be calibrated each day before it is used in the field. The instrument will also be checked at the end of each field day. These calibrations and end of the day checks follow the manufacturer's instructions as outlined in the instrument manuals. Field personnel will record YSI calibrations on calibration sheets, which will be filed.

Laboratory

Maintenance procedures are detailed in the manufacturer's specifications, laboratory's QA manual, or laboratory SOPs. Instrument calibration procedures are specified in the analytical method, laboratory's QA manual, or laboratory SOPs.

XIII. Inspection/Acceptance for Supplies and Consumables

Level 1 certified bottles that have been pre-preserved (when necessary) are used for sample collection. References used for external QA incorporation have certified values from the vendor. Spike solutions used for external QA incorporation will be certified to be within 90%-110% of the expected value prior to use.

XIV. Data Management

The alpha-numeric field sample identifications assigned for this project will include a station code and a numerical sequence, i.e. NW-DS-001. Numbers are assigned sequentially, beginning with 001.

The assigned field station identifications are:

- DMC/NW – Delta Mendota Canal at Newman Wasteway
- NW-US – Newman Wasteway upstream at MM 1.14
- NW-DS – Newman Wasteway downstream
- SJR –US – San Joaquin River upstream
- SJR-DS – San Joaquin River downstream
- MM6.88 – Newman Wasteway mile marker 6.88
- SJR/NW – San Joaquin River/Newman Wasteway Confluence
- SJR/MR – San Joaquin River/Merced River Confluence
- SCL – San Joaquin River at Crows Landing

The DMT is responsible for storing and securing field sheets, instrument calibration sheets, COCs, laboratory data reports, field log books and project binders. Additionally, the DMT enters the necessary information from these documents into the Environmental Monitoring Database.

Field sheets, instrument calibration sheets, and COC's are generated, inspected and signed by the field sampler. These documents are turned in to the QA specialist. The QA specialist will contact any field sampler whose paper work contains significant errors or omissions. The QA specialist turns these documents to the DMT to be entered into the Environmental Monitoring Database and filed in the project binder.

Laboratory data reports are received by the QA specialist; the QA specialist validates the results and documents QA metadata. After the laboratory data reports are validated by the QA specialist, the data reports are signed and sent to the DMT. The DMT enters the analytical results and the QA metadata in the Environmental Monitoring Database; the laboratory data reports are filed in the project binder.

All data entered into the database follows the protocols in the DMT SOP. As a QC check, all data entered will be secondarily reviewed by an additional DMT member; the secondary review is documented with initials and the date. After all data has been entered into the database, the data is signed, dated, and filed in project binders.

Assessment and Oversight

XVI. Reports to Management

All sample data will be supplied with an accompanying quality assurance report to support the validity of the water quality data associated with the San Joaquin River Recirculation Pilot Study. Only data that has passed quality assurance requirements will be included in data assessments.

Data Validation and Usability

XVII. Data Review, Verification, and Validation

If all external QA samples and laboratory QC samples meet the acceptance criteria, all results are not outliers, and all samples are analyzed within the holding time, all data will be accepted as valid.

If a result is confirmed after reanalysis, the result will be accepted as valid.

Data will be qualified if results demonstrate unacceptable QA, if an outlier is unconfirmed after being reanalyzed, if the laboratory QC sample results are unacceptable, or if the holding times were exceeded.

The data assessor will determine the usability of the data.

XVIII. Verification and Validation Methods

The QA specialist will validate the data by following the guidelines in the EPA National Functional Guidelines. Validation consists of reviewing the results of external quality assurance samples and laboratory quality control results. Holding times, completeness, and historical outliers will also be assessed.

If any of the inorganic, external QA sample results do not meet the acceptance criteria stated or if any inorganic result is determined to be a historical outlier, the samples are submitted for reanalysis. If the laboratory confirms the original result, the original data is accepted based on the laboratory demonstrating that sample preparation and instrumentation was run properly on the initial analysis. If the original result cannot be confirmed, the laboratory must then analyze a bracket of samples or the entire batch of samples an additional time for the parameter. The bracket of samples or the entire batch of samples that has been analyzed an additional time is then evaluated for the parameter to see if the results meet the acceptance criteria or if any result is an outlier. Professional judgment is used to decide which set of data to accept and whether or not the data should be qualified if both sets of data demonstrate unacceptable external QA sample results or if both sets of data have outlier results.

Due to the short holding time for *E. coli*, no reanalysis is requested if the external QA results do not meet the acceptance criteria. Professional judgment is used to decide how to qualify the data based on the external QA sample results and laboratory quality control sample results.

XIX. Reconciliation with User Requirements

After the sampling event, calculations and determinations for precision, accuracy, contamination, and completeness will be made and corrective actions implemented if needed. If data quality indicators do not meet the study's specifications, data may be either qualified or discarded. Additionally, it is possible that re-sampling may occur.

Any qualified results will be identified to the DMT. Additionally, if results are qualified, the result will be marked with a footnote on the data table submitted to the data assessor; the footnote will detail the qualification.

Appendix 1: Area Map 1