Quality Assurance Project Plan

For Current Use Pesticide Monitoring

Under The

Sacramento-San Joaquin Delta Regional Monitoring Program

(Version 1.3)

Submitted On

June 1, 2022

Revised on August 12, 2022, October 25, 2022, and December 20, 2022

Prepared By:

MLJ ENVIRONMENTAL

1 APPROVAL SIGNATURES

* This is a contractual document. The signature dates indicate the earliest date when the project can start.

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Program Manager	Melissa Turner	MLJ Environmental	DocuSigned by: Melissa Turner 3796DD913C44446...	1/14/2023
Quality Assurance Officer	Will Hagan	MPSL-MLML	DocuSigned by: Will Hagan A1D771E8E56040F...	1/13/2023
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Central Valley Regional Water Quality Control Board

TITLE	NAME	AFFILIATION	SIGNATURE	DATE
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Quality Assurance Representative	Selina Cole	CVRWQCB	DocuSigned by: Selina Cole F3102A0E248746B...	1/23/2023

State Water Resources Control Board

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Project Personnel

TITLE	NAME	AFFILIATION	SIGNATURE	DATE
USGS Project Manager	Jim Orlando	USGS	DocuSigned by: Jim Orlando B4DDF22E261F427...	1/17/2023

Laboratory Personnel

TITLE	NAME	AFFILIATION	SIGNATURE	DATE
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Laboratory Project Manager	Allie Guerra	Babcock Laboratories	DocuSigned by: Allie Guerra C31DC1B674B945D...	3/13/2023
Laboratory QA Officer	Stacey Fry	Babcock Laboratories	DocuSigned by: Urvashi Patel A8EE54AC1A81473...	3/13/2023

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2.4 LIST OF ACRONYMS

BOD	Board of Directors

CEDEN	California Environmental Data Exchange Network
COC	Chain of Custody
CRM	Certified Reference Material
CV RDC	Central Valley Regional Data Center
CVRWQCB	Central Valley Regional Water Quality Control Board
Delta RMP	Delta Regional Monitoring Program
DMT	Data Management Team
DQI	Data Quality Indicator
DQO	Data Quality Objective
E	Environmental Sample
EDD	Electronic Data Deliverable
ELAP	Environmental Laboratory Accreditation Program
EPA	Environmental Protection Agency
FD	Field Duplicate
LCS	Lab Control Sample
LCSD	Lab Control Sample Duplicate
MLJ Environmental	Michael L. Johnson Environmental
MLML	Moss Landing Marine Laboratory
MPSL	Marine Pollution Studies Laboratory
MQO	Measurement Quality Objective
MS	Matrix Spike
MSD	Matrix Spike Duplicate
MS4	Municipal Separate Stormwater Sewer System
NOAA	National Oceanic and Atmospheric Administration
PDF	Portable Document Format
POTW	Publicly Owned Treatment Works
PR	Percent Recovery
QA	Quality Assurance
QAM	Quality Assurance Manual
QAPP	Quality Assurance Project Plan
QC	Quality Control
RPD	Relative Percent Difference
SC	Steering Committee
SOP	Standard Operating Procedure
SRM	Standard Reference Material
SWAMP	Surface Water Ambient Monitoring Program
SWRCB	State Water Resources Control Board
TAC	Technical Advisory Committee

2.5 LIST OF UNITS

°C	degrees Celsius
cm	centimeter
g	gram
kg	kilogram
L	liter
mg	milligram
mL	milliliter
ng	nanogram
µg	microgram
µS	microsiemen

2.6 REVISION HISTORY

VERSION	DATE	REVISION DESCRIPTION
1.0	6/1/2022	Original submittal to the CVRWQCB.
1.1	8/12/2022	Resubmittal incorporating comments from CVRWQCB and SWRCB. Added Water Quality Metrics that were received from the CVRWQCB on 6/23/2022.
1.2	10/25/2022	Resubmittal incorporating comments from CVRWQCB and SWRCB regarding analyte MQOs, analytical batch definitions, laboratory QC sample requirements, data processing steps and data rejection protocols.
1.3	12/22/2022	Resubmittal incorporating comments from CVRWQCB and SWRCB regarding data review communication procedures (Element 20), data rejection language (Element 22), and an updated Data Management SOP (Appendix II). DOC MDL/RL corrected.

GROUP A. PROJECT MANAGEMENT

This Quality Assurance Project Plan (QAPP) describes the procedures, objectives, and responsible personnel for ensuring the quality of data generated by the Current Use Pesticide (CUP) study design under the Delta Regional Monitoring Program (Delta RMP).

3 DISTRIBUTION LIST

The individuals and groups listed below will receive a final, executed copy of this document and any subsequent revisions. Copies of this document will be made available to the public via the Delta RMP website, https://DeltaRMP.org/.

Title	Name	Affiliation	Contact Information
Delta RMP Steering Committee	Distribution List	NA	--
CUP Technical Advisory Committee	Distribution List	NA	--
Delta RMP Board of Directors President	Debbie Webster	CVCWA	eofficer@cvcwa.org
Delta RMP Program Manager	Melissa Turner	MLJ Environmental	mturner@mljenvironmental.com
Delta RMP Quality Assurance Officer	Will Hagan	MPSL-MLML	William.hagan@sjsu.edu
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CVRWQCB Quality Assurance Representative	Selina Cole	CVRWQCB	Selina.Cole@waterboards.ca.gov
SWRCB Quality Assurance Officer	Andrew Hamilton	SWRCB	Andrew.Hamilton@waterboards.ca.gov
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Lead Chemist	Michelle Hladik	USGS	mhladik@usgs.gov
Project Director	Stephen Clark	PER	slclark@pacificecorisk.com

Title	Name	Affiliation	Contact Information
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Project Manager	Allie Guerra	Babcock	aguerra@babcocklabs.com
Project QA Officer	Stacey Fry	Babcock	sfry@babcocklabs.com

4 PROJECT TASK/ORGANIZATION

4.1 DELTA REGIONAL MONITORING PROGRAM STRUCTURE

The purpose of the Delta RMP is to educate and inform decisions on how to protect, and where necessary, restore beneficial uses of water in the Sacramento-San Joaquin River Delta area of California, by producing objective and cost-effective scientific information critical to understanding regional water quality conditions and trends. The Implementing Entity for the Delta RMP is a nonprofit public benefit corporation under which the Board of Directors (BOD) oversee operations of the program.

The Delta RMP pursues the following objectives:

a) Improve the efficiency of water quality data collection and management in the Delta.

b) Generate information that informs and educates the public, agencies, and decision makers.

c) Raise awareness of Delta water quality conditions and how they impact beneficial uses.

d) Foster independent science, objective peer review, and a transparent review process.

The Delta RMP is implemented with stakeholder participation of various coordinated monitoring, resource, regulatory and regulated entities. These groups give technical and policy recommendations to the BOD through participation in the Steering Committee and various project-specific technical advisory committees (TACs). The Program structure is illustrated below in

Figure 1.

Participation in the Delta RMP by a discharger consists of providing funds and/or in-kind services to the Delta RMP at least equivalent to discontinued individual monitoring and study efforts. Participating discharger agencies in the Delta RMP include wastewater treatment, stormwater, agriculture, flood control, ports, and dredgers. The implementation of the Program is therefore done in close coordination with the Central Valley Regional Water Quality Control Board (CVRWQCB) to ensure that the participating dischargers remain in compliance with their individual regulatory requirements. The expectations of these requirements are outlined in Resolution R5-2021-0054, Approval of Delta Regional Monitoring Program Governance Structure and Implementing Entity, which provides the general approval of the Delta RMP Implementing Entity and governance structure (see **Regulatory Criteria**). All monitoring

and data generation occurring under this QAPP must be in accordance with the submission requirements and due dates defined in the Resolution Attachment A.

4.2 GOVERNING BOARDS AND ADVISORY COMMITTEES

4.2.1 Board of Directors

The BOD consists of directors dedicated to the purposes of the Delta RMP and appointed by their sector's appointing agency(ies). The BOD makes all binding decisions for the Delta RMP. The BOD will appoint both standing committees of the Board and advisory committees to the BOD. The BOD also appoints four Board Officers from among the existing members including a President, Vice President, Secretary, and Treasurer.

On a two-year rotation, agencies will put forth a nominee for their respective seat(s) to represent them on the BOD. Currently, the Bylaws provide for 11 director seats as follows:

- Agricultural interest (2 seats)
- Publicly Owned Treatment Works (POTW– 3 seats)
- Storm Water Agencies (MS4s – 3 seats).
- Water Supply Agencies (1 seat)
- Habitat Restoration/Flood Management (1 seat)
- 'At large' seat appointed by the Board of Directors (1 seat)

The responsibilities of the Board include (also See Article V, Section 1 of the Bylaws):

- Adopt policies, rules and procedures for the management and operation of the Delta RMP
- Develop the financial operations of the nonprofit
    - Create and approve budgets and expenditures,
    - Receive and accept contributions, grants, etc.
- Hire leadership staff, as necessary, to run the nonprofit and implement the Delta RMP program
- Enter into contracts with entities and individuals as necessary to operate and implement the Delta RMP
- Appoint and/or form Committees of the Board or Advisory Committees (technical and administrative) (See Section VI)
    - Under nonprofit law, committees of the Board must be comprised of only Board members. Advisory Committees can be made up of both Board members and non-Board members.

    - The Bylaws currently identify two Standing committees, the Executive Committee and the Steering Committee (SC). All other committees (i.e., those that are not Standing Committees, either of the Board or Advisory) are formed by resolution of the Board.
- Establish and oversee the implementation of policies and priorities of the Delta RMP.

4.2.2 Executive Committee

The Executive Committee is a standing Committee of the Board and has the authority between Board meetings to make decisions and take action relative to the operation of the nonprofit organization on behalf of the Board following developed policies and procedures of the Board. The Executive Committee consists of the four Board officers. The Executive Committee is responsible for authorizing the daily management of the Corporation including setting agendas for Board meetings, making/approving authorized limit expenditures, and similar. The Executive Committee may develop policies for Board approval and may review and recommend to the Board changes to the bylaws and to other operating policies.

The Executive Committee consists of the following Board officers which are selected from existing members of the Board: President, Vice President, Secretary, and Treasurer.

4.2.3 Steering Committee

The Steering Committee is a standing Advisory Committee to the BOD as described in the Bylaws and consists of representatives of the same categories as those defined for the members of the BOD, and with the same number of seats per category, plus representatives of regulatory agencies. These representative categories are listed below, specifically:

- Agricultural interest - 2 seats.
- Publicly Owned Treatment Works (POTWs) – 3 seats.
- Storm Water Agencies (MS4s) – 3 seats.
- Water Supply Agencies – 1 seat.
- Habitat Restoration/Flood Management – 1 seat.
- Dredgers – 1 seat
- Coordinated monitoring (Interagency Ecological Program/California Department of Fish and Wildlife) - 1 seat.
- Resource Agencies (NOAA Fisheries) - 1 seat.
- Regulatory Agencies (US Environmental Protection Agency, State Water Resource Control Board, and CVRWQCB-Management level staff) - 3 seats.

The Steering Committee is charged with the authority and responsibility to:

- Serve as an advisory body to the BOD
- Advise on strategic direction and the policies and procedures to implement the DRMP in a manner consistent with regulatory conditions and priorities
- Recommend direction for technical committees on priorities, constraints, and management questions to develop technical recommendations and products within the resource allocations determined by the BOD
- Recommend DRMP work products and any other plans or products.

All decisions by the Steering Committee will be in the form of advice/recommendations to the Board. The Steering Committee will have no binding authority on Delta RMP implementation. The Board will consider all recommendations by the Steering Committee in a timely manner.

All decisions by the Steering Committee are subject to subsequent timely consideration by the Board including but not limited to pursuit of opinions by others (e.g., the Executive Director, the Program Manager and other technical specialists (as warranted)).

Some decisions by the Steering Committee that are time sensitive or less significant can be made via e-mail or telephone conference, but only if these items have previously been discussed in a Steering Committee meeting.

4.2.4 Current Use Pesticide (CUP) Project Technical Advisory Committees

For this project, the CUP TAC has been established to provide recommendations to the Steering Committee and the Board of Directors regarding technical recommendations for the implementation of this project. The TAC has been provided specific responsibilities associated with expected deliverables by the Board (e.g., the "Charge") as also informed by Steering Committee recommendations. The TAC members serving as technical advisors for this project are identified in **Table 1**.

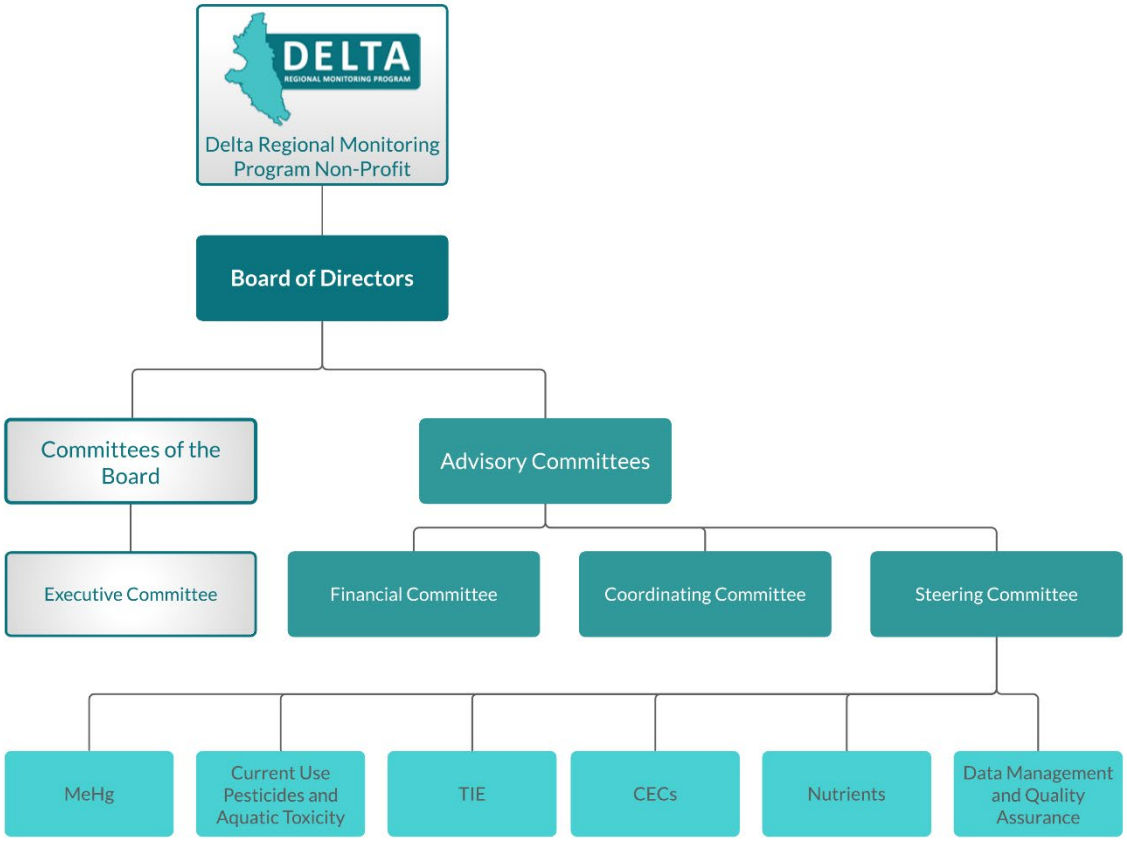
In addition to the CUP TAC, an additional rapid response committee is available for the purpose of making immediate decisions regarding the resources allocated to Toxicity Identification Evaluations (TIEs) conducted by toxicity labs in the event that samples are found to be sufficiently toxic. The procedures by which the TIE TAC decides whether or not to conduct a TIE are outlined in **Element 13.3**.

Table 1. Current Use Pesticides Technical Advisory Committee members.

TITLE	COMMITTEE(S)	NAME	AFFILIATION	CONTACT INFORMATION
Contributing Entities Representative	CUP	Karen Ashby	Larry Walker Associates (LWA)	karena@lwa.com

Title	Committee(s)	Name	Affiliation	Contact Information
Contributing Entities Representative	CUP, TIE	Michael Johnson	MLJ Environmental	mjohnson@mljenvironmental.com
Contributing Entities Representative	CUP	Armand Ruby	Armand Ruby Consulting	armand@armandrubyconsulting.com
Regulator Representative	CUP, TIE	Selina Cole	Regional Board	selina.cole@waterboards.ca.gov
Expert Representative	CUP, TIE	Cam Irvine	RBI	cam@robertson-bryan.com
Project / Laboratory Lead	CUP, TIE	Jim Orlando	USGS	jorlando@usgs.gov
Project / Laboratory Lead	CUP	Matthew De Parsia	USGS	mdeparsia@usgs.gov
Project / Laboratory Lead	CUP, TIE	Stephen Clark	Pacific EcoRisk	slclark@pacificecorisk.com
Project / Laboratory Lead	CUP, TIE	Stevi Vasquez	Pacific EcoRisk	svasquez@pacificecorisk.com

Figure 1. DRMP Non-Profit Structure (as of January 2022).



4.3 PROGRAM MANAGEMENT

4.3.1 Delta RMP Program Manager Role

The BOD has hired Melissa Turner of MLJ Environmental as the Program Manager. The Program Manager oversees all technical programs and associated leadership and staff for each technical area of the Delta RMP. The Program Manager will be responsible for planning and overseeing Delta RMP projects to ensure that they are completed within a timely manner and within budget. It is the Program Manager's responsibility to plan projects, prepare budgets, monitor progress, and keep stakeholders informed.

The Program Manager is responsible for the implementation of the project in accordance with Resolution R5-2021-0054, the approved fiscal year Workplan, and the QAPP. The Program Manager ensures the communication of direction, decisions, and challenges to implementation between technical staff and committees, the CVRWQCB, the Steering Committee, and the BOD.

4.4 QUALITY ASSURANCE OVERSIGHT

4.4.1 Program Quality Assurance Officer Role

The Delta RMP Program Quality Assurance (QA) Officer is Will Hagan of the Moss Landing Marine Laboratories, Marine Pollution Studies Lab (MLML-MPSL). The Program QA Officer provides ultimate quality assurance oversight for field and laboratory procedures, and final data review and assessment of completeness, accuracy, and precision of data generated by this project. The Delta RMP QA Officer is independent of any direct data generation, such as sample collection, field parameter recording, or laboratory analysis.

In addition to procedural QA/QC, the Program QA Officer, in coordination with the Program Manager, is responsible for reviewing laboratory protocols to confirm laboratory compliance with the overall requirements of the Delta RMP and is ultimately responsible for reviewing project data both for accuracy and comparability with the State Water Resource Control Board's Surface Water Ambient Monitoring Program (SWAMP). The Program QA Officer may stop all actions, including those conducted by the laboratories, if there are significant deviations from required QAPP practices or if there is evidence of a systematic failure.

Quality assurance oversight for the implementation of Delta RMP projects and studies is conducted in coordination with the CVRWQCB QA Representative, Selina Cole. The State Water Resource Control Board (SWRCB) QA Officer, Andrew Hamilton, will also be consulted to ensure consistency with SWRCB data management policies; the SWRCB QA Officer is a signatory of the QAPP and their approval is required prior to the implementation of this project.

Deviations to this QAPP will be reviewed by the Program QA Officer, the Program Manager, and the CVRWQCB QA Representative to assess impacts on data quality and project objectives. All deviations must be approved by the CVRWQCB QA Representative or the SWRCB QA Officer prior to implementation. When prior approval is not possible, the deviations must be reported to the CVRWQCB QA Representative within seven (7) calendar days per Resolution R5-2021-0054. Deviations to this QAPP are documented according to the procedures outlined in **Element 20**.

4.4.2 Data Manager Role

The Central Valley Regional Data Center (CV RDC) Manager (Victoria Bowles) coordinates the Data Management Team, which performs data review and verification to ensure that data submitted by subcontractor laboratories are timely, complete, and properly incorporated into the Regional Data Center database. Cassandra Lamerdin- (MLJ Environmental) will be the project Data Manager leading the DMT under the direction of the CV RDC Manager. Ms Lamerdin is responsible for data processing,

QA/QC review, and data upload to the California Environmental Data Exchange Network (CEDEN). Once the data have been reviewed and processed, they will undergo a final review and qualification by Will Hagan, the Program QA Officer, and/or a delegate of the QA Officer. In the event there are changes to the data after it has been published, they will be communicated to data users in a timely manner.

4.5 CURRENT USE PESTICIDES PROJECT PERSONNEL

4.5.1 Field, Laboratory, and Technical Services

Field and analytical services are coordinated by the USGS California Water Science Center (CWSC). Jim Orlando is the USGS Project Manager and is responsible for the implementation of the project, including overseeing that samples are collected, transferred, analyzed, and reported according to the requirements outlined in this QAPP. He is also responsible for receiving project data from the laboratories and the provision of these results to the CV RDC DMT. Mr. Orlando works under the direction of and reports project status updates to the Delta RMP Program Manager.

Field sampling is conducted by the USGS CWSC staff. Matt De Parsia serves as the CWSC field lead and is responsible for the proper training of field staff, for ensuring that samples are collected and preserved according to the approved procedures, the initial logging and processing of water samples, and the transfer of samples to the associated laboratory for analysis.

Samples are analyzed for current use pesticides and total suspended solids by the USGS Organic Chemistry Research Laboratory (OCRL). Michelle Hladik serves as the lead chemist and is responsible for supervising all laboratory activities, including that all activities are completed following the procedures established in this QAPP. Dissolved copper and additional ancillary parameters are analyzed by Babcock Laboratories, Inc. Samples are processed and transferred to Babcock Laboratories by staff at the CWSC; analytical results are provided to the CV RDC DMT.

Toxicity testing is conducted by Pacific EcoRisk (PER). Stephen Clark is the PER Project Director for the Delta RMP. Mr. Clark reports to the Delta RMP Program Manager and provides toxicity testing result updates to the CUP TAC. Stevi Vasquez serves as the PER Project Manager and is responsible for ensuring the toxicity testing is conducted according to the guidelines and procedures outlined in this QAPP. Ms. Vasquez is responsible for compiling toxicity test results and providing these data to the CV RDC DMT.

All commercial contract laboratories must maintain the appropriate accreditation with the California Environmental Laboratory Accreditation Program (ELAP). Wherever possible, the laboratories must be accredited in the specific analytical methods used for performing analysis under this QAPP. The ELAP certificate numbers of each of the

contract laboratories are listed in **Table 2**. The USGS OCRL laboratory is not a commercial laboratory and is not subject to the ELAP accreditation requirement.

Table 2. Commercial laboratories ELAP certificate numbers.

LABORATORY	ELAP CERTIFICATE NO.
PER	2085
Babcock Laboratories	2698

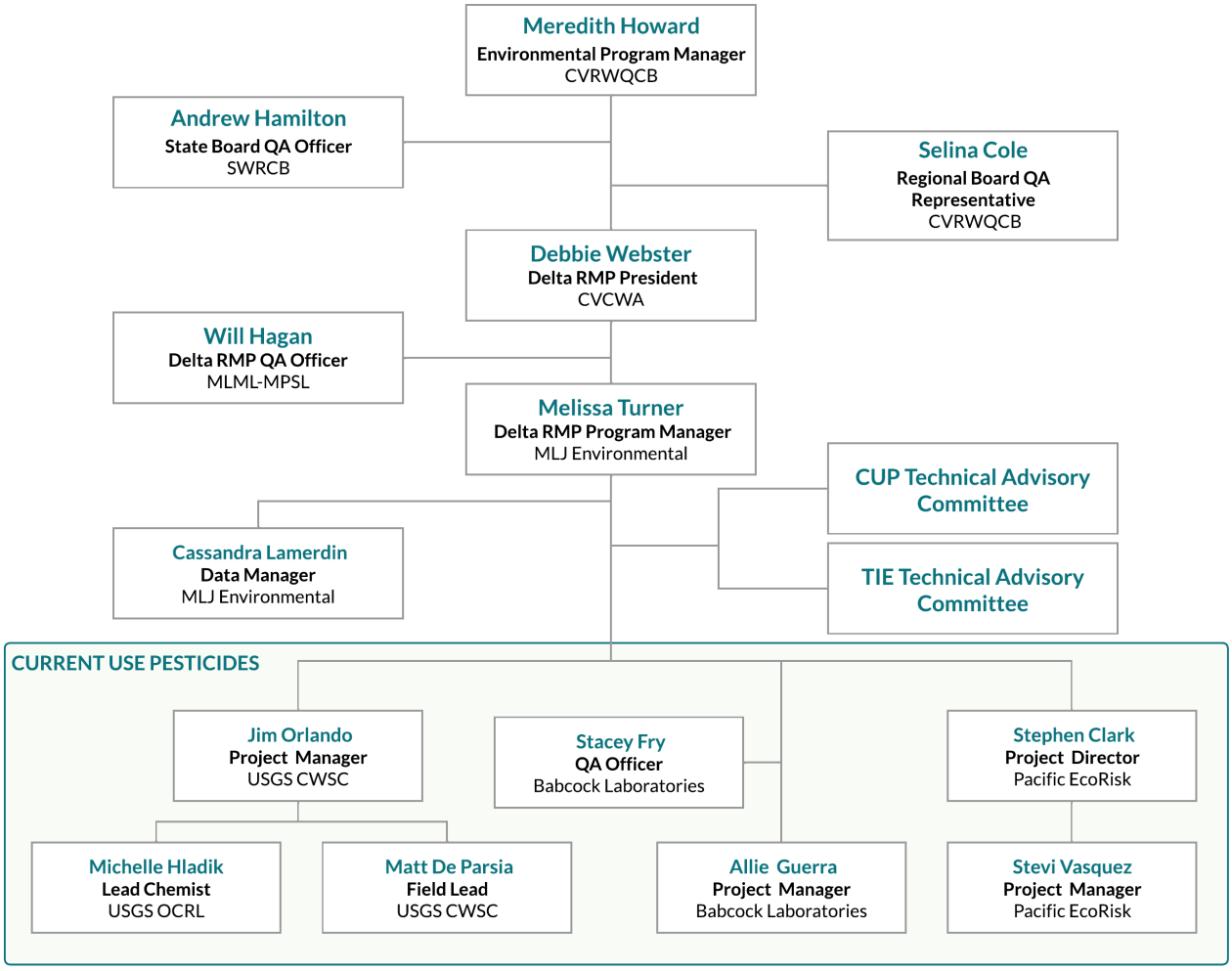
4.6 PERSONS RESPONSIBLE FOR QAPP MAINTENANCE

The Delta RMP Program Manager and Program QA Officer are responsible for creating, maintaining, and updating this QAPP, including the submission of amendments to reflect updates to the project implementation. This QAPP must be reviewed and approved by the CVRWQCB QA Representative and SWRCB QA Officer. Project implementation cannot occur until the QAPP is approved.

Amendments to this document should be made in concurrence with the CUP TAC and must be approved by either the SWRCB QA Officer or the CVRWQCB QA Representative prior to implementation. The Delta RMP Program Manager is responsible for documenting changes, submitting these changes for review and approval by Waterboards staff, and obtaining final signatures for all revision and amendments to the QAPP.

4.7 ORGANIZATIONAL CHART AND RESPONSIBILITIES

Figure 2. Project organizational chart for oversight of project data generation.



5 PROJECT DEFINITION/BACKGROUND

5.1 PROBLEM STATEMENT

The Sacramento-San Joaquin Delta (Delta) is an important water supply for municipal, industrial, and agricultural use for much of the state and is a critical ecosystem for fish and wildlife, including many rare and endangered species. The native fishes of the Sacramento–San Joaquin Delta have been declining at an increasingly rapid rate for more than two decades. This decline has significant consequences for water resource management in the Delta. There is no single cause for the decline of these fishes. All facets of the Delta ecosystem have changed dramatically in the past two decades and most changes have been detrimental to native fishes. Climate change, recent droughts, and increasing wildfires are a few of these changes. Another factor that can cause harm to native species are point or non-point discharges that alter water quality (through land and water use activities). Upstream water diversions also affect increased contaminant concentrations and water temperatures through changes in flows, and current export pumping practices can exacerbate poor water quality conditions in altered habitats. Contaminants have been documented in all major aquatic habitats in the Delta and Suisun Marsh. Discharges that alter water quality can affect both individual and populations of native species. The magnitude of cumulative effects of multiple contaminants that alter water quality is not well documented in the Delta. However, cumulative effects of harmful contaminants may also affect native species through direct toxicity or disruption of food webs.

The Delta RMP was initiated under the encouragement of the CVRWQCB with the primary goal of tracking and documenting the effectiveness of beneficial use protection and restoration efforts through comprehensive monitoring of water quality constituents and their effects in the Delta. Understanding the current water quality conditions within the Delta and the potential impacts to water quality conditions is important to preserve and enhance the Delta and inform corresponding regulatory and management decisions, which should be based upon sound science.

A better understanding of the effects of contaminants in the apparent decline of Delta ecosystems is a priority for regulators and stakeholders. Pesticide use in the Delta and Central Valley is one of the potential drivers of these effects. Constantly changing pesticide use presents a challenge for environmental scientists, resource managers, and policy makers trying to understand whether these contaminants are impacting aquatic systems and if so, which pesticides are the biggest problem. Less than half of the pesticides currently applied in the Central Valley are routinely analyzed in monitoring studies and new pesticides are continually being registered for use. Therefore, baseline monitoring of ambient surface water for both aquatic toxicity and a broad list of current

use pesticides is needed to understand whether current use pesticides contribute to observed toxicity in the Delta.

5.2 DECISIONS AND OUTCOMES

Pesticide monitoring is one of the original focus areas of the Delta RMP. The Delta RMP began pesticide monitoring in 2015 to characterize the spatial and temporal variability of pesticide concentrations and toxicity to aquatic organisms. The CUP monitoring is intended to provide useful information to state and federal water quality regulators, characterize the types of pesticides observed, the frequency, and the potential effects on aquatic life.

5.2.1 Management and Assessment Questions

The overall purpose of the CUP study design is to characterize status and trends of pesticide concentrations and toxicity in the Delta.

The CUP study is designed to help answer the core Delta RMP Management Question: Is water quality currently or trending towards adversely affecting beneficial uses of the Delta?

More specifically to pesticides and aquatic toxicity, the CUP study has the goal of answering the following Delta RMP Assessment Questions:

- Status & Trends 1 - To what extent do current use pesticides contribute to observed toxicity in the Delta?
    - Status & Trends 1.1 - If samples are toxic, do detected pesticides explain the toxicity?
    - Status & Trends 1.2 - What are the spatial and temporal extent of lethal and sublethal aquatic and sediment toxicity observed in the Delta?
- Status & Trends 2 - What are the spatial/temporal distributions of concentrations of currently used pesticides identified as possible causes of observed toxicity?

In order to answer these questions, the primary study objectives are defined as follows:

- Collect water samples from a variety of locations across Delta subregions and analyze them for a broad suite of current use pesticides and for toxicity to aquatic organisms.
- Test whether pesticides in ambient water samples exceed aquatic life benchmarks.
- Test for the co-occurrence of pesticides and observed aquatic toxicity.

The following examples illustrate how the data from the CUP study design can inform scientists, water managers, and regulators:

- The Delta RMP may use this information to determine what percentage of Delta waters exhibit toxicity to aquatic organisms or have concentrations of pesticides that exceed screening values.
- State water quality regulators may use this information to help evaluate if waterways should be classified as impaired under Section 303(d) of the Clean

Water Act. Regulators will be able to evaluate particular stream segments and parameters for signs of impairment, and, after several years of monitoring, may be able to track changes in impairment over time.

- If certain compounds are found to have adverse impacts on the aquatic environment that prevent attainment of beneficial uses, regulators may require the development of a management plan to prevent or mitigate pesticide contamination of waterways or, when warranted, adopt restrictions to further protect surface water from contamination.

5.3 REGULATORY CRITERIA

A variety of permittees throughout the Central Valley regulated by the CVRWQCB contribute and participate in the Delta RMP. In 2013, the CVRWQCB passed R5-2013-0130 allowing permittees with sufficient participation in the Delta RMP to modify or reduce some of the requirements of their own permits in exchange for their contribution to the Program. As such, the close collaboration with the CVRWQCB is essential to ensure the continued value and effectiveness of regional monitoring in lieu of individual monitoring and special studies that otherwise might be required by CVRWQCB for participating permittees.

In October 2021, the CVRWQCB passed Resolution R5-2021-0054 approving the updated Delta RMP governance structure as a vehicle for this modified monitoring to occur. Attachment A of Resolution R5-2021-0054 outlines the reporting requirements of the Delta RMP to the CVRWQCB in order to ensure added value of the coordinated efforts under the Program are adequate to investigate water quality issues in lieu of individual monitoring and special studies.

The requirements in Resolution R5-2021-0054 relevant to the QAPP include:

- Developing QAPPs that meet the requirements of the Water Boards and US Environmental Protection Agency (EPA)
- A documentation process for deviations and an assessment and a corrective action process
- Approval by the SWRCB QA Officer (Andrew Hamilton) prior to implementation of monitoring
- Deviations to the QAPP must be approved by the CVRWQCB QA Representative (Selina Cole) or the SWRCB QA Officer (Andrew Hamilton)
    - When prior approval is not possible for QAPP deviations, they must be reported to the Central Valley Water Board Quality Assurance Representative within 7 Calendar Days of the BOD or contractors becoming aware of the deviation

Any results reported above Water Quality Metrics must be reported to the CVRWQCB within 60 calendar days of the sample analysis, per R5-2021-054. The Water Quality

Metrics constitute the project action limits for samples collected under this QAPP and are defined by the CVRWQCB by July 1 of each year, also per R5-2021-054. The Delta RMP received the Water Quality Metrics deliverable on June 23, 2022, including metrics that apply to the CUP monitoring. These metrics are provided in **Table 14** which also includes the laboratory analysis limits (Reporting and Minimum Detection Limits).

Delta RMP pesticides data analyzed by the USGS OCRL laboratory are not intended to determine regulatory compliance. Rather, the sample results of the suite of pesticides may be compared to the values listed in **Table 14** for screening purposes only.

6 PROJECT DESCRIPTION

6.1 WORK STATEMENT AND DELIVERABLES

Monitoring for the Delta RMP CUP project includes the collection of samples for aquatic toxicity testing and the analysis of pesticide concentrations in water at multiple sample locations across the Delta over multiple years of monitoring with the goal of answering the Management and Assessment questions identified in **Decisions and Outcomes**. Addressing the questions will require a correspondingly large effort over the course of several years. The study design was developed to make the best use of available funding to answer the highest priority Management and Assessment Questions in an initial effort to characterize the status and trends of pesticide concentrations and toxicity in the Delta.

Sample locations are randomly selected based on a rotating basin monitoring design. According to this design, the Delta waterways are divided into six smaller geographic areas, or subregions, with two of these areas being assessed each year on a set rotation cycle such that monitoring of the entire Delta region will be completed over the course of four years. The detailed CUP study design is provided as Appendix 1 in the Delta RMP Workplan for FY 22-23.

The rotating basin design allows for the assessment of pesticides and toxicity conditions in individual subregions of the Delta and in the Delta as a whole. The goal of this design is to collect a minimum of 24 samples from 24 different locations in each subregion, allowing for an assessment of the conditions of all six subregions over a four-year period. In addition, samples are collected from two fixed sites during each event over the entire study period. These sites represent two entry points of discharges into the Delta from a mixture of urban and agricultural sources and allows for a more effective assessment of the temporal aspects of the management questions than could be achieved by the rotating sampling design alone.

Samples collected are analyzed for a broad suite of pesticides with the goal of including as many of the products and ingredients currently applied throughout the Central Valley as possible. The chemical analyte groups for this monitoring element include several classes of chemicals that are referred to throughout this document as pesticides, including insecticides, herbicides, fungicides, and other compounds in products that are licensed and sold to farmers and residents in California. Likewise, the toxicity tests include five different species and evaluations of both lethal and sublethal endpoints for a broad characterization of the potential effects of observed pesticide concentrations. Ancillary parameters that allow for further characterization of the bioavailability of organic constituents in the water column, such as the presence of organic carbon and suspended solids, are also analyzed in all samples to allow for the further interpretation of the relationship between pesticide and toxicity results.

6.2 CONSTITUENTS TO BE MONITORED

Table 3 lists the constituents associated with this project. The entire suite of constituents is monitored during each of the six annual sampling events.

Table 3. Constituents and parameters.

CONSTITUENT	PARAMETER TYPE	AGENCY	MATRIX	METHOD	FRACTIONS/ ENDPOINTS	REPORTING UNITS
Dissolved Oxygen	Field Measure	CSWC	Water	--	--	mg/L
Oxygen Saturation	Field Measure	CSWC	Water	--	--	% saturation
pH	Field Measure	CSWC	Water	--	--	pH units
Salinity	Field Measure	CSWC	Water	--	--	ppt
Specific Conductivity	Field Measure	CSWC	Water	--	--	µS/cm
Temperature	Field Measure	CSWC	Water	--	--	ºC
Temperature	Field Measure	CSWC	Air	--	--	ºC
Turbidity	Field Measure	CSWC	Water	--	--	NTU
Dissolved Organic Carbon [1]	Ancillary Parameters	Babcock	Water	SM 5310 B	Dissolved	mg/L
Total Organic Carbon [1]	Ancillary Parameters	Babcock	Water	SM 5310 B	Total	mg/L
Nitrate + Nitrite as N [2]	Ancillary Parameters	Babcock	Water	EPA 353.2	Total	mg/L
Total Kjeldahl Nitrogen (TKN) [2]	Ancillary Parameters	Babcock	Water	EPA 351.2	Total	mg/L
Total Kjeldahl Nitrogen (TKN) [2]	Ancillary Parameters	Babcock	Water	EPA 351.2	Dissolved	mg/L
Total Suspended Solids	Ancillary Parameters	OCRL	Water	EPA 160.2	Particulate	mg/L
Hardness [3]	Ancillary Parameters	Babcock	Water	SM 2340 B	Dissolved	mg/L
Calcium [3]	Ancillary Parameters	Babcock	Water	EPA 200.7	Dissolved	mg/L
Magnesium [3]	Ancillary Parameters	Babcock	Water	EPA 200.7	Dissolved	mg/L
Copper	Trace Metals	Babcock	Water	EPA 200.8	Dissolved	µg/L
Ceriodaphnia dubia	Aquatic Toxicity	PER	Water	EPA 821/R-02-013	Reproduction, Survival	Num/Rep, %
Chironomus dilutus	Aquatic Toxicity	PER	Water	EPA 600/R-99-064M	Growth, Survival	mg/ind, %
Hyalella azteca	Aquatic Toxicity	PER	Water	EPA 821/R-02-012	Survival	%
Pimephales promelas	Aquatic Toxicity	PER	Water	EPA 821/R-02-013	Growth, Survival	mg/ind, %

Constituent	Parameter Type	Agency	Matrix	Method	Fractions/ Endpoints	Reporting Units
Selenastrum capricornutum	Aquatic Toxicity	PER	Water	EPA 821/R-02-013	Growth	cells/mL
OCRL Pesticide Suite [4]	Current Use Pesticides	OCRL	Water	OCRL-WATER-PEST_05	Dissolved, Particulate	ng/L

[1] Total and dissolved organic carbon measurements are used to calculate the particulate fraction of organic carbon.
[2] Nitrate + nitrite as N and Total Kjeldahl Nitrogen and Dissolved Kjeldahl Nitrogen are used to calculate the total, dissolved, and particulate fractions of total nitrogen present.
[3] Hardness by calculation (SM 2340 B) is obtained by the sum of calcium and magnesium measurements.
[4] The OCRL pesticide suite comprises the individual constituents provided in **Table 14 .**

6.3 HABITAT OBSERVATIONS

In addition to the samples and measurements collected in the field, sampling crews shall record habitat parameters documenting the qualitative site condition information at the time that samples were collected. The required habitat observations are consistent with SWAMP surface water sample collection protocols and are defined on the SWAMP field sheets used for this project (**Figure 6**). The following observations should be recorded by field crews with each sample collection:

- Site odor
- Sky code
- Other presence
- Dominant substrate
- Water clarity
- Water odor
- Water color
- Overland runoff (last 24 hours)
- Observed flow
- Wadeability
- Wind speed (Beaufort scale)
- Wind direction
- Precipitation (at time of sampling)
- Precipitation (last 24 hours)
- Occupation Method
- Starting bank (facing downstream)
- Distance from bank (m)
- Stream width (m)
- Water depth (m)
- Location

- Hydromodification

6.4 PROJECT SCHEDULE

Monitoring priorities and designs are assessed on an annual basis based on recommendations from the Steering Committee as part of developing annual Workplans and associated budgets which are developed on a fiscal year basis (July 1 through June 30). Workplans outlining the study goals, designs, and budgets for all projects in the upcoming fiscal year are provided to the CVRWQCB by May 1 annually and must be approved by the CVRWQCB prior to implementation.

All deliverable dates will, at a minimum, meet the reporting requirements outlined in Resolution R5-2021-005. Preliminary data must be reported to the CVRWQCB within 60 calendar days of the sample analysis and Annual Reports are due on February 1 each year for the previous fiscal year.

Monitoring under the CUP study design occurs on a water year (WY) basis. The current design was approved by the Steering Committee in July 2018; monitoring began in the 2019 WY starting in October 2018. Monitoring was originally planned to be completed over four consecutive water years, with sampling beginning in October of 2018 and concluding through September of 2022. Monitoring was completed the first year (2019 WY) through March of 2020; however, due to a combination of COVID-19 restrictions and the changing of toxicity laboratories, monitoring was paused from March 2020 through March 2021, with Year 2 monitoring being partially completed in the 2020 WY and being extended through the 2021 WY. There were delays in obtaining an approval of the QAPP associated with the planned analytical methodology which resulted in a delay in being able to monitor during the 2022 WY. The Delta RMP BOD approved the delay of Year 3 monitoring to WY 2023 based on a recommendation from the Steering Committee which will allow for the collection of samples for all six events during the same water year. The fourth and final year of the study design will be completed in the 2024 WY. Years 1 and 2 of the current design were completed under a previous version of the general Delta RMP QAPP; the third and fourth years of monitoring will be conducted under this CUP QAPP.

Table 4 summarizes the schedule of work to be performed and deliverables to be submitted. Monitoring data (and associated metadata) will be made available to the CVRWQB within 60 calendar days of sample analysis date (for preliminary raw data and monitoring results) and the fully reviewed data will be made publicly accessible no more than six months after the last sample collection in the water year consistent with the Board Resolution Number R5-2021-0054. The last sample collection date is expected to be no later than September 30 annually.

Data will be evaluated on a water year in annual data reports. Annual data reports should provide an overview of the monitoring activities that occurred during the WY, chemical

analyses and, toxicity testing completed, and the results received. The data report should also include QA assessment which will evaluate the results received according to the quality objectives outlined in this QAPP. Reports will be submitted to the CUP TAC for technical review prior to publication on the Delta RMP website.

An intermediate QA assessment will also occur as a part of the Delta RMP Annual Report, which is due to the CVRWQCB annually by February 1. These assessments will occur based on the CUP monitoring that occurred during the previous Delta RMP FY which will have been verified according to the steps outlined in **Element 23.1** minus the transfer to CEDEN. The requirements of QA assessment as part of the Delt RMP Annual Report are outlined in R5-2021-0054.

Finalized data will be reported to CEDEN on a water year basis upon finalization of the data verification steps outlined in this QAPP and ideally upon the approval of the associated data report; however, data publication timelines are not to exceed those required in R5-2021-0054 unless otherwise approved by the CVRWQCB Executive Officer (EO).

Upon completion of the entire four-year study design, a final interpretive report providing a summary of all monitoring occurring under the current design and a technical evaluation of the study results in relation to the assessment questions is anticipated to be completed in 2025.

Table 4. Project deliverable schedule timeline.

Deliverable	Deliverable Due Date	Activity Period or Trigger	Frequency
Remaining Monitoring Deliverables			
Year 3 Monitoring	--	October 2022 through September 2023	Annually
Year 3 Data Report	April 2024	2023 WY	Annually
Year 4 Monitoring	--	October 2023 through September 2024	Annually
Year 4 Data Report	April 2025	2024 WY	Annually
CUP Interpretive Report	2025	October 2019 through September 2024	Once
Resolution Deliverables			
Preliminary CUP Data	60 calendar days	Sample analysis	Per event
Finalized CUP Data	6 months	Sample analysis	Per event
Transfer of CUP Data to CEDEN	6 months	Final sampling event of the water year	Per water year
Delta RMP FY Annual Report	February 1	Previous July through June	Annually

6.5 GEOGRAPHICAL SETTING

The geographic scope of the Delta RMP encompasses the legal Delta (as defined by Section 12220 of the Water Code), as well as water bodies that directly drain into the Delta, the Yolo Bypass, and Suisun Bay (**Figure 3**). The Delta Primary Zone encompasses approximately 500,000 acres of waterways, levees, and farmed lands, including the Yolo Bypass. Most of Yolo Bypass is located within the Primary Zone. The Secondary Zone includes approximately 250,000 acres that are surrounding the Primary Zone and are subject to increasing urban and suburban development. Suisun Marsh on the northern side of Suisun Bay consists of approximately 110,000 acres of managed wetlands. The southern side of the Suisun Bay shoreline encompasses additional tidal wetlands as well as urban, suburban, and industrial areas.

Water dynamics in the Delta and Suisun Bay are governed by inflows from the Sacramento and San Joaquin watershed, tidal exchange with the Pacific Ocean, and water withdrawals for municipal and agricultural use. The main tributaries are the Sacramento River and the San Joaquin River. Additional tributaries include the Mokelumne River, Cosumnes River, Calaveras River, Bear Creek, Marsh Creek, Cache Creek, Putah Creek, and Ulatis Creek. Flows from the Sacramento River, San Joaquin River, and other tributaries are transported across the Delta through a complex network of rivers, channels, and flooded islands, before entering Suisun Bay or the intakes of the federal and state water projects. Flows in the Delta are highly seasonal and peak in the spring and early summer when snowmelt waters from the upper watersheds arrive.

For monitoring of pesticides and aquatic toxicity, all samples will be collected from within the legal boundaries of the Delta. The Delta has further been divided into the six subregions identified in **Figure 4** which have been used to select monitoring sites based on the rotating basin study design. An overview of random site selections across these six subregions is provided in **Element 10.**

6.6 CONSTRAINTS

The CUP monitoring design calls for collecting samples for both toxicity and chemistry analysis at the same place and time. This sample design is intended to determine whether there is a relationship between pesticides in Delta waterways and harm to aquatic ecosystems. Pacific EcoRisk will be able to accept samples any day of the week, therefore not constraining sampling time.

The ability to measure some of the target compounds at the ultra-trace levels found in the ambient environment may be constrained by the detection limits routinely achievable by analytical laboratories.

An inherent limitation of discrete samples is that they represent only a moment in time and may not represent conditions during other time periods.

Figure 3. Map of the legal boundary of the Sacramento-San Joaquin Delta.

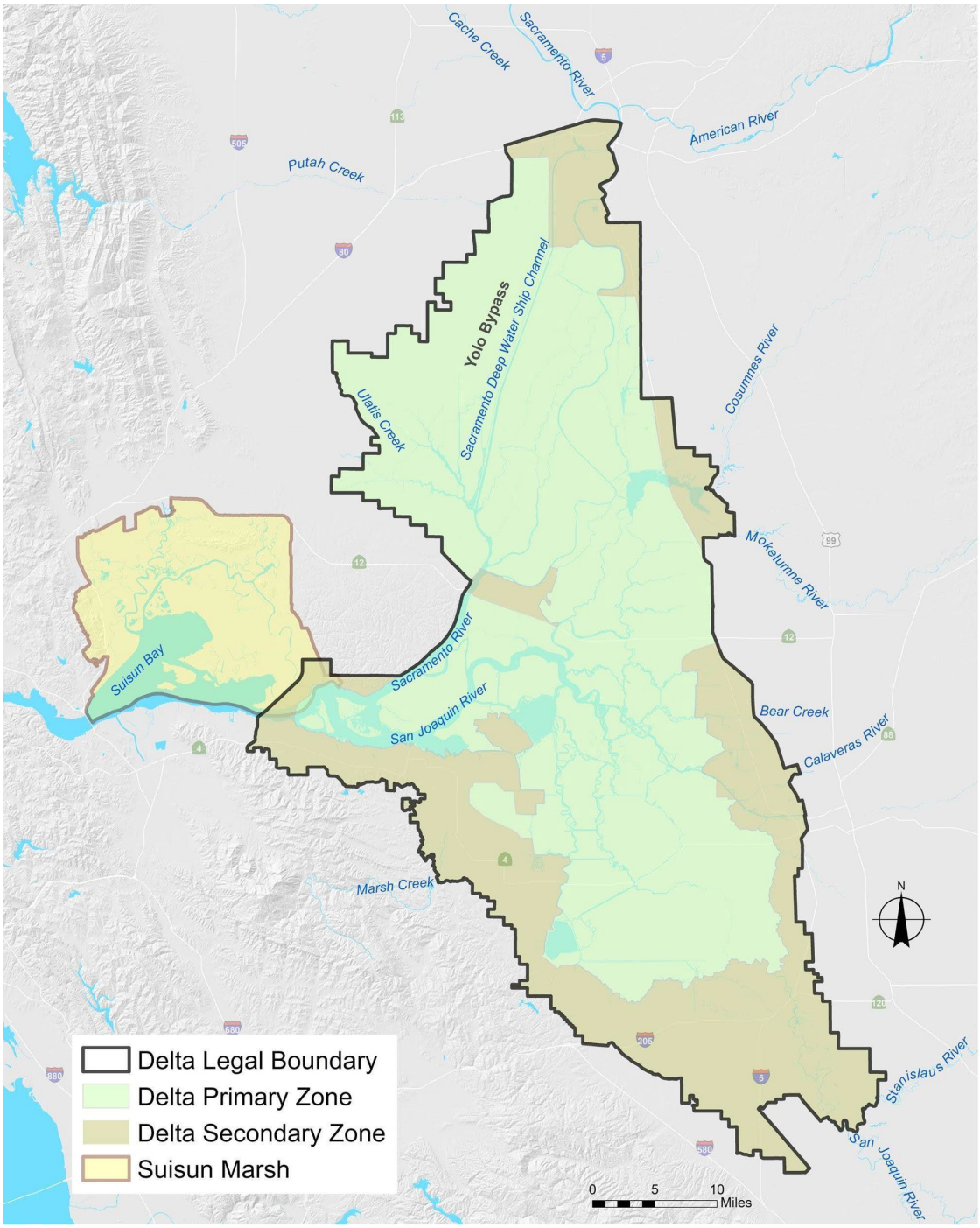
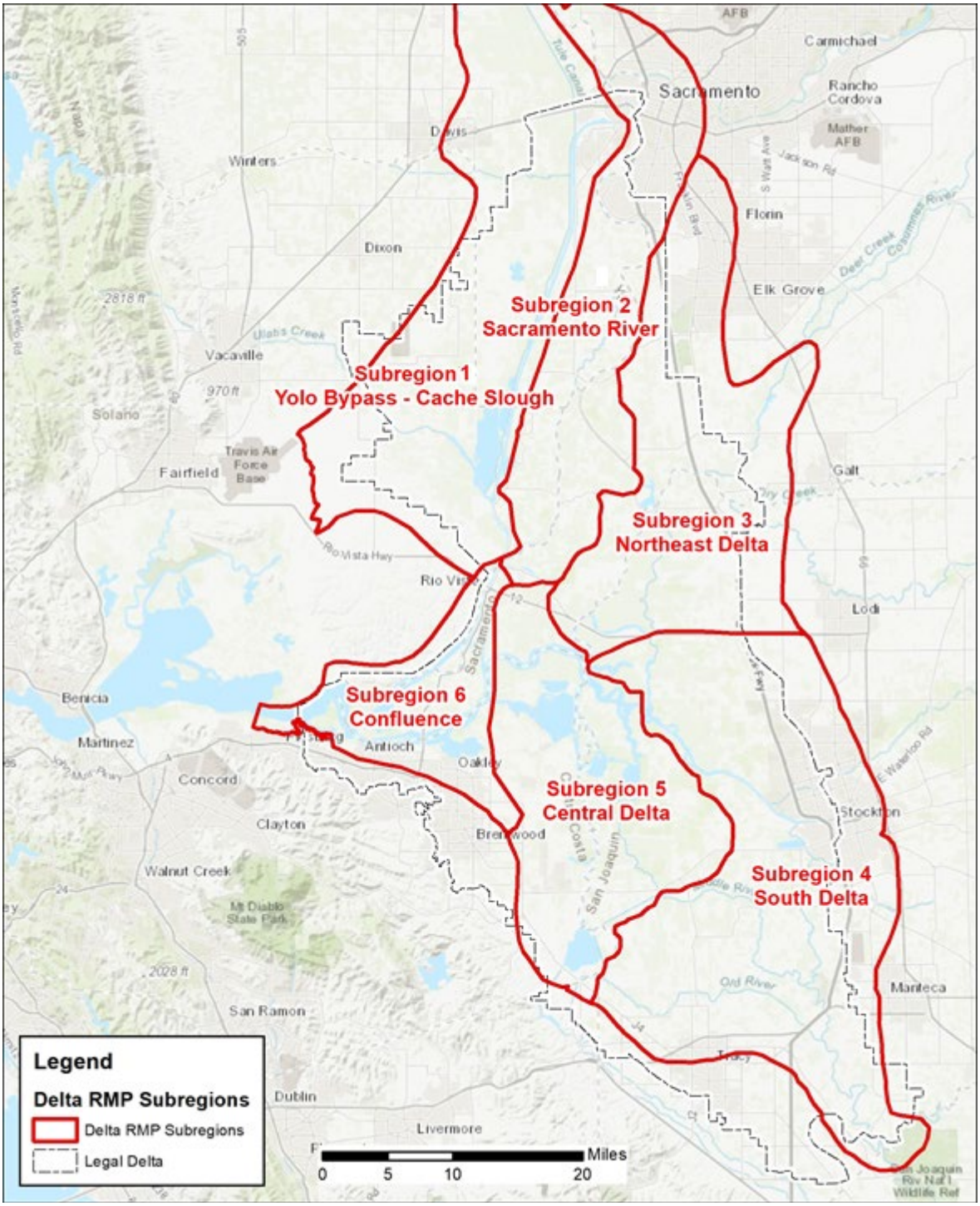


Figure 4. Map of the Delta RMP subregions for pesticide and toxicity sampling.



7 QUALITY OBJECTIVES AND CRITERIA

7.1 DATA QUALITY OBJECTIVES

In order to account for the inherent level of uncertainty that can occur from the sampling design process through the result documentation, it is important for the project to have set limits of allowable error to ensure data are useable and supportive of the project goals.

Data quality objectives (DQOs) are the qualitative and quantitative statements that define the appropriate metrics that will be used to establish the level of quality for project (EPA 2006). Data will be considered valid if DQOs for each of the data quality indicators outlined below are achieved. The effectiveness of the QA/QC program will be assessed by the quality of the data generated by the analytical laboratory and determination of field parameters.

7.2 DATA QUALITY INDICATORS

Data Quality Indicators (DQIs) are the quantitative statistics and qualitative descriptors used to interpret the degree of acceptability or utility of data to the user (US EPA QA/G-5, 2002). The principal data quality indicators are precision, accuracy (bias), representativeness, comparability, completeness, and sensitivity.

Limits for error must be established for all applicable DQIs for every measurement conducted under the Delta RMP. Program definitions for each DQI are provided below. Minimum targets associated with each of the following DQIs are outlined below in **Element 7.3 Performance Criteria.**

7.2.1 Precision and Accuracy (Bias)

Precision measures the agreement among repeated measurements of the same property under identical, or substantially similar, conditions. The closer two values that result from the same measurement under the same conditions are, the higher the degree of precision. The degree of precision can be a result of error and/or the limits of the measurement system. A measurement quality objective (MQO) can be set for the allowable amount of variation between multiple measurements to account for limits of the measurement system and the inherent amount of user error associated with the measurement system. Program precision is monitored using duplicate quality control samples, including but not limited to field duplicates (or replicates), laboratory duplicates, and matrix spike duplicates.

Accuracy is a measure of the overall agreement of a measurement to a known value. Accuracy includes a combination of random error (precision) and systematic error (bias) components that are due to sampling and analytical operations.

MQOs can be set to limit bias and to set an amount of error as compared to a true value achieved for a measurement. Contamination, measurement error, and matrix interference are all examples of causes of reduction in accuracy of a measurement.

Contamination that may be introduced during sample handling, preparation, or analysis can be monitored with the use of field blanks and laboratory blanks. If contamination is introduced, blank sample results can provide the degree of bias resulting from the error or analytical bias.

Measurement errors can be monitored through the analysis of a known concentration range and compared to measured results. This can be done using certified reference materials and laboratory control spike samples.

Bias introduced through interfering conditions present in the sample matrix can be monitored by duplicate environmental samples with a known concentration of target analytes prior to analytical process, known as matrix spike samples.

Data quality will be attained by maximizing the accuracy and precision of the methods used. Any changes in procedures due to equipment changes or to improved precision and accuracy will be documented. All analyses and determinations must be performed by qualified personnel in conformance with all current EPA standards and procedures. All laboratories will employ only methods and techniques which have been determined to produce measurement data of a known and verifiable quality and which are of quality sufficient to meet the overall objectives of the project.

7.2.2 Representativeness

Representativeness is the degree to which data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental condition. Representativeness for the Delta RMP can be defined as the degree to which the environmental data generated by the monitoring program accurately and precisely represent actual environmental conditions. For this project, this objective is addressed by the overall study design, adherence with sampling SOPs, and meeting holding times. Assuring that the data are representative of the program objectives is addressed primarily by selecting appropriate locations, methods, times, and frequencies of sampling for each environmental parameter, and by maintaining the integrity of the sample after collection. The overall study design and rationale is provided in the workplan and is summarized in **Element 10**.

7.2.3 Comparability

Comparability is a measure of the confidence with which one data set or method can be compared to another. Project data are comparable when evaluated against similar quality objectives and when utilizing similar methodology and reporting requirements. All projects contributing to the Delta RMP must maintain comparability by following the provisions outlined in the Delta RMP Data Management Plan (to be completed in October 2022).

7.2.4 Completeness

Completeness is a measure of the amount of valid data obtained from a measurement system. This assessment is typically expressed as a percentage of measurements reported within the prescribed limits associated with the respective DQOs, compared to those initially planned. Completeness evaluations ensure program requirements for data generation and reporting are met by contributing projects. Program completeness is assessed on three levels: field and transport, analytical, and batch completeness. Field completeness requires that sampling crews successfully visit each site, document the visit, and collect the field information and samples as outlined in **Elements 10-12**. Transport completeness requires that the samples collected by field crews are successfully transported to the laboratories. Analytical completeness is based on the number of samples successfully analyzed by the laboratory and for which valid results are generated. Batch completeness is based on whether batches were processed with the appropriate QC samples, as prescribed by the method or defined by the laboratory. Minimum QC sample frequency requirements can be found in **Element 14**.

7.2.5 Sensitivity and Resolution

Analytical sensitivity is commonly defined as the lowest value an instrument or method can measure with reasonable degree of certainty. Resolution is the capability of a method or instrument to discriminate between measurement responses representing different levels of a variable of interest. These limits are important to know when evaluating the appropriateness of a method or instrument for the requirements of a given study. Reporting limits represent the level at which a method or instrument can accurately measure a target compound. Wherever analytically feasible, reporting limits should be lower than the required project action limit to be appropriate for the project.

7.2.6 Minimizing Bias

Bias in field sampling quality control monitoring is minimized by randomly distributing QC samples among all sites throughout the year. Bias in analysis is minimized through the use

of professional, private, objective third-party labs. Any potential bias that may be introduced by these labs is assessed with QC samples.

7.3 PERFORMANCE CRITERIA

Measurement quality objectives are the specific criteria to which environmental or quality control measures are compared to determined acceptability. Measurement quality objectives for accuracy, precision, completeness, recovery, and contamination are assessed through a combination of instrument calibration and the analysis of duplicates, blanks, and spikes. Completeness is assessed based on the number of samples successfully obtained and validated for use and the proportion of quality control samples that are within acceptance criteria. Measurement quality objectives are listed below and in **Table 5** and **Table 6** and are the performance criteria utilized to evaluate whether the data quality objectives were met.

Field measurements are taken with multi-parameter systems; accuracy and precision are measured during calibration (if applicable), taking into account the manufacturers specifications. For all other types of analyses accuracy, precision, and recovery are assessed through use of QC samples, including laboratory spikes and matrix spikes to assess accuracy and recovery, and laboratory and field duplicates to assess precision.

Table 5. Measurement quality objectives for field accuracy, precision, and completeness measurements.

Measurement quality objectives in measurements of accuracy, precision, and completeness. Testing frequency is annual for all field measurements.

CONSTITUENT	ACCURACY/PRECISION	COMPLETENESS
Temperature	±0.2 °C	90%
pH	± 0.1 pH units	90%
Specific Conductivity	±0.5 µS/cm	90%
Dissolved Oxygen	±0.2 mg/L	90%
Turbidity	±1 NTU	90%

Table 6. Measurement quality objectives for laboratory accuracy, precision, and completeness measurements.

Constituent	Matrix Spike Frequency	Lab Control Spike Frequency[1]	Matrix Spike Accuracy/ Recovery	Lab Control Spike Accuracy/ Recovery	Lab Duplicate Frequency[2]	Precision	Completeness
Ancillary Parameters							
Dissolved Organic Carbon	1 per batch	1 per batch	80-120%	80-120%	1 per batch	RPD ≤ 25	90%
Total Organic Carbon	1 per batch	1 per batch	80-120%	80-120%	1 per batch	RPD ≤ 25	90%
Nitrate + Nitrite as N	1 per batch	1 per batch	90-110%	90-110%	1 per batch	RPD ≤ 20	90%
Total Kjeldahl Nitrogen	1 per batch	1 per batch	80-120%	90-110%	1 per batch	RPD ≤ 25	90%
Total Suspended Solids	NA	NA	NA	NA	NA	NA	90%
Hardness	NA	NA	NA	NA	NA	NA	90%
Calcium	1 per batch	1 per batch	70-130%	85-115%	1 per batch	RPD ≤ 20	90%
Magnesium	1 per batch	1 per batch	70-130%	85-115%	1 per batch	RPD ≤ 20	90%
Trace Metals							
Copper	1 per batch	1 per batch	75-125%	85-115%	1 per batch	RPD ≤ 25	90%
Aquatic Toxicity							
Aquatic Toxicity	NA	NA	NA	NA	NA	NA	90%
Pesticides							
OCRL Pesticide Suite	1 per 20 samples	1 per batch	70-130%	70-130%	1 per batch	RPD ≤ 25	90%

[1] A certified reference material (CRM) may be used in place of a laboratory control spike.
[2] A matrix spike duplicate or a laboratory control spike duplicate may function as the laboratory duplicate in any batch.

All environmental and QC samples analyzed for pesticides must also be spiked and processed with a mixture of surrogate analytes to monitor extraction efficiency and analytical performance. The required surrogates and their acceptability criteria are outlined in **Table 7**.

Table 7. Surrogate sample requirements for OCRL pesticide constituents analyzed in water.

Surrogate Constituent	Method	Instrument	Fraction	Frequency	Surrogate Accuracy/ Recovery
p,p'-DDE-$^{13}C_{12}$	OCRL-WATER-PEST_05	GC-MS/MS	Dissolved, Particulate	Every sample	70-130%
cis-Permethrin-$^{13}C_6$	OCRL-WATER-PEST_05	GC-MS/MS	Dissolved, Particulate	Every sample	70-130%
Trifluralin-d_{14}	OCRL-WATER-PEST_05	GC-MS/MS	Dissolved, Particulate	Every sample	70-130%
Atrazine-$^{13}C_3$	OCRL-WATER-PEST_05	LC-MS/MS	Dissolved, Particulate	Every sample	70-130%
Fipronil-$^{13}C_4$,$^{15}N_2$	OCRL-WATER-PEST_05	LC-MS/MS	Dissolved, Particulate	Every sample	70-130%
Imidacloprid-d_4	OCRL-WATER-PEST_05	LC-MS/MS	Dissolved, Particulate	Every sample	70-130%
Metolachlor-$^{13}C_6$	OCRL-WATER-PEST_05	LC-MS/MS	Dissolved, Particulate	Every sample	70-130%
Tebuconazole-$^{13}C_3$	OCRL-WATER-PEST_05	LC-MS/MS	Dissolved, Particulate	Every sample	70-130%

7.4 PROJECT ACTION LIMITS

Water Quality Metrics are provided to the Delta RMP by the CVRWQCB by July 1 annually; these values are provided in **Table 14**. Water quality results that exceed these water quality metrics must be reported to the CVRWQCB within 60 calendar days of sample analysis, per R5-2021-0054.

Toxicity samples that display an effect of greater than 50% on the test organisms must undergo consideration for the completion of a TIE. When this occurs the TIE TAC must be convened to recommend which TIE procedures, if any, should be performed. The procedures for determining if and how TIEs should be run are outlined in **Element 13.3**.

7.5 ACCEPTANCE CRITERIA FOR PRIOR/EXTERNAL DATA

Previously collected information (not generated under this QAPP) or data collected by other monitoring entities will undergo a more general QA/QC review to identify potentially erroneous data. **Element 18** identifies any non-direct measurements that may be used for this project and provides general guidance for evaluating the data quality. Non-direct measurements must meet the minimum requirements outlined within **Element 18** before being accepted for use. The necessity and means by which external data are used and evaluated will be specified in the relevant data reports; the requirements for how external data will be used and discussed will be included in the planning for the 2025 CUP Interpretive Report.

8 SPECIAL TRAINING/CERTIFICATIONS

8.1 SPECIALIZED TRAINING OR CERTIFICATIONS

All personnel performing sampling are trained in proper sampling techniques. Training includes a review of all SOPs and detailed information on filling sample bottles for the various types of analysis and proper procedures for filling field QC samples. Other topics covered are sample transport, calibration, use and maintenance of meters, and sample site confirmation. To further safeguard against sampling error, all sampling by personnel undergoing training is done under the supervision of more experienced personnel who accompany sampling crews each time they go in the field until training is completed. In addition to sampling training all sampling staff attends a field safety course.

8.2 TRAINING OF PERSONNEL

The Field Lead is responsible for training all sampling personnel in field sampling and safety (**Table 8**). Laboratory training takes place at the appropriate laboratory. Laboratory training procedures are outlined in the respective laboratory Quality Assurance Manual (QAM).

OCRL laboratory personnel must be trained in proper laboratory safety and general laboratory protocols before following the procedures for analyzing pesticide samples. Trainers must be trained in proper laboratory safety and must demonstrate adequate performance following the methods described by the SOPs, as verified by consistent surrogate and matrix spike recoveries along with minimal errors over a 40-hour period of sample processing as described by the SOP. If performance is less than adequate without improvement over a 40-hour period of sample processing as described in the SOP, re-training by laboratory management must occur.

Table 8. Specialized personnel training and certification.

Specialized Training Course Title or Description	Training Provider	Personnel Receiving Training/ Organizational Affiliation	Location of Records & Certificates
Field Sampling	Field Lead	All Sampling Personnel	CWSC Offices
Field Safety	Field Lead	All Sampling Personnel	CWSC Offices
Laboratory Procedures	Lead Chemist	All Analysts	OCRL

Specialized Training Course Title or Description	Training Provider	Personnel Receiving Training/ Organizational Affiliation	Location of Records & Certificates
Laboratory Safety	Lead Chemist	All Analysts	OCRL
Laboratory Procedures	Quality Assurance Manager	All Analysts	PER

8.3 TRAINING AND CERTIFICATION DOCUMENTATION

Field training documentation that records the types of training provided in preparation for sampling activities that includes name of trainer, name of trainee, dates on which training occurred will be maintained at the respective field office. Laboratory training records and documentation of demonstrations of capability are maintained by the respective Laboratory QA Officer.

8.4 TRAINING AND CERTIFICATION OVERSIGHT

It is the responsibility of the QA Officers for contracted laboratories, and the responsibility of the Field Lead for the samplers, to ensure that all employees achieve satisfactory training, including any necessary certifications. Signatures of participants are collected as evidence of attendance and this documentation is kept at the respective laboratory or field office.

8.5 OBTAINING TRAINING AND CERTIFICATION RECORDS.

To obtain copies of sampler training materials and documentation contact the Program Manager. Contract laboratory training and certification records can be obtained from the contract Laboratory QA Officer identified in **Element 3** of this QAPP.

9 DOCUMENTATION AND RECORDS

9.1 REPORT FORMAT

Field records, sample records, and data records for each sample collected are submitted by field and laboratory staff to the CV RDC Data Manager. These records are filed and maintained by the CV RDC DMT and are distributed to the appropriate Delta RMP Stakeholders and interested parties. All laboratory data are received as CEDEN comparable EDDs, which are uploaded to the CV RDC by the DMT. Toxicity data from PER are also received in PDF report format.

Preliminary raw data and monitoring results shall be provided to the CVRWQCB within 60 calendar days from the date of sample analysis. Sampling and monitoring results shall be submitted to the CVRWQCB within 6 months from the date of sample analysis and the data must go through primary quality verification and corrective actions completed, if applicable.

9.2 ADDITIONAL DOCUMENTS AND RECORDS

Additional documents may include photographic documentation, summary reports, meeting notes, presentations, and reports. All forms of documentation must be held on file where they are readily available if requested.

Reporting of results that exceed any water quality metrics provided in **Table 14** will occur within 60 calendar days of the sample analysis, per R5-2021-0054. Exceedance reports will be submitted electronically to the CVRWQCB by the Program Manager or a delegate. Copies of exceedance reports will be retained and maintained by the Program Manager.

9.3 RETENTION OF DOCUMENTS AND RECORDS

All data and/or other products created by the program will be retained by the participating entities and contract laboratories for a minimum of 10 years. The documents may be held for 10 years as electronic copies. Servers where the files reside will be backed up nightly.

Table 9. Document and record retention, archival, and disposition information.

Record Type	Record Needed	Retention	Archival	Disposition
Sample Collection Records	Field Sheets	MLJ Environmental	MLJ Environmental	Stored at CWSC or in MLJ office for at least 10 years

Record Type	Record Needed	Retention	Archival	Disposition
Sample Transfer Records	COC/Analytical Request Forms	MLJ Environmental	MLJ Environmental	Stored at lab or in MLJ office for at least 10 years
Analytical Records	Laboratory Reports and Electronic Data Deliverables	MLJ Environmental	MLJ Environmental	Stored at lab or in MLJ office for at least 10 years
Data Records	CV RDC	Remote Server, Moss Landing	Remote Server, Moss Landing	Permanent Storage on Remote Server
Assessment Records	CUP Data Reports	MLJ Environmental	MLJ Environmental	Permanent Storage on Delta RMP Website

9.4 ELECTRONIC RECORD BACKUPS

All electronic copies of files maintained by MLJ Environmental are stored on a local server. Records on the MLJ server are backed up hourly to a local backup server. Local backups are moved to a cloud data center operated by an independent IT service provider and replicated to an additional data center each night.

Files stored by MLJ Environmental on a sharing platform to provide access to Delta RMP stakeholders are housed on a third-party cloud server with nightly backups replicated to at least one independent server to create redundancy and allow for instant replication if a failure occurs.

The Program Manager in coordination with the Data Manager will maintain the records in the CV RDC database; data management procedures including back-up plans for data stored in the CV RDC are outlined in **Element 19** of this QAPP.

9.5 QAPP DISTRIBUTION

The Program Manager will ensure that copies of this QAPP will be distributed to all parties involved with the project. Electronic copies will be sent to all labs for review and reference. Final, approved copies will also be published on the Delta RMP website (DeltRMP.org). Any future amended QAPPs will be held and distributed in the same fashion. All originals and subsequent amended QAPPs will also be held at the CVRWQCB.

GROUP B. DATA GENERATION AND ACQUISITION

10 SAMPLING PROCESS DESIGN

The monitoring design summarized below was approved as a part of the Annual Monitoring Workplan, submitted to the CVRWQCB on May 1. Any deviations from the design outlined in the Monitoring Workplan and in this QAPP must be approved by the CVRWQCB prior to implementation. When prior approval is not possible, deviations must be reported to the CVRWQCB QA Representative within 7 calendar days of the BOD or contractors becoming aware of the deviation.

The detailed study plan is provided in Appendix 1 of the Delta RMP Workplan for FY 22-23. A summary of the study design and sampling strategy is provided below.

10.1 DESIGN STRATEGY

A rotating basin probabilistic monitoring design was chosen for the purpose of understanding the spatial extent of toxicity and pesticide concentrations. In this instance, the "basins" are six Delta subregions. Under the rotating basin monitoring design, crews will collect enough samples in each subregion to adequately characterize the mean and variance of pesticide concentrations and toxicity in each subregion. Samples will be collected by boat at randomly selected locations within each subregion.

The rotating basin design covers the monitoring of two subregions per water year, in addition to the two fixed sites. One subregion is sampled in its entirety in a single year with four sites being sampled over six events for the total 24 sites in a single year. In addition, some subregions are sampled over the course of two water years, with two sites being sampled each of the six annual events to reach the total 24 samples over a two-year time period. These four intensive subregion sites along with the two multiyear subregion sites are monitored each event with the two fixed sites to total of eight sites sampled for each event. Each of the six subregions will have the full 24 monitoring sites sampled over the course of four years of monitoring, as shown in **Table 11**.

Specific sample collection locations for the rotating sites were randomly selected within each subregion from a pool of potential locations using the Generalized Random-Tessellation Stratified (GRTS) method which identifies monitoring sites based on a stratified random selection process. Additional oversample site locations were also identified as a part of this analysis to be used in the event that a location is inaccessible or impractical to reach. The GRTS site selection was also further stratified by water body

type (i.e., large fast-flowing river channels to smaller creeks and sloughs), ensuring that the entire Delta is adequately represented in the sampling design and that assessments can be made regarding the characterization of different types of water bodies.

Sampling site locations were selected from within the legal boundaries of the Delta (**Figure 3**). The Delta RMP has divided the Delta into seven subregions in previous analyses based on the contribution of source waters, as described in the 2018 report *Modeling to Assist Identification of Temporal and Spatial Data Gaps for Nutrient Monitoring* (Jabusch, Trowbridge, Heberger, and Guerin 2018). The boundaries of the subregions are shown in **Figure 4**. The rotating basin monitoring design includes monitoring six of the seven subregions, excluding the Suisun Bay subregion which is outside of the Legal Delta. The 24 randomly selected sites for each of the six subregions are provided in **Table 12**, along with the ten additional randomly selected GRTS oversample sites for each subregion. The oversample sites were selected using the same methodology as the 24 scheduled sites for the purpose of designating contingency sites for scenarios in which a site cannot or should not be sampled for any reason during a monitoring event.

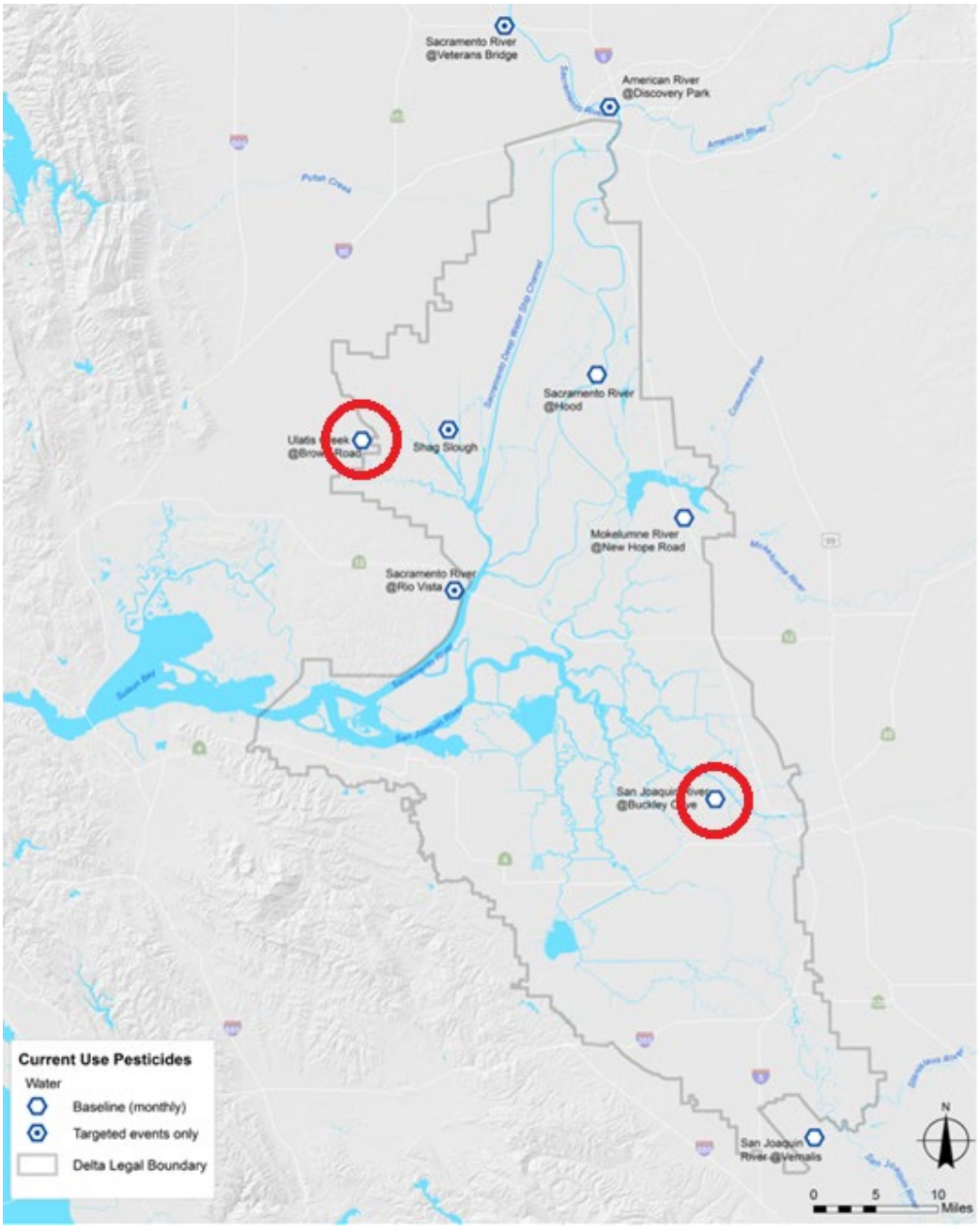
In addition to the GRTS sites, the monitoring design calls for continued monitoring during each event at two fixed sites. Both sites, Ulatis Creek at Brown Road and San Joaquin River at Buckley Cove, are locations where aquatic toxicity has been observed by Delta RMP monitoring in the past (**Figure 5**). For more information on the first year of Delta RMP pesticides monitoring, see recent reports by the USGS (De Parsia et al. 2018 and 2019) and SFEI-ASC (Jabusch, Trowbridge, Heberger, Orlando, et al. 2018). Fixed site monitoring is intended to allow the Delta RMP to detect temporal trends at these two sites as well as analyze relationships between observed pesticide concentrations and aquatic toxicity. Sampling at the same location repeatedly holds a greater number of factors constant in comparison to the rotating basin component of the monitoring design. Any relationship between pesticides and toxicity may have less variability (i.e., less noise) and be easier to identify at fixed locations than between parameters at locations that change.

Due to the nature of the study design, all samples collected are considered critical. Any reduction in the planned sites or sample analyses has the potential to reduce the statistical power of any analyses aimed at characterizing the occurrence of pesticides and aquatic toxicity once the study is complete. Any decisions that may result in the reduction of samples collected from any of the fixed sites or subareas should be considered by the CUP TAC and reviewed and recommended for approval by the Steering Committee.

Adaptive management of the monitoring design is an important component of Delta RMP monitoring. Changes to the schedule described here may be made based on budgets, evolving priorities, or lessons learned from the sampling and data analysis. Changes may be made by the Delta RMP Program Manager, in consultation with the CUP TAC and with

the approval of the CVRWQCB QA Representative. The CVRWQCB QA Representative, Project Manager, and QA Officer decide whether the project workplan and QAPP require modification; proposed modifications are brought to the TAC and SC for review and recommendation for approval by the BOD prior to submitting to the CVRWQCB. Final approval for any modifications to the Monitoring Workplan must be approved by the EO prior to implementation. Deviations to the Workplan and/or QAPP must be approved by the SWRQCB QA Officer or the CVRWQCB QA Representative.

Figure 5. Map of sites previously monitored by the Delta RMP for pesticides and aquatic toxicity including the two fixed monitoring sites under the current study design.



10.2 SAMPLE COLLECTION

Surface water samples for toxicity testing and pesticide constituents identified in **Table 3** are collected in six sampling events during each water year (weather/hydrological conditions permitting). Samples are typically collected over the course of two to three days during each monitoring event. These events represent times of interest such as high agricultural and/or urban irrigation, periods of high flow, or following storms when pollutants are flushed from land surfaces into waterways via overland flow and drains.

Sampling sites will be identified by the coordinates provided in **Table 12**. If the sampling crews determine in the field that target coordinates are inaccessible or unsafe, a sample should be taken within 100 meters of the target coordinates, if possible, and only if there is not some obvious change in the environment, such as moving downstream of an outfall, a change in water clarity, etc. If it is not possible to sample within 100 m of a rotating GRTS site, the crew should choose the next site on the oversample list shown in **Table 12.** The use of oversample sites and the reasons for their use will be documented in the Delta RMP Annual Report and in the annual data reports for each water year. The inability to collect a sample from within 100m of the two fixed sites would constitute a deviation from this QAPP and must be reported to the CVRWQCB QA Representative within seven calendar days of the event.

The planned timing of sampling events is shown in **Table 10**. Among the six planned events, three will be representative of storm conditions and three will represent the dry weather/irrigation season. The three storm events should capture the first flush of the water year, and, if climate conditions allow, two additional winter storm events. In the event that there is not sufficient rainfall to reach the storm triggers for all three storm requirements during a storm season (October through April), the first monitoring event should be conducted by the end of December, the second by the end of February, and the third monitoring event should be conducted by the end of April regardless of rainfall. While not directly monitoring the runoff from a storm, this dry April event will serve to characterize the spring snowmelt period prior to the beginning of irrigation season in the Central Valley.

The first flush storm will be defined as a storm in which at least 0.5 inches of rain is forecasted to fall within a 24-hour period. The two additional winter storms will be determined using guidance plots at appropriate discharge sites or recorded discharge at upstream flow stations that show an approximately 2-3X increase in flows (https://cdec.water.ca.gov/guidance_plots). Timing of actual sampling must take streamflow peak travel time into consideration. If storm events occur in rapid succession, sampling may be postponed due to the demand on the toxicity laboratory. In general, a minimum of two weeks should pass between one sampling event and the next to provide

the laboratory time to complete the tests from the previous event before being required to initiate new tests. In addition to the laboratory timing concerns, concurrent storms may also introduce bias in characterizing pesticide constituents in storm runoff due to the fact that applications are less likely to occur during periods of continued rain. For this reason, there should be at least ten consecutive dry days between storm sampling events to allow for pesticide applicators time to use the products between rain events.

Additional sources of bias regarding the timing of storm sampling may be introduced by reservoir releases for flood control which have the potential to mask storm runoff signals. This potential bias, as well as any other characteristics of the storm such as the resulting peak flows will be taken into consideration when determining the timing of storm monitoring events. The timing of sampling events shall be planned by the field crews and scientists at the CWSC in collaboration with staff of PER to ensure that the laboratory is ready to accept water samples and initiate the toxicity tests. The sampling triggers for storm sampling in **Table 10** are guidelines and actual sampling dates may be adjusted by the USGS field crews based on their best professional judgment and with the goal to be as consistent as possible with the sampling triggers. Scheduling of sampling events and changes to the schedule shall be determined in coordination with the Program Manager and the CUP TAC in a timely manner.

Irrigation/baseflow events should occur from May through September. The first spring event should take place in approximately May through June; however, the timing of this sampling event is variable based on winter/spring rainfall timing and initiation of irrigation. The timing of the spring event should allow for at least 30 days following last major rainfall/runoff event in Central Valley to give time for drying of soils and the initiation of the irrigation season. The summer event shall occur in approximately mid-July, and the final fall event should take place in approximately mid-September. The exact dates of these events may vary slightly depending on hydrologic conditions or sampling logistics.

Staff will track the planned and actual monitoring dates as they are established and communicate these events to the necessary stakeholders and advisors; the Delta RMP Program Manager is responsible for tracking and communicating to the CVRWQCB QA Representative, CUP TAC, and Steering Committee the status of monitoring.

Table 10. Sample event triggers and timing criteria for CUP monitoring.

NO.	EVENT TYPE	EVENT	SAMPLING TRIGGERS [1]	ADDITIONAL CRITERIA
1	Storm Sampling	First Flush	0.5” of rainfall forecast in 24 hours [2]	First runoff event after Oct 1. Sample by the end of December if no significant storm occurs.

No.	Event Type	Event	Sampling Triggers [1]	Additional Criteria
2	Storm Sampling	Second Winter Storm	Approx. 2-3X increase in flows [3]	≥ 2 weeks since last event ≥ 10 days dry weather. Sample by the end of February if no significant storm occurs.
3	Storm Sampling or Winter Runoff	Third Winter Storm or Spring Snowmelt	Approx. 2-3X increase in flows [3]	≥ 2 weeks since last event ≥ 10 days dry weather Sample by the end of April if no significant storm occurs
4	Irrigation/ Baseflow	Spring [4]	May-June	≥ 30 days following last major rainfall event
5	Irrigation/ Baseflow	Summer [4]	Mid-July	None
6	Irrigation/ Baseflow	Fall [4]	Mid-September	None

[1] Rainfall determinations are obtained from one of the following sources: Community Collaborative Rain, Hail, and Snow Network (https://www.cocorahs.org/), San Joaquin County Rain Map (https://sanjoaquin.onerain.com/map/?view=www_sanjoaquin&status=300&message=Redirection:%20Multiple%20Choices&continue=ZOOy42OAoI6L55Px2M_DqNe_3aOim5qP3g&status=300&message=Redirection:%20Multiple%20Choices&continue=ZOOy42OAoI6L55Px2M_DqNe_3aOim5qP3nzt1bnYqumOpmRxUJKL48nbyL2hh9u13KamjZmP38S0hoqUguu9552xlopLooa9ycfNmNvEmZewmJmP3svfnrKzhO-FpYOCmW5cvIuvsdCWgtWV5IKmiViHv7_nlsm0aN0), Solano County Water Agency (https://www.scwamonitoring.com/floodmap/index.htm).
[2] Trigger updated in 2020 to capture more precipitation events that did not meet the previous flow increase triggers.
[3] Guidance plots developed by the California Department of Water Resources show forecast river flow and stage and are available for dozens of river reaches in the Central Valley. https://cdec.water.ca.gov/guidance_plots
[4] Sample time periods are approximated.

10.3 TOTAL NUMBER OF SAMPLES

The monitoring locations and total number of samples anticipated to be collected are outlined in **Table 11** and **Table 12.** All samples collected are surface water samples.

Table 11. Planned sample collection counts by WY and Delta subregion.

Water Year	Event	Event Type	GRTS Sites Subregion 1	GRTS Sites Subregion 2	GRTS Sites Subregion 3	GRTS Sites Subregion 4	GRTS Sites Subregion 5	GRTS Sites Subregion 6	Fixed Site 1	Fixed Site 2	Total
Year 1	Event 1	Storm	4	2	--	--	--	--	1	1	8
	Event 2	Storm	4	2	--	--	--	--	1	1	8
	Event 3	Storm	4	2	--	--	--	--	1	1	8
	Event 4	Irrigation	4	2	--	--	--	--	1	1	8
	Event 5	Irrigation	4	2	--	--	--	--	1	1	8
	Event 6	Irrigation	4	2	--	--	--	--	1	1	8
Year 2	Event 1	Storm	--	2	4	--	--	--	1	1	8
	Event 2	Storm	--	2	4	--	--	--	1	1	8
	Event 3 [1]	Storm	--	2	4	--	--	--	1	1	8
	Event 4	Irrigation	--	2	4	--	--	--	1	1	8
	Event 5	Irrigation	--	2	4	--	--	--	1	1	8
	Event 6	Irrigation	--	2	4	--	--	--	1	1	8
Year 3	Event 1	Storm	--	--	--	4	2	--	1	1	8
	Event 2	Storm	--	--	--	4	2	--	1	1	8
	Event 3	Storm	--	--	--	4	2	--	1	1	8
	Event 4	Irrigation	--	--	--	4	2	--	1	1	8
	Event 5	Irrigation	--	--	--	4	2	--	1	1	8
	Event 6	Irrigation	--	--	--	4	2	--	1	1	8
Year 4	Event 1	Storm	--	--	--	--	2	4	1	1	8

Water Year	Event	Event Type	GRTS Sites Subregion 1	GRTS Sites Subregion 2	GRTS Sites Subregion 3	GRTS Sites Subregion 4	GRTS Sites Subregion 5	GRTS Sites Subregion 6	Fixed Site 1	Fixed Site 2	Total
	Event 2	Storm	--	--	--	--	2	4	1	1	8
	Event 3	Storm	--	--	--	--	2	4	1	1	8
	Event 4	Irrigation	--	--	--	--	2	4	1	1	8
	Event 5	Irrigation	--	--	--	--	2	4	1	1	8
	Event 6	Irrigation	--	--	--	--	2	4	1	1	8
Total Samples			**24**	**24**	**24**	**24**	**24**	**24**	**24**	**24**	**192**

[1] The total samples in subregions 2 and 3 increased because of repeating Event 3 from WY 20 since those samples were not analyzed for toxicity due to the onset of the COVID 19 pandemic restrictions (samples from that event were successfully analyzed for pesticides).

Table 12. Monitoring locations.

Site Subregion	Year	Station Name	CEDEN Station Code	Station Type	Planned Event	Latitude	Longitude	Datum	No. Samples
Fixed	Year 1-Year 4	San Joaquin River at Buckley Cove	544LSAC13	Fixed	All Events	37.9718	-121.3736	WGS84	24
		Ulatis Creek at Brown Road	511ULCABR	Fixed	All Events	38.307	-121.7942	WGS84	24
1. Yolo Bypass-Cache Slough	Year 1 (2019 WY)	Yolo Bypass Site #1	Yolo-001	GRTS	Event 1	38.27952	-121.661	NAD83	1
		Yolo Bypass Site #2	Yolo-002	GRTS	Event 1	38.26919	-121.692	NAD83	1
		Yolo Bypass Site #3	Yolo-003	GRTS	Event 1	38.26105	-121.748	NAD83	1
		Yolo Bypass Site #4	Yolo-004	GRTS	Event 1	38.31957	-121.693	NAD83	1
		Yolo Bypass Site #5	Yolo-005	GRTS	Event 2	38.25905	-121.668	NAD83	1
		Yolo Bypass Site #6	Yolo-006	GRTS	Event 2	38.25214	-121.676	NAD83	1
		Yolo Bypass Site #7	Yolo-007	GRTS	Event 2	38.27122	-121.703	NAD83	1
		Yolo Bypass Site #8	Yolo-008	GRTS	Event 2	38.2743	-121.674	NAD83	1
		Yolo Bypass Site #9	Yolo-009	GRTS	Event 3	38.24957	-121.675	NAD83	1
		Yolo Bypass Site #10	Yolo-010	GRTS	Event 3	38.46178	-121.589	NAD83	1
		Yolo Bypass Site #11	Yolo-011	GRTS	Event 3	38.30568	-121.657	NAD83	1
		Yolo Bypass Site #12	Yolo-012	GRTS	Event 3	38.28241	-121.681	NAD83	1
		Yolo Bypass Site #13	Yolo-013	GRTS	Event 4	38.2082	-121.663	NAD83	1
		Yolo Bypass Site #14	Yolo-014	GRTS	Event 4	38.38195	-121.626	NAD83	1
		Yolo Bypass Site #15	Yolo-015	GRTS	Event 4	38.26789	-121.663	NAD83	1
		Yolo Bypass Site #16	Yolo-016	GRTS	Event 4	38.25806	-121.726	NAD83	1
		Yolo Bypass Site #17	Yolo-017	GRTS	Event 5	38.2833	-121.686	NAD83	1
		Yolo Bypass Site #18	Yolo-018	GRTS	Event 5	38.26025	-121.679	NAD83	1
		Yolo Bypass Site #19	Yolo-019	GRTS	Event 5	38.43301	-121.603	NAD83	1
		Yolo Bypass Site #20	Yolo-020	GRTS	Event 5	38.27881	-121.678	NAD83	1
		Yolo Bypass Site #21	Yolo-021	GRTS	Event 6	38.30108	-121.73	NAD83	1

Site Subregion	Year	Station Name	CEDEN Station Code	Station Type	Planned Event	Latitude	Longitude	Datum	No. Samples
		Yolo Bypass Site #22	Yolo-022	GRTS	Event 6	38.31798	-121.652	NAD83	1
		Yolo Bypass Site #23	Yolo-023	GRTS	Event 6	38.27899	-121.688	NAD83	1
		Yolo Bypass Site #24	Yolo-024	GRTS	Event 6	38.18487	-121.661	NAD83	1
	--	Yolo Bypass Oversample Point #1	Yolo-025	GRTS Oversample	--	38.53725	-121.584	NAD83	--
		Yolo Bypass Oversample Point #2	Yolo-026	GRTS Oversample	--	38.26114	-121.673	NAD83	--
		Yolo Bypass Oversample Point #3	Yolo-027	GRTS Oversample	--	38.28616	-121.722	NAD83	--
		Yolo Bypass Oversample Point #4	Yolo-028	GRTS Oversample	--	38.26864	-121.677	NAD83	--
		Yolo Bypass Oversample Point #5	Yolo-029	GRTS Oversample	--	38.26053	-121.689	NAD83	--
		Yolo Bypass Oversample Point #6	Yolo-030	GRTS Oversample	--	38.411	-121.616	NAD83	--
		Yolo Bypass Oversample Point #7	Yolo-031	GRTS Oversample	--	38.288	-121.682	NAD83	--
		Yolo Bypass Oversample Point #8	Yolo-032	GRTS Oversample	--	38.2411	-121.683	NAD83	--
		Yolo Bypass Oversample Point #9	Yolo-033	GRTS Oversample	--	38.37009	-121.632	NAD83	--
		Yolo Bypass Oversample Point #10	Yolo-034	GRTS Oversample	--	38.23202	-121.675	NAD83	--
2. Sacramento River	Year 1 (2019 WY)	Sac. R. Site #1	Sacr-001	GRTS	Event 1	38.16498	-121.621	NAD83	1
		Sac. R. Site #2	Sacr-002	GRTS	Event 1	38.26207	-121.651	NAD83	1
		Sac. R. Site #3	Sacr-003	GRTS	Event 2	38.23917	-121.521	NAD83	1
		Sac. R. Site #4	Sacr-004	GRTS	Event 2	38.37058	-121.553	NAD83	1

Site Subregion	Year	Station Name	CEDEN Station Code	Station Type	Planned Event	Latitude	Longitude	Datum	No. Samples
		Sac. R. Site #5	Sacr-005	GRTS	Event 3	38.18899	-121.641	NAD83	1
		Sac. R. Site #6	Sacr-006	GRTS	Event 3	38.24024	-121.602	NAD83	1
		Sac. R. Site #7	Sacr-007	GRTS	Event 4	38.47372	-121.52	NAD83	1
		Sac. R. Site #8	Sacr-008	GRTS	Event 4	38.19473	-121.619	NAD83	1
		Sac. R. Site #9	Sacr-009	GRTS	Event 5	38.31436	-121.577	NAD83	1
		Sac. R. Site #10	Sacr-010	GRTS	Event 5	38.45881	-121.502	NAD83	1
		Sac. R. Site #11	Sacr-011	GRTS	Event 6	38.51454	-121.546	NAD83	1
		Sac. R. Site #12	Sacr-012	GRTS	Event 6	38.19272	-121.568	NAD83	1
	Year 2 (2020 WY - 2021 WY)	Sac. R. Site #13	Sacr-013	GRTS	Event 1	38.33821	-121.565	NAD83	1
		Sac. R. Site #14	Sacr-014	GRTS	Event 1	38.3777	-121.542	NAD83	1
		Sac. R. Site #15	Sacr-015	GRTS	Event 2	38.53481	-121.519	NAD83	1
		Sac. R. Site #16	Sacr-016	GRTS	Event 2	38.17289	-121.649	NAD83	1
		Sac. R. Site #17	Sacr-017	GRTS	Event 3	38.27415	-121.589	NAD83	1
		Sac. R. Site #18	Sacr-018	GRTS	Event 3	38.23966	-121.54	NAD83	1
		Sac. R. Site #19	Sacr-019	GRTS	Event 4	38.57538	-121.512	NAD83	1
		Sac. R. Site #20	Sacr-020	GRTS	Event 4	38.1846	-121.648	NAD83	1
		Sac. R. Site #21	Sacr-021	GRTS	Event 5	38.31035	-121.598	NAD83	1
		Sac. R. Site #22	Sacr-022	GRTS	Event 5	38.41424	-121.521	NAD83	1
		Sac. R. Site #23	Sacr-023	GRTS	Event 6	38.49416	-121.556	NAD83	1
		Sac. R. Site #24	Sacr-024	GRTS	Event 6	38.2297	-121.603	NAD83	1
	--	Sac. R. Oversample Point #1	Sacr-025	GRTS Oversample	--	38.294	-121.582	NAD83	--
		Sac. R. Oversample Point #2	Sacr-026	GRTS Oversample	--	38.34605	-121.543	NAD83	--
		Sac. R. Oversample Point #3	Sacr-027	GRTS Oversample	--	38.47041	-121.507	NAD83	--

Site Subregion	Year	Station Name	CEDEN Station Code	Station Type	Planned Event	Latitude	Longitude	Datum	No. Samples
		Sac. R. Oversample Point #4	Sacr-028	GRTS Oversample	--	38.22488	-121.557	NAD83	--
		Sac. R. Oversample Point #5	Sacr-029	GRTS Oversample	--	38.33216	-121.583	NAD83	--
		Sac. R. Oversample Point #6	Sacr-030	GRTS Oversample	--	38.39327	-121.514	NAD83	--
		Sac. R. Oversample Point #7	Sacr-031	GRTS Oversample	--	38.56492	-121.521	NAD83	--
		Sac. R. Oversample Point #8	Sacr-032	GRTS Oversample	--	38.16693	-121.629	NAD83	--
		Sac. R. Oversample Point #9	Sacr-033	GRTS Oversample	--	38.24861	-121.602	NAD83	--
		Sac. R. Oversample Point #10	Sacr-034	GRTS Oversample	--	38.43376	-121.532	NAD83	--
3. Northeast Delta	Year 2 (2020 WY - 2021 WY)	NE Delta Site #1	Nort-001	GRTS	Event 1	38.14477	-121.439	NAD83	1
		NE Delta Site #2	Nort-002	GRTS	Event 1	38.16557	-121.491	NAD83	1
		NE Delta Site #3	Nort-003	GRTS	Event 1	38.2702	-121.466	NAD83	1
		NE Delta Site #4	Nort-004	GRTS	Event 1	38.11585	-121.552	NAD83	1
		NE Delta Site #5	Nort-005	GRTS	Event 2	38.1425	-121.497	NAD83	1
		NE Delta Site #6	Nort-006	GRTS	Event 2	38.25355	-121.48	NAD83	1
		NE Delta Site #7	Nort-007	GRTS	Event 2	38.22487	-121.534	NAD83	1
		NE Delta Site #8	Nort-008	GRTS	Event 2	38.12016	-121.583	NAD83	1
		NE Delta Site #9	Nort-009	GRTS	Event 3	38.12235	-121.498	NAD83	1
		NE Delta Site #10	Nort-010	GRTS	Event 3	38.26999	-121.477	NAD83	1
		NE Delta Site #11	Nort-011	GRTS	Event 3	38.14596	-121.601	NAD83	1
		NE Delta Site #12	Nort-012	GRTS	Event 3	38.1228	-121.525	NAD83	1
		NE Delta Site #13	Nort-013	GRTS	Event 4	38.20981	-121.507	NAD83	1

Site Subregion	Year	Station Name	CEDEN Station Code	Station Type	Planned Event	Latitude	Longitude	Datum	No. Samples
		NE Delta Site #14	Nort-014	GRTS	Event 4	38.24697	-121.498	NAD83	1
		NE Delta Site #15	Nort-015	GRTS	Event 4	38.12969	-121.562	NAD83	1
		NE Delta Site #16	Nort-016	GRTS	Event 4	38.20163	-121.541	NAD83	1
		NE Delta Site #17	Nort-017	GRTS	Event 5	38.14276	-121.47	NAD83	1
		NE Delta Site #18	Nort-018	GRTS	Event 5	38.16881	-121.47	NAD83	1
		NE Delta Site #19	Nort-019	GRTS	Event 5	38.28613	-121.503	NAD83	1
		NE Delta Site #20	Nort-020	GRTS	Event 5	38.13087	-121.574	NAD83	1
		NE Delta Site #21	Nort-021	GRTS	Event 6	38.15614	-121.503	NAD83	1
		NE Delta Site #22	Nort-022	GRTS	Event 6	38.26963	-121.496	NAD83	1
		NE Delta Site #23	Nort-023	GRTS	Event 6	38.10115	-121.563	NAD83	1
		NE Delta Site #24	Nort-024	GRTS	Event 6	38.13515	-121.563	NAD83	1
		NE Delta Oversample Point #1	Nort-025	GRTS Oversample	--	38.12899	-121.499	NAD83	--
		NE Delta Oversample Point #2	Nort-026	GRTS Oversample	--	38.22743	-121.496	NAD83	--
		NE Delta Oversample Point #3	Nort-027	GRTS Oversample	--	38.15123	-121.542	NAD83	--
		NE Delta Oversample Point #4	Nort-028	GRTS Oversample	--	38.1161	-121.548	NAD83	--
		NE Delta Oversample Point #5	Nort-029	GRTS Oversample	--	38.20663	-121.482	NAD83	--
		NE Delta Oversample Point #6	Nort-030	GRTS Oversample	--	38.23858	-121.497	NAD83	--
		NE Delta Oversample Point #7	Nort-031	GRTS Oversample	--	38.11541	-121.584	NAD83	--
		NE Delta Oversample Point #8	Nort-032	GRTS Oversample	--	38.21212	-121.537	NAD83	--

Site Subregion	Year	Station Name	CEDEN Station Code	Station Type	Planned Event	Latitude	Longitude	Datum	No. Samples
		NE Delta Oversample Point #9	Nort-033	GRTS Oversample	--	38.14361	-121.506	NAD83	--
		NE Delta Oversample Point #10	Nort-034	GRTS Oversample	--	38.20431	-121.457	NAD83	--
4. South Delta	Year 3 (2023 WY)	South Delta Site #1	Sout-001	GRTS	Event 1	38.05283	-121.499	NAD83	1
		South Delta Site #2	Sout-002	GRTS	Event 1	37.95823	-121.379	NAD83	1
		South Delta Site #3	Sout-003	GRTS	Event 1	38.04623	-121.476	NAD83	1
		South Delta Site #4	Sout-004	GRTS	Event 1	37.80751	-121.415	NAD83	1
		South Delta Site #5	Sout-005	GRTS	Event 2	38.03876	-121.483	NAD83	1
		South Delta Site #6	Sout-006	GRTS	Event 2	38.03283	-121.38	NAD83	1
		South Delta Site #7	Sout-007	GRTS	Event 2	37.99765	-121.41	NAD83	1
		South Delta Site #8	Sout-008	GRTS	Event 2	38.08578	-121.553	NAD83	1
		South Delta Site #9	Sout-009	GRTS	Event 3	37.82028	-121.492	NAD83	1
		South Delta Site #10	Sout-010	GRTS	Event 3	38.00564	-121.444	NAD83	1
		South Delta Site #11	Sout-011	GRTS	Event 3	37.79368	-121.307	NAD83	1
		South Delta Site #12	Sout-012	GRTS	Event 3	38.10007	-121.489	NAD83	1
		South Delta Site #13	Sout-013	GRTS	Event 4	37.95268	-121.342	NAD83	1
		South Delta Site #14	Sout-014	GRTS	Event 4	38.04105	-121.43	NAD83	1
		South Delta Site #15	Sout-015	GRTS	Event 4	37.79666	-121.467	NAD83	1
		South Delta Site #16	Sout-016	GRTS	Event 4	38.08991	-121.481	NAD83	1
		South Delta Site #17	Sout-017	GRTS	Event 5	38.04166	-121.498	NAD83	1
		South Delta Site #18	Sout-018	GRTS	Event 5	37.88673	-121.445	NAD83	1
		South Delta Site #19	Sout-019	GRTS	Event 5	38.05089	-121.465	NAD83	1
		South Delta Site #20	Sout-020	GRTS	Event 5	38.10563	-121.489	NAD83	1
		South Delta Site #21	Sout-021	GRTS	Event 6	37.81977	-121.526	NAD83	1
		South Delta Site #22	Sout-022	GRTS	Event 6	38.05065	-121.418	NAD83	1

Site Subregion	Year	Station Name	CEDEN Station Code	Station Type	Planned Event	Latitude	Longitude	Datum	No. Samples
		South Delta Site #23	Sout-023	GRTS	Event 6	37.9959	-121.369	NAD83	1
		South Delta Site #24	Sout-024	GRTS	Event 6	38.06388	-121.498	NAD83	1
	--	South Delta Oversample Point #1	Sout-025	GRTS Oversample	--	37.91663	-121.321	NAD83	--
		South Delta Oversample Point #2	Sout-026	GRTS Oversample	--	38.00774	-121.456	NAD83	--
		South Delta Oversample Point #3	Sout-027	GRTS Oversample	--	37.80179	-121.313	NAD83	--
		South Delta Oversample Point #4	Sout-028	GRTS Oversample	--	38.08441	-121.503	NAD83	--
		South Delta Oversample Point #5	Sout-029	GRTS Oversample	--	37.95635	-121.293	NAD83	--
		South Delta Oversample Point #6	Sout-030	GRTS Oversample	--	38.01117	-121.46	NAD83	--
		South Delta Oversample Point #7	Sout-031	GRTS Oversample	--	37.81982	-121.477	NAD83	--
		South Delta Oversample Point #8	Sout-032	GRTS Oversample	--	38.08585	-121.433	NAD83	--
		South Delta Oversample Point #9	Sout-033	GRTS Oversample	--	38.03779	-121.486	NAD83	--
		South Delta Oversample Point #10	Sout-034	GRTS Oversample	--	38.01175	-121.37	NAD83	--
5. Central Delta	Year 3 (2023 WY)	Central Delta Site #1	Cent-001	GRTS	Event 1	37.83573	-121.555	NAD83	1
		Central Delta Site #2	Cent-002	GRTS	Event 1	37.92102	-121.517	NAD83	1
		Central Delta Site #3	Cent-003	GRTS	Event 2	38.07762	-121.576	NAD83	1
		Central Delta Site #4	Cent-004	GRTS	Event 2	38.03804	-121.597	NAD83	1
		Central Delta Site #5	Cent-005	GRTS	Event 3	37.90153	-121.614	NAD83	1

Site Subregion	Year	Station Name	CEDEN Station Code	Station Type	Planned Event	Latitude	Longitude	Datum	No. Samples
		Central Delta Site #6	Cent-006	GRTS	Event 3	37.99242	-121.523	NAD83	1
		Central Delta Site #7	Cent-007	GRTS	Event 4	38.10001	-121.601	NAD83	1
		Central Delta Site #8	Cent-008	GRTS	Event 4	38.04206	-121.59	NAD83	1
		Central Delta Site #9	Cent-009	GRTS	Event 5	37.99109	-121.578	NAD83	1
		Central Delta Site #10	Cent-010	GRTS	Event 5	37.97646	-121.515	NAD83	1
		Central Delta Site #11	Cent-011	GRTS	Event 6	38.03492	-121.6	NAD83	1
		Central Delta Site #12	Cent-012	GRTS	Event 6	38.0232	-121.514	NAD83	1
	Year 4 (2024 WY)	Central Delta Site #13	Cent-013	GRTS	Event 1	37.94248	-121.559	NAD83	1
		Central Delta Site #14	Cent-014	GRTS	Event 1	38.06307	-121.561	NAD83	1
		Central Delta Site #15	Cent-015	GRTS	Event 2	38.05692	-121.609	NAD83	1
		Central Delta Site #16	Cent-016	GRTS	Event 2	38.1042	-121.593	NAD83	1
		Central Delta Site #17	Cent-017	GRTS	Event 3	37.92026	-121.556	NAD83	1
		Central Delta Site #18	Cent-018	GRTS	Event 3	37.99156	-121.515	NAD83	1
		Central Delta Site #19	Cent-019	GRTS	Event 4	38.06157	-121.619	NAD83	1
		Central Delta Site #20	Cent-020	GRTS	Event 4	38.02919	-121.583	NAD83	1
		Central Delta Site #21	Cent-021	GRTS	Event 5	37.8893	-121.575	NAD83	1

Site Subregion	Year	Station Name	CEDEN Station Code	Station Type	Planned Event	Latitude	Longitude	Datum	No. Samples
		Central Delta Site #22	Cent-022	GRTS	Event 5	38.00364	-121.529	NAD83	1
		Central Delta Site #23	Cent-023	GRTS	Event 6	38.05159	-121.634	NAD83	1
		Central Delta Site #24	Cent-024	GRTS	Event 6	38.03892	-121.57	NAD83	1
	--	Central Delta Oversample Point #1	Cent-025	GRTS Oversample	--	38.00963	-121.547	NAD83	--
		Central Delta Oversample Point #2	Cent-026	GRTS Oversample	--	37.97532	-121.529	NAD83	--
		Central Delta Oversample Point #3	Cent-027	GRTS Oversample	--	38.02158	-121.607	NAD83	--
		Central Delta Oversample Point #4	Cent-028	GRTS Oversample	--	38.05344	-121.529	NAD83	--
		Central Delta Oversample Point #5	Cent-029	GRTS Oversample	--	37.97748	-121.576	NAD83	--
		Central Delta Oversample Point #6	Cent-030	GRTS Oversample	--	38.0854	-121.575	NAD83	--
		Central Delta Oversample Point #7	Cent-031	GRTS Oversample	--	38.05183	-121.612	NAD83	--
		Central Delta Oversample Point #8	Cent-032	GRTS Oversample	--	38.09282	-121.668	NAD83	--
		Central Delta Oversample Point #9	Cent-033	GRTS Oversample	--	37.91614	-121.573	NAD83	--
		Central Delta Oversample Point #10	Cent-034	GRTS Oversample	--	37.98716	-121.513	NAD83	--
6. Confluence		Confluence Site #1	Conf-001	GRTS	Event 1	38.04107	-121.825	NAD83	1

Site Subregion	Year	Station Name	CEDEN Station Code	Station Type	Planned Event	Latitude	Longitude	Datum	No. Samples
	Year 4 (2024WY)	Confluence Site #2	Conf-002	GRTS	Event 1	38.05926	-121.822	NAD83	1
		Confluence Site #3	Conf-003	GRTS	Event 1	38.02936	-121.754	NAD83	1
		Confluence Site #4	Conf-004	GRTS	Event 1	38.0217	-121.735	NAD83	1
		Confluence Site #5	Conf-005	GRTS	Event 2	38.02386	-121.816	NAD83	1
		Confluence Site #6	Conf-006	GRTS	Event 2	38.06217	-121.843	NAD83	1
		Confluence Site #7	Conf-007	GRTS	Event 2	38.07803	-121.683	NAD83	1
		Confluence Site #8	Conf-008	GRTS	Event 2	38.04345	-121.709	NAD83	1
		Confluence Site #9	Conf-009	GRTS	Event 3	38.03502	-121.831	NAD83	1
		Confluence Site #10	Conf-010	GRTS	Event 3	38.0252	-121.748	NAD83	1
		Confluence Site #11	Conf-011	GRTS	Event 3	38.10005	-121.719	NAD83	1
		Confluence Site #12	Conf-012	GRTS	Event 3	38.10961	-121.71	NAD83	1
		Confluence Site #13	Conf-013	GRTS	Event 4	38.07439	-121.773	NAD83	1
		Confluence Site #14	Conf-014	GRTS	Event 4	38.04787	-121.795	NAD83	1
		Confluence Site #15	Conf-015	GRTS	Event 4	38.02104	-121.704	NAD83	1
		Confluence Site #16	Conf-016	GRTS	Event 4	38.13653	-121.687	NAD83	1
		Confluence Site #17	Conf-017	GRTS	Event 5	38.04499	-121.802	NAD83	1
		Confluence Site #18	Conf-018	GRTS	Event 5	38.05608	-121.807	NAD83	1
		Confluence Site #19	Conf-019	GRTS	Event 5	38.05904	-121.678	NAD83	1
		Confluence Site #20	Conf-020	GRTS	Event 5	38.0094	-121.72	NAD83	1
		Confluence Site #21	Conf-021	GRTS	Event 6	38.02724	-121.811	NAD83	1
		Confluence Site #22	Conf-022	GRTS	Event 6	38.07076	-121.837	NAD83	1
		Confluence Site #23	Conf-023	GRTS	Event 6	38.08438	-121.71	NAD83	1
		Confluence Site #24	Conf-024	GRTS	Event 6	38.03909	-121.725	NAD83	1
	--	Confluence Oversample Point #1	Conf-025	GRTS Oversample	--	38.06592	-121.793	NAD83	--
		Confluence Oversample Point #2	Conf-026	GRTS Oversample	--	38.03582	-121.777	NAD83	--

Site Subregion	Year	Station Name	CEDEN Station Code	Station Type	Planned Event	Latitude	Longitude	Datum	No. Samples
		Confluence Oversample Point #3	Conf-027	GRTS Oversample	--	38.05161	-121.692	NAD83	--
		Confluence Oversample Point #4	Conf-028	GRTS Oversample	--	38.1158	-121.685	NAD83	--
		Confluence Oversample Point #5	Conf-029	GRTS Oversample	--	38.08838	-121.74	NAD83	--
		Confluence Oversample Point #6	Conf-030	GRTS Oversample	--	38.02255	-121.8	NAD83	--
		Confluence Oversample Point #7	Conf-031	GRTS Oversample	--	38.01509	-121.695	NAD83	--
		Confluence Oversample Point #8	Conf-032	GRTS Oversample	--	38.14447	-121.692	NAD83	--
		Confluence Oversample Point #9	Conf-033	GRTS Oversample	--	38.0364	-121.807	NAD83	--
		Confluence Oversample Point #10	Conf-034	GRTS Oversample	--	38.07157	-121.852	NAD83	--
Total Samples									**192**

11 SAMPLING METHODS

All samples are collected according to detailed SOPs for collection of samples (**Appendix I**). The SOPs contain instructions for collecting and preserving samples and cleaning equipment between samples. These methods are summarized below.

Any deviation to the procedures outlined in this QAPP must be either approved prior to implementation (if anticipated) or reported to the CVRWQCB within 7 days (if unanticipated).

Samples are collected according to the methods described in the USGS National Field Manual (U.S. Geological Survey, variously dated). The USGS field manual is a dynamic document that has been in constant development since 1991 by the scientists and technicians at the USGS National Water Quality Laboratory and National Research Program. The current editions of the relevant chapters are provided in **Appendix I – Field Sampling Procedures**.

For CUP monitoring, surface water samples for pesticide, toxicity, copper, and ancillary water quality parameters are collected concurrently at each site. All samples are collected as grab samples due to the large volume of water required for collecting toxicity and pesticide samples together, even in hydrologic conditions that might otherwise dictate integrated sampling techniques. Grab samples are collected by submerging narrow-mouthed bottles at target coordinates to a depth of 0.5 m. For tidally influenced sites, samples are collected between the high and low tide, or on the ebb tide.

Samples are collected by boat using a weighted bottle sampler with the exception of the fixed sampling station at Ulatis Creek at Browns Road, where samples are collected by wading into the stream and submerging handheld bottles. In high flow conditions or for sites with difficult bank access, samples shall be collected from bridges using weighted bottle samplers.

Pesticide samples are collected in precleaned, baked glass amber bottles and transported on ice to the USGS OCRL in Sacramento, Calif., for processing and analysis. Samples for analysis at Babcock Laboratories are collected in Teflon bottles and transported on ice to the USGS CWSC for processing. Prior to sampling, the Teflon bottles are cleaned with tap water and laboratory-grade detergent, rinsed with a 5 percent hydrochloric-acid solution, triple rinsed with ASTM Type-I deionized water, and stored in sealed plastic bags. The Teflon bottles are triple rinsed with native water prior to sample collection. Toxicity samples are collected in glass amber bottles that are triple rinsed with native water on-site prior to sample collection. Ten bottles are collected at each site and transported on ice to PER for analysis. Sample container and volume information as well as initial and secondary preservation requirements are provided in **Table 13**.

Field duplicates and samples for matrix spikes are collected by the same procedures for collecting environmental samples immediately after the initial samples have been collected. Field blank samples are processed in the field identically as the other samples using deionized water as sample water. Field QC samples are preserved and stored alongside the environmental samples until extraction or analysis and are required at the frequency outlined in **Table 15**.

Basic water-quality measurements (water temperature, specific conductance, dissolved oxygen, pH, and turbidity) are taken at a depth of 1.5 ft at mid-channel during each sample collection using a YSI multiparameter meter. The meter is calibrated using appropriate procedures and standards prior to sample collection as described in the USGS National Field Manual.

In the event that any of the GRTS sites cannot be accessed, crews will collect samples from the next oversample site identified for the subregion in which monitoring is occurring in accordance with the monitoring study design.

12 SAMPLING HANDLING AND CUSTODY

All sample bottles are labeled with indelible marker clearly stating sample ID, collection date and time, and collector. Immediately after collection, sample containers are checked for integrity (e.g., bottle caps are tightened, no leakage is occurring) and preserved according to the requirements provided in **Table 13.**

Samples are collected by USGS CWSC field crews and are placed into coolers with wet ice to maintain a temperature of ≤ 6°C during transport to the CWSC/OCRL offices. Upon arrival of samples, appropriate laboratory processing forms noting unique laboratory ID, site name, collection time and date, receiving technician's name, requested analysis, and date and time of receipt will be filled out. Signed copies of Chain-of-Custody (COC) forms will be maintained with the appropriate OCRL field and laboratory forms.

Pesticide samples are filtered through a 0.7 µm filter and extracted upon arrival at the OCRL. If this is not possible, they are stored at ≤ 6°C until processing can occur; filtration and extraction must occur within 48 hours of sample collection. Filter papers containing suspended sediments are dried at room temperature overnight (in the dark), then stored in a freezer at −20 °C until extraction. After extraction, all in-process samples are stored in a freezer (-20 °C); samples must be analyzed by liquid chromatography tandem mass spectrometry (LC-MS/MS) and gas chromatography tandem mass spectrometry (GC-MS/MS) within 30 days of processing.

Samples being analyzed for copper and ancillary parameters are collected in precleaned Teflon bottles and are processed at CWSC/OCRL prior to being transferred to Babcock Laboratories. Samples for dissolved copper and hardness analyses are filtered using 0.45 µm filters and acidified to a pH less than 2 with nitric acid. Samples for DOC analysis are filtered using 0.45 µm pore size glass-fiber into amber glass bottles and acidified with sulfuric acid. Samples for TOC are transferred into amber glass unfiltered and acidified with sulfuric acid. Samples for nitrogen are transferred to polyethylene and acidified with sulfuric acid; dissolved TKN samples are filter through a 0.45 µm prior to acidification.

Toxicity samples are collected in amber glass and are delivered to PER within 24 hours of sample collection. Upon arrival at PER, toxicity testing samples will be immediately removed from the ice chests and the laboratory staff receiving the coolers will complete the accompanying COC. PER will initiate tests within 48 hours of sample collection, although under rare circumstances, this holding time may be extended to 120 hours for storm events, or when courier delivery schedules on weekends and holidays limit the availability of test organisms. In these instances, the Delta RMP Program Manager, QA Officer, and the CVRWQCB QA Representative will be notified, and the associated data will be flagged appropriately for the hold time violation.

Field crews are required to fill out standardized field sheets for each sampling event. A standardized field sheet is provided as **Figure 6**.

Custody of all samples is documented and traceable from collection time to submittal for analysis on a COC form. An example COC form is provided as **Figure 7**. The COC accompanies the samples at all times. Samples are considered under custody if:

- they are in actual possession;
- they are in view after being in physical possession;
- they are placed in a secure area (accessible by or under the scrutiny of authorized personnel only after in possession).

Custody forms are completed by samplers and must be signed by the sampler in charge to relinquish samples into the custody of the laboratory and/or intermediate couriers. Individuals relinquishing custody must provide their name, the date, and the time at which custody was transferred. Individuals taking custody of samples must also sign and date the forms to indicate the time at which the samples were received. Errors or amendments to COC forms should be clearly documented in order to maintain a clear record of sample possession from collection to analysis.

It is the responsibility of the field crews, laboratory personnel, and any intermediate sample custodians to maintain proper documentation of sample custody from sample collection through transit to and receipt by the laboratory.

Once in the laboratory's possession, it is the responsibility of the analyzing laboratory to maintain custody logs sufficient to track each sample submitted and to analyze or preserve each sample within specified holding times. The contract laboratory follows sample custody procedures outlined in their QAM; contract laboratory QAMs are on file with the respective laboratories. It is the responsibility of the personnel of each analytical laboratory to ensure that all applicable regulations are followed in the disposal of samples or related chemicals remaining after successful completion of analyses.

Table 13. Sampling handling and custody.

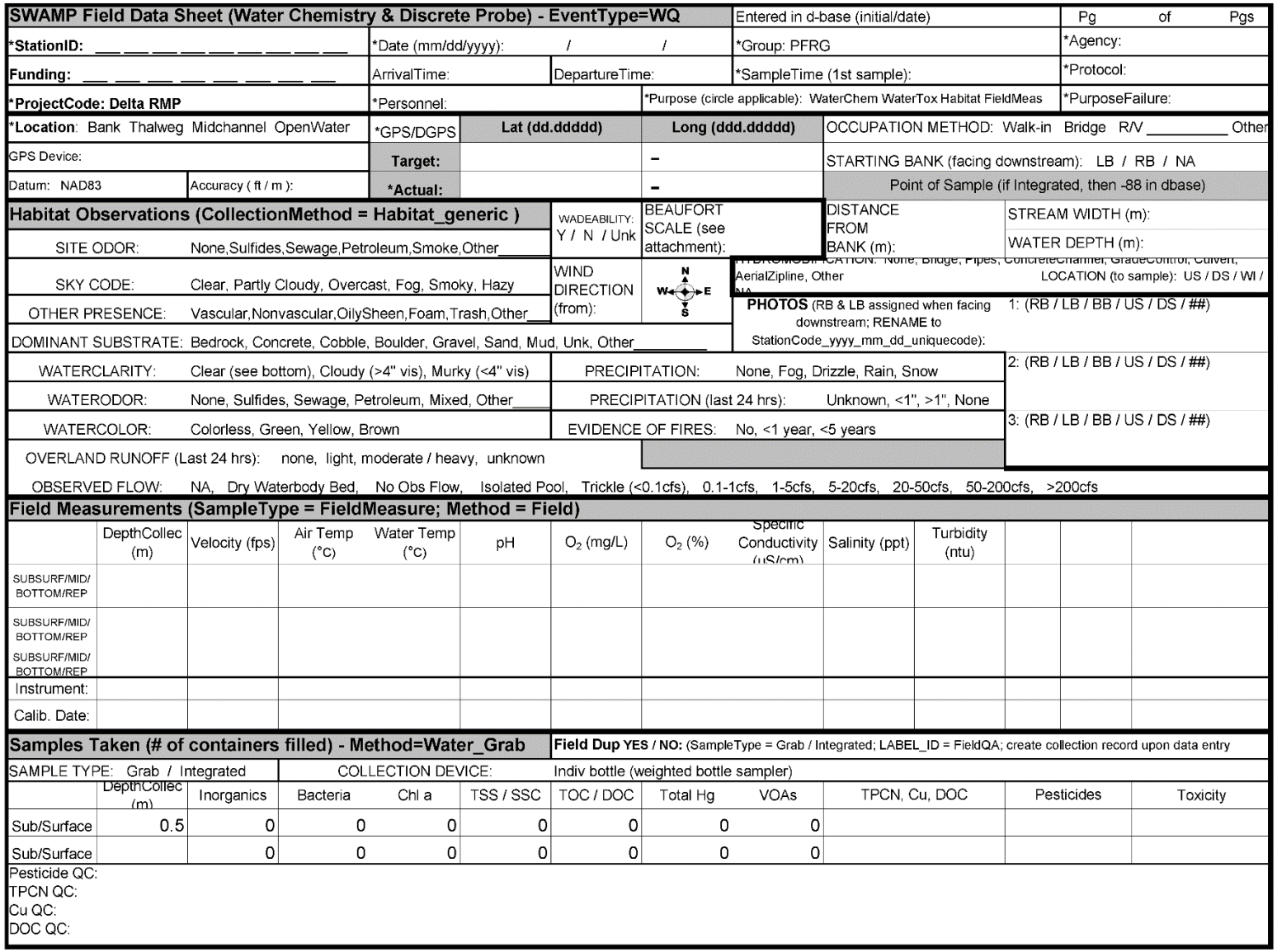
Analytical Parameter	Fraction	Sample Container Material and Volume	Initial Preservation/Holding Requirements	Extraction/ Preparation Holding Time	Analysis Holding Time
Pesticides	Particulate, Dissolved	1 Liter Amber Glass	Store at ≤ 6°C; filter within 48 hours of collection	48 hours	30 days
Copper	Dissolved	500 mL Polyethylene		--	6 months
Hardness	Dissolved			--	6 months
Calcium	Dissolved			--	6 months

Analytical Parameter	Fraction	Sample Container Material and Volume	Initial Preservation/Holding Requirements	Extraction/ Preparation Holding Time	Analysis Holding Time
Magnesium	Dissolved		Store at ≤ 6°C; filter and preserve to pH <2 with HNO_3 within 24 hours of collection		
Dissolved Organic Carbon	Dissolved	3 X 40 mL VOA vial	Store at ≤ 6°C; filter and preserve to pH <2 with H_2SO_4 within 24 hours of collection	--	28 days
Total Organic Carbon	Total	3 X 40 mL VOA vial	Store at ≤ 6°C; preserve to pH <2 with H_2SO_4 within 24 hours of collection	--	28 days
Nitrate + Nitrite as N	Total	500 mL Polyethylene	Store at ≤ 6°C; preserve to pH <2 with H_2SO_4 within 24 hours of collection	--	28 days
TKN				--	28 days
TKN	Dissolved	500 mL Polyethylene	Store at ≤ 6°C; filter and preserve to pH <2 with H_2SO_4 within 24 hours of collection	--	28 days
Aquatic Toxicity	--	10 x 4 Liter Amber Glass	store at ≤ 6°C	--	48 hours

12.1 STANDARDIZED FORMS

Figure 6 and **Figure 7** are examples of the standardized forms for field sheets and COC forms.

Figure 6. Field sheet completed by USGS field crews for collecting water samples.



SWAMP Field Data Sheet (Water Chemistry & Discrete Probe) - EventType=WQ

Entered in d-base (initial/date) | Pg of Pgs

*StationID: __ __ __ __ __ __ __ __ __ __

*Date (mm/dd/yyyy): / /

*Group: PFRG

*Agency:

Funding: __ __ __ __ __ __ __ __ __

ArrivalTime: DepartureTime:

*SampleTime (1st sample):

*Protocol:

*ProjectCode: Delta RMP

*Personnel:

*Purpose (circle applicable): WaterChem WaterTox Habitat FieldMeas

*PurposeFailure:

*Location: Bank Thalweg Midchannel OpenWater

*GPS/DGPS | Lat (dd.ddddd) | Long (ddd.ddddd)

OCCUPATION METHOD: Walk-in Bridge R/V _____ Other

GPS Device:

Target: –

STARTING BANK (facing downstream): LB / RB / NA

Datum: NAD83 Accuracy (ft / m):

*Actual: –

Point of Sample (if Integrated, then -88 in dbase)

Habitat Observations (CollectionMethod = Habitat_generic)

WADEABILITY: Y / N / Unk

BEAUFORT SCALE (see attachment):

DISTANCE FROM BANK (m):

STREAM WIDTH (m):

WATER DEPTH (m):

SITE ODOR: None,Sulfides,Sewage,Petroleum,Smoke,Other

SKY CODE: Clear, Partly Cloudy, Overcast, Fog, Smoky, Hazy

WIND DIRECTION (from): N W E S

AerialZipline, Other

LOCATION (to sample): US / DS / WI / NA

OTHER PRESENCE: Vascular,Nonvascular,OilySheen,Foam,Trash,Other

DOMINANT SUBSTRATE: Bedrock, Concrete, Cobble, Boulder, Gravel, Sand, Mud, Unk, Other

PHOTOS (RB & LB assigned when facing downstream; RENAME to StationCode_yyyy_mm_dd_uniquecode):

1: (RB / LB / BB / US / DS / ##)

2: (RB / LB / BB / US / DS / ##)

3: (RB / LB / BB / US / DS / ##)

WATERCLARITY: Clear (see bottom), Cloudy (>4" vis), Murky (<4" vis)

PRECIPITATION: None, Fog, Drizzle, Rain, Snow

WATERODOR: None, Sulfides, Sewage, Petroleum, Mixed, Other

PRECIPITATION (last 24 hrs): Unknown, <1", >1", None

WATERCOLOR: Colorless, Green, Yellow, Brown

EVIDENCE OF FIRES: No, <1 year, <5 years

OVERLAND RUNOFF (Last 24 hrs): none, light, moderate / heavy, unknown

OBSERVED FLOW: NA, Dry Waterbody Bed, No Obs Flow, Isolated Pool, Trickle (<0.1cfs), 0.1-1cfs, 1-5cfs, 5-20cfs, 20-50cfs, 50-200cfs, >200cfs

Field Measurements (SampleType = FieldMeasure; Method = Field)

	DepthCollec (m)	Velocity (fps)	Air Temp (°C)	Water Temp (°C)	pH	O_2 (mg/L)	O_2 (%)	Specific Conductivity (uS/cm)	Salinity (ppt)	Turbidity (ntu)			
SUBSURF/MID/ BOTTOM/REP													
SUBSURF/MID/ BOTTOM/REP													
SUBSURF/MID/ BOTTOM/REP													
Instrument:													
Calib. Date:													

Samples Taken (# of containers filled) - Method=Water_Grab

Field Dup YES / NO: (SampleType = Grab / Integrated; LABEL_ID = FieldQA; create collection record upon data entry

SAMPLE TYPE: Grab / Integrated

COLLECTION DEVICE: Indiv bottle (weighted bottle sampler)

	DepthCollec (m)	Inorganics	Bacteria	Chl a	TSS / SSC	TOC / DOC	Total Hg	VOAs	TPCN, Cu, DOC	Pesticides	Toxicity
Sub/Surface	0.5	0	0	0	0	0	0	0			
Sub/Surface		0	0	0	0	0	0	0			

Pesticide QC:
TPCN QC:
Cu QC:
DOC QC:

Figure 7. Chain-of-custody form for toxicity samples transferred to PER.

Pacific EcoRisk
2250 Cordelia Rd., Fairfield, CA 94534
(707) 207-7760 FAX (707) 207-7916

CHAIN-OF-CUSTODY RECORD

Results To:	Delta RMP	**Invoice To:**	CVCWA
Address:		**Address:**	808 R Street, Ste 209
			Sacramento, CA 95811
Phone:		**Phone:**	
Attn:	Melissa Turner	**Attn:**	Kathryn Garcia
E-mail:	mturner@mljenvironmental.com	**E-mail:**	Kathryn.Garcia@stocktonca.gov
Project Name:	Delta Regional Monitoring Program		
P.O.#/Ref:			

	Client Sample ID	Sample Date	Sample Time	Sample Matrix*	Grab/ Comp	Container Number	Container Type	Chronic *S. capricomutum* algal growth (EPA-821-R-02-013)	Chronic *C. dubia* Survival & Reproduction (EPA-821-R-02-013)	Chronic *P. promelas* Survival & Growth (EPA-821-R-02-013)	96-hr Acute *H. azteca* Survival (EPA-821-R-02-012)	10-day Chronic *C. dilutus* Survival & Growth (EPA 600/R-99/064M)						
								REQUESTED ANALYSIS										
1																		
2																		
3																		
4																		
5																		
6																		
7																		
8																		
9																		
10																		

Samples collected by:			
Comments/Special Instruction:	**RELINQUISHED BY:**	**RECEIVED BY:**	
	Signature:	**Signature:**	
	Print:	**Print:**	
	Organization:	**Organization:**	
	Date: **Time:**	**Date:** **Time:**	
	RELINQUISHED BY:	**RECEIVED BY:**	
	Signature:	**Signature:**	
	Print:	**Print:**	
	Organization:	**Organization:**	
	Date: **Time:**	**Date:** **Time:**	

***Example Matrix Codes**: (**EFF** - Effluent) (**FW** = Freshwater); (**SW** = Saltwater); (**WW** = Wastewater); (**STRMW** = Stormwater); (**SED** = Sediment); or other

13 ANALYTICAL METHODS

Field measurements will be performed according to the standard procedures outlined in **Appendix I** . Field technicians will be properly trained on how to deploy, operate, and maintain field instruments according to the requirements outlined in **Element 8**. Laboratory analyses will be performed according to the methods and SOPs outlined in **Table 14**. Analytical results will be evaluated according to the detection and reporting limits outlined in **Table 14** . Commercial laboratories will be accredited by ELAP to perform all analyses according to the methods listed below.

Field and laboratory analyses will require the equipment listed in **Table 17**. In the event of equipment failure or deviation, the Laboratory QA Officer or Project Manager should notify the Program Manager and the Program QA Officer as soon as possible and provide the appropriate documentation including whether corrective actions were initiated. Specifics regarding the type of failure or deviation, reasons, and any laboratory corrective actions that were already initiated will be provided to the CVRWQCB QA Representative within seven calendar days of notification. Any additional corrective actions required by the CVRWQCB QA Representative or requested by TAC members will then be communicated back to the laboratory by the Program Manager.

Corrective actions must be implemented by the laboratory on a case-by-case basis to address a root cause of failure or deviation. Once corrective actions are implemented, re-extraction, re-analysis, or resampling may be requested if the sample data cannot be salvaged (**Table 16**). If the failure necessitates a qualifier or flag in the database, it is the Program QA Officer's responsibility to ensure that the correct qualifier or flag is applied. Once the appropriate corrective actions have been implemented, the failure and the associated corrective actions will be documented on a QAPP Deviation Form and submitted to the CVRWQCB for approval.

Laboratory reporting turnaround times (beginning at the time of sample receipt) may vary according to the specific analytical method, sample preparation, and sample holding time requirements. Regardless of turnaround times specified in individual laboratory contracts, the reporting of preliminary data to the Delta RMP is not to exceed 60 calendar days from the time of sample analysis by the laboratory, per R5-2021-0054.

A laboratory must store surplus volume for re-extraction or reanalysis according to their laboratory policies. For the pesticide analyses the entire sample volume is used in the initial extraction and no additional sample volume is available for re-extraction. Sample extracts are stored frozen for the duration of the project after the initial analysis and may be reanalyzed as necessary. Due to the short hold times associated with the toxicity testing and pesticide analyses, and the fact that these samples involve whole bottle

extractions/analyses, the study design does not include the collection of additional sample volume for the specific intent of reanalysis/retesting. Samples analyzed by Babcock Laboratories will be stored at the laboratory for six weeks from the receipt date prior to being disposed, unless otherwise indicated on the COC. All laboratories shall dispose of all samples in accordance with state and federal regulations.

13.1 NON-STANDARD METHODS

The pesticide analyses for CUP monitoring that are completed by the USGS OCRL are not done under a published method promulgated by the EPA, Standard Methods, or a similar organization. The OCRL is a research laboratory with the ability to detect many constituents that are not available for commercial analyses, which is crucial to the design focused on a wide suite of products currently in use, and as many novel products as possible. The methodology used by the OCRL has been published in various forms; the specific procedures have been documented in detail for the Delta RMP stakeholders. The method procedures and validation data have undergone review by the SWRCB QA Officer to ensure compliance with the data requirements of the State Water Boards.

13.2 TOXICITY TESTING PROCEDURES

Toxicity testing is conducted on five test organisms by PER according to the methodology defined by the US EPA. Chronic toxicity testing for *Ceriodaphnia dubia*, *Pimephales promelas*, and *Selenastrum capricornutum* follow the protocols outlined in *Short-term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms* (EPA-821-R-02-013, 2002). *Chironomus dilutus* water-only testing protocols and MQOs are defined by SWAMP. Organism responses to sample water are evaluated at various endpoints, including survival and growth (measured as ash-free dry weight per surviving individual) for *C. dilutus*, survival and reproduction (measured as number of young per surviving female) for *C. dubia*, survival and growth (measured as biomass as wight per original individual) for *P. promelas*, and growth (measured as total cell count) for *S. capricornutum*.

Acute 96-hour toxicity testing for *Hyalella azteca* follows acute protocols and MQOs outlined in SWAMP Guidance and *Methods for Measuring Acute Toxicity of Effluents and Receiving Waters to Freshwater and Marine Organisms* (EPA 821/R-02-012, 2002). The response of *H. azteca* is evaluated as the survival of individuals.

Staff of PER shall perform aquatic toxicity testing following EPA methods, SWAMP MQOs, and the lab's SOPs as listed in **Table 16**. Additional project-specific requirements are listed below for the five test species.

Any use of surrogate species must be approved by the Delta RMP QA Officer and the CVRWQCB QA Representative or SWRCB QA Officer. Furthermore, it should be discussed by the CUP TAC and recommended by the Steering Committee to the BOD for approval. Alternative protocols can be proposed to SWAMP and EPA, but tests shall be run per the method for this project.

13.2.1 *Ceriodaphnia dubia* Procedures

All ambient samples for the Delta RMP will be run through a clean 60-µm Nitex screen to remove potential indigenous organisms prior to use in the testing.

Toxicity testing according to SWAMP MQOs describes the recommendation for secondary conductivity controls when an ambient sample conductivity is outside of the physiological range of the test organisms. Procedures for additional conductivity controls are outlined in **Additional Toxicity Controls for *Ceriodaphnia Dubia***. *Ceriodaphnia dubia* will not be tested in samples with specific conductance > 2,500 µS/cm, which is outside of the maximum tolerance of this test species. SWAMP MQOs state that *Hyalella azteca* can be used as a surrogate for *C. dubia* in this case. The Delta RMP is already testing with *H. azteca*.

Additionally, low conductivity samples will also require additional testing for research purposes, with the intent of understanding if nutrient additions to low conductivity samples will increase *C. dubia* reproduction as has shown it does in the tolerance controls (Stillway and Irvine 2018). If there is at least one sample with conductivity ≤ 130 µS/cm in a batch, the lab shall use water from one low-conductivity environmental sample to run an additional nutrient addition test. In this sample, the lab will treat the environmental sample by adding the standard blend of nutrients (i.e., biotin, sodium selenate, vitamin B_{12}, and thiamine hydrochloride). The amount of nutrients added should match the amount added to the lowest conductivity tolerance control. The results of the research treatments will be compared to the secondary controls with the most closely matching conductivity and also with the untreated sample. These data may inform the Delta RMP if background water quality and/or nutrients affect the test organism response. Nutrient addition results will be stored in the CV RDC and provided to the TAC and stakeholders for review . At this time, a minimum sample size has not been identified.

13.2.2 *Hyalella azteca* Procedures

Feeding during toxicity tests will follow the SCCWRP method where food is given two hours prior to water changes (Schiff and Greenstein 2016). This approach is consistent with SWAMP MQOs and reduces the potential for contaminants to sorb to food where they may be less bioavailable to the organism and bias the results. *Hyalella azteca* testing will be conducted at 20° C in accordance with the EPA requirements. If indigenous

organisms that may be confused with or attack the test organisms are observed in any ambient water sample for the Delta RMP, the sample will be run through a clean 500-µm Nitex screen prior to use in the testing.

13.2.3 *Selenastrum capricornutum* Procedures

Micronutrient stock solution should NOT contain ethylenediaminetetraacetic acid (EDTA), as EDTA is known to chelate metals and therefore the presence of EDTA in the algal growth test can mask metal toxicity. All ambient samples for the Delta RMP will be 0.45-µm filtered prior to use in the testing.

13.2.4 *Pimephales promelas* Procedures

If indigenous organisms that may be confused with or attack the test organisms are observed in any ambient water sample for the Delta RMP, the sample will be run through a clean 500-µm Nitex screen prior to use in the testing.

13.2.5 *Chironomus dilutus* Procedures

If indigenous organisms that may be confused with or attack the test organisms are observed in any ambient water sample for the Delta RMP, the sample will be run through a clean 500-µm Nitex screen prior to use in the testing.

13.2.6 Statistical Analyses

Statistical analysis of laboratory toxicity test data will be consistent with standard single concentration statistical protocols (EPA 2002; Appendix H, page 306-308). This approach compares each sample with the appropriate control and calculates the test result according to standardized statistical methods used in aquatic toxicology. Statistics for toxicity data will be made with the software application Comprehensive Environmental Toxicity Information System™ (CETIS; Tidepool Scientific, McKinleyville, CA, USA).

If there are tests with unequal number of organisms per replicate, these tests will include a QA Code of "TOQ". If replicates are impacted by cannibalism, pupation, metamorphosis, or escape, the data will include the QA Code "TMO", and these particular organisms must be excluded from all calculations made on the Summary and Results tabs. This rule is in accordance with SWAMP guidance (Toxicity Template Guide, October 2021; https://drive.google.com/file/d/1WOV57vhPDsKJP_ulAqWBHeyYsaaFupzp/view). A comment should be added to the **LabResultComments** field regarding how many organisms were excluded and how many organisms in each replicate were included in the statistical analysis or percent survival calculation (e.g., 1 organism pupated, 1 missing; 9 organisms used in the calculation). When a significant number of absent organisms are observed such that there are concerns regarding a bias of the statistical analyses, a retest

may be requested. Decisions to request a retest due to a high occurrence of missing organisms will be made in coordination with the Program Manager, the Project QA Officer, the CVRWQCB QA Representative, and the TIE TAC.

13.3 TOXICITY IDENTIFICATION EVALUATIONS

A TIE is an investigative process that uses laboratory modifications of test sample chemistry and resulting changes in toxicity to identify the constituent groups (e.g., organophosphates) that are the likely cause(s) of toxicity.

The trigger for a TIE shall be a ≥ 50% reduction in the organism response compared to the appropriate lab control. This trigger shall apply to all test organisms and all endpoints (acute and chronic). The decision on whether or not to perform a TIE will be made by the Delta RMP TIE TAC in consultation with the toxicity testing laboratory. Decisions to perform a TIE are event-specific and dependent on the degree of effects observed in baseline testing, what is known about the sample (e.g., location, previous effects and toxicants, relevant pesticide applications), test species, and the available funding to conduct the TIE. The TIE TAC and testing lab shall quickly decide whether to conduct TIEs (the TAC should be notified within 24 hours of the TIE trigger, and the TIE should begin less than 72 hours after the TIE trigger), and whether to conduct any follow-up study (e.g., additional TIE treatments, supporting analytical chemistry).

This description is intended to be a starting point to inform the discussion and interpretation of any TIEs that are conducted on Delta RMP samples. TIEs may provide additional information that leads to other approaches to identify the cause of effects that are not identified here.

Phase 1 TIEs attempt to characterize the physical and chemical properties of the possible toxicant(s) in the sample. Information is gained regarding the physical/chemical properties of the toxicant(s) when the toxicity endpoint effect is reduced in the treated sample, adding to the weight of evidence regarding the class of contaminants that may have caused the toxicity. Phase 2 TIEs attempt to identify specific constituents causing or contributing to toxicity through chemical analyses or additional TIE treatments. Multiple TIE methods are presented in EPA guidance documents (USEPA 1991, 1992, 1993a, 1993b). Other approaches may be adopted from the peer-reviewed literature (e.g., Wheelock et al., 2004) or developed to address study-specific questions.

The TIEs should be initiated as soon as possible (within 72 hours) after exceeding the TIE trigger and following approval of the TIE TAC.

All TIEs should be chronic tests, even when observed toxicity is acute unless there is no chronic endpoint (i.e., the 96-hour *H. azteca* survival test), in consultation with the TIE TAC and PER.

The laboratory must also conduct a preliminary validation of the initial toxicity test results by confirming that basic water quality parameters (e.g., conductivity, dissolved oxygen) were within acceptable ranges for the affected test species and that test acceptability criteria were met, unless sufficient acute effects provide clear direction on the need for retesting. Follow-up investigations (e.g., Phase 2 or 3 TIEs) may also be considered.

Delta RMP TIE testing has the primary goal of identifying whether pesticides are causing or contributing to observed toxic effects. A secondary goal may be to identify (or exclude) other factors (i.e., water quality conditions or other toxicants) contributing to reduced survival, growth, or reproduction. A phased TIE approach will be used, to the extent possible, to achieve these goals by initially focusing on treatments that identify major classes of contaminants that could include pesticides:

- Cation exchange column (removes metals and other divalent cations)
- Solid-phase extraction column (e.g., C-8 or C-18; evidence of toxicity due to non-polar organics, organic-metal chelates, and some surfactants)
- Centrifugation (evidence of toxicity due to particulate-bound contaminants such as chlorpyrifos and pyrethroids; use with turbid samples or at the discretion of the TIE TAC)
- Piperonyl Butoxide (PBO) (evidence of toxicity due to a substance that is metabolized by the CYP450 enzyme system; evidence of OP insecticides if toxicity is reduced and of pyrethroid insecticides if toxicity is potentiated)
- Carboxylesterase addition (evidence of toxicity due to a contaminant with an ester bond, such as pyrethroid insecticides)
- Bovine serum albumin (BSA) addition (acts as a large organic molecule control for carboxylesterase treatment)
- Baseline (confirms if the toxicity is persistent)

If the cause of an observed effect is not clear after initial TIE testing, or if further detail describing the type or specific toxicant is desired, then the TIE TAC may choose to have the laboratory conduct additional TIE treatments. Considerations for additional TIEs could include the level of available funding, magnitude of toxicity (TIE treatment effectiveness is easier to determine when there is a strong toxicity signal), species tested, and other data (e.g., potential sources, initial TIE results, and the likelihood that pesticides will be identified). As examples, the following TIE treatments could be selected to assess factors contributing to the observed effect:

- Low temperature – evidence of toxicity due to a contaminant that is metabolized, so lower temperatures slow the organisms' metabolism; increases the toxicity of pyrethroid insecticides
- Aeration – evidence of toxicity due to volatile, sublatable, or oxidizable compounds including surfactants

- Non-polar organic solid-phase extraction (SPE) column – evidence of toxicity due to a relatively polar organic contaminant
- pH 3/11 – evidence of toxicity due to hydrolysable/pH-dependent compounds (and filtration to assess/remove/control for settleable/coagulated toxicants and particulates).
- $Na_2S_2O_3$ – evidence of toxicity due to oxidants
- EDTA – evidence of metals toxicity
- Chemical analysis of cyanotoxins (to be compared with species-specific toxicity values). This would require freezing a subsample of the freshly collected sample for potential analysis if toxicity is observed from a location with known or potential cyanobacteria bloom.

The specific TIE treatments will depend on the test species. Salinity/conductivity is an important factor affecting toxicity test results for some species in the Delta, and TIEs in some samples with species sensitive to conductivity may require appropriate low-specific conductance or high-specific conductance secondary controls in addition to laboratory culture water controls treatments as indicated in SWAMP MQOs.

13.4 TOXICITY SAMPLE RETESTING PROCEDURES

When a toxicity test fails to meet Test Acceptability Criteria, the Delta RMP project team may request a retest. Therefore, retesting samples may require using samples that have exceeded the 48-hour hold time. Decisions to retest samples need to be made as quickly as possible by the testing lab in consultation with the Delta RMP Program Manager, the CVRWQCB QA Representative, and TIE TAC. The laboratory will notify the Delta RMP Program Manager, the CVRWQCB QA Representative, and TIE TAC by email of the possible need to retest immediately upon identifying an invalid test or, if possible, when the control is exhibiting a poor or irregular survival or reproduction pattern that causes the laboratory staff to anticipate that Test Acceptability Criteria may not be met. In this notification, the laboratory will describe the concern and could provide a recommendation for retesting or continued monitoring of the results.

Within 24 hours of test result notification from the toxicity laboratory, the TIE TAC will review the laboratory notification, discuss (i.e., over email or a conference call), and make a consensus decision regarding whether to retest a sample. The Program Manager, who will be a part of the TIE TAC communications, will inform the laboratory of the decision on retesting. The laboratory will initiate the retest of the previously collected sample within 24 hours of notification from the TIE TAC (i.e., within 48 hours of the lab notification).

If the TIE TAC does not respond within 24 hours, or if there is not clear direction from the TIE TAC to the toxicity laboratory, then the laboratory will implement its

recommendation. In the event that retesting is delayed beyond this timeline (e.g., organisms need to be ordered from a supplier or samples need to be recollected), such delays will be communicated to the TIE TAC and documented. Any issues contributing to an invalid test and its resolution will also be documented and submitted to the Delta RMP QA Officer, the Delta RMP Program Manager, and the CVRWQCB QA Representative to inform adaptive management of the Delta RMP.

The potential need for resampling or retesting may also arise if, for example, samples are accidentally lost or destroyed in whole or in part. The bioassay laboratory will immediately notify the TIE TAC, the Program Manager, the CVRWQCB QA Representative and the USGS analytical lab with a description of the problem so that a decision to resample can be made by the project team.

Table 14. Field and laboratory analytical methods. All samples are surface water.

Constituent (CEDEN Analyte Name)	Agency	Method	Analysis	Fraction	Units	MDL	RL	Water Quality Metric	SOP
Ancillary Parameters									
Dissolved Organic Carbon	Babcock	SM 5310 B	Combustion	Dissolved	mg/L	0.19	0.30	--	**Appendix III** – Organic Carbon by SM 5310 B
Total Organic Carbon	Babcock	SM 5310 B	Combustion	Total	mg/L	0.13	0.70	--	
Nitrate + Nitrite as N	Babcock	EPA 353.2	Colorimetry	Total	mg/L	0.0038	0.010	--	**Appendix III** – Nitrate + Nitrite by EPA 353.2
TKN	Babcock	EPA 351.2	Colorimetry	Total	mg/L	0.093	0.10	--	**Appendix III** – TKN by EPA 351.2
TKN	Babcock	EPA 351.2	Colorimetry	Dissolved	mg/L	0.093	0.10	--	
Total Suspended Solids	OCRL	EPA 160.2	--	Particulate	mg/L	2	2	--	NA
Hardness	Babcock	SM 2340 B	Calculation	Dissolved	mg/L	1.0	1.0	--	**Appendix III** – Cations by EPA 200.7
Calcium	Babcock	EPA 200.7	ICP-AES	Dissolved	mg/L	0.33	1.0	--	
Magnesium	Babcock	EPA 200.7	ICP-AES	Dissolved	mg/L	0.33	1.0	--	

Constituent (CEDEN Analyte Name)	Agency	Method	Analysis	Fraction	Units	MDL	RL	Water Quality Metric	SOP
Trace Metals									
Copper	Babcock	EPA 200.8	ICP-MS	Dissolved	µg/L	0.25	0.50	--	**Appendix III** – Trace Elements by EPA 200.8
Aquatic Toxicity									
Ceriodaphnia dubia	PER	EPA 821/R-02-013	Chronic (6-8 day)	Survival	%	--	--	--	**Appendix III** – Chronic *C. dubia*
Ceriodaphnia dubia	PER	EPA 821/R-02-013	Chronic (6-8 day)	Young/ female	Num/ Rep	--	--	--	
Chironomus dilutus	PER	EPA 600/R-99-064M	Chronic (10-day)	Growth (ash-free dry wt/ surv indiv)	mg/ ind	--	--	--	**Appendix III** – Chronic *C. dilutus*
Chironomus dilutus	PER	EPA 600/R-99-064M	Chronic (10-day)	Survival	%	--	--	--	
Hyalella azteca	PER	EPA 821/R-02-012	Acute (96-hour)	Survival	%	--	--	--	**Appendix III** – Acute *H. Azteca*
Pimephales promelas	PER	EPA 821/R-02-013	Chronic (7-day)	Biomass (wt/orig indiv)	mg/ ind	--	--	--	**Appendix III** – Chronic *P. promelas*
Pimephales promelas	PER	EPA 821/R-02-013	Chronic (7-day)	Survival	%	--	--	--	
Selenastrum capricornutum	PER	EPA 821/R-02-013	Chronic (96-hour)	Total Cell Count	cells/ mL	--	--	--	**Appendix III** – Chronic *S. capricornutum*

Constituent (CEDEN Analyte Name)	Agency	Method	Analysis	Fraction	Units	MDL	RL	Water Quality Metric	SOP
Pesticides									
Acetamiprid	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Particulate	ng/L	2.2	4.4	2,100	**Appendix III** - SOP – OCRL-WATER-PEST_05
Acetamiprid	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Dissolved	ng/L	1.1	2.1	2,100	
Acibenzolar-S-methyl	OCRL	OCRL-WATER-PEST_05	GC-MS/MS	Particulate	ng/L	5.6	11.1	26,000	
Acibenzolar-S-methyl	OCRL	OCRL-WATER-PEST_05	GC-MS/MS	Dissolved	ng/L	5.3	10.7	26,000	
Allethrin	OCRL	OCRL-WATER-PEST_05	GC-MS/MS	Particulate	ng/L	3.1	6.2	1,050	
Allethrin	OCRL	OCRL-WATER-PEST_05	GC-MS/MS	Dissolved	ng/L	2.5	5	1,050	
Atrazine	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Particulate	ng/L	1.4	2.7	1,000	
Atrazine	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Dissolved	ng/L	0.9	1.7	1,000	
Azoxystrobin	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Particulate	ng/L	2.2	4.3	44,000	
Azoxystrobin	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Dissolved	ng/L	0.8	1.6	44,000	
Benfluralin	OCRL	OCRL-WATER-PEST_05	GC-MS/MS	Particulate	ng/L	3.4	6.8	1,900	
Benfluralin	OCRL	OCRL-WATER-PEST_05	GC-MS/MS	Dissolved	ng/L	1.8	3.6	1,900	
Bentazon	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Dissolved	ng/L	1.3	2.5	4,500,000	
Benzobicyclon	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Particulate	ng/L	1.8	3.5	1,475	
Benzobicyclon	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Dissolved	ng/L	1.2	2.3	1,475	
Benzovindiflupyr	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Particulate	ng/L	1.8	3.6	950	
Benzovindiflupyr	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Dissolved	ng/L	1.2	2.3	950	
Bifenthrin	OCRL	OCRL-WATER-PEST_05	GC-MS/MS	Particulate	ng/L	0.8	1.5	0.05	
Bifenthrin	OCRL	OCRL-WATER-PEST_05	GC-MS/MS	Dissolved	ng/L	0.6	1.1	0.05	
Boscalid	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Particulate	ng/L	1.7	3.5	116,000	
Boscalid	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Dissolved	ng/L	1	2	116,000	
Broflanilide	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Particulate	ng/L	2.1	4.2	5,930	
Broflanilide	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Dissolved	ng/L	1.9	3.9	5,930	
Bromuconazole	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Particulate	ng/L	1.9	3.8	20,000	
Bromuconazole	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Dissolved	ng/L	1.5	3	20,000	
Butralin	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Particulate	ng/L	1.8	3.6	600,000	

Constituent (CEDEN Analyte Name)	Agency	Method	Analysis	Fraction	Units	MDL	RL	Water Quality Metric	SOP
Butralin	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Dissolved	ng/L	1.2	2.5	600,000	
Carbaryl	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Particulate	ng/L	1.7	3.5	500	
Carbaryl	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Dissolved	ng/L	0.8	1.7	500	
Carbendazim	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Particulate	ng/L	2.5	4.9	830,000	
Carbendazim	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Dissolved	ng/L	1.2	2.5	830,000	
Carbofuran	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Particulate	ng/L	1.5	3.1	750	
Carbofuran	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Dissolved	ng/L	0.6	1.3	750	
Chlorantraniliprole	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Particulate	ng/L	1.8	3.7	3,020	
Chlorantraniliprole	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Dissolved	ng/L	0.7	1.5	3,020	
Chlorfenapyr	OCRL	OCRL-WATER-PEST_05	GC-MS/MS	Particulate	ng/L	2.5	5	2,915	
Chlorfenapyr	OCRL	OCRL-WATER-PEST_05	GC-MS/MS	Dissolved	ng/L	2.5	5	2,915	
Chloro-N-(ethoxymethyl)-N-(2-ethyl-6-methylphenyl)acetamide, 2-	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Particulate	ng/L	1.7	3.4	1,430	
Chloro-N-(ethoxymethyl)-N-(2-ethyl-6-methylphenyl)acetamide, 2-	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Dissolved	ng/L	1.6	3.1	1,430	
Chlorothalonil	OCRL	OCRL-WATER-PEST_05	GC-MS/MS	Particulate	ng/L	9	18	600	
Chlorothalonil	OCRL	OCRL-WATER-PEST_05	GC-MS/MS	Dissolved	ng/L	5.7	11.5	600	
Chlorpyrifos	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Particulate	ng/L	1.9	3.9	15	
Chlorpyrifos	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Dissolved	ng/L	1.2	2.4	15	
Chlorpyrifos Oxon	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Particulate	ng/L	2	3.9	--	
Chlorpyrifos Oxon	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Dissolved	ng/L	1	2	--	

Constituent (CEDEN Analyte Name)	Agency	Method	Analysis	Fraction	Units	MDL	RL	Water Quality Metric	SOP
Clomazone	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Particulate	ng/L	1.8	3.6	167,000	
Clomazone	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Dissolved	ng/L	1.2	2.4	167,000	
Clothianidin	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Particulate	ng/L	2.8	5.7	50	
Clothianidin	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Dissolved	ng/L	1	2	50	
Clothianidin-Desmethyl	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Particulate	ng/L	2.8	5.6	--	
Clothianidin-Desmethyl	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Dissolved	ng/L	1.8	3.7	--	
Coumaphos	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Particulate	ng/L	1.8	3.7	33.7	
Coumaphos	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Dissolved	ng/L	1.2	2.3	33.7	
Cyantraniliprole	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Particulate	ng/L	2	3.9	6,560	
Cyantraniliprole	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Dissolved	ng/L	1.1	2.2	6,560	
Cyazofamid	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Particulate	ng/L	1.8	3.6	8,700	
Cyazofamid	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Dissolved	ng/L	0.8	1.7	8,700	
Cyclaniliprole	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Particulate	ng/L	1.4	2.9	9,600	
Cyclaniliprole	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Dissolved	ng/L	1.4	2.7	9,600	
Cycloate	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Particulate	ng/L	1.7	3.4	30,000	
Cycloate	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Dissolved	ng/L	1.5	3	30,000	
Cyfluthrin, total	OCRL	OCRL-WATER-PEST_05	GC-MS/MS	Particulate	ng/L	1	2.1	0.12	
Cyfluthrin, total	OCRL	OCRL-WATER-PEST_05	GC-MS/MS	Dissolved	ng/L	0.8	1.7	0.12	
Cyhalofop-butyl	OCRL	OCRL-WATER-PEST_05	GC-MS/MS	Particulate	ng/L	2.2	4.4	47,400	
Cyhalofop-butyl	OCRL	OCRL-WATER-PEST_05	GC-MS/MS	Dissolved	ng/L	1.5	3	47,400	
Cyhalothrin, Total	OCRL	OCRL-WATER-PEST_05	GC-MS/MS	Particulate	ng/L	1	1.9	6,200	
Cyhalothrin, Total	OCRL	OCRL-WATER-PEST_05	GC-MS/MS	Dissolved	ng/L	0.6	1.2	6,200	
Cymoxanil	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Particulate	ng/L	2.2	4.3	980	
Cymoxanil	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Dissolved	ng/L	2.3	4.6	980	
Cypermethrin, Total	OCRL	OCRL-WATER-PEST_05	GC-MS/MS	Particulate	ng/L	1.1	2.2	0.05	

Constituent (CEDEN Analyte Name)	Agency	Method	Analysis	Fraction	Units	MDL	RL	Water Quality Metric	SOP
Cypermethrin, Total	OCRL	OCRL-WATER-PEST_05	GC-MS/MS	Dissolved	ng/L	0.9	1.8	0.05	
Cyproconazole	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Particulate	ng/L	1.9	3.8	60,000	
Cyproconazole	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Dissolved	ng/L	1.4	2.8	60,000	
Cyprodinil	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Particulate	ng/L	1.6	3.2	8,200	
Cyprodinil	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Dissolved	ng/L	2.1	4.3	8,200	
Dacthal	OCRL	OCRL-WATER-PEST_05	GC-MS/MS	Particulate	ng/L	1.2	2.5	11,000,000	
Dacthal	OCRL	OCRL-WATER-PEST_05	GC-MS/MS	Dissolved	ng/L	1.2	2.3	11,000,000	
DDD(p,p')	OCRL	OCRL-WATER-PEST_05	GC-MS/MS	Particulate	ng/L	1.1	2.3	--	
DDD(p,p')	OCRL	OCRL-WATER-PEST_05	GC-MS/MS	Dissolved	ng/L	1.4	2.7	--	
DDE(p,p')	OCRL	OCRL-WATER-PEST_05	GC-MS/MS	Particulate	ng/L	1.2	2.5	--	
DDE(p,p')	OCRL	OCRL-WATER-PEST_05	GC-MS/MS	Dissolved	ng/L	1.5	3	--	
DDT(p,p')	OCRL	OCRL-WATER-PEST_05	GC-MS/MS	Particulate	ng/L	1.8	3.6	1	
DDT(p,p')	OCRL	OCRL-WATER-PEST_05	GC-MS/MS	Dissolved	ng/L	1.4	2.7	1	
Deltamethrin	OCRL	OCRL-WATER-PEST_05	GC-MS/MS	Particulate	ng/L	1.4	2.8	0.026	
Deltamethrin	OCRL	OCRL-WATER-PEST_05	GC-MS/MS	Dissolved	ng/L	1.1	2.2	0.026	
Desethyl-Atrazine	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Particulate	ng/L	2.3	4.5	--	
Desethyl-Atrazine	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Dissolved	ng/L	1.6	3.2	--	
Desisopropyl-Atrazine	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Particulate	ng/L	2.8	5.6	--	
Desisopropyl-Atrazine	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Dissolved	ng/L	1.8	3.7	--	
Desnitro-imidacloprid	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Particulate	ng/L	5.4	10.8	--	
Desnitro-imidacloprid	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Dissolved	ng/L	3.7	7.4	--	
Desthio-prothioconazole	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Particulate	ng/L	1.4	2.8	4,800	
Desthio-prothioconazole	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Dissolved	ng/L	0.7	1.3	4,800	
Diazinon	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Particulate	ng/L	1.6	3.3	100	
Diazinon	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Dissolved	ng/L	1.1	2.3	100	

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Diazinon oxon	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Particulate	ng/L	2.1	4.1	--	
Diazinon oxon	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Dissolved	ng/L	0.7	1.5	--	
Dichloroaniline, 3,5-	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Particulate	ng/L	3	5.9	--	
Dichloroaniline, 3,5-	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Dissolved	ng/L	2.8	5.6	--	
Dichlorobenzenamine, 3,4-	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Particulate	ng/L	1.2	2.5	--	
Dichlorobenzenamine, 3,4-	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Dissolved	ng/L	1.2	2.4	--	
Dichlorophenyl Urea, 3,4-	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Particulate	ng/L	1.7	3.5	--	
Dichlorophenyl Urea, 3,4-	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Dissolved	ng/L	1.1	2.3	--	
Dichlorophenyl-3-methyl Urea, 3,4-	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Particulate	ng/L	1.3	2.6	7,100	
Dichlorophenyl-3-methyl Urea, 3,4-	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Dissolved	ng/L	1.5	3	7,100	
Dichlorvos	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Particulate	ng/L	0.9	1.8	5.8	
Dichlorvos	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Dissolved	ng/L	1.2	2.4	5.8	
Difenoconazole	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Particulate	ng/L	1.4	2.8	860	
Difenoconazole	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Dissolved	ng/L	1.3	2.7	860	
Dimethomorph	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Particulate	ng/L	2.8	5.5	107,000	
Dimethomorph	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Dissolved	ng/L	0.7	1.4	107,000	
Dinotefuran	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Particulate	ng/L	3.6	7.3	6,000,000	
Dinotefuran	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Dissolved	ng/L	1.8	3.6	6,000,000	
Dithiopyr	OCRL	OCRL-WATER-PEST_05	GC-MS/MS	Particulate	ng/L	1.3	2.5	20,000	
Dithiopyr	OCRL	OCRL-WATER-PEST_05	GC-MS/MS	Dissolved	ng/L	1.1	2.3	20,000	
Diuron	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Particulate	ng/L	1.9	3.8	130	

Constituent (CEDEN Analyte Name)	Agency	Method	Analysis	Fraction	Units	MDL	RL	Water Quality Metric	SOP
Diuron	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Dissolved	ng/L	0.7	1.4	130	
EPTC	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Particulate	ng/L	1.4	2.8	40,000	
EPTC	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Dissolved	ng/L	2.5	5	40,000	
Esfenvalerate	OCRL	OCRL-WATER-PEST_05	GC-MS/MS	Particulate	ng/L	1.2	2.4	0.0309	
Esfenvalerate	OCRL	OCRL-WATER-PEST_05	GC-MS/MS	Dissolved	ng/L	0.7	1.5	0.0309	
Ethaboxam	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Particulate	ng/L	1.7	3.5	50,000	
Ethaboxam	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Dissolved	ng/L	1.5	3	50,000	
Ethalfluralin	OCRL	OCRL-WATER-PEST_05	GC-MS/MS	Particulate	ng/L	3.1	6.2	400	
Ethalfluralin	OCRL	OCRL-WATER-PEST_05	GC-MS/MS	Dissolved	ng/L	2.7	5.4	400	
Ethofenprox	OCRL	OCRL-WATER-PEST_05	GC-MS/MS	Particulate	ng/L	1.7	3.4	170	
Ethofenprox	OCRL	OCRL-WATER-PEST_05	GC-MS/MS	Dissolved	ng/L	1.2	2.3	170	
Etoxazole	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Particulate	ng/L	1.9	3.7	130	
Etoxazole	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Dissolved	ng/L	1.2	2.4	130	
Famoxadone	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Particulate	ng/L	9	18	85	
Famoxadone	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Dissolved	ng/L	6.9	13.9	85	
Fenamidone	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Particulate	ng/L	1	1.9	4,700	
Fenamidone	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Dissolved	ng/L	1	1.9	4,700	
Fenbuconazole	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Particulate	ng/L	1.5	2.9	27,000	
Fenbuconazole	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Dissolved	ng/L	0.9	1.8	27,000	
Fenhexamid	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Particulate	ng/L	10.4	20.8	101,000	
Fenhexamid	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Dissolved	ng/L	10.3	20.5	101,000	
Fenpropathrin	OCRL	OCRL-WATER-PEST_05	GC-MS/MS	Particulate	ng/L	1.7	3.3	1.5	
Fenpropathrin	OCRL	OCRL-WATER-PEST_05	GC-MS/MS	Dissolved	ng/L	1.1	2.2	1.5	
Fenpyroximate	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Particulate	ng/L	2.2	4.3	16	
Fenpyroximate	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Dissolved	ng/L	1.5	3	16	
Fipronil	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Particulate	ng/L	1.2	2.4	11	
Fipronil	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Dissolved	ng/L	0.9	1.8	11	

Constituent (CEDEN Analyte Name)	Agency	Method	Analysis	Fraction	Units	MDL	RL	Water Quality Metric	SOP
Fipronil Desulfinyl	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Particulate	ng/L	1	2.1	530	
Fipronil Desulfinyl	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Dissolved	ng/L	1	2	530	
Fipronil Desulfinyl Amide	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Particulate	ng/L	1.2	2.4	--	
Fipronil Desulfinyl Amide	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Dissolved	ng/L	1.2	2.4	--	
Fipronil Sulfide	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Particulate	ng/L	1	1.9	830	
Fipronil Sulfide	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Dissolved	ng/L	0.8	1.5	830	
Fipronil Sulfone	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Particulate	ng/L	1.2	2.4	220	
Fipronil Sulfone	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Dissolved	ng/L	0.9	1.7	220	
Flonicamid	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Particulate	ng/L	2.5	5	200,000	
Flonicamid	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Dissolved	ng/L	1.2	2.4	200,000	
Florpyrauxifen-Benzyl	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Particulate	ng/L	1.7	3.3	16.2	
Florpyrauxifen-Benzyl	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Dissolved	ng/L	1.5	3.1	16.2	
Fluazinam	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Particulate	ng/L	1.4	2.8	690	
Fluazinam	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Dissolved	ng/L	1.2	2.4	690	
Fludioxonil	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Particulate	ng/L	1.3	2.7	14,000	
Fludioxonil	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Dissolved	ng/L	1	2.1	14,000	
Flufenacet	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Particulate	ng/L	1.9	3.8	2,450	
Flufenacet	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Dissolved	ng/L	1.8	3.7	2,450	
Fluindapyr	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Particulate	ng/L	1.6	3.2	31,000	
Fluindapyr	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Dissolved	ng/L	1.4	2.7	31,000	
Flumetralin	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Particulate	ng/L	1.9	3.8	10,000,000	
Flumetralin	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Dissolved	ng/L	1.7	3.4	10,000,000	
Fluopicolide	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Particulate	ng/L	1.9	3.8	151,000	
Fluopicolide	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Dissolved	ng/L	0.8	1.6	151,000	
Fluopyram	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Particulate	ng/L	1.8	3.6	71,000	

Constituent (CEDEN Analyte Name)	Agency	Method	Analysis	Fraction	Units	MDL	RL	Water Quality Metric	SOP
Fluopyram	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Dissolved	ng/L	0.8	1.5	71,000	
Fluoxastrobin	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Particulate	ng/L	1.9	3.8	45,000	
Fluoxastrobin	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Dissolved	ng/L	1.4	2.8	45,000	
Flupyradifurone	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Particulate	ng/L	1.7	3.3	460,000	
Flupyradifurone	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Dissolved	ng/L	0.7	1.4	460,000	
Fluridone	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Particulate	ng/L	2.1	4.2	480,000	
Fluridone	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Dissolved	ng/L	1.5	2.9	480,000	
Flutolanil	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Particulate	ng/L	1.9	3.7	220,000	
Flutolanil	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Dissolved	ng/L	1.3	2.6	220,000	
Flutriafol	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Particulate	ng/L	1.9	3.8	300,000	
Flutriafol	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Dissolved	ng/L	1.4	2.7	300,000	
Fluxapyroxad	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Particulate	ng/L	1.7	3.4	120,000	
Fluxapyroxad	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Dissolved	ng/L	0.7	1.4	120,000	
Halauxifen-methyl	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Particulate	ng/L	1.1	2.2	135	
Halauxifen-methyl	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Dissolved	ng/L	0.7	1.4	135	
Hexazinone	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Particulate	ng/L	1.7	3.3	7,000	
Hexazinone	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Dissolved	ng/L	0.6	1.2	7,000	
Hydroxy-Boscalid, 5-	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Particulate	ng/L	1.7	3.3	--	
Hydroxy-Boscalid, 5-	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Dissolved	ng/L	0.8	1.6	--	
Hydroxy-Imidacloprid, 5-	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Particulate	ng/L	2.2	4.4	--	
Hydroxy-Imidacloprid, 5-	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Dissolved	ng/L	2	4.1	--	
Imazalil	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Dissolved	ng/L	1.5	3	639,000	
Imidacloprid	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Particulate	ng/L	1	2.1	10	
Imidacloprid	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Dissolved	ng/L	1	2	10	
Imidacloprid olefin	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Particulate	ng/L	5.5	11	--	

Constituent (CEDEN Analyte Name)	Agency	Method	Analysis	Fraction	Units	MDL	RL	Water Quality Metric	SOP
Imidacloprid olefin	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Dissolved	ng/L	3.3	6.6	--	
Imidacloprid urea	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Particulate	ng/L	2	4	47,400,000	
Imidacloprid urea	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Dissolved	ng/L	1.4	2.8	47,400,000	
Indaziflam	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Particulate	ng/L	2	4	100,000	
Indaziflam	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Dissolved	ng/L	0.8	1.7	100,000	
Indoxacarb	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Particulate	ng/L	1.7	3.5	75,000	
Indoxacarb	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Dissolved	ng/L	1.6	3.2	75,000	
Ipconazole	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Particulate	ng/L	2.1	4.1	180	
Ipconazole	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Dissolved	ng/L	1.2	2.4	180	
Iprodione	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Particulate	ng/L	1.9	3.8	120,000	
Iprodione	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Dissolved	ng/L	1.2	2.4	120,000	
Isofetamid	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Particulate	ng/L	1.5	3	86,000	
Isofetamid	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Dissolved	ng/L	1.7	3.3	86,000	
Kresoxim-methyl	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Particulate	ng/L	1.6	3.1	30,300	
Kresoxim-methyl	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Dissolved	ng/L	1.1	2.2	30,300	
Malaoxon	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Particulate	ng/L	1.9	3.8	--	
Malaoxon	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Dissolved	ng/L	0.7	1.4	--	
Malathion	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Particulate	ng/L	2	4	49	
Malathion	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Dissolved	ng/L	1.1	2.2	49	
Mandestrobin	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Particulate	ng/L	1.7	3.3	5,400,000	
Mandestrobin	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Dissolved	ng/L	1.6	3.2	5,400,000	
Mandipropamid	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Particulate	ng/L	2.3	4.6	220,000	
Mandipropamid	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Dissolved	ng/L	1.3	2.6	220,000	
Metalaxyl	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Particulate	ng/L	2.2	4.4	1,200,000	
Metalaxyl	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Dissolved	ng/L	0.6	1.1	1,200,000	
Metalaxyl-hydroxymethyl	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Particulate	ng/L	2	4	--	

Constituent (CEDEN Analyte Name)	Agency	Method	Analysis	Fraction	Units	MDL	RL	Water Quality Metric	SOP
Metalaxyl-hydroxymethyl	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Dissolved	ng/L	1.3	2.5	--	
Metconazole	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Particulate	ng/L	2.1	4.1	2,900	
Metconazole	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Dissolved	ng/L	1	2.1	2,900	
Methoprene	OCRL	OCRL-WATER-PEST_05	GC-MS/MS	Particulate	ng/L	6.8	13.5	48,000	
Methoprene	OCRL	OCRL-WATER-PEST_05	GC-MS/MS	Dissolved	ng/L	5.8	11.6	48,000	
Methoxyfenozide	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Particulate	ng/L	1.5	3.1	3,100	
Methoxyfenozide	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Dissolved	ng/L	1	1.9	3,100	
Metolachlor	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Particulate	ng/L	1.5	3	1,000	
Metolachlor	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Dissolved	ng/L	1.5	3.1	1,000	
Myclobutanil	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Particulate	ng/L	2.1	4.2	150,000	
Myclobutanil	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Dissolved	ng/L	0.6	1.1	150,000	
Naled	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Particulate	ng/L	11.8	23.7	10	
Naled	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Dissolved	ng/L	10.6	21.1	10	
Napropamide	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Particulate	ng/L	1.5	3	350,000	
Napropamide	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Dissolved	ng/L	1	2	350,000	
Nitrapyrin	OCRL	OCRL-WATER-PEST_05	GC-MS/MS	Particulate	ng/L	1.6	3.3	103,000	
Nitrapyrin	OCRL	OCRL-WATER-PEST_05	GC-MS/MS	Dissolved	ng/L	1.1	2.1	103,000	
Novaluron	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Particulate	ng/L	2.2	4.4	30	
Novaluron	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Dissolved	ng/L	2.2	4.5	30	
Oryzalin	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Particulate	ng/L	1.6	3.2	13,000	
Oryzalin	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Dissolved	ng/L	2.1	4.2	13,000	
Oxadiazon	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Particulate	ng/L	1.9	3.9	880	
Oxadiazon	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Dissolved	ng/L	1.2	2.4	880	
Oxathiapiprolin	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Particulate	ng/L	1.5	3	140,000	
Oxathiapiprolin	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Dissolved	ng/L	1.4	2.7	140,000	
Oxyfluorfen	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Particulate	ng/L	1.3	2.5	290	

Constituent (CEDEN Analyte Name)	Agency	Method	Analysis	Fraction	Units	MDL	RL	Water Quality Metric	SOP
Oxyfluorfen	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Dissolved	ng/L	1.4	2.7	290	
Paclobutrazol	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Particulate	ng/L	2.3	4.5	8,000	
Paclobutrazol	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Dissolved	ng/L	1.1	2.2	8,000	
PCNB	OCRL	OCRL-WATER-PEST_05	GC-MS/MS	Particulate	ng/L	3	6	6,000	
PCNB	OCRL	OCRL-WATER-PEST_05	GC-MS/MS	Dissolved	ng/L	1.4	2.9	6,000	
Pendimethalin	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Particulate	ng/L	2	3.9	5,200	
Pendimethalin	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Dissolved	ng/L	1.5	3	5,200	
Penoxsulam	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Dissolved	ng/L	2.2	4.4	3,000	
Pentachloroanisole	OCRL	OCRL-WATER-PEST_05	GC-MS/MS	Particulate	ng/L	2.3	4.7	--	
Pentachloroanisole	OCRL	OCRL-WATER-PEST_05	GC-MS/MS	Dissolved	ng/L	1.2	2.3	--	
Penthiopyrad	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Particulate	ng/L	1.9	3.9	100,000	
Penthiopyrad	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Dissolved	ng/L	1.1	2.2	100,000	
Permethrin, Total	OCRL	OCRL-WATER-PEST_05	GC-MS/MS	Particulate	ng/L	0.7	1.5	3.3	
Permethrin, Total	OCRL	OCRL-WATER-PEST_05	GC-MS/MS	Dissolved	ng/L	1.1	2.2	3.3	
Phenothrin	OCRL	OCRL-WATER-PEST_05	GC-MS/MS	Particulate	ng/L	1.3	2.6	470	
Phenothrin	OCRL	OCRL-WATER-PEST_05	GC-MS/MS	Dissolved	ng/L	2.1	4.2	470	
Phosmet	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Particulate	ng/L	1.6	3.3	750	
Phosmet	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Dissolved	ng/L	0.7	1.4	750	
Picarbutrazox	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Particulate	ng/L	1.6	3.2	76,000	
Picarbutrazox	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Dissolved	ng/L	1.3	2.7	76,000	
Picoxystrobin	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Particulate	ng/L	2	4.1	1,000	
Picoxystrobin	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Dissolved	ng/L	1.3	2.6	1,000	
Piperonyl Butoxide	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Particulate	ng/L	2.1	4.3	30,000	
Piperonyl Butoxide	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Dissolved	ng/L	1	2.1	30,000	
Prodiamine	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Particulate	ng/L	2.1	4.1	1,500	
Prodiamine	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Dissolved	ng/L	2.2	4.4	1,500	
Prometon	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Particulate	ng/L	1.4	2.8	98,000	

Constituent (CEDEN Analyte Name)	Agency	Method	Analysis	Fraction	Units	MDL	RL	Water Quality Metric	SOP
Prometon	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Dissolved	ng/L	1.5	2.9	98,000	
Prometryn	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Particulate	ng/L	1.7	3.3	1,040	
Prometryn	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Dissolved	ng/L	0.7	1.4	1,040	
Propanil	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Particulate	ng/L	1.9	3.8	9,100	
Propanil	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Dissolved	ng/L	1.2	2.5	9,100	
Propargite	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Particulate	ng/L	1.7	3.4	7,000	
Propargite	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Dissolved	ng/L	1.2	2.4	7,000	
Propiconazole	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Particulate	ng/L	1.3	2.6	15,000	
Propiconazole	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Dissolved	ng/L	0.7	1.5	15,000	
Propyzamide	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Particulate	ng/L	1.9	3.7	77,000	
Propyzamide	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Dissolved	ng/L	1	2.1	77,000	
Pydiflumetofen	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Particulate	ng/L	2	4.1	540,000	
Pydiflumetofen	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Dissolved	ng/L	1	2.1	540,000	
Pyraclostrobin	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Particulate	ng/L	1.8	3.6	1,500	
Pyraclostrobin	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Dissolved	ng/L	1.5	2.9	1,500	
Pyridaben	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Particulate	ng/L	1.3	2.6	44	
Pyridaben	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Dissolved	ng/L	1.4	2.7	44	
Pyrimethanil	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Particulate	ng/L	1.1	2.2	20,000	
Pyrimethanil	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Dissolved	ng/L	1.3	2.6	20,000	
Pyriproxyfen	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Particulate	ng/L	1.7	3.3	15	
Pyriproxyfen	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Dissolved	ng/L	1.1	2.3	15	
Quinoxyfen	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Particulate	ng/L	1.7	3.4	13,000	
Quinoxyfen	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Dissolved	ng/L	1.1	2.3	13,000	
Sedaxane	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Particulate	ng/L	1.5	3	650,000	
Sedaxane	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Dissolved	ng/L	0.9	1.8	650,000	
Simazine	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Particulate	ng/L	1.4	2.7	4,000	
Simazine	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Dissolved	ng/L	1.2	2.4	4,000	

Constituent (CEDEN Analyte Name)	Agency	Method	Analysis	Fraction	Units	MDL	RL	Water Quality Metric	SOP
Sulfoxaflor	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Particulate	ng/L	2.4	4.8	300,000	
Sulfoxaflor	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Dissolved	ng/L	1.2	2.4	300,000	
Tebuconazole	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Particulate	ng/L	2.3	4.6	11,000	
Tebuconazole	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Dissolved	ng/L	0.6	1.3	11,000	
Tebuconazole-tert-Butylhydroxy	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Dissolved	ng/L	0.7	1.3	--	
Tebufenozide	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Particulate	ng/L	1.5	3	29,000	
Tebufenozide	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Dissolved	ng/L	1.2	2.4	29,000	
Tebupirimfos	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Particulate	ng/L	2.3	4.6	11	
Tebupirimfos	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Dissolved	ng/L	1.3	2.5	11	
Tebupirimfos oxon	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Particulate	ng/L	1.4	2.8	--	
Tebupirimfos oxon	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Dissolved	ng/L	0.8	1.5	--	
Tefluthrin	OCRL	OCRL-WATER-PEST_05	GC-MS/MS	Particulate	ng/L	1.2	2.4	4	
Tefluthrin	OCRL	OCRL-WATER-PEST_05	GC-MS/MS	Dissolved	ng/L	0.7	1.3	4	
Tetraconazole	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Particulate	ng/L	2.3	4.6	43,000	
Tetraconazole	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Dissolved	ng/L	0.6	1.2	43,000	
Tetramethrin	OCRL	OCRL-WATER-PEST_05	GC-MS/MS	Particulate	ng/L	1.4	2.7	1,850	
Tetramethrin	OCRL	OCRL-WATER-PEST_05	GC-MS/MS	Dissolved	ng/L	1.1	2.2	1,850	
T-Fluvalinate	OCRL	OCRL-WATER-PEST_05	GC-MS/MS	Particulate	ng/L	1.1	2.1	64	
T-Fluvalinate	OCRL	OCRL-WATER-PEST_05	GC-MS/MS	Dissolved	ng/L	0.9	1.9	64	
Thiabendazole	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Particulate	ng/L	2.2	4.5	42,000	
Thiabendazole	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Dissolved	ng/L	1.7	3.4	42,000	
Thiacloprid	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Particulate	ng/L	2.2	4.3	970	
Thiacloprid	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Dissolved	ng/L	1.2	2.5	970	
Thiamethoxam	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Particulate	ng/L	1.7	3.5	740	
Thiamethoxam	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Dissolved	ng/L	0.6	1.1	740	

Constituent (CEDEN Analyte Name)	Agency	Method	Analysis	Fraction	Units	MDL	RL	Water Quality Metric	SOP
Thiamethoxam Degradate (CGA-355190)	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Particulate	ng/L	2.6	5.2	--	
Thiamethoxam Degradate (CGA-355190)	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Dissolved	ng/L	1.4	2.9	--	
Thiamethoxam Degradate (NOA-407475)	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Dissolved	ng/L	2.7	5.4	--	
Thiobencarb	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Particulate	ng/L	2	4	1,000	
Thiobencarb	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Dissolved	ng/L	1.2	2.4	1,000	
Tolfenpyrad	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Particulate	ng/L	1.7	3.5	81.5	
Tolfenpyrad	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Dissolved	ng/L	1.6	3.3	81.5	
Triadimefon	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Particulate	ng/L	1.7	3.4	52,000	
Triadimefon	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Dissolved	ng/L	1.3	2.6	52,000	
Triadimenol	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Particulate	ng/L	1.1	2.2	20,000	
Triadimenol	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Dissolved	ng/L	1.2	2.4	20,000	
Triallate	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Particulate	ng/L	4.8	9.6	14,000	
Triallate	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Dissolved	ng/L	4.7	9.4	14,000	
Tributyl Phosphorotrithioate, S,S,S-	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Particulate	ng/L	1.1	2.2	1,000	
Tributyl Phosphorotrithioate, S,S,S-	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Dissolved	ng/L	1.4	2.8	1,000	
Trifloxystrobin	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Particulate	ng/L	2	4	2,760	
Trifloxystrobin	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Dissolved	ng/L	1.3	2.6	2,760	
Triflumizole	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Particulate	ng/L	1.6	3.1	33,000	

Constituent (CEDEN Analyte Name)	Agency	Method	Analysis	Fraction	Units	MDL	RL	Water Quality Metric	SOP
Triflumizole	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Dissolved	ng/L	1.3	2.6	33,000	
Trifluralin	OCRL	OCRL-WATER-PEST_05	GC-MS/MS	Particulate	ng/L	2.2	4.3	1,900	
Trifluralin	OCRL	OCRL-WATER-PEST_05	GC-MS/MS	Dissolved	ng/L	1.3	2.6	1,900	
Triticonazole	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Particulate	ng/L	1.9	3.7	1,000,000	
Triticonazole	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Dissolved	ng/L	1.3	2.6	1,000,000	
Valifenalate	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Particulate	ng/L	2.4	4.8	500,000	
Valifenalate	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Dissolved	ng/L	1	2	500,000	
Zoxamide	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Particulate	ng/L	1.9	3.8	3,480	
Zoxamide	OCRL	OCRL-WATER-PEST_05	LC-MS/MS	Dissolved	ng/L	1.2	2.4	3,480	

14 QUALITY CONTROL

This project will comply with the QC guidelines and corrective actions listed in **Table 15** (field sampling QC) and **Table 16** (analytical QC). Field QC frequencies are calculated to ensure that a minimum of 5% of all analyses are for QC purposes (both field duplicate and field blanks). The percent total is calculated as follows:

$$\%\ Total\ =\ \left(\frac{N_{FB}\ or\ N_{FD}}{N_E}\right)\ \times 100$$

N_{FB} = The number of field blanks
N_{FD} = The number of field duplicates
N_E = The number of environmental samples

All analytical QC samples must be analyzed at a frequency of 1 per analytical batch; an analytical batch is not to exceed 20 environmental samples. Quality Control activities for this project are listed in the **Table 15** and **Table 16**.

Precision is assessed through a combination of field duplicate samples and laboratory duplicate samples. Precision of a pair of samples is measured as the relative percent difference (RPD) between a sample and its duplicate—a laboratory control sample (LCS) and its duplicate (LCSD), a matrix spike (MS) and matrix spike duplicate (MSD), an environmental sample (E) and field duplicate (FD), or an environmental sample and its associated laboratory generated duplicate. It is calculated as follows:

$$RPD\,(\%)\ =\ \left|\frac{2(V_i\ -\ V_D)}{V_i\ +\ V_D}\right|\ \times 100$$

V_i = The measured concentration of the initial sample
V_D = The measured concentration of the sample duplicate

For precision assessment purposes any laboratory duplicate, including a matrix spike duplicate, an un-spiked environmental laboratory duplicate, or a lab control spike duplicate, may function as the lab duplicate in any batch.

Accuracy is assessed using either an LCS or MS. For an LCS lab water is spiked with a known concentration of a target analyte and the percent recovery (PR) is reported. The PR in an LCS is calculated as follows:

$$\%\ Recovery\ =\ \left(\frac{V_{LCS}}{V_{Spike}}\right)\ \times 100$$

V_{LCS} = The measured concentration of the spiked control sample
V_{Spike} = The expected spike concentration

A MS can also be used to assess accuracy. For an MS, environmental water is spiked with a known concentration of a target analyte and the PR is reported. The PR in an MS is calculated as follows:

$$\%\ Recovery = \left(\frac{V_{MS} - V_E}{V_{Spike}}\right) \times 100$$

V_{MS} = The measured concentration of the spiked matrix sample
V_{Spike} = The concentration of the spike added
V_E = The measured concentration of the original (unspiked) matrix sample

The MS should not be used solely to assess accuracy due the likelihood of matrix interference however if an LCS does not fall within acceptance criteria an MS may be used to validate a batch if the MS is within acceptance criteria. Some constituents are difficult to spike and therefore a laboratory may choose to analyze a certified/standard reference material (CRM or SRM). A CRM or SRM analysis may be used in place of an LCS analysis.

For MS samples previously performed by the USGS OCRL, the initial concentration used in recovery calculations for spiked samples was adjusted based on the measured spike verification results to account for variability resulting from analyte loss or concentration of the matrix spike solutions. Samples will no longer be adjusted for this variability; all calculations of spike recoveries will assume the target concentration of the original standard stock as the original concentration.

Positive control samples evaluated for analyte performance by the USGS OCRL are spiked upon completion of the filtration step for each individual fraction analyzed. At a minimum of once per water year, the OCRL will perform an analysis of samples spiked on the whole sample volume, filtered into the individual fractions, and assessed based on both fraction results as a quality control check to demonstrate acceptable recoveries on the basis of the total fraction.

When quality control sample results do not meet the data quality objectives provided in this QAPP the laboratory must implement corrective measures as outlined in **Table 16**. Detections in blanks must be sourced and field, analytical, or cleaning practices must be modified to reduce the risk of further contamination. Excessive RPD values or percent recoveries outside of criteria may also require a change of field or laboratory practices. Exceedances of analytical control limits must be reported in the appropriate lab report and qualified in the EDD according to the procedures outlined in the Data Management SOP.

If corrective measures require reanalysis of the sample, and the results repeatedly fail to meet the objectives, then the lab is obligated to halt the analysis of samples, identify the source of the imprecision, and make corrections where appropriate before proceeding. In

scenarios where the actions outlined below cannot be completed and/or results cannot be brought within control limits the laboratory must notify the Program Manager and the Program QA Officer as soon as possible and provide the appropriate documentation and details of corrective actions taken. Specifics regarding the type of failure, reasons for failure, and any laboratory corrective actions that were already initiated will be provided to the CVRWQCB QA Representative, and the TAC within seven calendar days of notification. Any additional corrective actions required by the CVRWQCB QA Representative or requested by TAC members will then be communicated back to the laboratory by the Program Manager.

Control failures that cannot be rectified are documented with a QAPP Deviation Form (**Figure 10**) and submitted to the CVRWQCB for approval.

If results for any field duplicates and associated environmental samples do not meet the data quality objectives listed in the above tables then the samplers must assess sampling practices and make corrections to their field procedures which will ensure homogeneity in the samples before proceeding. Any deviation from the sampling procedures outlined in this QAPP must approved by the CVRWQCB QA Representative prior to implementation (if anticipated) or be reported to within seven calendar days (if unanticipated).

Analytical QC results must adhere to the minimum limits of error and frequency requirements detailed in **Table 16.**

Table 15. Field sampling QC.

Sample Type	Frequency	Acceptable Limits	Corrective Action	Sampling SOP
Ancillary Parameters				
Field Blank	5% annual total	< RL	Investigate and remove sources of contamination.	**Appendix I**
Field Duplicate	5% annual total	RPD ≤25% if native concentrations ≥ RL	Determine cause, take appropriate corrective action.	
Trace Metals				
Field Blank	5% annual total	< RL	Investigate and remove sources of contamination.	**Appendix I**
Field Duplicate	5% annual total	RPD ≤25% if native concentrations ≥ RL	Determine cause, take appropriate corrective action.	
Pesticides				
Field Blank	5% annual total	< RL	Investigate and remove sources of contamination.	**Appendix I**
Field Duplicate	5% annual total	RPD ≤25% if native concentrations ≥ RL	Determine cause, take appropriate corrective action.	
Aquatic Toxicity				

Sample Type	Frequency	Acceptable Limits	Corrective Action	Sampling SOP
Field Duplicate	5% annual total	RPD ≤25%	Determine cause, take appropriate corrective action.	**Appendix I**

Table 16. Analytical QC.

Sample Type	Frequency	Acceptable Limits	Corrective Action	Analytical SOP
Ancillary Parameters by EPA 160.2 — TSS				
Laboratory Blank	1 per 20 samples, minimum 1 per batch	< MDL	Determine cause of problem, remove sources of contamination, reanalyze suspect samples or flag all suspect data.	--
Laboratory Duplicate	1 per 20 samples, minimum 1 per batch	RPD<25% (n/a if native concentration of either sample<RL)	Visually inspect the samples to determine if a high RPD could be attributed to sample heterogeneity. Reanalyze suspect samples or qualify the results and document the heterogeneity.	--
Ancillary Parameters				
Laboratory Blanks	1 per 20 samples, minimum 1 per batch	< MDL	Determine cause of problem, remove sources of contamination, reanalyze suspect samples or flag all suspect data.	**Appendix III** – Organic Carbon by SM 5310 B, TKN by EPA 351.2, Cations by EPA 200.7
Laboratory Control Spike	1 per 20 samples, minimum 1 per batch	80-120%	Determine cause, take appropriate corrective action. Recalibrate and reanalyze all suspect samples or flag all suspect data.	
Matrix Spike	1 per 20 samples, minimum 1 per batch	80-120%	Determine cause, take appropriate corrective action. Recalibrate and reanalyze all suspect samples or flag all suspect data.	
Matrix Spike Duplicate	1 per 20 samples, minimum 1 per batch	RPD ≤ 25	Determine cause, take appropriate corrective action. Recalibrate and reanalyze all suspect samples or flag all suspect data.	

Sample Type	Frequency	Acceptable Limits	Corrective Action	Analytical SOP
Trace Metals				
Laboratory Blanks	1 per 20 samples, minimum 1 per batch	< MDL	Determine cause of problem, remove sources of contamination, reanalyze suspect samples or flag all suspect data.	**Appendix III** – Trace Elements by EPA 200.8
Laboratory Control Spike	1 per 20 samples, minimum 1 per batch	75-125%	Determine cause, take appropriate corrective action. Recalibrate and reanalyze all suspect samples or flag all suspect data.	
Matrix Spike	1 per 20 samples, minimum 1 per batch	75-125%	Determine cause, take appropriate corrective action. Recalibrate and reanalyze all suspect samples or flag all suspect data.	
Matrix Spike Duplicate	1 per 20 samples, minimum 1 per batch	RPD ≤ 25	Determine cause, take appropriate corrective action. Recalibrate and reanalyze all suspect samples or flag all suspect data.	
Pesticides				
Laboratory Blanks	1 per 20 samples, minimum 1 per batch	< MDL	Determine cause of problem, remove sources of contamination, reanalyze suspect samples or flag all suspect data.	**Appendix III** – SOP - OCRL-WATER-PEST_05
Laboratory Control Spike	1 per 20 samples, minimum 1 per batch	70-130%	Determine cause, take appropriate corrective action. Recalibrate and reanalyze all suspect samples or flag all suspect data.	
Matrix Spike	1 per 20 samples	70-130%	Determine cause, take appropriate corrective action. Recalibrate and reanalyze all suspect samples or flag all suspect data.	

Sample Type	Frequency	Acceptable Limits	Corrective Action	Analytical SOP
Matrix Spike Duplicate	1 per 20 samples	RPD ≤ 25	Determine cause, take appropriate corrective action. Recalibrate and reanalyze all suspect samples or flag all suspect data.	
Surrogates	Every sample	70-130%	Determine cause, take appropriate corrective action. Recalibrate and reanalyze all suspect samples or flag all suspect data.	
Aquatic Toxicity				
Lab Control Sample, *Ceriodaphnia dubia*	1 per 20 samples, minimum 1 per batch	≥80% mean survival; 60% of the surviving control females must produce 3 broods with an average of 15 or more young per female; all performance criteria outlined in SOP are met.	Determine cause, take appropriate corrective action. Reanalyze all suspect data.	**Appendix III** – Chronic S. capricornutum Growth, Chronic C. dubia Survival and Reproduction, Chronic P. promelas Survival and Growth, Acute H. azteca Survival, Chronic C. dilutus Survival and Growth
Lab Control Sample, *Chironomus dilutus*	1 per 20 samples, minimum 1 per batch	≥80% mean survival; an average of ≥0.60 mg ash-free dry weight for surviving individuals; all performance criteria outlined in SOP are met.	Determine cause, take appropriate corrective action. Reanalyze all suspect data.	
Lab Control Sample, *Hyalella azteca*	1 per 20 samples, minimum 1 per batch	≥90% mean survival in the controls; all performance criteria outlined in SOP are met.	Determine cause, take appropriate corrective action. Reanalyze all suspect data.	

Sample Type	Frequency	Acceptable Limits	Corrective Action	Analytical SOP
Lab Control Sample, *Pimephales promelas*	1 per 20 samples, minimum 1 per batch	≥80% mean survival; an average of ≥0.25 mg dry weight for surviving individuals; all performance criteria outlined in SOP are met.	Determine cause, take appropriate corrective action. Reanalyze all suspect data.	
Lab Control Sample, *Selenastrum capricornutum*	1 per 20 samples, minimum 1 per batch	≥ 200,000 cells/mL; variability of control replicates ≤ 20%; all performance criteria outlined in SOP are met.	Determine cause, take appropriate corrective action. Reanalyze all suspect data.	

*For the purposes of this project it is acceptable for the matrix spike duplicate or the laboratory control duplicate to stand in for the lab duplicate as a measure of the precision of the analytical method.

14.1 ADDITIONAL TOXICITY CONTROLS FOR *CERIODAPHNIA DUBIA*

Toxicity testing according to SWAMP MQOs describes the recommendation for secondary conductivity controls when an ambient sample specific conductivity is outside of the physiological range of the test organisms. These can be either high-conductivity controls (i.e., synthetic control waters salted up to match the highest conductivity of the ambient samples collected) or low-conductivity controls (i.e., synthetic control waters diluted with de-ionized water to match the lowest conductivity of the ambient samples collected). The latter will include nutrients (i.e., biotin, sodium selenate, and vitamin B_{12},, and thiamine hydrochloride) added to match the target concentrations in culture water. Secondary controls will be tested as outlined below.

Depending on the conductivity range observed in ambient sample waters, additional negative controls may be tested to control for water quality near the organisms' tolerance screening value. **Figure 8** and **Figure 9** outline procedures for how low-conductivity controls for *C. dubia* toxicity testing should be handled. **Figure 8** is a flowchart depicting what controls the lab should prepare based on the range of conductivity in ambient samples. **Figure 9** is a flowchart showing to which control each ambient sample should be compared

SWAMP guidance states that for *C. dubia* toxicity testing, the sample conductivity should be above 100 µS/cm; however, previous Delta RMP testing found that *C. dubia* reproduction in cultures may be affected by conductivity as high as 127 µS/cm. Therefore, the lab shall run a tolerance control matching the lowest sample conductivity when there are sample(s) with conductivity ≤ 130 µS/cm. The laboratory will also have discretion to run a second tolerance control when there are multiple samples with conductivity ≤ 130 µS/cm (i.e., if samples with conductivity ≤ 130 µS/cm have a difference of at least 50 µS/cm).

Figure 8. Flowchart illustrating procedure for preparing the appropriate low-conductivity controls for *C. dubia* toxicity testing.

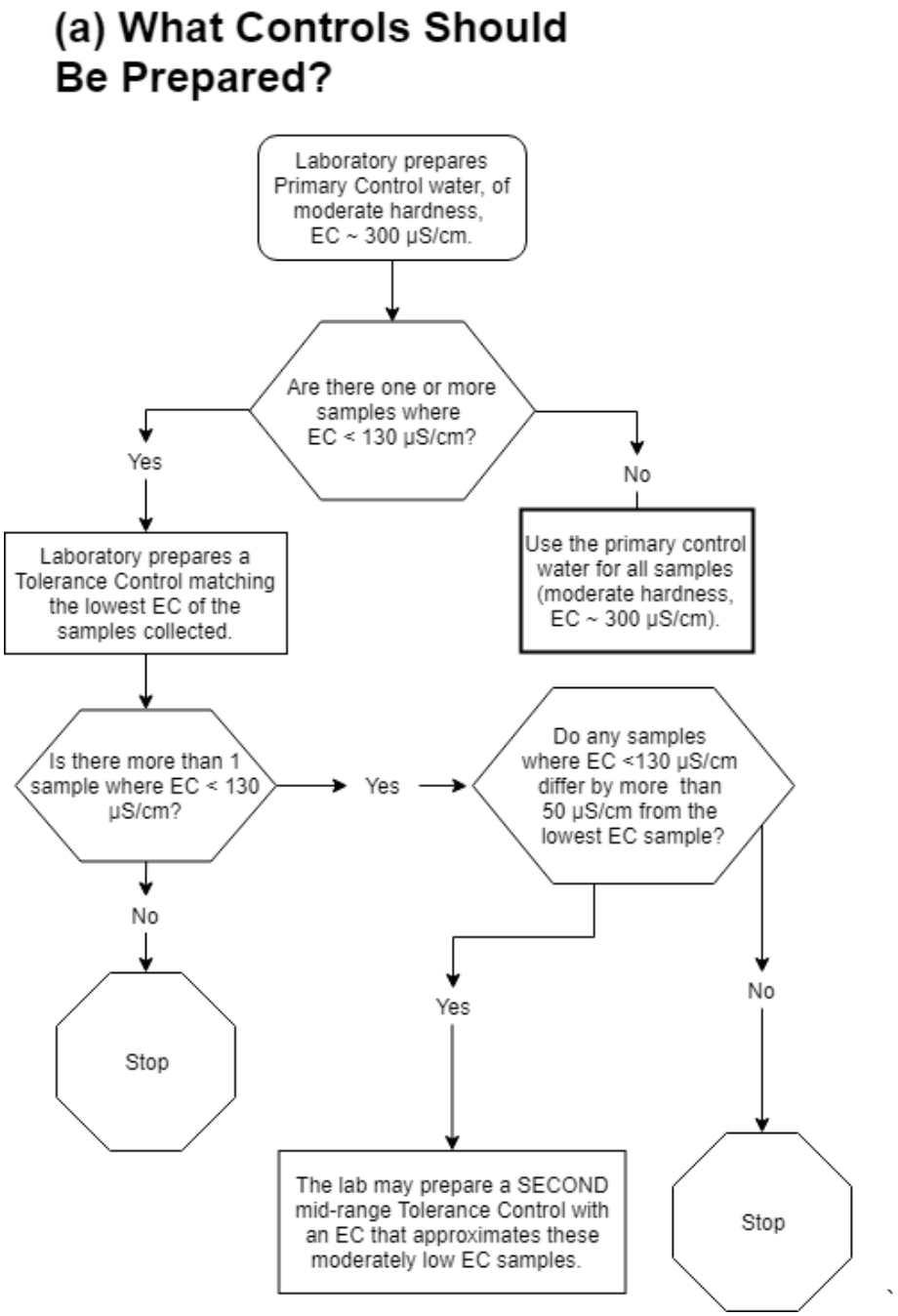
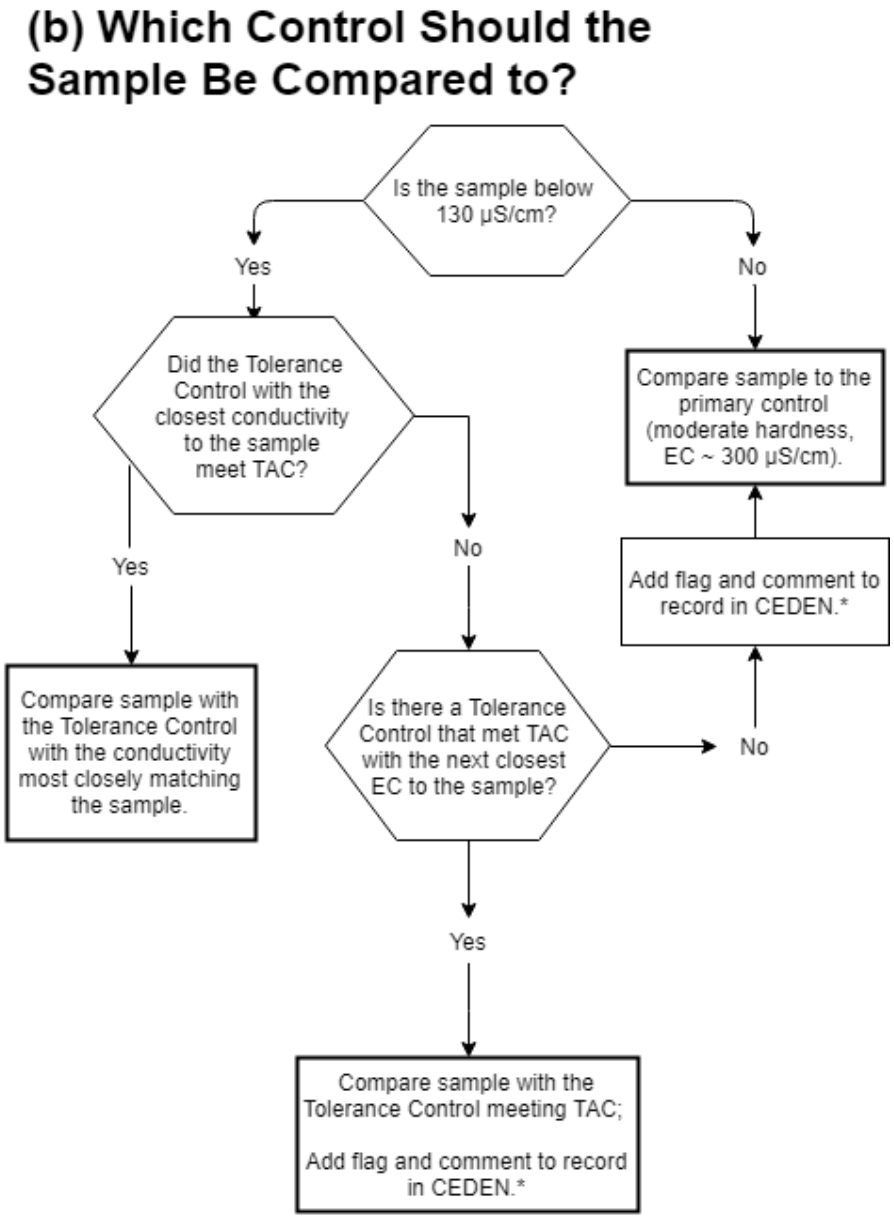


Figure 9. Flowchart illustrating procedure for selecting the appropriate low-conductivity controls for *C. dubia* toxicity testing.



Samples will be compared with the appropriate negative control. This will be the negative control (i.e., primary or tolerance control) with water quality (i.e., specific conductance) most closely matching the sample when multiple negative controls are included as part of a toxicity test. See the SWAMP 2018 Memo: "Use of Additional Controls in SWAMP Toxicity Tests."

Statistical analyses shall follow the method and SWAMP memo for additional controls. Specifically:

- Samples with conductivity > 130 µS/cm will be compared with the primary control.
    - If the primary control does not meet Test Acceptability Criteria, then results are rejected. Retesting the sample and control can be considered.
- Samples with conductivity ≤ 130 µS/cm will be compared with the tolerance control. If there is more than one tolerance control then samples with ≤ 130 µS/cm will be compared with the tolerance control with water quality (i.e., conductivity) most closely matching the sample.
    - If the tolerance control with water quality (i.e., conductivity) most closely matching the sample does not meet Test Acceptability Criteria then either:
        - 1) Compare the sample with the other tolerance control if the other tolerance control meets Test Acceptability Criteria. Add a flag and a comment to the record in CEDEN.
        - 2) Compare the sample with the primary control if there was no other tolerance control that met Test Acceptability Criteria. Add a flag and a comment to the record in CEDEN.

In cases where sample conductivity is low, but the low-conductivity tolerance control does not meet test acceptability criteria, the sample should be compared to the regular, medium-hardness control which has higher EC (**Figure 9**). In such cases, the result of the statistical comparison may indicate that the sample is toxic, but it may not be (entirely) due to toxic contaminants, but rather due to a deficiency of ions that *C. dubia* need in order to thrive. Therefore, add a comment to the CEDEN database field **ToxTestComments** (limit 255 characters) as follows: "Tolerance control based on sample conductivity did not meet test acceptability criteria; percent effect based on comparison with standard control. Effects may include response to low EC in sample." In addition, it is also appropriate to add a "TW" flag to the field ToxResultQACode. This code means, "Water quality parameters outside recommended test method ranges."

Sample comparisons with the primary control will generally determine toxicity due to contaminants in the sample when the sample is not outside or near the organisms' limit of tolerance. Likewise, comparing samples outside or near an organism's tolerance limit with the appropriate tolerance control accounts for possible background water quality effects to indicate effects due to contaminants. These comparisons will help answer the Delta RMP Assessment Question 1 (Status and Trends) "To what extent do current use pesticides contribute to observed toxicity in the Delta?" by identifying toxicity effects due to contaminants (e.g., pesticides).

When a tolerance control fails to meet Test Acceptability Criteria, it is an indication that the background water quality does not support the test organism and that the toxicity endpoint is not a reliable indicator of the effects due to contaminants in samples with similar water quality. Background water quality effects may be included in the observed

effects when comparisons are made between a sample at or near an organism's tolerance limit and the primary control when the tolerance control fails to meet test acceptability criteria. This may describe the 'absolute toxicity' of a sample (i.e., difference between the sample performance and the maximum potential performance in its normal culture water conditions), but the result may reflect effects of the background water quality.

Delta RMP samples will be compared with the control (either primary or secondary/tolerance control) with the most similar water quality conditions, measured by specific conductivity. This group or 'batch' will be analyzed independently of other batches. If the negative control for a batch does not meet Test Acceptability Criteria, then the test organism health is compromised in those water quality conditions. There is not a valid benchmark for comparing the toxicity endpoint in samples associated with a negative control that does not meet Test Acceptability Criteria. Samples may be retested once. Sample results will remain invalid if a batch control fails to meet Test Acceptability Criteria in a retest. The potential cause(s) of repeated control failures will then be investigated, and corrective actions identified.

15 INSTRUMENT/EQUIPMENT TESTING, INSPECTION, AND MAINTENANCE

Laboratory equipment is maintained by a qualified technician at the frequency listed in **Table 17**. Field equipment and meters are maintained according to standard procedures and at the frequency listed in **Table 17.** Laboratories are responsible for maintaining all laboratory equipment according to manufacturer specifications. Frequency and procedures for maintenance of analytical equipment used by each laboratory are documented in the Quality Assurance Manual for each laboratory, which is available from the laboratory on request. Laboratories are responsible for testing, inspecting, and maintaining all analytical equipment. In the event of equipment failure, the source of the failure must be identified and rectified, the equipment must be recalibrated, and any samples analyzed outside of calibration limits must be reanalyzed. The Program Manager, Delta RMP QA Officer, and CVRWQCB QA Representative will then work with the laboratory to identify the causes and address deficiencies in the SOPs that resulted in failures. If the problem is serious and cannot be corrected by the laboratory, the Program Manager, Delta RMP QA Officer, and CVRWQCB QA Representative will discuss and identify alternatives, including changing the sampling materials and methods, the extraction and analytical methods, the laboratory, or any combination of these Any changes to the Monitoring Workplan must be approved by the EO prior to implementation. Amendments to the QAPP must be approved by the SWRCB QA Officer and/or the CVRWQCB QA Officer.

Table 17. Testing, inspection, maintenance of field and analytical instruments.

Due to the complexity and sensitivity of most laboratory instruments the testing, inspection, and maintenance procedures are difficult to summarize. A brief and general summary for each instrument follows; however, this table is not intended to describe all testing, inspection, and maintenance procedures for all tests, nor will this QAPP attempt to report SOPs for all such procedures. It is expected that laboratories will employ knowledgeable staff capable of testing, inspecting, and maintaining analytical instruments to ensure a level of data quality that matches or exceeds that demanded in this QAPP.

Analyte Type	Equipment / Instrument	Maintenance, Testing, or Inspection Activity	Frequency	Responsible Individual	SOP
Field Measures	YSI Multiparameter Meter - DO probe	Visually inspect; clean probe according to manufacturer recommended procedures	Prior to sampling or when drifting/inaccurate readings or slow stabilization are observed	Field Lead	**Appendix I**
	YSI Multiparameter Meter - pH probe	Visually inspect; clean glass bulb according to manufacturer recommended procedures	Prior to sampling or when drifting/inaccurate readings or slow stabilization are observed	Field Lead	
	YSI Multiparameter Meter - Conductivity and Temperature probe	Visually inspect; clean probe according to manufacturer recommended procedures	Prior to sampling or when drifting/inaccurate readings or slow stabilization are observed	Field Lead	
	YSI Multiparameter Meter - Turbidity probe	Visually inspect; clean probe according to manufacturer recommended procedures	Prior to sampling or when drifting/inaccurate readings or slow stabilization are observed	Field Lead	

Analyte Type	Equipment / Instrument	Maintenance, Testing, or Inspection Activity	Frequency	Responsible Individual	SOP
Pesticides	Agilent 1260 High Performance Liquid Chromatograph / 6430 tandem Mass Spectrometer	Check mobile phase and needle wash solvent levels. Purge solvent lines. Rinse ESI spray chamber with isopropanol (IPA). Wipe interior surfaces of spray chamber with Kimwipe and IPA Wipe off spray shield with Kimwipe and IPA. Open ballast on rough pump if oil is present in oil mist filter. Equilibrate LC-MS/MS system for 15 min. Check solvent waste bottles.	Prior to running samples	Analyst	**Appendix III** – SOP - OCRL-WATER-PEST_05
	Trace 1310 Gas Chromatograph / TSQ 9000 tandem Mass Spectrometer	Check for sufficient carrier gas. Perform inlet maintenance by changing liner, septum, ferrule, or injector as needed. Fill wash solvent vials for autosampler; empty wash solvent waste vial. Check GC autosampler syringe for clogged needle or seized plunger. Change if necessary	Prior to running samples	Analyst	**Appendix III** – SOP - OCRL-WATER-PEST_05

Analyte Type	Equipment / Instrument	Maintenance, Testing, or Inspection Activity	Frequency	Responsible Individual	SOP
Organic Carbon	Shimadzu TOC-VCSH Organic Carbon Analyzer	Inspections: check dilution water levels, drain vessel and humidifier water.	Inspections daily. Maintenance according to manufacturer specifications.	Lab QA Officer	**Appendix III** – Organic Carbon by SM 5310 B
Nitrogen Measures by Colorimetry	Block Digester-Environmental Express Hot block SC100	Visually inspect and wipe down	As needed	Lab QA Officer	**Appendix III** – TKN by EPA 351.2
	SEAL Discrete Automated Colorimetry Analyzer	Visually inspect and wipe down.	Inspections daily. Maintenance according to manufacturer specifications.	Lab QA Officer	**Appendix III** – TKN by EPA 351.2
Trace Metals	Perkin Elmer ELAN 9000, Perkin Elmer NexION 2000, and ThermoFisher Scientific iCAP Q ICP-MS	Visually inspect and replace specific parts.	According to manufacturer specifications.	Lab QA Officer	**Appendix III** – Trace Elements by EPA 200.8
Cations	PerkinElmer Optima 5300 DV inductively coupled plasma optical emission spectrometer and Avio 500 ICP Optical Emission Spectrometer.	Inspect and clean sample introduction system(nebulizer, torch, injector tube, uptake tubing).	Daily or as needed.	Lab QA Officer	**Appendix III** – Cations by EPA 200.7

16 INSTRUMENT/EQUIPMENT CALIBRATION

Field equipment and meters are calibrated according to standard procedures and at the frequency listed in **Table 18.** Laboratories are responsible for calibrating all laboratory equipment according to manufacturer specifications. Frequency and procedures for calibration of analytical equipment used by each laboratory are documented in the Quality Assurance Manual for each laboratory, which is available from the laboratory on request. A record of pre- and post-calibration results are logged and maintained for calibration records. All equipment capable of being calibrated must be successfully calibrated before analysis. If calibration fails, all affected samples must be re-analyzed, or the data flagged, and the equipment must be repaired before further analysis.

Table 18. Calibration of field and analytical equipment.

Analyte Type	Equipment / Instrument	Calibration Description and Criteria	Frequency of Calibration	Responsible Individual	SOP
Field Measures	YSI Multiparameter Meter - DO probe	Calibration in oxygen saturated water	Daily within 24 hours prior to sampling	Field Lead	**Appendix I**
	YSI Multiparameter Meter - pH probe	Calibration at 4,7, 10; post-sampling check at 7	Daily within 24 hours prior to/following sampling	Field Lead	
	YSI Multiparameter Meter - Conductivity and Temperature probe	Conductivity calibration at a value closest to the native water; temperature calibration at 6, 20, and 40 °C	Conductivity daily within 24 hours prior to sampling; temperature annually.	Field Lead	
	YSI Multiparameter Meter - Turbidity probe	Calibration at 0, 20, 200, 800 NTUs	Quarterly	Field Lead	
Pesticides	Agilent 1260 High Performance Liquid Chromatograph / 6430 tandem Mass Spectrometer	Regression analysis $R^2 \geq 0.99$ using a 9-point calibration curve (of which at least 5 points must be used) ranging from 0.0025 to 1 ng/µL	With each batch. Additionally, calibrations are completed following major disruptions or when routine calibration check (CCVs) fall out of specific control limits.	Analyst	**Appendix III** – SOP - OCRL-WATER-PEST_05
	Trace 1310 Gas Chromatograph / TSQ 9000 tandem Mass Spectrometer	Regression analysis $R^2 \geq 0.99$ using a 9-point calibration curve (of which at least 5 points must be used) ranging from 0.0025 to 1 ng/µL	With each batch. Additionally, calibrations are completed following major disruptions or when routine calibration check (CCVs) fall out of specific control limits.	Analyst	
Organic Carbon	Shimadzu TOC-VCSH Organic Carbon Analyzer	9-point curve, $r^2 \geq 0.99$	When CCVs out of acceptance criteria. ICV following calibration, CCV and CCB every 15 samples and at the end of the run.	Lab QA Officer	**Appendix III** – Organic Carbon by SM 5310 B

Analyte Type	Equipment / Instrument	Calibration Description and Criteria	Frequency of Calibration	Responsible Individual	SOP
Nitrogen Measures by Colorimetry	Block Digester- Environmental Express Hot block SC100	Not Applicable	Not Applicable	Lab QA Officer	**Appendix III** – TKN by EPA 351.2
	SEAL Discrete Automated Colorimetry Analyzer	6-point curve, $r^2 \geq 0.995$	Every run or when CCVs out of acceptance criteria. ICV following calibration, CCV and CCB every 10 samples and at the end of the run.	Lab QA Officer	**Appendix III** – TKN by EPA 351.2
Trace Metals	Perkin Elmer ELAN 9000, Perkin Elmer NexION 2000, and ThermoFisher Scientific iCAP Q ICP-MS	High end linear calibration standards.	At the beginning of each run or when continuing calibration check exceed 10% of calibration.	Lab QA Officer	**Appendix III** – Trace Elements by EPA 200.8
Cations	PerkinElmer Optima 5300 DV inductively coupled plasma optical emission spectrometer and Avio 500 ICP Optical Emission Spectrometer.	Calibration against specific wavelengths or as corrected for spectral interferences.	Daily or when instrument performance checks exceed 10% of calibration.	Lab QA Officer	**Appendix III** – Cations by EPA 200.7

17 INSPECTION/ACCEPTANCE OF SUPPLIES AND CONSUMABLES

Project consumables are listed in **Table 19**. Consumables are rejected for use if obvious signs of contamination or tampering exist. All laboratories are responsible for inspecting and testing all consumables against laboratory-specific acceptance criteria and maintaining adequate records.

Table 19. Inspection/acceptance testing requirements for consumables and supplies.

PROJECT-RELATED SUPPLIES (SOURCE)	INSPECTION / TESTING SPECIFICATIONS	ACCEPTANCE CRITERIA	FREQUENCY	RESPONSIBLE INDIVIDUAL
Sample bottles	bottles are inspected for physical integrity	Bottles and caps intact	At receipt date of shipment	Field Lead
Calibration standards	Solution bottles are inspected to verify factory seal and expiration date; initial measurements are compared to prior standard measurement	Manufacturer's seal intact, measurements within MQOs	Upon opening a fresh standard solution	Field Lead
Nitrile Gloves	Carton seal is visually inspected for damage or tampering	Carton is intact and gloves within are clean and intact	At receipt date of shipment	Field Lead

18 NON-DIRECT MEASUREMENTS (EXISTING DATA)

CEDEN houses various pesticide and toxicity data collected within the Delta region including data collected under previous CUP study designs and data collected as part of the Irrigated Lands Regulatory Program (ILRP). Data within CEDEN are associated with QAPPs and are managed consistently with controlled vocabulary to allow for data to be evaluated across programs. Additional pesticide data collected by USGS surface monitoring programs are available in the USGS National Water Information System (NWIS) database.

Non-Delta RMP data from programs that also collect pesticide data from the Delta, such as the ILRP, can be reviewed against the measurement quality objectives and used only if they meet all of the specified criteria. Data not meeting Delta RMP quality objectives should be used only in a qualitative manner for developing conceptual models and prioritizing future data needs.

Hydrologic data (stage, flow, etc.) will be obtained from existing gauges and recorders located at or near designated monitoring locations. Only fully QA-reviewed hydrologic data will be used in analysis and reporting. Acceptable sources include the USGS NWIS, (https://waterdata.usgs.gov/nwis) and the DWR Water Data Library (WDL, http://wdl.water.ca.gov/waterdatalibrary/). Provisional data and modeled/forecasted data may be used for planning sampling events, for example determining whether there is sufficient rainfall and runoff forecasted.

19 DATA MANAGEMENT

As established in **Element 9** above, MLJ Environmental will maintain an inventory of data and will periodically check the inventory against the records in their possession.

The Field Lead will scan and send an electronic copy of field sheets and COCs to the Program Manager. All scanned copies will be stored on the Droplet which is a shared file system that is accessible to TAC members and the CVRWQCB. All field data are entered into the CV RDC database after being reviewed and qualified. All data transcribed or transformed, electronically and otherwise, are double checked for accuracy by MLJ Environmental staff and records of this double-checking are maintained at the MLJ Environmental office.

The process for receiving and finalizing data is detailed below and will occur according to the following general steps:

1. Receive EDD within 60 days of sample analysis (shared with Regional Board and TAC)
2. Verify data per the Data Management SOP
3. Communicate with laboratory regarding any questions/concerns regarding data received; receive updated data, if necessary
4. Stage 1 verified data are loaded into the CV RDC (shared with Regional Board and TAC)
5. Second verification of the data
6. Stage 2 final data are ready for TAC review and discussion (shared with Regional Board and TAC)

Transfer of data from laboratories to MLJ Environmental is accomplished by electronic submittal. Lab reports are received as electronic Portable Document Formats (PDFs) and in CEDEN templates, both of which are filed on the Droplet. The EDDs are uploaded to the CV RDC according to the procedures outlined in the **Appendix II – Data Management Procedures.**

According to the requirements outlined in Resolution R5-2021-0054, preliminary data in the form of unverified/raw results provided by the project laboratories will be submitted within 60 days of the sample analysis date for each sampling event. Raw data and laboratory reports (where applicable) are provided to the CUP TAC and CVRWQCB staff via upload to a shared file storage site. Preliminary data on the file storage site (DRMP Droplet) are stored in a specific file under the CUP TAC primary folder; these files are considered static and are only updated if the laboratory resubmits new files. An associated Excel tracker (also stored on the Droplet) tracks the date the files were received, the project they are associated with, the file name, and the file location.

The Delta RMP will also email the following CVRWQCB staff with the preliminary data attached to the email when the files are uploaded to the file storage site: Executive Officer

Patrick Pulupa, Program Manager Meredith Howard, and Environmental Scientists Selina Cole and Ryan Brown.

The Data Management Team (DMT) consists of Cassandra Lamerdin who is the Data Manager for Delta RMP data and Data Specialists at MLJ Environmental. The DMT is responsible for reviewing reports and EDDs to ensure completeness, assessing whether project MQOs were met, and ensuring CEDEN/SWAMP comparability. The DMT is responsible for uploading data to the CV RDC, performing final checks, and transferring data to CEDEN annually within 6 months of the last sampling date per Resolution R5-2021-0054. The CV RDC will track completion of monitoring events and data received; this information will be used to complete the QA Report at the end of the WY.

Stage 1 data are reviewed by DMT staff during the data loading process for each individual EDD received. Data verification by the CV RDC DMT according to the approved Data Management SOP (**Appendix II**) occurs as close to receipt of the EDD as possible to ensure that any analytical issues identified during review can be communicated with laboratories and resolved in a timely manner. Once loaded into the CV RDC, an additional data verification is conducted by Program QA Officer (or a delegate) on a result and batch level for individual results sets. The QA Officer applies the appropriate compliance codes to each reviewed record, indicating the data are finalized on the result and batch level. These Stage 2 data are considered final data and are then exported and provided to the CUP TAC, stakeholders, and CVRWQCB staff. Per Resolution R5-2021-0054, this is done within six months of sample analysis.

Per the Resolution R5-2021-0054 requirement, a quality assurance assessment for samples collected in the previous fiscal year must be included in the Delta RMP Annual Report. This assessment will include all of the quality assurance section elements identified in R5-2021-0054 and is considered an intermediate QA Assessment since not all samples will have been received, verified, and finalized for the WY. The Program QA Officer will conduct a final review and assessment of the data prior to transfer to CEDEN including a QA Report for data collected during the WY.

All data residing on the Droplet is housed on a third-party cloud server with nightly backups replicated to at least one independent server to create redundancy and allow for instant replication if a failure occurs.

The CV RDC database resides on a server housed at Moss Landing Marine Laboratories (MLML) main laboratory server room. Server RDC-Gamma hosts both the CV RDC and MLML RDC database and connects to a second server (MLML RDC) which hosts the Central Valley Checker System. Servers are monitored daily with weekly software maintenance and backed up nightly. Hardware maintenance occurs on an as needed basis.

The most recent month of database backups are available for retrieval if needed; older backups are archived.

Monitoring reports which summarize the monitoring data are submitted to the Delta RMP and the CVRWQCB following the schedule outlined in **Element 6**.

The handling of pesticide analysis data generated by the OCRL is different from other Delta RMP datasets because the USGS is not simply a contract lab, but a federal science agency with its own long-standing policies and procedures. According to USGS policy, results from their labs shall be included in NWIS. This is an online database where results are freely available to the public.

OCRL staff perform a quality assurance review of the results generated in their lab, and then upload provisional data to the NWIS database. Afterwards, OCRL transmits the data to CV RDC in the CEDEN data template format. Data management staff format these data and perform a thorough and independent QA review. As with other datasets, if serious issues arise, data management staff will communicate with OCRL to resolve these issues in coordination with the Program Manager.

GROUP C. ASSESSMENT AND OVERSIGHT

20 ASSESSMENTS AND RESPONSE ACTIONS

Quality assurance reviews of data generated under the project will be made by the Program QA Officer according to this QAPP, and may include the Program Manager and CVRWQCB QA Representative, if necessary. Contract laboratories are responsible for self-assessment and oversight of finalized data submitted in laboratory reports and electronic deliverables, by the data managers, and/or the QA Officer. Once data are received, they will be reviewed and flagged according to the procedures outlined in **Appendix II**. The Program QA Officer and Program Manager are responsible for ensuring the proper flagging of all data that do not meet established QA/QC criteria.

If a discrepancy is discovered during a review, the Program Manager and Program QA Officer will discuss the discrepancy with the personnel responsible for the activity. The discussion will include the accuracy of the information, potential cause(s) leading to the deviation, how the deviation might impact data quality and the corrective actions that might be considered. Deviations to the QAPP that can prevent project and data quality objectives from being met shall be described in the QAPP and must be approved by the CVRWQCB QA Representative or the SWRCB QA Officer prior to implementation. When prior approval is not possible, the deviations must be reported to the CVRWQCB QA Representative within seven calendar days, per R5-2021-0054. The Program Manager is responsible for documenting and communicating all deviations from this QAPP to the TAC and appropriate stakeholder groups. For immediate deviation notification, communication will include the following information: the applicable Workplan and/or QAPP, constituents and/or locations affected, sampling dates, whether the deviation is affecting one or multiple events, description of the concern, the proposed solution and rationale, and a place for a final decision to be communicated.

Once QAPP deviations are identified and a resolution determined, the process is documented on a Delta RMP QAPP Deviation Form (**Figure 10**). Deviation forms shall be completed and included in the Quarterly Reports submitted to the CVRWQCB. At a minimum, deviation forms must document:

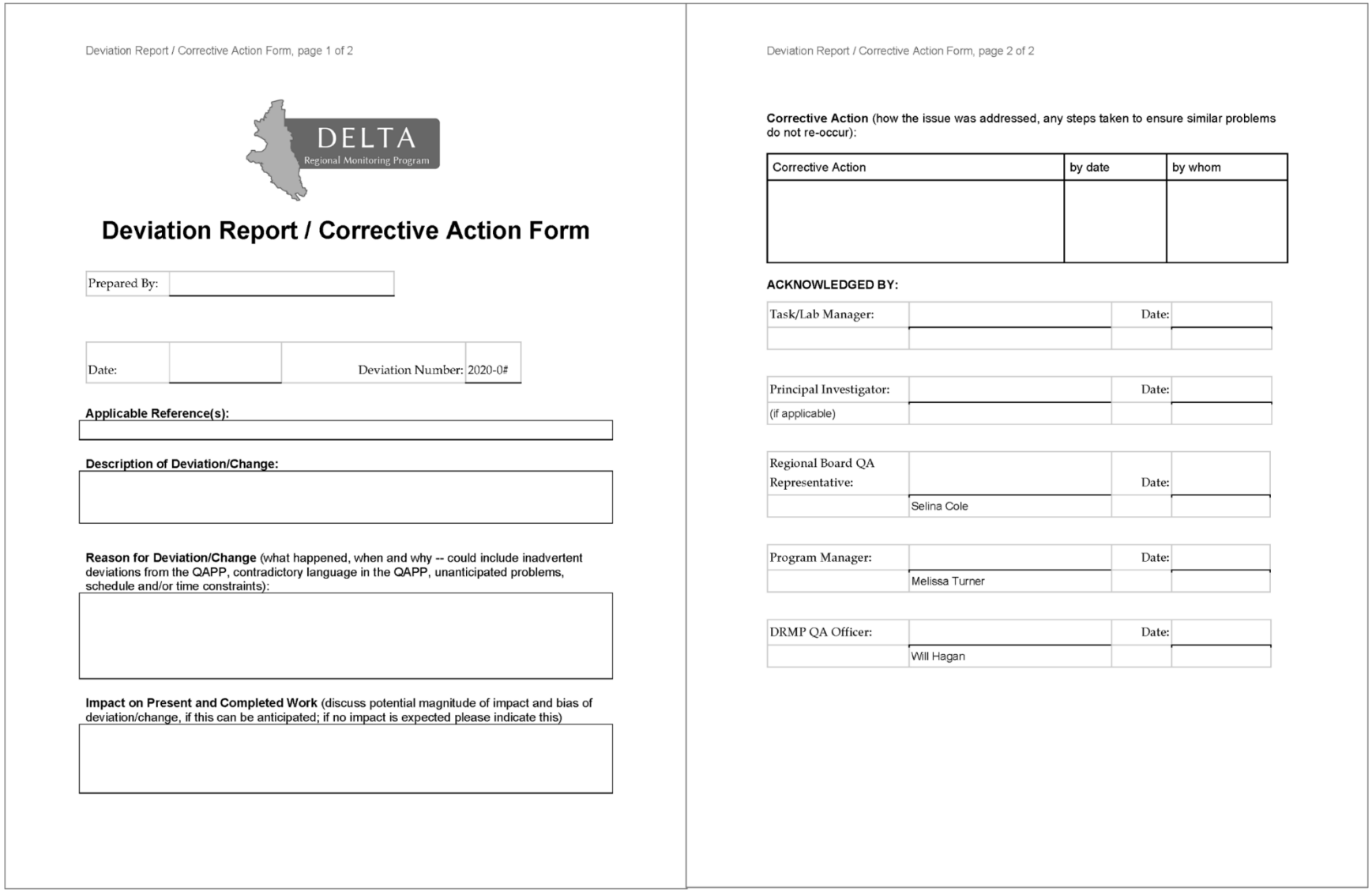
- A description of the deviation that occurred
- Reason for the deviation
- Impact on the present and completed work
- Corrective actions taken as a result, by when and by whom

Once completed, deviations forms are reviewed and approved by the CVRWQCB QA Representative. The Program Manager will follow up with the responsible party tasked with implementing the corrective actions and track when they are performed. Deviations and corrective actions are reported for the previous fiscal year in the Delta RMP Annual Report that is submitted annually to the CVRWQCB on February 1.

The Program Manager and the Program QA Officer have the power to halt all sampling and analytical work by both the field crews and contracted laboratory if the deviation(s) noted are considered detrimental to data quality.

The quality of data are routinely reviewed as a whole and assessed to determine if procedural (field and analytical) changes are necessary for improved data quality. The Program QA Officer (or designee) may request to visit the laboratory to discuss the review and data quality. Laboratory visits may occur as frequently as once a year or less depending on the need. Other assessments that occur periodically will be oral or electronic via email correspondences; if no discrepancies are noted and corrective action is not required, additional records are neither maintained nor reported. If discrepancies are observed, the details of the discrepancy and any corrective action will be reported in the quarterly and final monitoring report.

Figure 10. Deviation Form template.



Deviation Report / Corrective Action Form, page 1 of 2

DELTA
Regional Monitoring Program

Deviation Report / Corrective Action Form

Prepared By:

Date: | Deviation Number: 2020-0#

Applicable Reference(s):

Description of Deviation/Change:

Reason for Deviation/Change (what happened, when and why -- could include inadvertent deviations from the QAPP, contradictory language in the QAPP, unanticipated problems, schedule and/or time constraints):

Impact on Present and Completed Work (discuss potential magnitude of impact and bias of deviation/change, if this can be anticipated; if no impact is expected please indicate this)

Deviation Report / Corrective Action Form, page 2 of 2

Corrective Action (how the issue was addressed, any steps taken to ensure similar problems do not re-occur):

Corrective Action	by date	by whom

ACKNOWLEDGED BY:

Task/Lab Manager:		Date:	
Principal Investigator:		Date:	
(if applicable)			
Regional Board QA Representative:		Date:	
	Selina Cole		
Program Manager:		Date:	
	Melissa Turner		
DRMP QA Officer:		Date:	
	Will Hagan		

21 REPORTS TO MANAGEMENT

Quality assurance assessments are provided in individual project data reports, which are drafted upon the completion of a study or monitoring cycle, as needed. Data reports are reviewed by the appropriate TAC, recommended for approval by the steering Committee, and approved for publication by the BOD. Quality assurance assessments are also provided in the Delta RMP Annual Report according to the requirements outlined in Resolution R5-2021-0054.

The Data Manager is responsible for summarizing QA issues with reported data and communicating those issues to the Program Manager and the Program QA Officer. The Program Manager is responsible for communicating delays in data deliverables and/or QA issues to the CVRWQCB QA Representative and the appropriate stakeholders and committees.

Deviation Forms (**Figure 10**) are generated on an ad hoc basis to document any significant changes to the implementation of this QAPP, the impacts on project data, and the corrective actions that should be taken as a result. A record of all deviations including copies of completed Deviation Forms that occurred within a given reporting period is provided in the Delta RMP Quarterly Reports, submitted November 1, February 1, May 1, and August 1, annually, and in the Delta RMP Annual Report, submitted on February 1 of each year.

GROUP D. DATA VALIDATION AND USABILITY

22 DATA REVIEW, VERIFICATION, AND VALIDATION REQUIREMENTS

Data generated by this project will be reviewed against the measurement quality objectives cited in **Element 23** and QA/QC practices outlined in **Elements 14 – 17**. Data will be qualified according to the methods outlined in **Element 23**. The Program QA Officer will complete a secondary review to ensure that all data are properly qualified according to the project requirements. Data collected by other agencies, projects, or studies that are to be used in conjunction with the data generated under this QAPP will undergo the review requirements outlined in **Element 18**.

22.1 REJECTION OF DATA

The decision to accept or reject data will be made jointly by the Program QA Officer, the Program Manager, the CVRWQCB QA Representative, and if necessary, SWRCB QA staff. Data rejections will be documented with a deviation form or QAPP amendment and require the approval of the QA Representative and/or the SWRCB QA Officer. Decisions regarding accepting and rejecting data should also be informed by input from the TAC.

There are three time-steps where data may be identified for rejection: 1) identified by the laboratory prior to reporting to the Delta RMP, 2) during data verification (either Stage 1 or Stage 2), and 3) during the finalization of the data through the TAC process (Stage 3). Missing analytical records will be discussed in the Delta RMP Annual Report and Data Reports; rejection decisions may also lead to amendments to the Data Management SOP and/or the QAPP.

- Laboratory Review: The following situations will be communicated to the Program QA Officer, the Program Manager, the QA Representative, and, if necessary, the SWRCB QA Officer and documented in the laboratory report. The QA Representative or the SWRCB QA Officer will determine if a deviation form or other documentation is necessary.
    - The laboratory identifies that the analysis did not meet performance standards (e.g., instruments failure) or a quality control failure that results in the inability to accurately quantify the analyte.

    - When the QAPP does not clearly identify the performance standard not being met or quality control failure, the laboratory will provide a justification for the recommendation to omit the results from the EDDs.
- Data Management Verification: data verification occurs when the data are reviewed and flagged by the Data Manager (Stage 1) and again when the Program QA Officer reviews and verifies that data are flagged according to this QAPP (Stage 2).
    - Stage 1 – the Data Manager identifies egregious or numerous failures of MQOs during data review and notifies Program QA Officer, the Program Manager, the QA Representative, and, if necessary, the SWRCB QA Officer about the concern and potential for data rejection.
    - Stage 2 – the Program QA Officer identifies a situation during the secondary verification procedures where rejection of data is recommended.
    - In both cases, the Program QA Officer, the Program Manager, the QA Representative, and, if necessary, the SWRCB QA Officer will determine if the data should be rejected. The QA Representative or the SWRCB QA Officer will determine if a deviation form or QAPP amendment is necessary.
- TAC Review: the TAC will review the finalized dataset (Stage 3) and associated Data Report to assess the quality of the data relative to the project goals. During this review, TAC members may identify project-level data quality concerns that were not previously identified by the laboratory, Data Manager, or Program QA Officer. These situations will be communicated to the Program QA Officer, the Program Manager, the QA Representative, and the SWRCB QA Officer to determine if the results should be rejected. The QA Representative or the SWRCB QA Officer will determine if a deviation form or QAPP amendment is necessary.

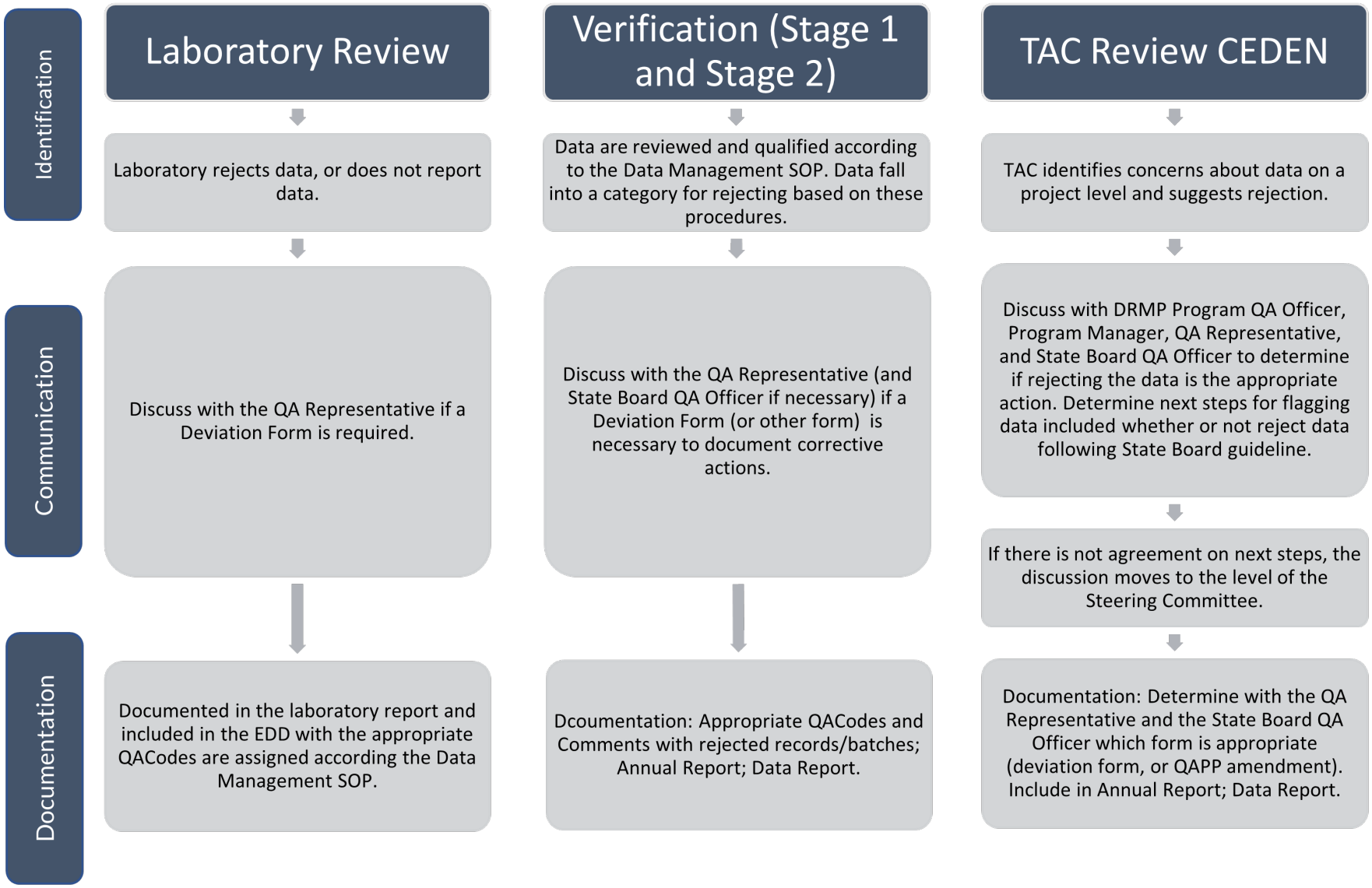
If the Program QA Officer, Program Manager, CVRWQCB QA Representative, and SWRCB QA Officer agree on whether to reject, qualify, or not publish data, the agreed upon next steps will be documented, implemented, and communicated to the CUP TAC and Steering Committee. If the Program QA Officer, Program Manager, CVRWQCB QA Representative, and SWRCB QA Officer cannot agree on whether to reject, qualify, or not publish data, the discussion will be elevated to the Steering Committee for a recommendation, and then on to the CVRWQCB Executive Officer and DRMP Executive Committee for discussion prior to a final decision by the CVRWQCB Executive Officer.

In the case where the Program QA Officer, Program Manager, CVRWQCB QA Representative, and SWRCB QA Officer cannot agree on whether to reject, qualify, or not publish data, two short memos, each authored by the proponents of the solution and describing the issue and proposed, will be provided to the Steering Committee Co-Chairs for dissemination to the Steering Committee and discussion at the next Steering

Committee meeting. The Steering Committee will be asked to provide advice and/or make a recommendation to the Board of Directors/Executive Committee concerning the data. As described in the Steering Committee Responsibilities and Voting language, consensus on a recommendation may come from an informal vote or simple question such as "Is any SC member opposed to a recommendation?". If there is clear consensus, the recommendation will be included in the meeting summary as being reached by consensus and that no vote was needed. If the Steering Committee members cannot come to consensus on a recommendation, the Steering Committee member(s) that are not in agreement should put forth a workable compromise to see if consensus can be gained. After discussion, if consensus cannot be gained informally, the Steering Committee Chairs should ask for a recommendation to vote on (ex., moved and seconded by SC members). Voting should be recorded as green (in favor), white (abstain), yellow (stand aside), and red (opposed/block). A single block means that consensus has not been achieved. Majority and minority opinions, reservations, and oppositions will be noted verbally at the meeting, including the member who has made such recommendations, and documented in the meeting summary.

Following the Steering Committee meeting, the Steering Committee Co-Chairs will provide the two memos and communicate the Steering Committee's recommendation (either consensus or non-consensus) to the CVRWQCB Executive Officer. The CVRWQCB Executive Officer will consult with the DRMP Executive Committee prior to making a final decision.

Figure 11. Process for identifying, communicating, and documenting data rejection decisions.



23 VERIFICATION AND VALIDATION METHODS

23.1 DATA VERIFICATION

The DMT will perform all data verification according to the methods outlined in **Appendix II**. These minimum requirements for data verification procedures are summarized below; however, the detailed procedures defined in the Data Management SOP must conform to the data management principles of the Water Boards. Conformity to these principles ensures that the data generated by this project are comparable and properly verified according to both the Delta RMP and Water Boards needs. The attached SOP has been reviewed by the SWRCB to ensure agreement with data processing procedures and SWRCB requirements.

All field collection records are entered either directly into the database or into a CEDEN comparable EDD format. Field data should be verified against the original collection records before finalized and, if necessary, exported to provide field collection details to laboratories.

The contract laboratories are responsible for the reduction of the raw data generated by the methods used to a data deliverable format determined by agreement between the laboratory and the Program Manager. Each contract laboratory's QA Officer will perform checks of all of its records at a frequency that the lab determines sufficient. The analytical process includes verification or a quality assurance review of the data, which includes:

- Verifying the calibration samples for compliance with the laboratory and project criteria;
- Verifying that the batch QC samples were analyzed at a proper frequency and the results were within specifications;
- Comparing the raw data (e.g., chromatogram) with reported concentration for accuracy and consistency;
- Verifying that the holding times were met and that the reporting units and quantitation limits are correct;
- Determining whether a corrective action was performed, and control was re-established and documented prior to reanalysis of QC or project samples;
- Verifying that all project and QC sample results were properly reported and flagged; and
- Preparing batch narratives that adequately identify and discuss any problems encountered.

- Verifying that all toxicity testing requirements were met and reporting any inconsistencies as deviations.

Data verification for the Delta RMP CUP project will take place on two levels: initial verification (Stage 1) and secondary verification (Stage 2).

23.1.1 Stage 1 – Reviewed Data

The purpose of the initial verification is to ensure that the original data provided by the laboratory includes the required data fields, formatted correctly, and flagged according to the QAPP requirements. Initial verifications are completed by the DMT, who communicate with the laboratory regarding any missing values or inconsistent reporting of data.

Once results are received from laboratories, the DMT reviews 100% of the reports and deliverables generated. Data verification procedures should at a minimum include:

- Verification of the results against the original sample collection records to ensure all expected results are received.
    - This may include the removal of superfluous results (such as non-project QC data) that should not be included in the final dataset.
- Verification of electronic data against lab reports or additional analysis records received to ensure consistent results between formats.
- Verification of sample processing and analysis information against the requirements outlined in this QAPP; this should include checks for
    - Expected analytes,
    - Expected methods,
    - Reporting limits and minimum detection limits
    - Batch definition, and
    - Reporting units.
- Verification that fields not controlled by lookup lists (e.g., comment fields) are formatted in a way that is consistent with the project requirements and the business rules of database into which the dataset will be loaded.
- Verification that all quality control evaluation calculations are complete (e.g., RPDs)
- Verification of all environmental and QC sample results against the MQOs outlined in this QAPP, and, where results do not meet the MQOs, verification that the

proper data qualifier is applied to the record. Checks against MQOs should include an evaluation of:

  - Holding time compliance,
  - QC sample frequency,
  - Detections in blank samples,
  - Recoveries of spiked samples and surrogates, and
  - Precision metrics of duplicate samples.

- Verification that all records are unique, and no duplicated data exist in the dataset.
- Verification that all required fields are completed.

Once all data verification steps are completed, DMT staff apply the appropriate CEDEN comparable Lab Submission Code and Batch Verification Code according to the project requirements, the results of the data review, and data verification steps that were completed. The list of acceptable codes can be found in the documentation of CEDEN lookup lists (http://ceden.org/CEDEN_Checker/Checker/LookUpLists.php). In addition, data processors may add to comment fields of the final data records any pertinent information from the laboratory report case narrative to further qualify data, as needed. If available for the data deliverable template that was provided, the finalized results should be run through an appropriate data checker once verification is complete to ensure that the final data meet the minimum requirements of the database into which they will eventually be loaded.

Data having completed initial verification are loaded into the CV RDC. At a minimum, data used for the intermediate QA Assessment conducted as a part of the February 1 Annual Report must have undergone this initial verification and be loaded into the CV RDC database.

23.1.2 Stage 2 – Verified Data

Once data are loaded into the CV RDC, they can undergo the secondary verification. The purpose of the secondary verification is to perform a second check of the data against the MQOs in the QAPP to ensure that all qualifying codes are applied consistently throughout the dataset on both a result and batch level. Once secondary verification is completed, the appropriate CEDEN compliance codes are applied to each data record. The secondary verification completed by the Program QA Officer or a delegate independent of data generation. Data that have undergone secondary verification and have the appropriate compliance codes applied are considered “final” on a results level and on a batch level. These data are then exported and provided to the CUP TAC, stakeholders, and CVRWQCB staff. Per Resolution R5-2021-0054, this is done within six months of sample

analysis. Data used in the final Data Reports generated at the end of a WY must have undergone initial and secondary verification.

All QA issues will be noted, and the associated results qualified with the appropriate data flag. When QA issues affect the useability of the associated results, reconciliation and correction of these issues will be done by a committee composed of the Program Manager, the Program QA Officer, the CVRWQC QA Representative, and the appropriate field and/or laboratory staff. Any resulting corrective actions will be documented with a Deviation Form (**Figure 10**) according to the procedures outlined in **Element 20**. The Program Manager is responsible for distributing results to the appropriate committees, stakeholders, and data users, and for ensuring data are submitted to the CVRWQCB within the timelines outlined in R5-2021-0054.

23.2 DATA VALIDATION

Data validation steps provide a broader assessment of data compliance with project requirements, useability, and suitability for their intended use. Such assessments may be conducted in long-term interpretive reports, trend analyses, or ad hoc quality assessments as requested by the Steering Committee or BOD; however, at this time there are no data validation requirements for the data generated under this QAPP.

24 RECONCILIATION WITH USER REQUIREMENTS

Procedures to review, verify, and validate data generated under this QAPP are outlined in **Element 23** and included as a part of **Appendix II**. These procedures ensure that all data uploaded into the database have been qualified on a result, batch, and project level with each deviation being coded and comments provided.

Data are reported to the CVRWQCB and TAC in a variety of formats including CEDEN templates, narrative data summaries (including data compiled into tables and charts), and laboratory reports. Limitations in data use will be reported to the CVRWQCB in the Annual Report and will be summarized in the water year QA Report.

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APPENDIX I – FIELD SAMPLING PROCEDURES

USGS National Field Manual

DOCUMENT	REFERENCE	TITLE	LINK
USGS National Field Manual	A1.	Preparations for Water Sampling	https://pubs.er.usgs.gov/publication/tm9A1
	A2.	Selection of Equipment for Water Sampling	https://pubs.er.usgs.gov/publication/twri09A2
	A3.	Cleaning of Equipment for Water Sampling	https://pubs.er.usgs.gov/publication/twri09A3
	A.4	Collection of Water Samples	https://pubs.er.usgs.gov/publication/twri09A4

APPENDIX II – DATA MANAGEMENT PROCEDURES

Standard Operating Procedures for Data Management

STANDARD OPERATING PROCEDURES FOR SURFACE WATER DATA MANAGEMENT

FOR DATA GENERATED UNDER THE DELTA REGIONAL MONITORING PROGRAM

REVISION 2.4

DECEMBER 21, 2022

Prepared by:

SOP for Surface Water Data Management revision history.

Revision No.	Revision Date	Person Responsible	Revision Description	Section(s) Affected
2.0	09/01/2021	L. McCrink	Update to MLJ Data Management Procedures to include updated checklists and tissue; addition of MIS procedures.	All
2.1	11/22/2021	L. McCrink	Updates regarding data Quality Assurance flagging rules when blank contamination is observed.	VII.E.7, Table 7, Attachment B
2.2	05/18/2022	L. McCrink	Updates regarding QA Codes and business rules added to chemistry and toxicity verification sections. Toxicity water quality parameter requirements checks added as Section VII.F.4 and Table 8. Clarified CEDEN upload timeline requirements to be in agreement with R5-2021-0054.	Table 7, Table 8, Table 9, VII.F.4, IX.C
2.3	10/20/2022	L. McCrink	Additional information regarding secondary verification procedures.	VIII
2.4	12/21/2022	L. McCrink	Updates to clarify the field data processing and verification procedures. Clarification of Secondary Results Verification procedures and Data Publication procedures based on comments received from CVRWQCB and SWRCB staff. Field result checklist added as Attachment A.	VI.A.2, VI.B, VIII, IX, Attachment A

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LIST OF ACRONYMS

CEDEN	California Environmental Data Exchange Network
CV RDC	Central Valley Regional Data Center
COC	Chain of Custody
EDD	Electronic Data Deliverable
eDERs	Environmental Data Entry and Reporting System
eQAPP	Electronic Quality Assurance Project Plan
IRLP	Irrigated Lands Regulatory Program
LCS	Laboratory Control Spike
LCSD	Laboratory Control Spike Duplicate
LIMS	Laboratory Information Management System
MDL	Minimum Detection Limit
MLJ DMT	Michael L Johnson Data Management Team
MLML-MPSL	Moss Landing Marine Laboratories Marine Pollution Studies Laboratory
MQO	Measurement Quality Objective
MIS	Management Information System
MS SQL	Microsoft SQL Server
MS	Matrix Spike
MSD	Matrix Spike Duplicate
PR	Percent Recovery
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
QC	Quality Control
RL	Reporting Limit
RPD	Relative Percent Difference
SOP	Standard Operating Procedures
SWAMP	Surface Water Ambient Monitoring Program
TIE	Toxicity Evaluation Identification
WQM	Water Quality Metrics
WY	Water Year

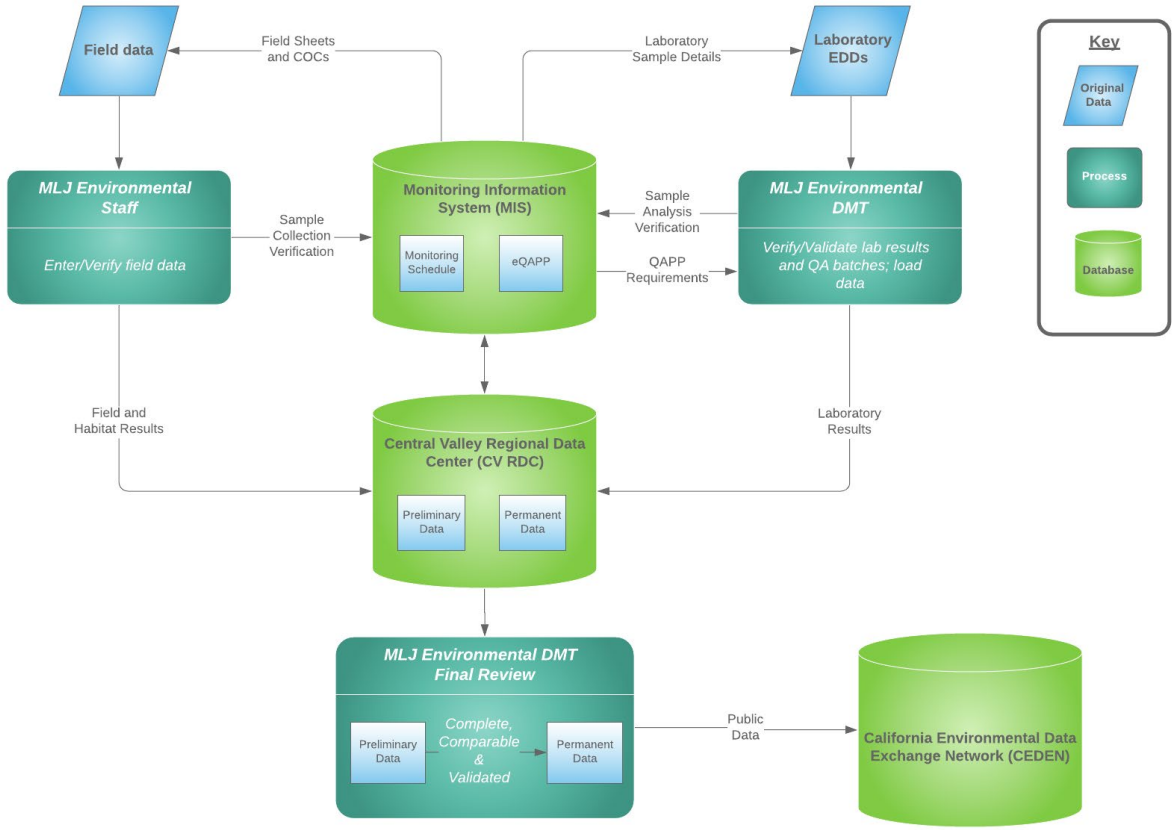
I. INTRODUCTION

The MLJ Environmental (MLJ) Standard Operating Procedures (SOPs) for Surface Water and Sediment Data Management describes the preparation, verification, quality control (QC), and processing of surface water, sediment, and tissue data completed by MLJ staff. Procedures outlined in this SOP apply to both chemistry and toxicity data.

A. PURPOSE

The following SOP outlines the procedures for the management of environmental quality data by MLJ Environmental. This document describes the general processes, minimum information requirements, and data verification procedures for field measurements and laboratory results, and the storage and management of those results in the Central Valley Regional Data Center (CV RDC) database. **Figure 1** is an illustration of the data flow from the receipt of data, through verification and quality control checks and finally uploaded and stored in relational databases managed by MLJ. Finalized data are transferred to the State Water Resources Control Board's (State Water Board) California Environmental Data Exchange Network (CEDEN) database when approved by the data provider.

Figure 1. Data flow diagram for water quality data (including sediment and tissue) managed in the CV RDC database and migrated to CEDEN.



B. DATABASES

There are three primary databases which are used throughout the data management process:

- ***Monitoring Information System (MIS Database).*** The MIS Database is an internal data management system managed and maintained by MLJ staff. The primary function of the MIS Database is to store and maintain programmatic information needed to manage and complete monitoring for various projects. Where necessary, data in the MIS are maintained in a format that is comparable to the CV RDC, allowing for monitoring data to be queried across both database systems for reporting purposes. There are two main elements of the MIS database that are used in different capacities throughout the data review and management process:
    - *Monitoring Schedule Database*: This element of the database stores scheduled sampling event details by project. The monitoring schedule is used to track samples collected and results received. Reports generated from this system are used to communicate the number of samples planned to be collected based on method and analyte to the laboratories and create field sampling materials including field sheets and chains of custody (COCs). It also stores information regarding the status and completion of

specific milestones for the processes outlined in this SOP such as completion dates for field data entry, laboratory deliverable receipt, and results loading into the CV RDC.
    - *eQAPP Database*: This element of the database stores Measurement Quality Objectives (MQOs) and quality assurance requirements for each project. The term "eQAPP" refers to an electronic Quality Assurance Project Plan (QAPP). This part of the database serves as the official repository for current QAPP requirements by project.
- ***Central Valley Regional Data Center Database (CV RDC).*** The CV RDC is one of three Regional Data Centers in California that can migrate data to CEDEN which is managed by the State Water Board. The relational design of the CV RDC was developed with the intent to ensure that data submitted through this process are CEDEN comparable and meet CEDEN minimum requirements and business rules. The CV RDC is synced with CEDEN weekly to ensure comparability of lookup lists. Data within the CV RDC are not publicly available through CEDEN until they are verified and marked as public.
- ***California Environmental Data Exchange Network (CEDEN).*** This statewide water quality database is the repository for the public results of most surface water monitoring occurring in the State of California. It is maintained and managed by State Water Board staff; data in it are publicly available through http://ceden.org.

C. PERMISSIONS AND SECURITY

The MIS is a MS SQL database that is hosted on Amazon Web Services (AWS). Permissions to the MIS occur at the project level for specific clients upon request as well as to MLJ staff, as necessary.

The CV RDC database is a Microsoft (MS) SQL database which can be accessed online by using the Environmental Data Entry and Reporting System (eDERS) hosted by Moss Landing Marine Laboratories (MLML) or internally by MLJ Data Management Team (DMT) staff using MS SQL Management Studio or MS Access interfaces. All users are assigned a username and password for access to data. Permissions are unique to individual staff logins and are granted on the individual result record level (Row Level Security or RLS) based on RowSecurityIDs applied to every table and record in the database. Permissions are assigned by MLJ DMT staff when new projects or user logins are created in the database.

The CV RDC database is hosted on the MLML server, along with the MLML RDC; both databases are maintained as separate environments by the respective data management staff and do not share data or permissions. MLML staff cannot assign permissions to data within the CV RDC and cannot access CV RDC data unless permissions are assigned to them for specific results by MLJ DMT staff as needed for various projects (e.g. Delta RMP data review).

II. PROJECT DEFINITION

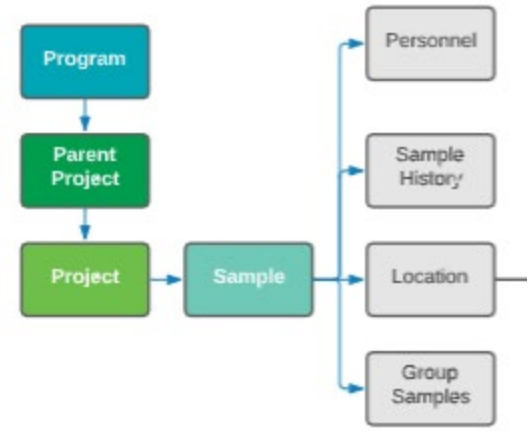
Certain elements of a monitoring project must be defined in the CV RDC Database before any results can be loaded or stored. High-level information associated with the project (Program Code, Parent Project Code, Project Code) and the sampling locations (Station Code, Target Latitude, Longitude, and datum) are required to be associated with any monitoring data in the CV RDC Database. Likewise, if elements of the monitoring program are managed by MLJ staff in the MIS Database, the same high-level project information stored in the CV RDC Database must also be within the MIS. Project definition information are stored in a comparable format between the MIS and the CV RDC such that data can easily be moved and queried between the two systems.

Data that are only being loaded directly to the CV RDC do not need to be defined in the MIS; however, at a minimum, the following fields must be populated in at least the CV RDC Database prior to loading any field or laboratory results.

- *Program Code.* The Program Code is the top tier of project definition information that can capture the requirements for initiating the project in the broadest sense, such as the regulatory program under which the project is required (e.g., Irrigated Lands Regulatory Program/ILRP).
- *Parent Project Code.* The Parent Project Code is the second tier of project definition information, further identifying the specific projects that operate within the defined program (e.g., specific coalitions under the ILRP, such as ILRP East San Joaquin Water Quality Coalition). For long term monitoring programs, the Parent Project Code should remain static as long as the monitoring is being conducted.
- *Project Code:* The Project Code associates surface water results with a higher-level Parent Project and Program Code. Project Codes can be used at the discretion of the Project Manager to logically combine samples in spatial or temporal groupings to meet programmatic needs. The Project Code also connects the station information and associated sampling results to the original workplan and monitoring schedules. When creating a Project Code, it is important to keep in mind that all data for a specific project code will be transferred at one time; therefore, Project Codes for long term projects often capture a specific time period that will be transferred in a single effort, such a quarter or a year.
- *Station Code*: The Station Code must be unique and reflects the station name; station codes can be no more than 25 characters. Whenever possible, station codes associated with data managed by the MLJ DMT should start with the 3-digit hydrologic unit code followed by six characters representing the station location e.g., 541MER520; this format is consistent with SWAMP station code formatting.
- *Target Latitude and Longitude*: Target latitude and longitude is used to positively identify the Station Code location during sampling and reporting.

The hierarchical groupings of Program, Parent Project, and Project Codes are outlined in **Figure 2**. This hierarchy allows managers the ability to group Project Codes into logical temporal time frames like water (WY) or calendar year focused on time frames for loading data to CEDEN.

Figure 2. Relationship of Program, Parent Project, and Project Codes to Sample Table in CV RDC Database.



Project data submitted to the CV RDC must meet minimum reporting requirements for the data to be made public via CEDEN when applicable; not all data submitted to the CV RDC are transferred to CEDEN based on client needs. These specific requirements are described in the CV RDC Entry Manuals on the MLJ Environmental website.

III. MANAGEMENT INFORMATION SYSTEM (MIS)

The MIS Database is an internal data management tool to help facilitate reporting of monitoring requirements for various projects managed by MLJ staff. Depending on the needs of each individual project, elements of the MIS may or may not need to be populated. The sections below describe the general design elements and their intended use. The overall design of the database is purposefully flexible to allow the data management in the MIS to be tailored to specific client and/or project needs.

A. MONITORING SCHEDULE

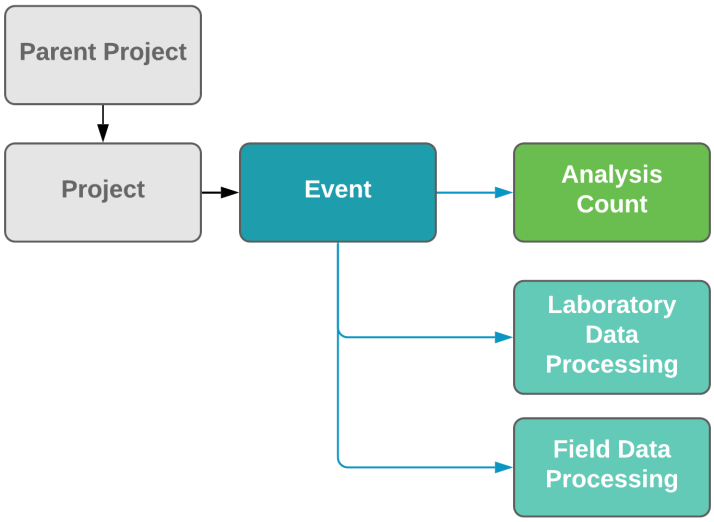
The monitoring schedule tables within the MIS Database are comprised of data necessary for developing monitoring schedules including where samples will be collected and what analytes will be measured. This monitoring schedule tables are used for the organization, planning, tracking and management of sample collection and analysis completion for each individual project.

Monitoring schedules are stored on two different levels: the sample event level and the individual analysis level (**Figure 3**).

Sample event data are associated with the Project Code defined in the MIS and the CV RDC. Each event is assigned an anticipated sampling date. Depending on the needs of the project, events can be assigned season codes and/or Event ID's which help categorize or qualify the sampling events as needed. Season codes are maintained in the MIS and are created based on project specifications (e.g., "Storm" event code for events triggered by rainfall in the area).

Individual samples are defined on the Analysis Count table and must be assigned to a sampling event. The locations (station codes) and constituents to be monitored for each sampling event are defined on this table. Sample replicates and additional quality control samples requiring additional volume are defined as individual records. Station Codes and constituents (defined by the analyte name, analytical method, matrix, fraction, and reporting units) must be comparable to lookup lists in the CV RDC. Monitoring scheduling information is captured on the individual sample level using the Monitoring Type Code on the Analysis Count table. Monitoring type codes describe how individual samples meet the requirements of the individual monitoring program requirements (e.g., an ILRP Management Plan Monitoring constituent would be coded "MPM").

Figure 3. Relationship of monitoring schedule tables in the MIS Database.



B. POPULATING THE MONITORING SCHEDULE IN THE MIS

1. Load Monitoring Schedule into the MIS Database

Data management staff work with the Project Manager to finalize and upload a complete monitoring schedule for each project. Monitoring schedules are exported directly from the MIS and can be used as part of regulatory compliance; any changes to the schedule must be updated within the database to allow for correct assessment of completion, cost estimates, and creation of field sheets and chain of custody forms.

The monitoring schedule tables (**Table 1**) include specific details necessary to achieve each project's specific data management and data usability goals; at a minimum this must include:

- Project information; comparable with the CV RDC
- Expected sample dates
- Sample event information
- Sample stations/locations; comparable with the CV RDC
- Sample type codes; comparable with the CV RDC
- Analysis information, including analyte, analytical method, matrix, fraction, and reporting units; comparable with the CV RDC
- Monitoring requirement type codes
- Sample qualifier codes

The monitoring schedule is then formatted for uploading and imported into the MIS for the tracking and reporting of completeness as monitoring occurs; this process is outlined in the SOP for Monitoring Schedule Updates and Loading into the MIS. All project, site location, and analytical

information associated with results that will be stored in the CV RDC will be maintained as comparable to the CV RDC lookup lists and codes. This ensures that data stored in the MIS Database can be linked to analytical results in the CV RDC allowing for completeness assessment and status updates during the data receipt, review and loading process.

Table 1. Monitoring schedule tables in the MIS Database.

Only the primary columns used by most projects are defined below. Ancillary fields are not included in this table; these fields can be used to manage data or further qualify project requirements where necessary.

TABLE NAME	FIELD NAME	FIELD DESCRIPTION	CV RDC COMPARABLE
Event	ParentProjectCode	High-level project definition code.	Yes
	ProjectCode	Project definition code, often specific to a designated time period in which sample collection occurs.	Yes
	ScheduledSampleDate	Anticipated date on which the sampling event will occur.	--
	SampleDate_Beginning	Actual date on which sampling began.	--
	SampleDate_End	Actual date on which sampling ended; this is the same as the beginning date if the sampling event was completed in one day.	--
	Season	Description of sampling periods, variable by to project.	--
Analysis Count	StationCode	Station at which sample is collected.	Yes
	SampleTypeCode	Code describing the type of sample to be collected (e.g., Grab, FieldBlank, etc.)	Yes
	Replicate	Sample replicate number.	Yes
	Constituent ID	Unique identifier that defines the specific constituent being sampled by analyte (or organism) name, matrix, method, fraction, and reporting units.	No[1]
	SampleCount	Number of samples associated with each record.	--
	MonitoringType	Code describing the monitoring requirements for the specific sample.	--
	SampleQualifierCode	Code describing if and by whom the sample is intended to be collected.	--
	SampleFailureCode	Code describing the reason why a sample was not collected or analyzed by the laboratory.	No
	SampleComplete	True/false field indicating whether a scheduled sample was collected; to be completed by staff during **Sample Collection Verification** outlined below.	--
	AnalysisComplete	True/false field indicating whether results were received for a collected sample; to be completed by staff during Verify **Sample Analysis** steps outlined below.	--

[1]Constituent IDs are managed separately by MLJ in both the MIS and the CV RDC. Constituent IDs in the MIS do not always directly compare to the CV RDC; however, each of the individual elements of a constituent code (analyte, matrix, method, fraction, and units) must be comparable to the CV RDC.

2. Monitoring Schedule Verification

Once the final monitoring schedule is imported into the MIS Database, the monitoring schedule is then exported and verified by the DMT, Project QA Officer, and Project Manager prior to being submitted for finalization and/or approval by a regulatory entity. This review, at a minimum, includes specific sample requirements (e.g., ensuring all dissolved metals samples are associated

with an analysis for hardness at the same site), database business rules (e.g., the correct application of data codes), and CV RDC data comparability (e.g., lookup lists). Project Managers are responsible for reviewing exported monitoring schedules for accuracy and project requirements. The Project QA Officer is responsible for reviewing this schedule to ensure all QAPP requirements (e.g., quality control sample frequency) are met. Any errors or changes found in the export are made in the database and the schedule is re-exported.

3. Analysis Count Reports for Laboratories

Finalized sample schedules are exported as reports and sent to the appropriate analytical laboratories. Laboratories can use the schedule to determine which analyses will be requested for how many samples prior to each sampling event. The Field Sampling Coordinator or Project Manager is responsible for providing these reports to laboratories when monitoring schedules are finalized in addition to coordinating with laboratory staff regarding updates to the monitoring schedule and sample bottle shipments prior to events.

C. POST-SAMPLING UPDATES TO MONITORING SCHEDULE

1. Tracking of Samples Collected

Once the sampling events scheduled in the database have occurred, MLJ staff update the MIS with specific information regarding what samples were collected during the event; this information is then compared to what was expected. These steps are discussed in the **Sample Collection Verification** section below.

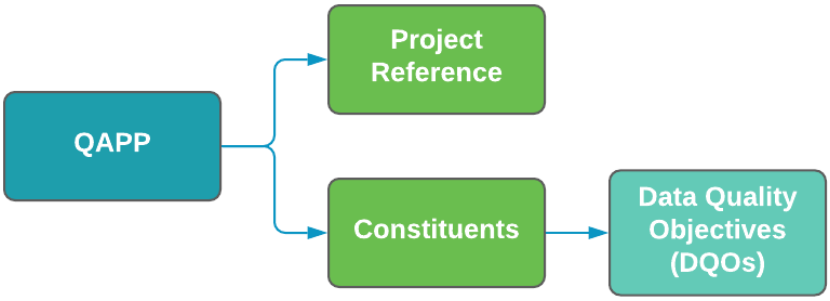
2. Informing Laboratories of Sample Details

For each event in which samples are submitted to a laboratory for analysis, specific reports (Laboratory Sample Details) are exported and sent to the analytical laboratories. These Laboratory Sample Details files provide the laboratories with the data that are required for generating CV RDC/CEDEN comparable electronic data deliverables (EDDs). The Laboratory Sample Details export process is outlined below in the **Laboratory Sample Details** section.

IV. ELECTRONIC QAPP (EQAPP) DATABASE

The electronic QAPP (eQAPP) is a relational database that stores quality assurance requirements and data quality objectives (DQOs) for each project and analyte, as defined by the project's QAPP, as shown in **Figure 4**. The eQAPP Database is the internal repository for all up-to-date quality assurance requirements for projects in which data are managed by MLJ staff. The eQAPP Database is updated when amendments to QAPPs are approved. Data exported from the eQAPP Database can be used to ensure document submittals match the most up to date quality assurance requirements stored in the database. The Project QA Officer is responsible for ensuring the eQAPP Database reflects current quality assurance requirements of each project.

Figure 4. Relationship of eQAPP tables in the MIS Database.



The MLJ DMT uses the data stored in the eQAPP Database to process EDDs received from laboratories and verify that the data reported in the EDDs meet the project requirements and associated measurement quality objects (MQOs). The eQAPP compiles quality assurance requirements in a format comparable to the CV RDC to ensure efficiency and accuracy when processing laboratory EDDs. A description of the specific fields which can be populated in the eQAPP Database are outlined in **Table 2**. Though specific requirements may vary by project, the eQAPP should include the following information to assess laboratory results:

- Original QAPP document reference and submittal information;
- Constituent information such as analyte name, matrix, method, fraction and unit, comparable with CV RDC/CEDEN;
- Preparation and digest extract methods, comparable with CV RDC/CEDEN;
- Expected MDL and RL values (not accounting for adjustments made when dilutions are performed);
- Required measurement quality objects (e.g., LCS percent recovery control limits);
- Batch completeness requirements.

Each of these elements must be defined in the database and verified by the Project QA Officer prior to the MLJ DMT processing any EDDs received for a project. Data are uploaded to and managed in the eQAPP according to the SOP, Procedures for eQAPP SQL Data Management.

Table 2. eQAPP tables in the MIS Database.

Only the primary columns used by most projects are defined below. Ancillary fields are not included in this table; these fields can be used to manage data or further qualify project requirements where necessary.

Table Name	Field Name	Field Description	CV RDC Comparable
QAPP	QAPPCode	A code representing the QAPP under which monitoring is being conducted.	--
	QAPPName	Title of the QAPP.	--
	QAPPDescription	Narrative description of the project defined by the QAPP.	--
	QAPPStartDate	Project start date.	--
	QAPPEndDate	Project end date.	--
Project Reference	ParentProjectCode	Parent Project Code associated with data generated under the QAPP.	Yes
Constituent	Laboratory	Laboratory contracted to analyze the constituent.	No
	Constituent ID	Unique identifier that defines the specific constituent being sampled by analyte (or organism) name, matrix, method, fraction, and reporting units.	No[1]
	PrepPreservationName	Preservative or sample preparation associated with the constituent (if applicable).	Yes
	DigestExtractMethod	Digestion or extraction methods used by the laboratory (if applicable).	Yes
	MDL	Constituent detection limit.	Yes
	RL	Constituent reporting limit.	Yes
	ConstituentStatus	Indicates whether the consituent definition is active or inactive	--
	Constituent AmendmentCode	Indicates the version of the QAPP in which the constituent information was approved.	--
	Constituent StartDate	Date on which the constituent information was approved.	--
	Constituent EndDate	Date on which the constituent information was removed from the QAPP or replace by more accurate information.	--
DQOs	DQOParameter	Specific data parameter being evaluated, e.g., field duplicate RPD, matrix spike percent recovery.	--
	DQOType	Reference to the specific data quality element being assessed (e.g., "PR" for percent recovery, "RefTox" for toxicity accuracy evaluation).	--
	DQOCriterion	Assessment criteria (e.g., less than a specific value)	--
	DQOValue	The specific value or threshold used for the assessment (e.g., a maximum RPD threshold of 25)	--
	DQOCriterion Second	Any secondary criteria that should also be considered when evaluating against the primary.	--
	DQOStatus	Indicates whether the specific objective is active or inactive.	--
	DQO AmendmentCode	Indicates the version of the QAPP in which the objective was approved.	--

[1]Constituent IDs are managed separately by MLJ in both the MIS and the CV RDC. Constituent IDs in the MIS do not always directly compare to the CV RDC; however, each of the individual elements of a constituent code (analyte, matrix, method, fraction, and units) must be comparable to the CV RDC.

V. PRE- AND POST-SAMPLING DATA MANAGEMENT

For projects in which MLJ is responsible for collecting samples and submitting them to laboratories, the monitoring schedule defined in the MIS Database is used to generate sampling materials and track the status of the samples required to be monitored. The following steps can be completed for projects for which MLJ staff are responsible for all components of the monitoring completion. Each step may or may not be necessary for all projects, depending on the level of participation of MLJ staff in the sample collection process and/or specific client needs.

A. SAMPLE PREPARATION FOR MLJ MANAGED PROJECTS

The MIS can be used to prepare field sheets, sample labels and COCs. This step occurs for projects with a sampling component managed by MLJ and is not required for other projects. MLJ Sampling Staff use the MIS to prepare for an upcoming sample collection event to confirm bottle counts and additional checks of sampling materials against the MIS sampling schedule information.

1. Bottle Counts

Prior to a sampling event, MLJ field crews assess the amount of sample containers required for the event. Bottle count reports are exported using sample collection requirements stored in the MIS Database. Counts of the required containers are used to submit bottle requests to laboratories and/or order containers directly from suppliers ahead of a sampling event to ensure the required sampling materials are in house prior to the event. Bottle count reports are also used to pack coolers and allocate materials to sampling teams in preparation for sampling events. The Field Sampling Coordinator is responsible for ensuring timely requests for sample bottles from laboratories and ensuring that all supplies are obtained prior to sampling.

2. Field Sheets, Sample Labels, and COCs

Field sheets and sample bottle labels are exported directly from the database using reports designed to pull formatted information from the MIS Database. Field sheets and labels are populated with as much information as possible prior to the event to streamline tasks in the field as well as avoid erroneous sample records or analysis requests. Chain of Custody forms, which must accompany all samples once they are collected, are generated in Excel using information from the MIS sampling schedule to ensure minimal manual updates to sample event information.

Sample collection contingency plans are also generated to account for in-field changes to the sampling schedule (such as sites that may not be able to be sampled) given future monitoring events and annual analyte counts. The Field Sampling Coordinator is responsible for ensuring all sample materials are verified against the original sample schedule in the MIS Database prior to the field sampling event.

B. SAMPLE EFFORT

Samples should be collected according to the sampling SOPs included in the associated project's QAPP to ensure the collection of field data are performed in a scientifically sound and repeatable manner. Many pre- and post-sampling details not directly replate to data management are detailed in the associate Sampling SOP and are not discussed in this document.

C. POST SAMPLING PROCESSES

1. Electronic Filing of Field Documentation

For projects managed by MLJ, field sheets, COCs, and sampling photos are stored electronically on a secure server which is backed up nightly. All hard copies are physically filed where they can be accessed by MLJ staff and the Project QA Officer if needed. Electronic documents must be retained for a minimum of 10 years.

2. Sampling Summary Report

For all projects in which monitoring was completed by MLJ field crews, a Sampling Summary Report is typed up after each sampling event which includes a short narrative of all stations that were sampled, sample failures, and any remarkable or anomalous events or observations made by field crews. The summary is distributed to the Project Managers and the DMT and is used to communicate the status of the sampling event including any anomalies encountered. The Field Sampling Coordinator is responsible for ensuring the Sample Summary Reports are complete and are distributed to appropriate staff.

3. Sample Collection Verification

Sample collection information is verified against the MIS schedule for each sampling event. After each sampling event, the MIS Database is updated to reflect which samples were collected based on the completed field sheets and COCs. At a minimum, the following items should be verified or updated once sampling is complete:

- **Sample Date**. The MIS Database is populated with expected sample dates when the initial monitoring schedule is loaded. These dates need to be verified or updated to the day or range of days on which the sampling event occurred.
- **Sample Complete**. Each sample that was scheduled should be marked as true/false for sample completed. All samples and analytes planned to be collected must be accounted for in the monitoring schedule in the MIS Database (**Table 1**). If a scheduled sample was not collected, the record in the database should be flagged with the correct failure code to qualify why the sample is missing. The acceptable failure codes currently listed in the database are provided in **Table 3**.

Table 3. Acceptable sample failure codes to be used in the MIS database.

Where possible, failure codes are similar to those defined in CEDEN; however, not all failure codes stored in the MIS Database are CEDEN comparable, some have been added for internal tracking.

SAMPLE FAILURE CODE	SAMPLE FAILURE	DESCRIPTION
BRK	Sample bottle broken	Sample bottle broken.
CMIS	Collection Missed	Sample failed to be collected due to oversite on COC/fieldsheet.
DIS	Discontinued	Sample was originally scheduled to be sample but was then discontinued. No sample was collected because it was no longer required.
DRY	Dry	Dry (No water)
FLD	Flooded	Flooded
HAB	Hard Bottom	Hard Bottom (no sediment)
INF	Instrument Failure	Instrument failure
ISP	Isolated Pool	Isolated pool not connected to moving water source, no flow.
LMIS	Laboratory Missed. Did Not Analyze	Sample was not analyzed by the lab due to lab error.
None	None	No failure, sample was collected.
TEMPLAB	Sample stored at improper temperature by Lab.	Sample stored at improper temperature by Lab. Not storing or utilizing results.
TOS	Too Shallow	Too shallow to collect water samples.

4. QC Sample Verification and Assessment

If there is a situation where a site is scheduled for QC sample collection and the samples could not be collected, the QC samples will need to be collected at a different site. The determination of the back-up site at which the QC samples are collected is usually made in the field based on sample collection contingency plans established prior to sampling. Wherever this occurs, the sample schedule in the MIS must be updated after the sampling event to include the field QC samples that were actually collected. In addition, field QC sample frequency requirements must be reassessed after every sampling event to ensure any changes in the field do not reduce the total amount of QC samples required for the project. The QC frequency percentages are recalculated following each event to ensure the minimum requirements for each analyte are still met. Any field QC that could not be collected during the event must be rescheduled for future events to ensure that QC frequency requirements are met. The Field Sampling Coordinator should notify the Project QA Officer if there are no future events in which the analyte(s) in question are scheduled and the QC frequency requirements required by the QAPP will not be met.

D. EXPECTED SAMPLE RESULTS TRACKING

The sample tracking component of the MIS Database is used to ensure that requirements are met for each sample from the beginning of the process (sample collection) to end (finalized results loaded in the CV RDC). Once a sample has been collected and verified against the monitoring schedule, a record must be created to track all future expected reporting deliverables. Reporting

deliverables will be project specific and may include preliminary laboratory results, laboratory reports, EDDs, and laboratory invoices.

Field result process and deliverables are tracked on the Field Data Processing table in the MIS Database (**Figure 3**). A record must be created on this table to track each of the steps outlined below for the **Field Data Processing** requirements. The specific fields on this table are outlined in **Table 4**.

Table 4. Field data processing steps tracked in the MIS Database.

TABLE NAME	FIELD NAME	FIELD DESCRIPTION	REFERENCE
Field Data Processing	FieldEntryCompleteDate	Date on which field data entry was completed.	**Field Data Entry**
	FieldEntryPerformedBy	Staff who completed field data entry	
	FieldVerificationCompleteDate	Date on which field data verification was completed.	**Field Result Quality Assurance**
	FieldVerificationPerformedBy	Staff who completed field data verification.	
	FieldEntryVerificationComments	Details regarding field data verification.	
	SampleDetailsSentDate	Date on which the sample details file was sent to the laboratory.	**Laboratory Sample Details**
	SampleDetailsSentBy	Staff who sent the sample details file to the laboratory.	
	SampleDetailComments	Details regarding sample details communications with laboratories.	
	FieldExceedanceReportRequired	Indication of additional project action requirements triggered by the field results.	--

In the Laboratory Data Processing table (**Figure 3**), a separate record needs to be created for each laboratory and report type combination that is expected to be received given what was collected and submitted for analysis. These records will be used for tracking expected reports from laboratories and paying laboratory invoices once all deliverables have been received, as outlined in **Table 5**.

The sample completion counts and expected report records are used by MLJ DMT staff in charge of receiving laboratory results to track timely receipt of deliverables from laboratories and to verify the completeness of the results received. Accurate sample counts are crucial to the analytical data verification steps outlined below (see **Laboratory Data Processing**). Sample collection verification activities are overseen by the Project QA Officer.

Table 5. Laboratory data processing steps tracked in the MIS Database.

TABLE NAME	FIELD NAME	FIELD DESCRIPTION	REFERENCE
Laboratory Data Processing	Laboratory	Analyzing laboratory form which a report is expected.	--
	ReportType	Description of expected report.	--
	ReportNumber	Report identifier provided by the laboratory.	--
	PrelimLabReportReceivedDate	Date on which preliminary results were received by the laboratory.	**Receipt and Filing of Laboratory Results**
	LabReportReceivedDate	Date on which the PDF report was received by the laboratory.	
	EDDReceivedDate	Date on which electronic data were received by the laboratory.	
	LabReportEDDReceivedComments	Details regarding the receipt of laboratory deliverables.	
	LabReportReviewedDate	Date on which the PDF report was reviewed by MLJ staff.	**Initial Laboratory PDF Review**
	LabReportReviewedBy	Staff who completed the report review.	
	LabReportReviewComments	Details regarding the review of the report.	
	LabExceedanceReportRequired	Indication of additional project action requirements triggered by the results.	
	EDDReviewedDate	Date on which the electronic data were reviewed by MLJ DMT.	**Processing of Chemistry EDDs, Processing of Toxicity EDDs, Processing of Tissue EDDs**
	EDDReviewedBy	Staff who completed the electronic data review.	
	EDDDoubleCheck	Staff who verified the electronic data processing.	**Loading Laboratory Results into CV RDC Database**
	EDDReadyToLoad	A true/false field indicating if an EDD is in the queue for loading to the CV RDC.	
	EDDLoadedDate	Date on which a processed EDD was loaded to the CV RDC.	
	EDDLoadedBy	Staff who loaded the data to the CV RDC.	
	EDDComments	Details regarding the processing and loading of the EDD.	
	InvoiceNumber	Identifier of the invoice for the analyses completed and data received.	--
	InvoiceDate	Date on which the invoice was received.	
	InvoiceComments	Details regarding the invoicing process.	

VI. FIELD DATA PROCESSING

A. FIELD DATA ENTRY

Field data must be entered into the CV RDC database after each sampling event is complete using information recorded on the field sheets. There are two options for field data entry into the CV RDC: 1) direct field data entry using the Environmental Data Entry and Reporting System (eDERS) hosted by MLML, or 2) upload of field results using the CEDEN Field Template.

1. Option 1 – Field Data Entry via eDERS

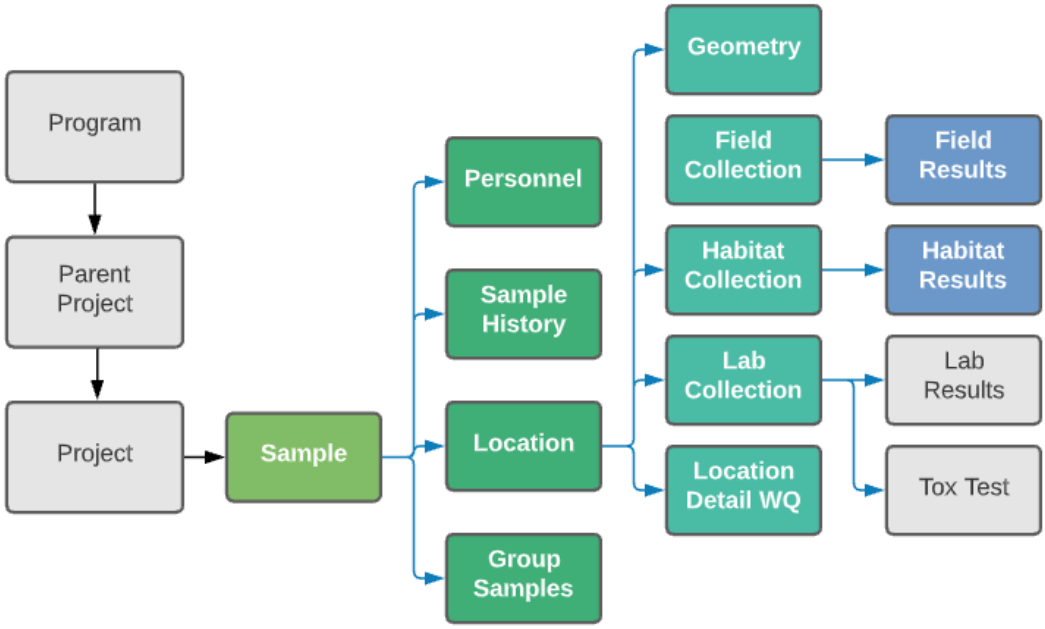
Data are entered directly into the CV RDC using the eDERS online webforms. Field data are entered according to the Field Data Entry SOP. The eDERS field data entry forms were developed based on SWAMP field sheets and include drop down lists from the valid lookup list tables to ensure CEDEN comparability.

2. Option 2 – Field Data Entry via CEDEN Field Template

If data are formatted in the Field Template, then MLJ DMT staff can load them directly into the CV RDC as a single file, rather than entering results by hand. Field EDDs are processed according to the detailed checklist provided in **Attachment A**. Data are loaded using a series of queries to add the results to the CV RDC relational database design. Automated checks are performed on the data during the loading process to ensure that results are unique, assigned to the correct project and site information, formatted correctly, contain the correct valid values, and that all required fields are populated. Result table counts are tracked prior to loading and compared to counts after loading to ensure all intended results were uploaded. After the Field Template is loaded, specific verification steps are performed to ensure the correct results have been added into the CV RDC database.

The conceptual relational table design in the CV RDC storing field data is shown in **Figure 5;** the CV RDC design matches the design in CEDEN to ensure comparability and ability to transfer data directly to CEDEN.

Figure 5. Sample through Field and Habitat Result tables the CV RDC Database.



The field data that are usually entered into the CV RDC by MLJ staff are listed in **Table 6**. Fields listed as "required" in **Table 6** must be entered into the database for each sample collected.

Table 6. Field and habitat result tables in the CV RDC.

Only primary fields are included; ancillary fields for each table referenced are not included but can be found in CV RDC documentation available online. All columns described below are preferred to be populated to best describe the project data; however, not all columns are required (are nullable) in the CV RDC database. Fields required to be populated are indicated with a "Yes" in the CV RDC Required column. In some cases, default values may be added by MLJ staff when information is not available from the data submitter.

TABLE NAME	FIELD NAME	FIELD DESCRIPTION	CV RDC REQUIRED
Sample	EventCode	Represents the primary reason for the sampling event at a particular station and date, e.g., water quality, tissue or bioassessment.	Yes
	ProjectCode	References the project that originated the sample.	Yes
	StationCode	A 9-digit assigned code that uniquely identifies the monitoring location within the CV RDC database.	Yes
	SampleDate	The date the sample was collected in the field, expressed as dd/mmm/yyyy.	Yes
	AgencyCode	The acronym for the agency that collected/created the sample.	Yes
	ProtocolCode	A code representing the sampling protocols and methods used during the sampling event.	Yes

TABLE NAME	FIELD NAME	FIELD DESCRIPTION	CV RDC REQUIRED
	SampleComments	The comments field should be used for any notes or comments specifically related to the sample collection.	
Sample History	SamplePurposeCode	A code representing the reason samples were collected from a specific station on a specific date to collect (e.g., habitat, water chemistry).	Yes
	PurposeFailureName	A code used to identify if there were any issues with collecting any of the intended samples/information at a site, (e.g., dry site).	Yes
Personnel	PersonnelCode	A code representing the personnel collecting the sample.	Yes
Group Sample	Group Code	Allows programs to group samples together to meet individual program needs, such as by Season.	Yes
Geometry	Latitude	Latitude from which sample was taken in decimal degrees with 5 decimal places.	Yes
	Longitude	Longitude from which sample was taken in decimal degrees with 5 decimal places.	Yes
	GPSDevice	A code identifying the GPS device used to collect the GPS measurements.	Yes
	Datum	The Datum field records the datum that was used on the GPSDevice to record the GPS measurements.	
	GPSAccuracy	The accuracy of the GPS device used to collect the GPS measurements.	
Location Detail	OccupationMethod	Method of station occupation for sample collection (e.g. "Walk In", "From Bridge", or report research vessel name).	
	Starting Bank	Bank where distances are measured from; left or right bank (when looking downstream).	
	Stream Width	Stream Width at the station where sample was taken.	
	Unit Stream Width	Units in which the stream width is measured.	
	Station Water Depth	The average of the water depth measurements when taking discharge.	
	Unit Station Water Depth	Unit in which Station Water Depth was measured.	

TABLE NAME	FIELD NAME	FIELD DESCRIPTION	CV RDC REQUIRED
	Hydromodification	Any hydromodification at sample site (e.g., Bridge, ConcreteChannel, Pipes).	
	Hydromodification Loc	Location of hydromodification relative to sample – upstream, downstream, not applicable, or not recorded	
	Location Detail WQ Comments	The comments field should be used for any notes or comments specifically related to location details. Put additional hydromodifications here.	
Lab Collection	Collection Method	The general method of collection (e.g., "Water_Grab", "Sed_Grab", "Autosampler24h")	Yes
	Sample Type	The type of sample collected or analyzed (e.g., "Grab", "Fieldblank", "LCS")	Yes
	Collection Time	The time when the first sample was collected at that site in the field, expressed as hh:mm. (24 hour clock).	Yes
	Replicate	A number that identifies replicates created in the field.	Yes
	Collection Device	The specific device used to collect samples.	Yes
	Position in Water Column	Position in water column where sample was taken.	
	Collection Depth	The depth at which the sample was collected.	Yes
	Unit Collection Depth	The units associated with the above "CollectionDepth" value.	Yes
Habitat Collection	CollectionMethodCode	A code referring to the general method of collection. Default for habitat is "Not Applicable".	Yes
	Collection Time	The time when the first sample was collected at that site in the field, expressed as hh:mm. (24 hour clock).	Yes
Habitat Result	Constituent	A combination of the analyte, matrix, method, fraction, and unit being collected.	Yes
	Variable Result	Non numerical or qualitative result collected as field observations.	
	ResQualCode	A code that qualifies the result for the sample, if necessary. The Default value is "=" for Habitat.	Yes
	QACode	A code that describes any special conditions, situations or outliers that occurred during or prior to the observation to achieve the result.	Yes

TABLE NAME	FIELD NAME	FIELD DESCRIPTION	CV RDC REQUIRED
	Collection Device	The specific device used to collect sample.	Yes
	Habitat Result Comments	The comments field should be used for any notes or comments specifically related to the habitat result. Put additional variable results here if needed.	
Field Collection	Collection Method	Refers to the general method of collection. Default value is "Field".	Yes
	Collection Time	The time when the first sample was collected at that site in the field, expressed as hh:mm. (24 hour clock).	Yes
	Collection Depth	The depth at which the sample was collected.	Yes
	Unit Collection Depth	The units associated with the "CollectionDepth" value. The default values should be "m" (meters) for water samples or "cm" (centimeters) for sediment samples.	Yes
	Position Water Column	The position in the water column where the sample was taken.	
Field Results	Constituent	A combination of the analyte, matrix, method, fraction, and unit being collected.	Yes
	Result	The result of the field measurement.	
	ResQualCode	Qualifies the result for the sample, if necessary. The Default value is "=".	Yes
	QACode	A code that describes any special conditions, situations or outliers that occurred during or prior to the observation to achieve the result.	Yes
	Collection Device	A code that refers to the refers to the specific device used in the collection of the sample.	Yes
	Calibration Date	Date on which the field collection device was calibrated.	Yes
	Field Result Comments	The comments field should be used for any notes or comments specifically related to the field result. If any failures or issues occurred put explanation here.	

For all samples collected by MLJ sampling staff, a combination of qualitative habitat results and quantitative field measurements are taken whenever a site is visited.

The habitat observations that are usually collected by MLJ sampling staff and entered into the CV RDC include:

- Color (specific to either the sediment or water being collected),
- Composition (specific to sediment),
- Dominant substrate,

- Observed flow,
- Odor (of the overall site and the water and/or sediment)
- Other presence,
- Precipitation,
- Precipitation in the last 24 hours,
- Sky code (clear, cloudy, etc.),
- Wadeability of the waterbody,
- Water clarity,
- Wind direction,
- Wind speed.

In addition, MLJ staff take photos of site conditions when visiting a sample location; codes referencing the photo documentation taken by sampling staff are stored in the CV RDC database with habitat parameters.

Quantitative measurements are taken in the field by MLJ staff whenever site conditions allow. Field measurements are taken using multiparameter meters and flow meters according to the Sample Collection SOPs followed by sampling staff. Specific field measurements may vary according to individual project requirements; however, in most cases MLJ staff collect the following measurements that are recorded in the CV RDC during field data entry:

- Air temperature in °C,
- Discharge in cfs,
- Dissolved oxygen in mg/L,
- Specific conductivity in uS/cm,
- pH,
- Water temperature in °C

Once complete, data entry should be tracked by adding the data entry staff name (formatted as last name and first initial) and date of entry in the Field Data Processing table in the MIS Database (**Table 4**).

B. FIELD RESULT QUALITY ASSURANCE

Once field data are entered into the CV RDC database, all electronic field data should be double checked against the original field collection records. Depending on the project this may be all records.

1. Direct Data Entry Verification

For field results entered directly into the CV RDC through the eDERs portal, the final field data are exported and copied into an Excel workbook to review for accuracy using the following steps.

a) EXPORT FIELD DATA FROM EDERS

Each of the following items should be exported into a single Excel sheet for the sampling event using the queries provided:

- Sample, Personnel, Group, Purpose, Location, Geometry, and Location Detail information

- Field Results
- Habitat Results
- Lab Collection

b) Compare the Electronic Field Data to the Field Sheets

Each Excel spreadsheet is verified against the field sheets from the sampling event. Data entry QC is completed by a staff member who did not complete the data entry. The Excel files and field sheets should be reviewed for both completeness and accuracy of entry. All sample failures (such as dry sites or sites to which sampling crews could not gain access) should be noted on the field sheets and recorded in the CV RDC and MIS Databases to account for any deviations from the planned monitoring schedule.

2. Field Result Verification

Field EDDs received in the CEDEN format are verified for formatting, CV RDC business rules, completeness, and accuracy according to the steps provided in **Attachment A**.

In addition, all field parameter measurements (either entered directly into the CV RDC or loaded with a field EDD) are verified against ranges of expected values to ensure the values recorded are reasonable given the environmental conditions of ambient surface water:

- Query field parameter measurements against the upper and lower thresholds identified in the field data review checklist (**Attachment A**, Section 5.1) to determine if they are outside of the range of reasonable values expected for the measurement.
    - If a field result is outside the specified limits, verify the value against the original fieldsheet to ensure it is not the result of a transcription error.
    - Any results identified as unlikely based on the specified limits and verified with the field sheet should be discussed with the Project Manager and QA Officer to determine if the result suspect.
        - It may be the case that the result is determined to be legitimately outside of the normal range based on further site-specific information or anomalous sampling conditions. If the result is determined to be useable, no further data qualifiers are required, though a note should be added to the comment field specifying that the result is anomalous but was verified after further review.
        - Values determined to be suspect should be updated to a null value with a ResQualCode of "NR", a QA code of “FIF” for Instrument Failure, and a specific comment including the original suspect result that was removed (e.g., "Value recorded as 45mg/L, suspected instrument failure").
        - Suspect measurements that are removed from the results field will be determined according to the data rejection procedures identified in the Delta RMP Data Management Plan and/or the associated project QAPP.

Once complete, field result verification should be tracked by adding the data entry staff name (formatted as last name and first initial) and date of verification in the Field Data Processing table in the MIS Database (**Table 4**).

Once field results are entered into the database and verification is complete, MLJ staff will compare the collection information to field QC requirements outlined in the QAPP to ensure that all required QC samples were collected (see **QC Sample Verification and Assessment**). Failure to meet minimum field QC sample requirements during a sampling event must be reported to the Project QA Officer and Project Manager.

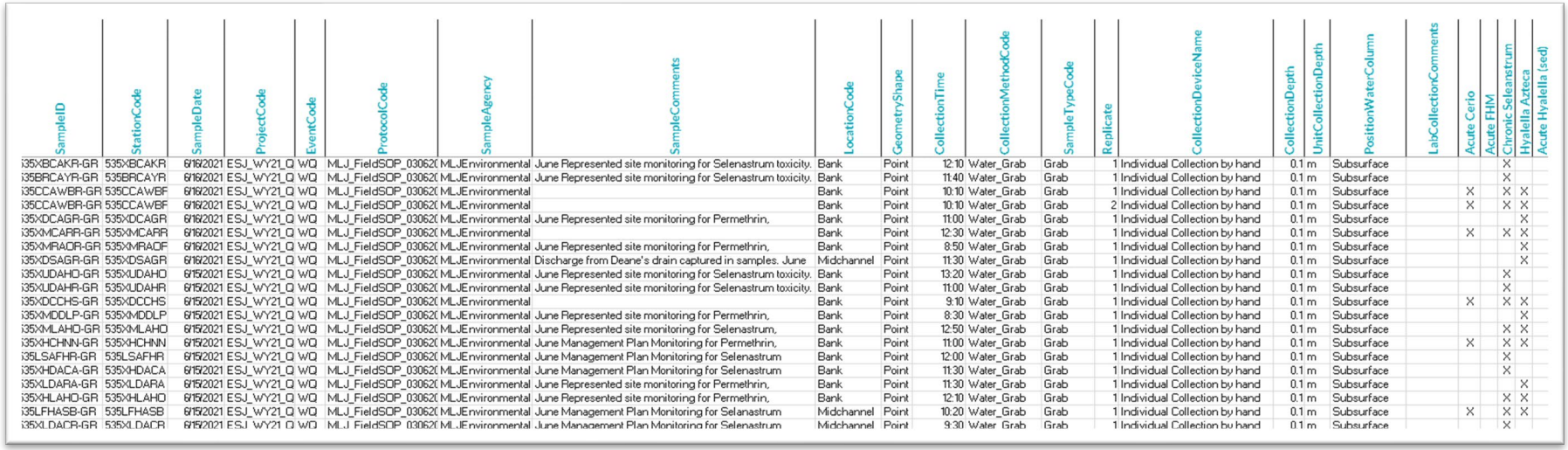
C. LABORATORY SAMPLE DETAILS

Once field data are entered into the CV RDC, the laboratory sample detail information is exported and submitted to the laboratories in an Excel file referred to as Sample Details. The laboratories use the Sample Details file to populate the sample collection information required in the CEDEN comparable EDD. The Sample Details includes the CEDEN analyte names of the constituents associated with samples submitted for analysis. Sample Details should be sent to the laboratory as soon as possible after the event is completed and field data are verified. The following information should be queried from the CV RDC to create Sample Details for each sampling event:

- Sample ID (generally a combination of the Station Code and the sample type information)
- Station Code
- Sample Date
- Project Code
- Event Code
- Protocol Code
- Agency Code
- Sample Comments
- Location Code
- Geometry Shape
- Collection Time
- Collection Method Code
- Sample Type Code
- Replicate
- Collection Device Name
- Collection Depth
- Unit Collection Depth
- Position Water Column
- Lab Collection Comments

Once submitted to the laboratory, the sample details should be tracked by adding the staff name (formatted as last name and first initial) and date on which the file was sent in the Field Data Processing table in the MIS Database (**Table 4**). An example of a final laboratory Sample Details report is shown in **Figure 6**.

Figure 6. Example sample details sent to a laboratory to assist in completing and formatting EDDs.



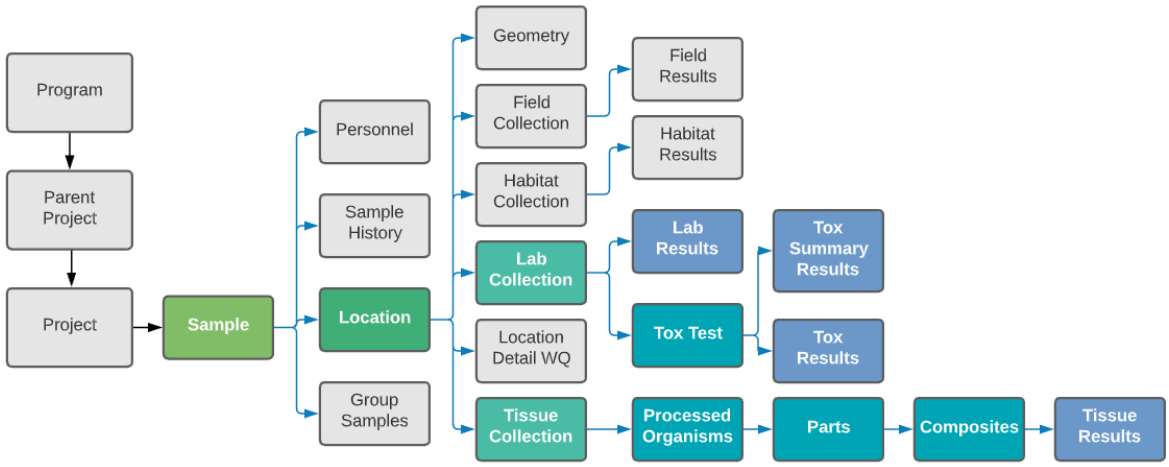
SampleID	StationCode	SampleDate	ProjectCode	EventCode	ProtocolCode	SampleAgency	SampleComments	LocationCode	GeometryShape	CollectionTime	CollectionMethodCode	SampleTypeCode	Replicate	CollectionDeviceName	CollectionDepth	UnitCollectionDepth	PositionWaterColumn	LabCollectionComments	Acute Cerio	Acute FHM	Chronic Selenastrum	Hyalella Azteca	Acute Hyalella (sed)
535XBCAKR-GR	535XBCAKR	6/16/2021	ESJ_WY21_Q	WQ	MLJ_FieldSOP_03062(	MLJEnvironmental	June Represented site monitoring for Selenastrum toxicity.	Bank	Point	12:10	Water_Grab	Grab	1	Individual Collection by hand	0.1	m	Subsurface				X		
535BRCAYR-GR	535BRCAYR	6/16/2021	ESJ_WY21_Q	WQ	MLJ_FieldSOP_03062(	MLJEnvironmental	June Represented site monitoring for Selenastrum toxicity.	Bank	Point	11:40	Water_Grab	Grab	1	Individual Collection by hand	0.1	m	Subsurface				X		
535CCAWBR-GR	535CCAWBF	6/16/2021	ESJ_WY21_Q	WQ	MLJ_FieldSOP_03062(	MLJEnvironmental		Bank	Point	10:10	Water_Grab	Grab	1	Individual Collection by hand	0.1	m	Subsurface		X		X	X	
535CCAWBR-GR	535CCAWBF	6/16/2021	ESJ_WY21_Q	WQ	MLJ_FieldSOP_03062(	MLJEnvironmental		Bank	Point	10:10	Water_Grab	Grab	2	Individual Collection by hand	0.1	m	Subsurface		X		X	X	
535XDCAGR-GR	535XDCAGR	6/16/2021	ESJ_WY21_Q	WQ	MLJ_FieldSOP_03062(	MLJEnvironmental	June Represented site monitoring for Permethrin,	Bank	Point	11:00	Water_Grab	Grab	1	Individual Collection by hand	0.1	m	Subsurface					X	
535XMCARR-GR	535XMCARR	6/16/2021	ESJ_WY21_Q	WQ	MLJ_FieldSOP_03062(	MLJEnvironmental		Bank	Point	12:30	Water_Grab	Grab	1	Individual Collection by hand	0.1	m	Subsurface		X		X	X	
535XMRAOR-GR	535XMRAOF	6/16/2021	ESJ_WY21_Q	WQ	MLJ_FieldSOP_03062(	MLJEnvironmental	June Represented site monitoring for Permethrin,	Bank	Point	8:50	Water_Grab	Grab	1	Individual Collection by hand	0.1	m	Subsurface					X	
535XDSAGR-GR	535XDSAGR	6/16/2021	ESJ_WY21_Q	WQ	MLJ_FieldSOP_03062(	MLJEnvironmental	Discharge from Deane's drain captured in samples. June	Midchannel	Point	11:30	Water_Grab	Grab	1	Individual Collection by hand	0.1	m	Subsurface					X	
535XUDAHO-GR	535XUDAHO	6/15/2021	ESJ_WY21_Q	WQ	MLJ_FieldSOP_03062(	MLJEnvironmental	June Represented site monitoring for Selenastrum toxicity.	Bank	Point	13:20	Water_Grab	Grab	1	Individual Collection by hand	0.1	m	Subsurface				X		
535XUDAHR-GR	535XUDAHR	6/15/2021	ESJ_WY21_Q	WQ	MLJ_FieldSOP_03062(	MLJEnvironmental	June Represented site monitoring for Selenastrum toxicity.	Bank	Point	11:00	Water_Grab	Grab	1	Individual Collection by hand	0.1	m	Subsurface				X		
535XDCCHS-GR	535XDCCHS	6/15/2021	ESJ_WY21_Q	WQ	MLJ_FieldSOP_03062(	MLJEnvironmental		Bank	Point	9:10	Water_Grab	Grab	1	Individual Collection by hand	0.1	m	Subsurface		X		X	X	
535XMDDLP-GR	535XMDDLP	6/15/2021	ESJ_WY21_Q	WQ	MLJ_FieldSOP_03062(	MLJEnvironmental	June Represented site monitoring for Permethrin,	Bank	Point	8:30	Water_Grab	Grab	1	Individual Collection by hand	0.1	m	Subsurface					X	
535XMLAHO-GR	535XMLAHO	6/15/2021	ESJ_WY21_Q	WQ	MLJ_FieldSOP_03062(	MLJEnvironmental	June Represented site monitoring for Selenastrum,	Bank	Point	12:50	Water_Grab	Grab	1	Individual Collection by hand	0.1	m	Subsurface				X	X	
535XHCHNN-GR	535XHCHNN	6/15/2021	ESJ_WY21_Q	WQ	MLJ_FieldSOP_03062(	MLJEnvironmental	June Management Plan Monitoring for Permethrin,	Bank	Point	11:00	Water_Grab	Grab	1	Individual Collection by hand	0.1	m	Subsurface		X		X	X	
535LSAFHR-GR	535LSAFHR	6/15/2021	ESJ_WY21_Q	WQ	MLJ_FieldSOP_03062(	MLJEnvironmental	June Management Plan Monitoring for Selenastrum	Bank	Point	12:00	Water_Grab	Grab	1	Individual Collection by hand	0.1	m	Subsurface				X		
535XHDACA-GR	535XHDACA	6/15/2021	ESJ_WY21_Q	WQ	MLJ_FieldSOP_03062(	MLJEnvironmental	June Management Plan Monitoring for Selenastrum	Bank	Point	11:30	Water_Grab	Grab	1	Individual Collection by hand	0.1	m	Subsurface				X		
535XLDARA-GR	535XLDARA	6/15/2021	ESJ_WY21_Q	WQ	MLJ_FieldSOP_03062(	MLJEnvironmental	June Represented site monitoring for Permethrin,	Bank	Point	11:30	Water_Grab	Grab	1	Individual Collection by hand	0.1	m	Subsurface					X	
535XHLAHO-GR	535XHLAHO	6/15/2021	ESJ_WY21_Q	WQ	MLJ_FieldSOP_03062(	MLJEnvironmental	June Represented site monitoring for Permethrin,	Bank	Point	12:10	Water_Grab	Grab	1	Individual Collection by hand	0.1	m	Subsurface				X	X	
535LFHASB-GR	535LFHASB	6/15/2021	ESJ_WY21_Q	WQ	MLJ_FieldSOP_03062(	MLJEnvironmental	June Management Plan Monitoring for Selanastrum	Midchannel	Point	10:20	Water_Grab	Grab	1	Individual Collection by hand	0.1	m	Subsurface		X		X	X	
535XLDACR-GR	535XLDACR	6/15/2021	ESJ_WY21_Q	WQ	MLJ_FieldSOP_03062(	MLJEnvironmental	June Management Plan Monitoring for Selenastrum	Midchannel	Point	9:30	Water_Grab	Grab	1	Individual Collection by hand	0.1	m	Subsurface				X		

VII. LABORATORY DATA PROCESSING (STAGE 1 DATA)

A. LABORATORY DATA TABLES AND STRUCTURE

Laboratory data are submitted to the MLJ DMT using a CEDEN comparable EDD template. Data are reviewed and loaded into the CV RDC Database through data loading tools that are maintained by the MLJ DMT staff (**Figure 1**). The relational table design in which laboratory data are stored in the CV RDC Database is shown in **Figure 7**.

Figure 7. Sample through Laboratory and Toxicity Result tables within the CV RDC database.



B. MINMUM REQUIREMENTS FOR DATA FORMATTING AND SUBMISSION

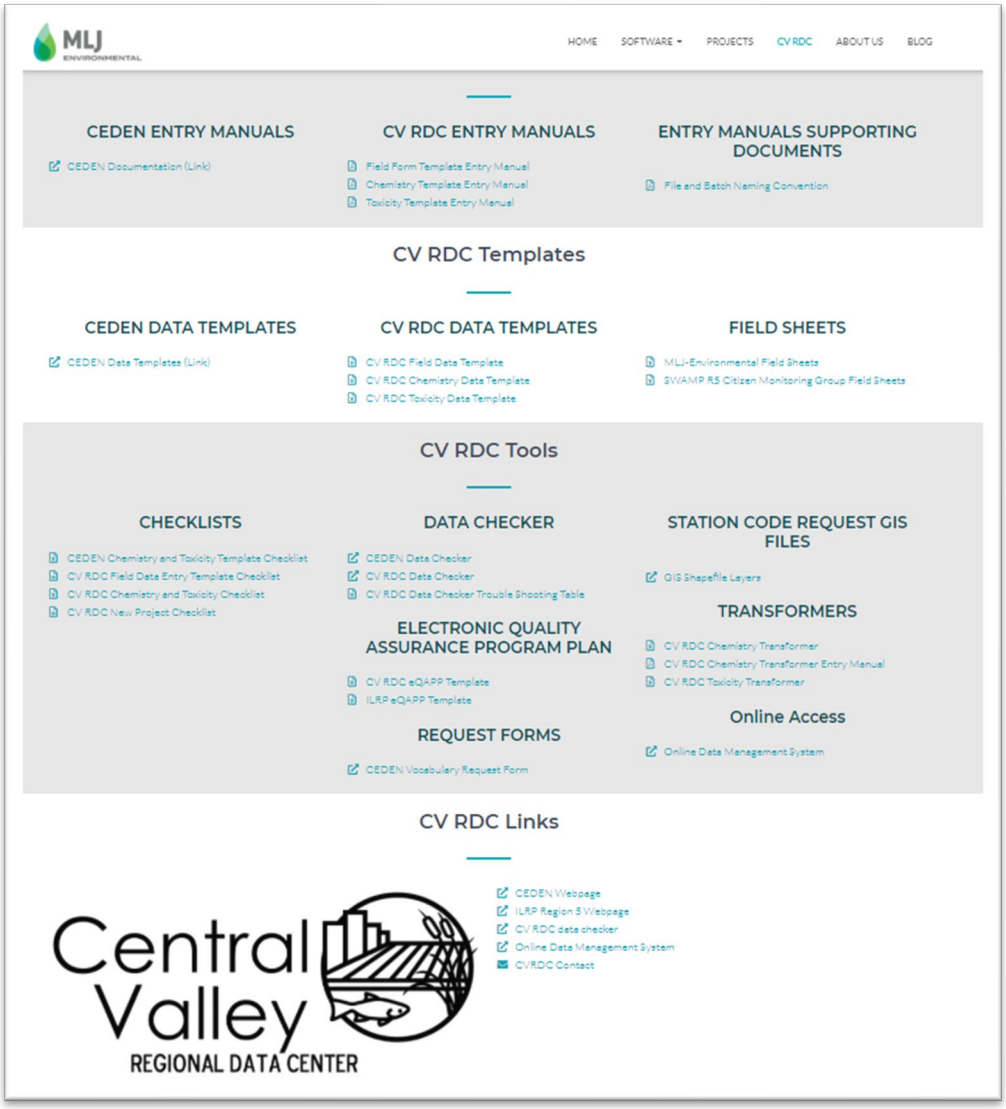
Reporting laboratories follow the CV RDC data submission steps can be found on the MLJ website. MLJ DMT staff are available to assist with questions about the processes outlined on the website. Data submission steps are as follows:

- Step 1: Review of required data elements,
- Step 2: Determine comparability and register project (see **Project Definition**),
- Step 3: Entry into appropriate templates,
- Step 4: Verification that data are correct and comparable,
- Step 5; Submission of data to CV RDC,
- Step 6: Coordination (if appropriate) whether data should be exported to CEDEN.

MLJ works in partnership with laboratories to assist with data reporting. MLJ staff generate **Laboratory Sample Details** for the laboratories to ensure the correct sample collection information is included in the EDD. MLJ ensures all necessary reporting templates and documentation are available online, including online data checkers to facilitate data submission

(**Figure 8**). These checkers allow the submitting agencies to double check the EDDs they have generated against common CV RDC/CEDEN business rules and lookup list values.

Figure 8. Online resources for data submissions available on the MLJ website.



C. RECEIPT AND FILING OF LABORATORY RESULTS

Laboratory results are typically received in two formats: a PDF report in the laboratory's standard output format and an EDD in CV RDC/CEDEN template formats. Once received, both the PDF and the original EDD are electronically filed on secure servers and marked as received by MLJ DMT staff in the Laboratory Data Processing table in the MIS Database (**Table 5**). All documents must be retained for a minimum of 10 years.

Laboratory reports and EDD files are received by email from the individual project and/or data managers for each laboratory. Results should be received according to the schedule as outlined in

individual laboratory contracts and the QAPP. Though turnaround times may vary, laboratories are generally expected to provide the PDF report within 30 days of sample submission and the EDD within 45 days; preliminary results from toxicity testing are generally expected within two weeks. Occasionally, unforeseen delays can occur for receiving laboratory information (such as re-analyses due to QC failure). When laboratory deliverables are not received within the specified timeframe, MLJ staff will follow up with laboratory staff and request an estimated date for the deliverable. Deliverables that are excessively late must be discussed with the Project QA Officer.

Laboratory deliverables must be entered in the MIS Database with a receipt date that reflects the business day on which the laboratory submitted them to MLJ. Any deliverables received before 4 PM on a business day should be recorded with that received date; any deliverables received on a weekend, holiday, or after 4 PM on a business day should be marked as received on the next business day.

D. INITIAL LABORATORY PDF REVIEW

Laboratory results are usually provided in the PDF report prior to receiving the EDDs. Results received in the PDF should be reviewed for completeness and high-level QC concerns immediately upon receiving the report from the laboratory. This initial review allows the opportunity to resolve questions or concerns with the laboratory before the results are provided in the EDD. Furthermore, for some projects, results exceeding thresholds or trigger limits are assessed and reported within a specific time frame according to their program requirements. Trigger limit assessments are completed during this review to ensure program deadlines are met.

Review of the laboratory report is only an initial review; the same checks are repeated during the more in-depth EDD review outlined below. At a minimum, the initial checks of the PDF report should include:

- **Initial sample completeness.** Ensure all analytes requested are reported.
- **Initial blank sample assessment.** Ensure there are no detections above the allowable limit in laboratory and field blanks.
- **Initial positive control sample assessment.** Check the recoveries reported for MS and LCS samples. For projects where the QAPP states that all MS samples with zero percent recovery are reanalyzed, MLJ DMT staff will ensure reanalysis did occur. Reports with multiple positive control failures should be reviewed by the Project QA Officer.
- **Case narrative review.** Any anomalous or concerning issues identified in the report case narrative should be communicated to and reviewed by the QA Officer.

Any reporting discrepancies should be communicated back to the laboratory for clarification and/or a revised report. Significant QC issues noted by MLJ DMT staff during the initial review should be further reviewed by the Project QA Officer to ensure the project requirements are met and determine whether corrective actions need to be taken by the laboratory or MLJ staff. Communications with the laboratory or the QA Officer should occur as soon as possible to ensure project timeline requirements (such as trigger limit exceedance reporting deadlines) are met.

E. PROCESSING OF CHEMISTRY EDDS

Prior to loading an EDD into the CV RDC database, each EDD is reviewed following a checklist that has been customized for the specific reporting laboratory, data type, and project (when applicable). The fundamental checklist items are described below; the detailed checklist used to process chemistry EDDs is provided in **Attachment B**.

EDD reviews require three items: the EDD, the accompanying PDF laboratory report, and eQAPP information.

1. Verify Sample Analysis

All laboratory results should be verified against the sample collection records and COCs upon receipt from the laboratory. Each record in the original monitoring schedule in the MIS that was marked as sampled should now be marked as completed for the analysis. Any missing or mis-reported analyses must be communicated back to the laboratory. Expected analyses that were not completed must be marked as incomplete and qualified with the correct Sample Failure Code on the Analysis Count table in the MIS Database (**Table 3**).

The Project QA Officer is responsible for overseeing laboratory result verification and ensuring that revised reports and data deliverables are received, as necessary. The Project QA Officer may delegate some of this work including communication with the laboratory, follow ups regarding revised report and tracking of QC anomalies.

Any re-analyses should be reviewed by the Project QA Officer for proper reporting procedures. The Project QA Officer or their delegate should communicate with the laboratory to decide which data are acceptable and ensure they are properly flagged and qualified. Only one set of results for any analysis will be loaded into the CV RDC Database (reanalysis results can be referenced in result comments).

2. Remove Extra Non-Project QC Data

Analytical batches processed in the laboratory often contain samples from multiple projects; when laboratories provide all QC results associated with a batch, they may include matrix spike results performed on samples from a different project. At the discretion of the QA Officer, MLJ DMT staff will remove any extra non-project or non-direct data that is not needed to qualify results. Occasionally non-project data are needed to fulfill batch QC requirements; when this occurs, data are assessed against the same QAPP requirements used for project-generated samples (see **Verify Laboratory Data Quality Control**).

3. Verify Results

Electronic data deliverables should be verified against the PDF reports to ensure reporting consistency between report formats. When laboratories generate EDDs directly from their Laboratory Information Management System (LIMS), a minimum of 10% of the data must be verified against the PDF report. When EDDs are hand entered by the laboratory, 100% of the results provided must be checked against the report.

If discrepancies are found during the 10% data verification, additional verification is needed to ensure the laboratory export is correct and matches the PDF laboratory report. Issues are communicated back to the laboratory and, if needed, a new export will be requested.

4. Verify Processing and Analysis Information

All analytical sample processing and analysis information should be verified against the project-specific requirements outlined in the eQAPP and against the business rules of the CV RDC (e.g., correct formatting of the LabBatch identifier). Any discrepancies between the processing and analysis information and the expected requirements in the project eQAPP should be communicated back to the contract laboratory and the report amended if applicable. At a minimum, results will be checked for:

- Expected LabBatch formatting utilizing CV RDC batch naming conventions.
- Expected batch grouping – ensure that the LabBatch is grouped by method.
- Expected batch completion times – ensure the analysis dates and digest/extract dates (where applicable) in a batch are within 24 hours of each other.
- Expected analyte/calculation reporting.
- Expected preparation or digest methods.
- Expected minimum detection limits (MDLs) and reporting limits (RLs) - ensure detection and reporting limits match those specified in the eQAPP. Diluted samples are reported with elevated detection and reporting limits, so only results with a dilution factor of 1 would be expected to match the QAPP.
- Expected reporting units.

5. Verify Formatting

Fields that are not controlled by valid values (e.g., comment fields) need to be reviewed to ensure consistency and usability. According to CV RDC business rules and the original SWAMP formatting, the Lab Result Comments field is used to capture percent recovery (PR) and relative percent difference (RPD) values for accuracy and precision control samples. The laboratory result comment field should be formatted as follows for all MS, LCS, laboratory duplicate, or field duplicate samples:

1. Indicate PR or RPD, followed by the calculated value: PR XX or RPD XX. (e.g, PR 99)
    - When in combination, separate the two values with a comma: PR XX, RPD XX (e.g. PR 99, RPD 5).
    - Some programs indicate FD RPD XX for field duplicates.

Any non-detect results should be blank and coded “ND” for the result qualifier code. Results below the MDL are considered non-detect.

6. Calculating Field Duplicate Precision

Field duplicate RPD (or applicable precision evaluation) calculations are not normally provided by the laboratory; these values must be calculated according to requirements outlined in the QAPP and added to the Lab Result Comments of the EDD for evaluating field duplicate acceptability.

When a field duplicate or parent sample result is non-detect the RPD cannot be calculated and the RPD is indicated as "RPD NA" in the Lab Result Comments field.

7. Verify Laboratory Data Quality Control

All laboratory analysis results will be verified against the current MQOs stored in the eQAPP Database. Any data that do not meet the project acceptability criteria must be flagged with an approved quality assurance flag defined in the CV RDC/CEDEN QACode LookUp lists. Common quality assurance flags are listed in **Table 7** as well as business rules for how the codes are applied for most projects in which data are processed by MLJ staff. All acceptable, unflagged data are assigned a QACode of None to indicate there were no anomalies for which a QACode is required. No records with an unpopulated QACode field can be loaded to the database.

If necessary, MLJ DMT staff will update QACodes applied by the laboratory to match the project QA requirements. Any updates will be highlighted and provided to the laboratory to ensure the correct QACode is applied in future EDDs.

Any quality assurance concerns that require an additional code not yet approved for use in a specific project must be reviewed by the project QA Officer. All approved codes are reviewed for CV RDC/CEDEN comparability and for consistency of QA failure classification by the Project QA Officer. Qualified data are still considered useable as multiple factors are considered when determining usability; refer to specific QAPPs for information regarding the determination of useable data.

At a minimum, the following QC checks must be performed prior to loading analytical data into the database:

- **Hold time compliance.** Samples are evaluated to ensure they were performed within the designated hold time outlined within the eQAPP.
- **QC sample frequency evaluation.** Depending on the specific requirements outlined in the QAPP, most batches should be analyzed with the following QC samples:
  - Laboratory blank,
  - Laboratory control spike (LCS),
  - Matrix spike (MS), and
  - Laboratory duplicate.

  When sample frequency requirements are not met, the LabSubmissionCode is updated to "QI" to indicate incomplete QC; otherwise, the LabSubmissionCode is populated according to the **LabBatch Information Updates** conventions. A Lab Batch Comment is always required to indicate why batch QC frequency was not met.
- **Field QC sample evaluation.** All applicable field QC should be evaluated according to the requirements in the eQAPP. This usually includes (but is not limited to):
  - Field blank detections – any field blank detections should be below the acceptable limit outlined in the eQAPP.
  - Field duplicate acceptability – field duplicate RPDs must be below the acceptable limit outlined in the eQAPP.

- **Laboratory QC sample evaluation.** All applicable Laboratory QC should be evaluated according to the requirements in the eQAPP. This usually includes (but is not limited to):
  - Laboratory blank detections – any laboratory blank detections should be below the acceptable limit outlined in the eQAPP.
    - When laboratory blank results do not meet MQOs, any associated environmental samples with detectable results (> MDL) should also be flagged as "FI" indicating the analyte was present in both the environmental sample and its associated blank.
  - Laboratory control spike (LCS) recoveries – PR values for LCS samples should be within the acceptable limits outlined in the eQAPP.
  - Matrix spike recoveries – PR values for MS samples should be within the acceptable limits outlined in the eQAPP.
  - Laboratory replicate acceptability – laboratory replicate RPDs must be below the acceptable limit outlined in the eQAPP.
  - Surrogate recoveries - PR values for surrogate samples should be within the acceptable limits outlined in the eQAPP.

Table 7. Common quality assurance codes and flagging rules for chemistry data.

Sample Type		QA Code	Code Description	Flagging Business Rules
Environmental Samples	Holding Time	H	A holding time violation has occurred	Apply to each result with the holding time exceeded. Apply to matrix spikes with parent environmental samples. Do not apply to LABQA.
	Dilutions performed	D	EPA Flag - Analytes analyzed at a secondary dilution	Apply to results with a dilution factor greater than 1.
	Blank Contamination	FI	Analyte in field sample and associated blank	Apply to environmental results with detections that are associated with a laboratory blank result that was above the acceptable limit. LabBlank is flagged with "IP"; LabBlank and environmental results are given a compliance code of QUAL.
Field QC Samples	Field Blanks	IP/IP5[1]	Analyte detected in method, trip, or equipment blank	Apply to field blank results with a detection above the acceptable limit.
	Field Duplicates	FDP	Field duplicate RPD outside of established limits	Apply to results for both replicates with an RPD above the acceptable limit.
Laboratory QC Samples	LabBlank	IP	Analyte detected in method, trip, or equipment blank	Apply to lab blank result with a detection above the acceptable limit.

Sample Type		QA Code	Code Description	Flagging Business Rules
	MS/MSD	GB	Matrix spike recovery not within control limits	Apply to MS or MSD result with a percent recovery outside of project QC limits.
	MS/MSD	BB	Sample > 4x spike concentration	Apply to MS and MSD results associated with high native concentrations; both RPD and PR should be recorded as "Not Calculable"
	MS/MSD	BBM	Sample > 2x but less than 4x spike concentration	Apply to MS and MSD results associated with high native concentrations; both RPD and PR should be recorded as "Not Calculable"
	LCS	EUM	LCS recovery is outside of control limits.	Apply to LCS results with a percent recovery outside of project QC limits.
	CRM	GBC	CRM analyte recovery is outside of control limits.	Apply to CRM results with a percent recovery outside of project QC limits.
	Laboratory Dup/MSD	IL	Duplicate analysis not within control limits.	Apply to results for both replicates with an RPD above the acceptable limit.
	000NONPJ samples	QAX	When the native sample for the MS/MSD or DUP is not included in the batch reported	Apply to 000NONPJ samples when the native sample is not included in the batch reported.
Surrogates		GN	Surrogate recovery is outside of control limits	Apply to both the surrogate that did not meet QC limits and to the analytes/sample associated to that surrogate. If there are two surrogates performed for a sample and one is outside project QC limits and one is inside QC limits, GN is applied to all analytes for that sample except the surrogate that was inside QC limits.
Isotope Dilution Analogues		GIDA	Isotope Dilution Analogue recovery not within control limits	Apply to both the labeled IDA that did not meet QC limits and to the environmental result(s) associated/ quantified with that IDA.
		IDA	Isotope Dilution Analogue corrected	Apply to applicable environmental result but not the IDA itself.

SAMPLE TYPE	QA CODE	CODE DESCRIPTION	FLAGGING BUSINESS RULES
Rejecting Batches	R	Data rejected - EPA Flag	Apply to all samples within a rejected batch (environmental and QC) that are outside project QC limits and the program QA officer determines to be rejected. (See Rejected Chemistry Results section for details)

[1]The use of the specific "IP" code may vary by project according to the FB evaluation requirements outlined in the QAPP; the determination of the correct code to use is at the discretion of the Project QA Officer.

8. LabBatch Information Updates

The CV RDC business rules applied to most projects when reviewing and updating the LabBatch worksheet within the CEDEN template are as follows:

- **LabSubmissionCode updates**. For data processed by MLJ DMT staff, the Lab Submission Code is updated anytime a QACode other than None is used in a batch. Batches where all results have a QACode of "None" have a LabSubmissionCode of "A" for acceptable. If the batch has any QACode other than "None", "A,MD" is applied indicating acceptable with minor deviations .
- **BatchVerificationCode updates.** Unless otherwise specified, all data processed by MLJ staff according to the steps outlined in this SOP are given a batch verification code of "VAC" indicating a cursory verification was completed.

9. Unique Row Verification

Unique records are verified by completing two checks:

- Ensure that there is only one analyte and fraction for each station, sample date, and sample type for environmental samples, and
- Ensure all required CV RDC fields are unique in the EDD.

10. Chemistry Data Checker

Once the EDD review is complete, the processed EDD is uploaded into a CV RDC/CEDEN online data checker for a verification of business rules and valid values by the MLJ DMT. A data checker is an online tool into which a data provider can upload a populated template to run the data set through a series of automated checks. The data checker provides a report to the data provider via email identifying errors that need to be resolved and issues that need to be reviewed in the submitted EDD. In most cases, errors identified by the data checker are database requirements and must be resolved for the data to be uploaded into the CV RDC database. Other items identified as potential issues with the EDD are warnings which may be project specific or not applicable to the data set. All potential issues identified by the data checker are evaluated and addressed, when applicable, by the MLJ DMT in coordination with the data provider and/or laboratory (as needed) prior to finalizing the EDD and loading it into the CV RDC database (see **Loading Laboratory Results into CV RDC Database**). Processed EDDs may be uploaded to the data checker more than once to ensure all applicable errors and warnings have been successfully corrected. Links to data checkers used for CV RDC data can be found on the MLJ Environmental

website; the specific data checker that should be used for an EDD is dependent on the project and the CEDEN template being submitted.

11. Rejected Chemistry Results

Results that do not meet project acceptance criteria must be assessed through the corrective action process (see Corrective Action/Resolution). When corrective actions are assessed and no resolution can be reached the rejection of results that do not meet QC requirements as outlined by the QAPP are left to the discretion of the Project QA Officer. The Project QA Officer works in coordination with data users and any project-specific authorities or regulators to assess the QC failures according to project goals and determine whether results should be rejected.

Results that are rejected by the QA Officer, and are therefore considered unusable for the project goals, are processed and flagged with a QACode of "R" for rejected. Individual rejected results should be formatted as follows:

- The result is removed from the Result column (cell is null) and the ResQualCode updated to "NR".
- The Lab Result Comments are updated to indicate the original result of the failed sample,
  - Example: "Original result 0.02 ug/L. Batch rejected. See batch comments."
- An applicable Lab Batch Comment is applied to indicate why the batch and/or result was rejected.
- Appropriate QACode flags, indicating that QC limits that were not met, are applied in addition to the rejected QACode.

If the whole batch is rejected, the following updates are made to the batch-level information:

- The Lab Submission Code is updated with an "R,QC" indicating that the batch is rejected;
- The batch verification code is updated to "VR"; and
- The compliance code is also updated to "Rej" to indicate that the data are rejected and unusable for intended purposes.

12. Chemistry EDD Review MIS Tracking

Once complete, the EDD review should be tracked by adding the staff name (formatted as last name and first initial) and date on which the review was completed in the Laboratory Data Processing table in the MIS Database (**Table 5**).

F. PROCESSING OF TOXICITY EDDS

Like the chemistry EDDs, MLJ DMT staff process individual toxicity EDDs prior to loading them into the CV RDC Database. Each EDD is reviewed following a checklist that has been customized for the specific reporting laboratory, data type, and project when applicable. The fundamental checklist items are described below; a detailed checklist used to process toxicity EDDs is provided in **Attachment C**.

EDD reviews require three items: the EDD, the accompanying PDF laboratory report, and the eQAPP project information.

1. Verify Sample Analysis

Toxicity results should be verified against the sample collection records and the MIS Database according to the same steps outlined above for chemistry results (**Verify Sample Analysis**).

2. Verify Results

Toxicity results should be verified against the final laboratory PDF report according to the same steps outlined above for chemistry results (**Verify Results**).

3. Verify Processing and Analysis Information

All toxicity sample processing and analysis information should be verified against the project-specific requirements outlined in the eQAPP and against the business rules of the CV RDC Database (e.g., correct formatting of the LabBatch identifier). Any discrepancies between the processing and analysis information and the expected requirements in the project eQAPP should be communicated back to the contract laboratory; if applicable, the report should be amended by the laboratory and resubmitted. At a minimum, toxicity results will be checked for:

- Expected ToxBatch formatting utilizing CV RDC batch naming conventions.
- Expected batch grouping – ensure that the ToxBatch is grouped by method and organism.
- Expected test and method information.
- Expected statistical information.
- Expected organisms and endpoints.

4. Verify Water Quality Information

The water quality parameter results reported by the laboratory along with the toxicity test results should be verified according to the requirements and frequency outlined in **Table 8**. Results associated with water quality measurements outside of the acceptable range are flagged accordingly.

Table 8. Water quality parameter requirements for toxicity samples analyzed by Pacific EcoRisk (PER).

Test	Parameter	Precision	Min	Max	Max difference	WQ Measurement Time Points
7-Day Chronic Freshwater *Pimephales promelas* Survival and Growth Toxicity Test	Specific Conductivity					initial, final
	Temperature		24	26	3	initial, final, renewal (daily); lab must report minimum and maximum measurement values
	Dissolved Oxygen					initial, final, renewal (daily, 1 in old solution and 1 in new solution)
	Ammonia					initial, final
	Hardness					initial
	Alkalinity					initial

Test	Parameter	Precision	Min	Max	Max difference	WQ Measurement Time Points
	Toxicity Testing Field Duplicates	Statistical agreement between duplicates (RPD <25%)				N/A
6-8-Day Chronic Freshwater *Ceriodaphnia dubia* Survival and Reproduction Toxicity Test	pH					initial, final, renewal (daily)
	Specific Conductance					initial, final
	Temperature		24	26	3	initial, final, renewal (daily); lab must report minimum and maximum measurement values
	Dissolved Oxygen					initial, final, renewal (daily, 1 in old solution and 1 in new solution)
	Ammonia					initial, final
	Hardness					initial
	Alkalinity					initial
	Toxicity Testing Field Duplicates	Statistical agreement between duplicates (RPD <25%)				N/A
96-Hour Chronic Freshwater *Selenastrum capricornutum* Growth Toxicity Test	pH					initial, final, renewal (daily)
	Specific Conductance					initial, final
	Temperature		24	26	3	initial, final, renewal (daily); lab must report minimum and maximum measurement values
	Dissolved Oxygen					initial, final, renewal (daily, 1 in old solution and 1 in new solution)
	Ammonia					initial, final
	Hardness					initial
	Alkalinity					initial
	Toxicity Testing Field Duplicates	Statistical agreement between duplicates (RPD <25%)				N/A
10-Day Chronic Freshwater *Chironomus dilutus*	pH					initial, final, renewal (daily)
	Specific Conductance					initial, final

Test	Parameter	Precision	Min	Max	Max difference	WQ Measurement Time Points
Survival and Growth Toxicity Test	Temperature		24	26	3	initial, final, renewal (daily); lab must report minimum and maximum measurement values
	Dissolved Oxygen					initial, final, renewal (daily, 1 in old solution and 1 in new solution)
	Ammonia					initial, final
	Hardness					initial
	Alkalinity					initial
	Toxicity Testing Field Duplicates	Statistical agreement between duplicates (RPD <25%)				N/A
96-Hour Acute Freshwater *Hyalella azteca* Survival Toxicity Test	pH					initial, final, renewal (daily)
	Specific Conductance					initial, final, renewal (daily)
	Temperature		20	20	1	initial, final, renewal (daily); lab must report minimum and maximum measurement values
	Dissolved Oxygen					initial, final, renewal (daily, 1 in old solution and 1 in new solution)
	Ammonia					initial, final
	Hardness					initial
	Alkalinity					initial
	Toxicity Testing Field Duplicates	Statistical agreement between duplicates (RPD <25%)				N/A

5. Calculating Field Duplicate Precision

Field duplicate RPD (or applicable precision evaluation) calculations are not normally provided by the laboratory; these values must be calculated according to the requirements outlined in the QAPP and added to the ToxPointSummaryComments field of the EDD for evaluating field duplicate acceptability. According to CV RDC business rules, the RPD calculation in the ToxPointSummaryComments field should be formatted as “RPD XX” or, for some projects, as “FD RPD XX” for field duplicates.

6. Verify Laboratory Data Quality Control

Toxicity results should be verified against the current MQOs stored in the eQAPP Database. Like chemistry data, any data that do not meet the project acceptability criteria must be flagged with an approved quality assurance flag defined on the CV RDC/CEDEN QA Code LookUp lists. Common quality assurance flags are listed in **Table 9**. All acceptable, unflagged data are assigned a QACode of None to indicate there were no anomalies for which a QACode is required. All records must have QACode field in order to be loaded to the database.

At a minimum, the following QC checks must be performed prior to toxicity data being loaded into the database:

- **Hold time compliance.** Samples are evaluated to ensure they were performed within the designated hold time outlined within the eQAPP.
- **QC sample frequency evaluation.** Depending on the specific requirements outlined in the eQAPP, toxicity batches should be analyzed with at least one negative control (CNEG) sample.
  When QC sample frequency requirements are not met, the LabSubmissionCode is updated to "QI" to indicate incomplete QC. A ToxBatchComments is required to indicate why batch QC frequency was not met.
- **Field QC sample evaluation.** All applicable field QC should be evaluated according to the frequency requirements in the eQAPP. This usually includes (but is not limited to):
  - Field duplicate acceptability – field duplicate RPDs must be below the acceptable limit outlined in the eQAPP.

Table 9. Common quality assurance codes and flagging rules for toxicity data.

SAMPLE TYPE		QA CODE	CODE DESCRIPTION	FLAGGING BUSINESS RULES FOR TOXSUMMARY TESTQACODE
Environmental Samples	Holding Time	H	A holding time violation has occurred	Apply to each result with the holding time exceeded. Do not apply to LABQA.
	Dilutions performed	D	EPA Flag - Analytes analyzed at a secondary dilution	Apply to results with a dilution other than 100.
Field QC Samples	Field Duplicates	FDP	Field duplicate RPD outside of established limits	Apply to results for both replicates with an RPD above the acceptable limit.
Laboratory Control Samples	CNEG	TAC	Alternative control used in toxicity statistical analysis	Apply to CNEG that was not utilized in statistical analysis
	CNSL/ CNpH[1]	TCF	Alternative control does not meet test acceptability criteria	Apply to alternative control result that is outside of TAC limits.

SAMPLE TYPE	QA CODE	CODE DESCRIPTION	FLAGGING BUSINESS RULES FOR TOXSUMMARY TESTQACODE
Samples with Water Quality Parameter Issues	TCI	Conductivity insufficient for test species	Apply to applicable sample only
	TCT	Conductivity tolerance exceeded for test species	Apply to applicable sample only
	TR	Test conditions not acceptable (temp, light)	Apply to applicable sample only
	TW	Water quality parameters outside recommended test method ranges	Apply to applicable sample only
	TWN	Required water quality parameters not measured	Apply to applicable sample only
	TA	Ammonia precision or accuracy exceeds laboratory control limit	Apply to applicable sample only
Sample with Organism or Survival Issues	PRM	Low survival in toxicity test resulted from test interference due to pathogen-related mortality	Apply to applicable sample only
	TAD	Additional metamorphosized or pupated organism accidently included in statistical analysis	Apply to applicable sample only
	TAF	Test organisms exceeds maximum weight requirement at test initiation	Apply to applicable sample only
	TMM	Male replicate excluded from test analysis	Apply to applicable sample only
	TMO	Test organisms escaped or are otherwise missing	Apply to applicable sample only; In replicate tab result comments add how many organisms were excluded and how many organisms were included in the statistics (e.g. 1 organism pupated, 9 organisms used in the calculation).

SAMPLE TYPE	QA CODE	CODE DESCRIPTION	FLAGGING BUSINESS RULES FOR TOXSUMMARY TESTQACODE
	TOQ	Number of organisms in a toxicity test do not meet the minimum quantity per replicate at test initiation or an unequal quantity of organisms per replicate is used	Apply to applicable sample only. Ensure OrganismPerRep is correct.
	TAE	Organism exceeds age limit	Apply to applicable sample only
Replicate Issues	RLST	Replicate lost or destroyed	Apply to applicable sample only. Ensure RepCount is adjusted accordingly.
Rejecting Batches	R	Data rejected - EPA Flag	Apply to all samples within a rejected batch (environmental and QC) that are outside project QC limits and the program QA officer determines to be rejected. (See **Rejected Toxicity Results** section for details)

7. ToxBatch Information Updates

ToxBatch information should be populated according to CV RDC business rules as outlined in the chemistry section; see **LabBatch Information Updates** section above.

8. Toxicity Unique Row Verification

Unique records are verified by completing two checks:

- Ensure that there is only one organism and endpoint for each station, sample date and sample type for environmental samples, and
- Ensure all required CV RDC fields are unique in the EDD.

9. Toxicity Data Checker

Once the EDD review is complete, toxicity results should be uploaded to the CV RDC/CEDEN data checkers according to the same steps outlined for chemistry data above (**Chemistry Data Checker**).

10. Rejected Toxicity Results

Results that do not meet project acceptance criteria must be assessed through the corrective action process (see Corrective Action/Resolution). When corrective actions are assessed and no resolution can be reached the rejection of results that do not meet QC requirements as outlined by the QAPP are left to the discretion of the Project QA Officer. The Project QA Officer works in

coordination with data users and any project-specific authorities or regulators to assess the QC failures according to project goals and determine whether results should be rejected.

Results that are rejected by the QA Officer are considered unusable for the project goals and are processed with other results and flagged with a QACode of "R" for rejected. Individual rejected toxicity results should be formatted as follows:

- PercentEffect is removed (cell is null),
- SigEffect updated to "NA"
- TestQACode updated to "R"
- ComplianceCode as "REJ"
- The mean is left as is with the mean populated
- The tox point summary comments are updated to indicate why the samples were rejected
  - Example: "Control did not meet test acceptability criteria. Rejected data."
- An applicable tox batch comment is applied to indicate why the batch or sample was rejected.
- Appropriate QACode flags, indicating that QC limits that were not met, are applied in addition to the rejected QACode.

If the whole batch is rejected, the following updates are made to the batch-level information:

- The LabSubmissionCode is updated with an "R,QC" indicating that the batch is rejected,
- The BatchVerificationCode is updated to "VAC,VCN" (Cursory Verification, Tox Control Failure, Flagged by QAO),
- The ComplianceCode is updated to "Rej" to indicate that the data is rejected and unusable for all intended purposes.

11. Toxicity EDD Review MIS Tracking

Once complete, the EDD review should be tracked by adding the staff name (formatted as last name and first initial) and date on which the review was completed in the Laboratory Data Processing table in the MIS Database (**Table 5**).

G. PROCESSING OF TISSUE EDDS

Prior to loading a tissue EDD into the CV RDC database, each EDD is reviewed following a checklist that has been customized for the specific reporting laboratory, data type, and project (when applicable). The fundamental checklist items are described below; the detailed checklist used to process chemistry EDDs is provided in **Attachment D**.

EDD reviews require three items: the EDD, the accompanying PDF laboratory report and eQAPP project information.

Tissue EDD processing follows the same steps outlined above in the **Processing of Chemistry EDDs** section; the major exception is the review of the sample composite information outlined below. The composite review steps are completed first, then the steps for chemistry EDDs can be followed to compete the process.

1. Fish Composite

For fish tissue samples the below items on the tissue template fish composite worksheet must be reviewed for accuracy, consistency and adherence to CV RDC business rules:

- Ensure sample and collection information matches field data entry (Columns A -N).
- Ensure TisSource is “NA”.
- Ensure Organism IDs follow a recognizable, consistent convention for the program.
- If fork and total length are recorded, ensure the total length is larger than fork length.
- If the project is a human health study, ensure that the smallest fish total length is no more than 20% difference compared to the largest fish total length (if applicable according to the QAPP).
- Review for extreme or erroneous values for fork length, total length, and weight of fish.
- Ensure TissueID’s follow a recognizable, consistent convention for the program.
- Ensure TissueName and PartsPrepPreservationName matches tissue processing procedures in QAPP.
- Review the tissue weight against the weight of fish to ensure the tissue weights are lower (or similar where the whole fish was used).
- Ensure CompositeIDs follow a recognizable, consistent convention for the program. Often CompositeIDs should include the StationCode, sample date, and organism reference. If the program has individual vs composite samples typically “I” or “C” are referenced in the CompositeID.
- Ensure that the CompositeWeight, CompositeType, CompositeReplicate, UnitCompositeWeight, HomogDate, OrganismGroup, ComAgencyCode are the same for each CompositeID.
- Review the individual organism weights against the CompositeWeights and ensure there are no extreme or erroneous values.

2. Bivalve Composite

For bivalve tissue samples the below items on the tissue template bivalve composite worksheet must be reviewed for accuracy, consistency, and adherence to business rules:

- Ensure sample and collection information matches field data entry (Columns A -N).
- Ensure TisSource is “Resident” or “Transplant”.
- Ensure OrganismID’s follow a recognizable, consistent convention for the program.
- Ensure ShellLength, ShellWidth and LengthWidthType are consistent; check for extreme or erroneous values.
- Ensure individual bivalve measurements are provided. If the program is not reporting individual bivalve measurements, ensure QAPP allows for averaging measurements.
- Ensure TissueID’s follow a recognizable, consistent convention for the program.
- Ensure TissueName and PartsPrepPreservationName match tissue processing procedures in QAPP.
- Review for erroneous values for tissue weight compared to organism weight (if reported).
- Ensure the CompositeIDs follow a recognizable, consistent convention for the program. CompositeIDs should include StationCode, sample date, and organism reference. If the

program has individual vs composite samples typically "I" or "C" are referenced in the CompositeID.
- Ensure that the CompositeWeight, CompositeType, CompositeReplicate, UnitCompositeWeight, HomogDate, OrganismGroup, ComAgencyCode are the same for each CompositeID.
- Review the individual organism weights against the CompositeWeights and ensure there are no extreme or erroneous values.

3. Super Composite

For super composite samples the below items on the tissue template super composite worksheet must be reviewed for ensure accuracy, consistency, and adherence to business rules:

- Ensure CompositeSourceID matches ID from original composite worksheet.
- Ensure CompositeType, CompositeReplicate, CompositeWeight and UnitCompositeWeight are the same for each SuperCompositeID.
- Ensure SuperCompositeIDs follow a recognizable, consistent convention for the program.
- Ensure CompositeType equals "super".

4. Verify Tissue Result

When verifying tissue chemistry results follow the steps outlined in the **Verify Results** section above for processing chemistry EDDs. In addition to those steps, tissue results must also be checked for the following:

- Ensure SampleTypeCode equals "Composite".
- Ensure the CompositeID matches between results worksheet and corresponding composite worksheet.
- Ensure OrganismGroup is applicable to the corresponding type of composite.

5. Verify Processing and Analysis Information

Processing and analysis information should be verified according to the **Verify Processing and Analysis Information** steps outlined for chemistry EDDs.

6. Verify Formatting

Formatting should be verified according to the **Verify Formatting** steps outlined for chemistry EDDs.

7. Verify Laboratory Data Quality Control

Laboratory data quality control samples are verified according to the **Verify Laboratory Data Quality Control** steps outlined for chemistry EDDs.

8. LabBatch Information Updates

Laboratory batch information should be process according to the **LabBatch Information Updates** steps outlined for chemistry EDDs.

9. Unique Row Verification

Unique row checks for tissue data are run according to the **Unique Row Verification** steps outlined for chemistry EDDs.

10. Tissue Chemistry Data Checker

Tissue data are run through data checkers according to the **Chemistry Data Checker** steps outlined for chemistry EDDs.

11. Rejected Tissue Chemistry Results

Results that do not meet project acceptance criteria must be assessed through the corrective action process (see Corrective Action/Resolution). When corrective actions are assessed and no resolution can be reached the rejection of results that do not meet QC requirements as outlined by the QAPP are left to the discretion of the Project QA Officer. The Project QA Officer works in coordination with data users and any project-specific authorities or regulators to assess the QC failures according to project goals and determine whether results should be rejected.

Tissue chemistry data are rejected and coded according to the **Rejected Chemistry Results** steps outlined for chemistry EDDs.

12. Chemistry EDD Review MIS Tracking

Once complete, the EDD review should be tracked by adding the staff name (formatted as last name and first initial) and date on which the review was completed in the Laboratory Data Processing table in the MIS Database (**Table 5**).

H. CORRECTIVE ACTION/RESOLUTION

Results that fail to meet project acceptance criteria due to errors in the field or lab trigger the initiation of the corrective action process. While the specific process may vary by project, there are four general steps that should be followed to complete this process:

1. Identification of the error or deviation,
2. Documentation and tracking,
3. Investigation of the root cause, and
4. Review/follow up to assess if the error has been successfully corrected.

As the MLJ DMT staff are the first reviewers of data received from laboratories, they are primarily involved in the identification and documentation of errors and deviations.

When errors are found in either the PDF report or the EDD file which prevent the data from being processed and/or loaded into the database, the following actions should be performed:

- The appropriate laboratory will be contacted regarding the issue(s) requiring resolution and sent a copy of the data file to use as a reference if needed.
- If the issue requires a resubmission, a revised data file and/or hardcopy report will be requested from the laboratory.

All minor issues will be revised by the MLJ DMT staff in the EDD file; the laboratory must be notified of any changes to the final data file prior to loading.

Similarly, for field deviations/errors identified during the data review process, the field crew and project manager will be notified, and any additional actions discussed for correcting the data and preventing similar issues in the future.

Any laboratory errors that cannot be resolved by an updated report or data file must be reviewed by the QA Officer and assessed for the necessity of further investigation or resolution. The QA Officer works with the labs to establish proper documentation and corrective actions for laboratory errors.

For most projects, follow up reviews of implemented corrective actions occur on two levels:

1. Summaries and reviews of corrective actions are provided to data users and regulators through annual QA assessment reports, and
2. Reviews with laboratory staff occur through annual meetings conducted by the QA Officer and data managers assessing performance and data needs.

The associated QAPP provides additional guidance regarding project-specific corrective actions and should be referenced when determining the level to which step 3 and 4 should be implemented.

I. PROVIDING CHEMISTRY RESULTS FOR TOXIC TOXICITY RESULTS (PHASE III TIE)

For certain projects, toxicity samples in which the organisms exhibit a certain amount of toxic effect may require further investigation as to the source of the toxicity in the samples. Toxicity Identification Evaluations (TIEs) may be performed and, as part of a Phase III TIE, chemistry results can be used to evaluate the toxic effect of specific analytes detected in the sample. When a TIE is triggered (according to limits defined by the program requirements), MLJ DMT staff provide relevant chemistry data associated with the sample that is determined to be toxic to one or more organisms, back to the toxicity laboratory so that a Phase III TIE can be completed.

If there are relevant chemistry results available to send back to the laboratory, MLJ DMT staff export these results into a Phase III TIE chemistry data template once the originally reported results have been verified and loaded into the database. The Laboratory Data Processing table in the MIS Database is updated to reflect that chemistry results were sent to the laboratory. The laboratory uses the data provided to calculate the toxic units of any detected analytes for the TIE investigation summary in the final laboratory report.

J. LOADING LABORATORY RESULTS INTO CV RDC DATABASE

Once an EDD is processed and verified (the checklist is completed and any remaining laboratory questions are answered and updated), the EDD is placed in a queue for loading into the CV RDC Database. Prior to loading, EDDs should be double-check by one additional staff member to ensure the data processing steps have been completed as outlined above. MLJ DMT staff follow

internal SOPs specific to loading chemistry, toxicity, and tissue EDDs into the CV RDC database. Completion of each of these steps are tracked in the Laboratory Data Processing table of the MIS Database.

Data are loaded using a series of queries to add the results to the CV RDC relational database design. Automated checks are performed on the data prior to loading to ensure that results are unique, assigned to the correct sample collection information, formatted correctly, contain the correct valid values, and that all required fields are populated. Result table counts are tracked prior to loading and compared to counts after loading to ensure all intended results were uploaded. After the EDD is loaded, specific verification steps are performed to ensure the correct results have been added into the CV RDC database. Basic data queries are run after all results are loaded to verify the correct permissions and usability codes are on the results.

Any discrepancies will be noted and communicated back to the Project Manager and Project QA Officer to be reconciled. The loaded EDD is filed in the appropriate internal system as described above (**Receipt and Filing of Laboratory Results**); loaded copies of EDDs containing any updates that occurred during data processing are saved with the end of the file name updated to indicate it was loaded and the date it was uploaded (e.g., "_LOADED_071821").

Once complete, the loaded EDD should be tracked by adding the staff name (formatted as last name and first initial) and date on which loading was completed in the Laboratory Data Processing table in the MIS Database (**Table 5**).

All final data loaded into the CV RDC and given the CEDEN Compliance Code of "Pend" to indicate they are pending the further QA review described below in Section **VIII. Secondary Results Verification (Stage 2 Data)**.

VIII. SECONDARY RESULTS VERIFICATION (STAGE 2 DATA)

Secondary verification is performed by the Marine Pollution Studies Laboratory (MPSL) on laboratory-submitted data that have undergone an initial verification by CV RDC staff during upload to the CV RDC. The intent of the secondary verification is to provide an independent data review against the applicable Delta RMP QAPP, and to confirm proper documentation of non-conformances. As part of the secondary verification, all verified data are assigned a classification and the corresponding CEDEN compliance code described below in **Table 10**.

Table 10. CEDEN Compliance Codes applied during secondary result verification.

CEDEN COMPLIANCE CODE	DEFINITION	DESCRIPTION
Com	Compliant	Data meet all requirements specified in the applicable DRMP QAPP.
Est	Estimated	Data (i.e., EPA "J" flag) are assigned to data batches and sample results that are not considered quantifiable.
Pend	Pending	Data are pending QA review (have not yet undergone Secondary Verification)
Qual	Qualified	Data do not meet one or more of the requirements specified in the applicable DRMP QAPP. These data are considered usable for their intended purpose following an additional assessment to determine the scope and impact of the deficiency.
Scr	Screening	Data are for information purposes only and are considered to be non-quantifiable.
Rej	Rejected	Data do not meet the minimum requirements specified in the applicable DRMP QAPP. These data are not considered usable for their intended purpose.
NA	Not Applicable	Data were not verified since there were no DRMP QAPP requirements for the specific parameter (e.g., oxygen saturation) or a failure (e.g., zero flow, probe malfunction) was reported that prevented data collection.

Secondary verification can begin once data have been processed according to the procedures listed in **Section VII** and loaded into the CV RDC by the DMT. Secondary verification is performed on field measurement, chemistry (water quality, sediment, and tissue), and toxicity data. Quality control samples without specific MQO defined in the applicable QAPP are verified against SWAMP MQOs, laboratory statistical limits, or method control limits. Results for QC samples not required by the applicable Delta RMP QAPP and/or method may not be evaluated; records that are not evaluated are given the compliance code of "NA" during the secondary verification process.

1. Secondary Verification of Field Results

All field measurements are verified against the requirements defined in the applicable QAPP. Field measurement results, including associated frequencies and collection devices are verified according to the following steps.

- Field measurement frequency: verify the number of results according to the frequency requirements outlined in the applicable QAPP (e.g., one measurement per water quality sample collection).
- Collection device calibration: Field probe calibration frequency is verified against the applicable QAPP requirements (e.g., within 24 hours prior to measurement collection).
    - All *QACodes* for collection or calibration failures are checked to confirm that they are present and applied correctly. When missing data flags are identified, the CEDEN codes applied by MPSL QA staff during secondary verification will be preceded by a "V", indicating the records were "flagged by QAO". The outlier is documented on the *Data Verification Comment* (DVC) Microsoft Excel Spreadsheet. In cases where there are systematic errors in the application of QACodes, these are discussed with the CV RDC DMT and the submitting laboratory.

2. Secondary Verification of Chemistry and Toxicity Results

All chemistry results for water quality, sediment, and tissue samples are reviewed following the SWAMP SOPs for chemistry data verification and according to the requirements of the Delta RMP Data Management Plan. All toxicity results are reviewed following the SWAMP SOPs for toxicity data verification and according to the requirements of the Delta RMP Data Management Plan. All results are verified against the requirements outlined in the applicable Delta RMP QAPP (including any amendments) and are reviewed for the following general steps.

- *QACodes* for preservation, holding times, and blank contamination (field and laboratory), as well as QC frequency, accuracy, and precision are checked to ensure that they have been applied correctly by the laboratory and/or CV RDC DMT.
- Missing *QACodes* are applied to the data as appropriate. *QACodes* that were applied incorrectly are either updated or removed following discussion with the CV RDC DMT. All instances of missing or incorrectly applied *QACodes* are recorded in the DVC Microsoft Excel spreadsheet.
    - When missing data flags are identified, the CEDEN codes applied by MPSL QA staff during secondary verification will be preceded by a "V", indicating the records were "flagged by QAO". The outlier is documented on the DVC Microsoft Excel Spreadsheet. In cases where there are systematic errors in the application of QACodes, these are discussed with the CV RDC DMT and the submitting laboratory.
- It is then confirmed that project method detection limits (MDLs) and reporting limits (RLs) are reported as required by the applicable Delta RMP QAPP and are adjusted correctly for any dilutions. Updates to MDLs or RLs are first discussed with the CV RDC DMT. Any outliers are recorded in the DVC spreadsheet.
- Percent recoveries and relative percent differences (RPDs) are recalculated at a rate of one analyte per reported QC type. If there are non-rounding discrepancies between the reported and calculated values, the CV RDC DMT is notified before involving the laboratory as necessary. Any outliers are recorded in the DVC spreadsheet.
- Data issues (e.g., calibration range exceedances) that do not fall under the typical accuracy and precision categories are also evaluated and applicable *QACodes* are assigned. If

appropriate, the laboratory is contacted by the CV DMT on behalf of the independent verifier. These issues are recorded in the DVC spreadsheet.

Once the data have been verified, results are assigned the appropriate compliance code (**Table 10**) and the data are marked as finalized for export to CEDEN as described below in Section **IX. Data Finalization and Publication**.

IX. DATA FINALIZATION AND PUBLICATION

A. INTERNAL DATA REVIEW

Prior to project deliverables and reporting of the project data set, the data in the CV RDC database is compared to information in the MIS to check for completeness, ensure specific business rules are applied, verify any Water Quality Metrics exceedances reported for applicable projects, and ensure data output for Project Managers and reports are exporting correctly. The main checks include:

- Ensure Analysis Count table in the MIS Database is marked correctly for sample collection and analysis completion (**Table 1**).
- Ensure completeness assessments in the MIS Database agree with the data loaded into the CV RDC.
- Ensure exceedances identified during the **Initial Laboratory PDF Review** section match the final results in the CV RDC.
- Verify that all field results are within the expected range (see **Field Result Verification** above).
- Ensure business rules for field entry have been correctly applied such as ResQualCodes and QACodes.

B. UPDATE CV RDC DATA FROM PRELIMINARY TO PERMANENT

Every result table in the CV RDC Database has a status column that indicates if the record is preliminary or permanent data. Permanent data have been fully reviewed and finalized; in most cases the finalization of the data is associated with the completion of an associated data report. Permanent data are ready to be transferred to CEDEN. Some data may not be included in the weekly synchronization between the CV RDC and CEDEN (e.g., they are already published on CEDEN through another program or are being published through NWIS or another publicly accessible database approved by the Central Valley Regional Water Board Executive Officer); these data are qualified with an appropriate status as outlined in **Table 11**.

Preliminary data are working data that have not been fully reviewed and/or finalized. Preliminary data must undergo a final review and be approved for finalization before being considered permanent. The specific valid values used to indicate these statuses are outlined in **Table 11**.

Each data set that is ready to be finalized will undergo a series of global query checks which ensure that the data submitted follow the documented CV RDC business rules. If any discrepancy is found during a review, MLJ DMT staff will discuss the discrepancy with the appropriate person. Discussion will cover whether the information collected is accurate, what the cause(s) leading to the deviation may be, how the deviation might impact data quality, and what corrective actions might be considered.

Once all the global query checks have been performed and documented, MLJ DMT staff will update the status of each record to indicate it is permanent data and notify the Project Manager.

Table 11. Status field valid values used in the CV RDC.

STATUS VALID VALUE	TRANSFER TO CEDEN	STATUS DESCRIPTION
CEDEN_Entry_CVRDC	No	Used for preliminary CV RDC data to be eventually exported to CEDEN, transfer to CEDEN cannot occur until the data are updated to permanent.
CEDEN_Perm_CVRDC	Yes	Used for permanent CV RDC data to be exported to CEDEN.
CVRDC_Entry	No	Used for internal preliminary CV RDC data not to be exported.
CVRDC_Perm	No	Used for internal permanent CV RDC data not to be exported.

C. TRANSFER DATA FROM THE CV RDC TO CEDEN

Data cannot be transferred to CEDEN until the status is marked as permanent, indicating it has undergone global query checks, and that it is intended to be published in CEDEN (**Table 11**). When data are finalized and ready for transfer, the MLJ DMT will receive final approval from the Project Manager. The Project Manager will receive an Excel file that summarizes the data to be transferred and provides result counts. All data transfers to CEDEN will be recorded and documented. Once the transfer is complete, the Project Managers will be notified.

Data should be transferred to CEDEN once any final reports including an assessment and interpretation of the associated results have been submitted to regulators and/or data users (unless specified otherwise by the project requirements). All data in a single dataset must be uploaded to CEDEN within 6 months of the last sampling event date for the applicable project code to be in compliance with Resolution R5-2021-0054. This occurs on an annual basis. The MLJ DMT generally publish finalized data to CEDEN within 1-2 months of report submittal. Excessive delays are generally not expected seeing as finalized, permanent data in the CV RDC do not need to undergo further data checks or verification steps prior to being transferred to CEDEN. If delays past this time period are to be expected, the reasons for the delay along with an expected timeline for publication should be provided to the data users; deviations from 6-month requirement for data publication to CEDEN require prior approval by the Central Valley Regional Water Board.

In addition to updating the status of each record to "CEDEN_Perm_CVRDC", several other fields in the CV RDC must be updated for any data that are data intended for CEDEN to ultimately be transferred. The following fields must be updated appropriately for the final CEDEN transfer to occur:

- Status,
- DataToBeExported,
- CollectionComplete, and
- Public.

Once datasets are appropriately updated in the CV RDC Database, the data will automatically be uploaded to CEDEN during the weekly synchronization that occurs every Saturday morning. This process is performed using automated run statements managed by MLML-MPSL.

In addition to the correct data coding in the CV RDC, MLJ DMT staff must also notify the CEDEN DMT to update the project lookup list to indicate the project is public; this step allows the data to be visible on any CEDEN export tool.

Any updates to CV RDC data that have already been transferred to CEDEN are synchronized with CEDEN on a weekly basis. Any significant changes to data in the CV RDC that affect results or the interpretation of results (e.g., sample location) are communicated to CEDEN staff and the agency associated with the project through the use of the CEDEN Data Modification Request Form (http://ceden.org/procedures.shtml). The Request Form serves as official notification to CEDEN staff that the change will occur; the changes will be implemented during the database synchronization unless concerns are raised during the notification process. Minor changes (e.g., spelling or formatting changes to comment fields) do not require that CEDEN be notified. All changes to data that have already been published, both significant and insignificant, are reviewed by the Project QA Officer and documented internally by the MLJ DMT.

ATTACHMENT A. MLJ ENVIRONMENTAL FIELD RESULTS REVIEW CHECKLIST

MLJ Field Results Checklist

Item No.			Component Name	Verified (No Verified Fixes Needed	Not Applicable	Comments
1			**Results Check**			
	1.1		Verify Results with the Fieldsheet			
		1.1.1	Check 10% of the results. Filter on the sample information to ensure that the sample information lines up with the results. If the 10% check is all correct, then proceed with processing the results. If errors are found, check all results against the field sheets.			
2			Field Sample Information			
	2.1		Field Samples			
		2.1.1	Station Code is correct format and within Stationlookup lists.			
		2.1.2	SampleDate is formatted as dd/mmm/yyyy (Note: in text box looks like mm/dd/yyyy).			
		2.1.3	ProjectCode is within the ProjectCodeLookup list (see eQAPP or ProjectLookUp).			
		2.1.4	EventCode = "WQ".			
		2.1.5	ProtocolCode is in Protocollookup list.			
		2.1.6	AgencyCode is within the AgencyCodeLookup list and is the Agency that collected the sample.			
		2.1.7	LocationCode = "Bank", "MidChannel", or "Thalweg".			
		2.1.8	Collection time is formatted as xx:xx (24 hour) (Note: text box looks like xx:xx:xx PM or AM).			
		2.1.9	CollectionMethodCode = "Field"			
		2.1.10	Replicate = "1"			
		2.1.11	CollectionDeviceName is within lookup list and associated with the project.			
		2.1.12	CollectionDepth matches Chain of Custody or Default of "0.1" for Environmental Samples, and "-88" for Field blanks DRMP Project Specific: airtemp colleciton depth =-88			
		2.1.13	UnitCollectionDepth = "m" or "cm" (for sediment).			
		2.1.14	PositioninWaterColumn = "Subsurface"; "Not Applicable" for air temp			
3			Field Analysis Information			
	3.1		Field Constituents			
		3.1.1	Verify Constituent with P_Constituent pivot table. (DRMP Project Specific: Extra constituents are ok; verify against ConstituentLookUp)			
		3.1.2	FieldReplicate = "1"			
4			Field Results and Coding for Special Conditions			
	4.1		Successful Chemistry and Discharge Measurements			
		4.1.1	Result is a numeric value with no symbols or text attached to the value.			
		4.1.2	ResQualCode = "=".			
		4.1.3	QACode = "None"			
		4.1.4	CalibrationDate is included and formatted as dd/mmm/yyyy (Note: in text box looks like mm/dd/yyyy).			
		4.1.5	ComplianceCode =Pend (or NR) and BatchVerificationCode=NA			

ITEM NO.			COMPONENT NAME	VERIFIED (NO VERIFIED FIXES NEEDED)	VERIFIED	FIXES NEEDED	NOT APPLICABLE	COMMENTS
	4.2		Chemistry - Special Conditions					
		4.2.1	**Instrument Failure:** Result= blank, ResultQualCode = “NR”, QACode = "FIF", Comments = "Instrument Failure"					
		4.2.2	**Cannot Deploy Instrument:** Result = blank, ResQualCode = "NR", QACode = "FUD", Comments = "Unable to deploy instrument for measurement"					
	4.3		Discharge – Special Conditions					
		4.3.1	**Instrument Failure:** Result= blank, ResultQualCode = “NR”, QACode = "FIF", Comments = "Instrument Failure"					
		4.3.2	**Water Present, but Cannot Deploy Instrument:** Result = blank, ResQualCode = "NR", QACode = "FUD", Comments = "Unable to deploy instrument, but flow is estimated to be XX CFS based on surface debris movement.					
		4.3.3	**Water Present, but Too Deep to Wade:** Result = blank, ResQualCode = "NR", QACode = "FUD", Comments = "Too deep to take discharge measurements".					
		4.3.4	**Water Present, but no Measurable Flow:** Result = "0", ResQualCode = "=", QACode = "FLV", Comments = "No Measurable Flow".					
		4.3.5	**Water Present, but Too Shallow to Take Discharge:** Result = blank, ResQualCode = "NR", QACode = "FS", Comments = " Too Shallow to take discharge measurement".					
		4.3.6	**Non-Contiguous/ Isolated Pool:** Result = "0", ResQualCode = "=", QACode = "FLV", Comments = "Non-Contiguous water body". (No field results should be taken now with isolated pools.)					
5			Field Result Accuracy and Quality Assurance/Control Review					
	5.1		Expected/Realistic Ranges for Field Measurement Values					
		5.1.1	**Dissolved Oxygen values should fall between 0 mg/L and 20mg/L.** • Make sure measurements are not recorded in % saturation. • If outside of this range double check the fieldsheet to verify the result. • If value matches fieldsheet leave as question for field crews/client. • If client feels result is suspect and directs to remove, update to: Result = blank, ResQualCode = "NR", appropriate QA code (e.g., "FIF" for Instrument Failure), Comments must contain original value and reason for failure, e.g.: "Value recorded as 45mg/L, suspected instrument failure".					
		5.1.2	**pH values should fall between 2 and 11 units.** • If outside of this range double check the fieldsheet to verify the result. • If value matches fieldsheet leave as question for field crews/client. • If client feels result is suspect and directs to remove, update to: Result = blank, ResQualCode = "NR", appropriate QA code (e.g., "FIF" for Instrument Failure), Comments must contain original value and reason for failure, e.g.: "Value recorded as 1 pH unit, suspected instrument failure".					

ITEM NO.			COMPONENT NAME	VERIFIED (NO VERIFIED)	FIXES NEEDED	NOT APPLICABLE	COMMENTS
		5.1.3	**Specific Conductivity values should fall between 50 µS and 10,000 µS.** • If outside of this range double check the fieldsheet to verify the result. • If value matches fieldsheet leave as question for field crews/client. • If client feels result is suspect and directs to remove, update to: Result = blank, ResQualCode = "NR", appropriate QA code (e.g., "FIF" for Instrument Failure), Comments must contain original value and reason for failure, e.g.: "Value recorded as 10 µS, suspected instrument failure".				
		5.1.4	**Turbidity values should fall between 0 NTU and 1,000 NTU.** • If outside of this range double check the fieldsheet to verify the result. • If value matches fieldsheet leave as question for field crews/client. • If client feels result is suspect and directs to remove, update to: Result = blank, ResQualCode = "NR", appropriate QA code (e.g., "FIF" for Instrument Failure), Comments must contain original value and reason for failure, e.g.: "Value recorded as 1600 NTU, suspected instrument failure".				
		5.1.5	**Water Temperature values should fall between 0 °C and 45 °C.** • If outside of this range double check the fieldsheet to verify the result. • If value matches fieldsheet leave as question for field crews/client. • If client feels result is suspect and directs to remove, update to: Result = blank, ResQualCode = "NR", appropriate QA code (e.g., "FIF" for Instrument Failure), Comments must contain original value and reason for failure, e.g.: "Value recorded as 60 deg C, suspected instrument failure".				
6			Habitat Results				
	6.1		Habitat Sample Information				
		6.1.1	Station Code is correct format and within StationLookup lists.				
		6.1.2	SampleDate is formatted as dd/mmm/yyyy (Note: in text box looks like mm/dd/yyyy).				
		6.1.3	ProjectCode is within the ProjectCodeLookup list (see eQAPP or ProjectLookUp).				
		6.1.4	EventCode = "WQ".				
		6.1.5	ProtocolCode is in Protocollookup list.				
		6.1.6	AgencyCode is within the AgencyCodeLookup list and is the Agency that collected the sample.				
		6.1.7	LocationCode = "Bank", "MidChannel", or "Thalweg".				
		6.1.8	Collection time is formatted as xx:xx (24 hour) (Note: text box looks like xx:xx:xx PM or AM).				
		6.1.9	CollectionMethodCode = "Habitat_Generic"				
		6.1.10	Replicate = "1"				
		6.1.11	CollectionDeviceName = "None"				

ITEM NO.			COMPONENT NAME	VERIFIED (NO VERIFIED FIXES NEEDED NOT APPLICABLE)				COMMENTS
	6.2		Habitat Observation Information					
		6.2.1	Matrix Name = "habitat", "samplewater", "sediment"					
		6.2.2	Method Name = "FieldObservation"					
		6.2.3	Analyte Name within AnalyteLookUp.					
		6.2.4	Fractions = "None"					
		6.2.5	UnitName = "None"					
		6.2.6	VariableResult is within LookupList					
		6.2.7	Result = blank					
		6.2.8	ResQualCode = "="					
		6.2.9	QACode = "None"					
		6.2.10	ComplianceCode =NA and BatchVerificationCode=NA					
7			Sample Information Consistency					
	7.1		Check Field/Habitat Sample Information Matches					
		7.1.1	Copy field and habitat sample information to the FieldHabitatSampleDetails. Populate source and run P_SampleDetailCheck. Check to ensure that field and habitat matches.					
8			Sample Purpose					
	8.1		Populate SamplePurpose					
		8.1.1	Create SamplePurpose tab: Take sample information from habitat tab and remove duplicates. Make a set for FieldMeasure, Habitat, and any lab parameters collected by site (e.g., WaterChem, WaterTox, SedChem, Sed Tox, Tissue).					
		8.1.2	Use a pivot table to ensure all SamplePurpose combinations are correct and line up by project, e.g., for every WaterTox record there should be a WaterChem record (see P_SamplePurpose).					
		8.1.3	Verify all SamplePurpose failures are documented with the appropriate Sample Purpose Failure Code. Comments should contain description of all sample purpose failures.					
9			Sample Locations					
	9.1		Check Sample Location Information					
		9.1.1	**There should be no stations without coordinates:** ensure all coordinates and the associated datum are populated.					
		9.1.2	Review actual lat/longs to make sure GIS coordinates look reasonable (values should be relatively similar based on location).					
		9.1.3	**Coordinate Source is a required field:** ensure all Coordinate Sources are populated; add "NR" if blank.					
		9.1.4	Confirm tab headers are correct					
	9.2		Check Location Distance from Target Location					
		9.2.1	Run the Distance Query in DMT file to check distance of the actual sample lat/longs from the target lat/longs. DRMP Project Specific: if distance is greater than allowed in QAPP, notify Program Manager and initiate deviation process.					

Item No.			Component Name	Verified (No Verified Fixes Needed	Not Applicable	Comments
10			Final Checks			
	10.1		Check Result Completeness			
		10.1.1	Use pivot table to ensure all stations and dates have every required analyte (use P_FieldResultAmountCheck).			
	10.2		Check Uniqueness			
		10.2.1	Use pivot tables to ensure that field results and habitat results are unique			
11			Data Checker			
	11.1		Data Checker: Run file through data checker and resolve any issues. When errors are found run through data checker again until all applicable items are resolved. Field templates are the CEDEN template, use the CEDEN data checker: http://ceden.org/CEDEN_checker/Checker/CEDENUpload.php.			
12			Tracking			
	12.1		MIS Database Tracking			
		12.1.1	Update MIS, FieldResultDataProcessing tracking information with the date completed and your name.			
		12.1.2	DRMP Project Specific: after the file has been posted to the Droplet, update the file sharing tracking information with the date and your name.			
	12.2		CV RDC Metadata			
		12.2.1	After the processed file is loaded to the CV RDC, add in personnel and sample locations through EDERs portal.			

ATTACHMENT B. MLJ ENVIRONMENTAL CHEMISTRY ANALYSIS REVIEW CHECKLIST

MLJ Water Chemistry Analysis Checklist

Item No.			Component Name	Verified (No	Verified	Fixes Needed	Not Applicable	Comments
1			**Results Check**					
	1.1		Verify Results with the PDF					
		1.1.1	Check 10% of the results. Filter on the sample information to ensure that the sample information lines up with the results. If the 10% check is all correct, then proceed with processing the EDD. If errors are found, check all results against the PDF.					
		1.1.2	Check the case narrative in each PDF for important information about reanalysis, hold time violations, or anything that appears out of the ordinary that could affect specific samples or the entire batch. Paste snips of pertinent information into the LaboratoryQuestions tab, and update LabResultsComments if necessary.					
2			Sample Information					
	2.1		Samples (Grab, field duplicates, field blanks, matrix spikes)					
		2.1.1	Lab Sample Details: Compare sample collection information from the database to the EDD to verify they are the same.					
3			Processing and Analysis Information					
	3.1		Lab Batches					
		3.1.1	Batch names should conform to the CV RDC batch naming guidelines, stored here: X:\P_CV_RDC\Management_Documentation\2_Documentation_EntryManuals \File-BatchName (or online at CV RDC batch naming conventions).					
		3.1.2	Batches are defined by Method. Each batch should have same Units (excluding surrogates) and Analysis Date. Analysis Dates in a batch should be within 24 hours of each other; if there is a Digest Date then digests/extractions should all be within 24 hours.					
	3.2		Matrix Name					
		3.2.1	When an MS is performed off blankwater, add the following comment to the CollectionComments. Include the period: "MS performed on FieldBlank."					
	3.3		Method Name, Analyte Name, Fraction Name, Unit, MDL and RL					
		3.3.1	Each method, analyte, fraction and unit should have the correct Preparation & Digestion methods reported. Review the eQAPP to verify.					
	3.5		ExpectedValue					
		3.5.1	All MS, LCS, CRM or Surrogate samples should have an expected value.					
	3.6		LabSampleComments					
		3.6.1	LabReplicates of 2 should have an RPD (Relative Percent Difference) recorded (excluding surrogate samples).					
		3.6.2	All LCS and MS samples should have a PR (Percent Recovery) recorded.					
		3.6.3	Check the correct format for PR and RPD was applied: use "PR XX" or "RPD XX"; when in combination (such as for an MSD), use "PR XX, RPD XX" (e.g., PR 99, RPD 5)					

ITEM NO.			COMPONENT NAME	VERIFIED (NO VERIFIED	FIXES NEEDED	NOT APPLICABLE	COMMENTS
		3.6.4	Calculate Field Duplicate RPDs: Calculate RPD for FieldDup (replicate of 2) and its associated environmental sample: Round results to TWO sig figs (unless 3 digits: i.e., 24, 2.5 163). See QAPP for calculation; example ABS((X-Y)/(X+Y))*100 (where X = env sample result and Y = fielddup result). FD RPD calculations do NOT apply to surrogates (unit=%). For ND results, enter "FD RPD NA" (if either the environmental sample or the field duplicate is ND) If RPD values equal zero (both replicates have the same positive value), use "FD RPD 0" (Project Specific: label only FD sample with "FD RPD XX")					
		3.6.5	Flag FD RPD (If Applicable): If the calculated RPD is outside limits, flag the FieldDup AND environmental sample with a QACode of "FDP". See eQAPP for project specific limits.					
		3.6.6	If the EDD includes bacteria results (E. coli) Calculate Field Duplicate/LabRep Rlog: W:\P_ILRP\2.3_DataMgmt\6_ReviewEDDs\EDDChecking\Rlog_calcs\2018 WY. If one sample is ND then enter "Rlog NA". If one sample is >2419.6 enter "Rlog NA". Remove FD RPD that is calculated by the lab and replace with Rlog you calculated as per eQAPP.					
	3.7		Submitting Agency					
		3.7.1	Submitting Agency is MLJ Environmental					
	3.8		BatchVerificationCode					
		3.8.1	Populate BatchVerificationCode column with VAC if all checks within this checklist are performed.					
4			QA Checks					
	4.1		Batch Amount Check: Verify laboratory batches have the correct amount of QC required by the QAPP; if QC is missing batch is appropriately flagged with a LabSubmissionCode of QI and a lab batch comment is included. (Verify with lab first as to why it is missing)					
	4.2		Hold Time Check: Check extraction/analysis occurred within the appropriate holding times; if holding times were not met the batch is appropriately flagged and a lab batch comment is included.					

Item No.			Component Name	Verified (No Verified	Fixes Needed	Not Applicable	Comments
	4.3		FieldBlank Check: (or any project blank samples) If a field blank flag is required notify QA Officer. Potentially need to reanalyze samples. If lab reanalyzed samples to confirm ensure LabResultComments indicates so. Project Specific: 1) Check that FieldBlanks meet eQAPP limits 2) If equal to or >RL, check if FB results is <1/5 env sample 3) If <1/5 env sample, leave QACode as None and add LabResultComments "<1/5 env sample, env sample=XX" 4) If >1/5 env sample, change QACode to IP5 and add LabResultComments ">1/5 env sample, env sample=XX" 5) For flagged samples, add LabBatchComm "Analyte detected in fieldblank (">1/5 env sample, env sample=XX)."					
	4.4		Laboratory QC Check: Laboratory QC (MS, LCS, MSD, Lab Blank, Lab Duplicates) Verify samples are within the eQAPP requirements; if QC is outside of requirements the batch is appropriately flagged and a lab batch comment is included. Verify LabBlanks, Matrix Spikes, Lab duplicates and LCS's and any other specific MQO's according to eQAPP. Project Specific: Where there is an exceedance of the MQO in the Lab Blank, verify the QACode "FI" is applied to all associated environmental samples with detectable results (> MDL).					
	4.5		LabBatch Comments Check: Once all QACodes are applied use a pivot table to verify that LabBatch comments reflect all QACodes in the Results tab. (Make sure to refresh pivot table before check and use the Standardized LabBatchComments.) Check that all QC issues explained at beginning of report are recorded in EDD with either a QACode or in the batch comment. Standardized LabBatchComments excel file is located here: W:\P_ILRP\2.3_DataMgmt\6_ReviewEDDs\EDDChecking					
	4.6		Project Specific: Look at LabReplicates: similar to Field Duplicates, if either lab results are ND, the RPD values should be NA. Change the value the lab has calculated to RPD NA if either rep 1 or rep 2 has a result of ND.					
	4.7		LabSubmissionCode Check: If the batch has any QACode other than "None", labbatch CANNOT be "A"; should be "A,MD" with a batch comment explaining the code; note that there is NO space between the "A," and "MD".					
	4.8		Lab Report qualifiers: double the check PDF lab report and make sure any appropriate qualifiers are added to either the result or batch comments.					
5			Unique Row Check					
	5.1		Unique Row: Verify that each row is unique. Sample and database unique.					
6			Data Checker					
	6.1		Data Checker: Run file through data checker and resolve any issues. http://checker.cv.mpsl.mlml.calstate.edu/CVRDC/CVRDCUpload.php. When errors are found run through data checker again until all applicable items are resolved. For CEDEN template use: http://ceden.org/CEDEN_checker/Checker/CEDENUpload.php					
	6.2		LabBatch naming convention changed. Verify less than 50 characters (max for the database). The data checker will show an error for anything over 35 characters, which is ok. No action necessary to change if under 50 characters.					
7			Tracking					

	ITEM NO.		COMPONENT NAME	VERIFIED (NO VERIFIED	FIXES NEEDED	NOT APPLICABLE	COMMENTS
	7.1		Counts: Refresh pivot table for counting analytes for each environmental sample. Update analysis count in MIS ensure all analytes expected were received.				
	7.2		Tracking: Update MIS, LaboratoryDataProcessing group, qry2_ReportEDDProcessing with date EDD is complete and your name.				

ATTACHMENT C. MLJ ENVIRONMENTAL TOXICITY ANALYSIS REVIEW CHECKLIST

MLJ Toxicity Analysis Checklist

Delta RMP Version 1.0, Last updated on September 1, 2021

Item No.			Component Name	Verified (No	Verified	Fixes Needed	Not- Applicable	Comments
1			Summary and Replicate Results Check					
	1.1		Verify Summary Results with the PDF					
		1.1.1	Check the Mean					
		1.1.2	Check the Percent Control					
		1.1.3	Check the SigEffect: The field cannot be empty- for LABQAs it is "NA" NSG= not significant, greater than threshold SG= significant, greater than threshold NSL=not significant, less than threshold SL= significant, less than threshold					
		1.1.4	For information about TIEs reference the report to correctly format the comment. Project Specific: TIENarrative: Any sample that is SL with a PctControl less then (<) 50% should have a TIE run (excluding not applicable Field duplicate samples see comment below for this situation). To check if chemistry has been done on our end, check: W:\2.3_DataMgmt\2.1_ResultDetails_PhaseIII_TIE. The comment should include any TIE comments/conclusions if a TIE was run: "A TIE was conducted on XX/XX/XX and it was concluded that X was the cause of toxicity." "No TIE was conducted due to…" (Do not apply this comment to samples with a percent effect greater than 50%) "No TIE was conducted on field duplicate due to the TIE being performed on environmental sample."					
	1.2		Verify WQ Replicate Results with pdf					
		1.2.1	Double Check WQ Results using the P_WQResults: 1) Check WQ Results against the PDF (Copy the P_WQResults into new Workbook) 2) Check high low results: Check the high/low values are correct. Use the formulas contained in the TOXEDD_WQMeasurement_HighLowCheck excel file (newer EDDs may have hi/low tab in EDD) located in the checklist folder: W:\2.3_DataMgmt\6_ReviewEDDs\EDDChecking\EDDChecklists (Notes for Sediment: Conductivity, DO, Temp and pH can be checked using the individual water quality measurement data sheets, and Ammonia is found on a separate sheet (Total Ammonia Analysis, check Day0 and Day10 ammonia values). Project Specific: 3) Check if applicable renewal WQ Results for DO, pH, conductivity, and temperature are included in bench sheet section within lab report for *Ceriodaphnia*, *Chironomus*, *Hyalella* and *Pimephales* tests.					

ITEM NO.			COMPONENT NAME	VERIFIED (NO	VERIFIED	FIXES NEEDED	NOT- APPLICABLE	COMMENTS
		1.2.2	ResQualCode: "=" (default); "ND" (non-detect); or "NR" for results that were not recorded (due to replicate loss; not required by the program; or by negligence). "NSI" (no surviving individuals) ResQualCode to be applied if a chronic endpoint could not be recorded due to 100% mortality in a replicate and the values should be added to the datasheet if they are missing.					
	1.3		Samples (Grab, field duplicates, field blanks)					
		1.3.1	Lab Sample Details: Compare sample collection information from the database to EDD to verify elements are the same.					
	1.4		Laboratory Quality Assurance Samples (Control Samples)					
		1.4.1	Check the AgencyCode is in the AgencyCodeLookup list and is the Laboratory that created the sample.					
		1.4.2	Project Specific: Check TAccC (Test Acceptibility Criteria) are met (see Section 9 of this checklist for DRMP specific TAccC criteria).					
		1.4.3	UnitCollectionDepth = m (for water) or cm (for sediment).					
2			Processing and Analysis Information (For Summary and Results Tab)					
	2.1		Collection Information					
		2.1.1	Project Specific: Check Protocol Code is correct for individual project.					
		2.1.2	Project Specific: Agency Code = Sampling Agency for environmental samples and Lab Agency for LABQA samples.					
		2.1.3	Check the GeometryShape = "Point" for env. samples or is left blank for LABQA samples					
		2.1.4	Project Specific: Check the CollectionDeviceName = “Individual bottle by hand” or "Individual bottle by USGS-PFRG weighted sampler"; or "None" for LABQA.					
		2.1.5	PositionWaterColumn = "Subsurface" (water) or "Not Applicable" (LABQA or Sediment)					
	2.2		Toxicity Batch					
		2.2.1	Batch names should conform to the CV RDC batch naming guidelines, stored here: X:\P_CV_RDC\Management_Documentation\2_Documentation_EntryManuals\File-BatchName (or online at CV RDC batch naming conventions).					
		2.2.2	Batches are grouped by OrganismName and Method; and include supporting QA samples.					
	2.3		MatrixName, Method Name, Test Duration, Organism Name, Test Exposure Type, QA Control ID, Treatment, Concentration, Unit Treatment, Analyte Name, Unit Analyte, QA Code, Compliance Code					
		2.3.1	Matrix Name: "samplewater" (env. Sample) or "labwater" (LABQA sample)					
		2.3.2	Check the MethodName matches the requirements for the specific organism in the QAPP.					
		2.3.3	TestDuration: Check test duration matches the requirements of the method used.					
		2.3.4	Check the OrganismName matches the lookup list					
		2.3.5	Project Specific: TestExposureType = Chronic or Acute. Check Test Exposure Type reported is appropriate for the method used per the QAPP.					

Item No.			Component Name	Verified (No	Verified	Fixes Needed	Not- Applicable	Comments
		2.3.6	QA Control ID = LabSampleID of Control used for statistical analysis. Use "Control" if left blank by laboratory.					
		2.3.7	Project Specific: Treatment = “None” if no Treatment is applied. Otherwise, check if Treatment reported is appropriate per the QAPP.					
		2.3.8	Project Specific: Concentration = “0” if no Treatment is reported. If a Treatment is applied, check that the Concentration is appropriate per the QAPP.					
		2.3.9	Project Specific: UnitTreatment = “None” if no Treatment is applied. Otherwise, check if TreatmentUnit reported is appropriate per the QAPP.					
		2.3.10	Dilution = 100					
		2.3.11	Project Specific: AnalyteName = Check Analyte Name matches desired endpoints per the QAPP.					
		2.3.12	Project Specific: UnitAnalyte = Check Unit of Analyte matches desired units for endpoints per the QAPP.					
		2.3.13	QACode = "None" unless there was a deviation from expected test parameters. Refer to CEDEN lookup lists to verify any QACodes reported by the lab other than "None".					
		2.3.14	Project Specific: Compliance code = COM or PEND, depending on chain of review for the individual project					
3			Processing and Analysis Information - Summary Worksheet Only					
	3.1		Analysis Check					
		3.1.1	WQSource = Not Applicable (default)					
		3.1.2	ToxPointMethod = None (default)					
		3.1.3	Project Specific: AnalyteName = Check Analyte Name matches desired endpoints per the QAPP.					
		3.1.4	Fraction = None (default)					
		3.1.5	Project Specific: UnitAnalyte = Check Unit of Analyte matches desired units for endpoints per the QAPP.					
		3.1.6	Project Specific: Time Point = Check Time Points required per QAPP					
		3.1.7	Project Specific: Replicate Count = Replicate Count required per QAPP					
		3.1.8	Statistical Method =T-test or Mann-U (when applicable) or Fisher (when applicable)					
		3.1.9	Percent of Control and Effect values are calculated for all environmental samples. Compare to those listed in Lab Report.					
		3.1.10	Sig Effect is found in the SigEffectLookup (NA = LABQA)					
	3.2		ToxPointSummaryComments					
		3.2.1	Calculate Field Duplicate Relative Percent Difference (RPD) for field duplicates (Grab rep 2) and its associate environmental sample: See QAPP for calculation; example ABS((X-Y)/(X+Y))*100 (where X = env sample result and Y = field dup result). If RPD values equal zero (both replicates have the same positive value), use “RPD 0”. (Project Specific: label only FD sample as "FD RPD XX"					

Item No.			Component Name	Verified (No	Verified	Fixes Needed	Not- Applicable	Comments
		3.2.2	Flag FD RPD (If Applicable): If the calculated FD RPD is outside limits, flag the FieldDup AND environmental sample with a QACode of "FDP". See eQAPP for project specific limits.					
4			QA Checks					
	4.1		Laboratory batches have the correct amount of QC required by the QAPP. Each batch must have a control with it.					
	4.2		Hold Time Check: Check that all analyses were run within the appropriate holding times. If holding times were not met a QA Code of "H" is to be entered in TestQACode field in SUMMARY TAB ONLY (not Replicate tab).					
5			Toxicity Batch Worksheet					
	5.1		Submitting Agency					
		5.1.1	Project Specific: Submitting Agency is "MLJ Environmental" unless specified otherwise by the project manager.					
	5.2		LabSubmissionCode					
		5.2.1	If batch has a QACode other than "None", lab batch CANNOT be "A"; should be "A,MD" with a batch comment explaining the code; note that there is NO space between the A, and MD.					
	5.3		ToxBatchComments					
		5.3.1	Include lab batch comment explaining any QACode associated with the batch. If no code, leave blank.					
		5.3.2	Project Specific: Depending on chain of review for individual projects, populate BatchVerificationCode column with "NR"; the final verification will be done by MLM who will apply "VAC" after their final review.					
6			Unique Row Check					
	6.1		Unique Row: Verify that each row is unique for the Summary tab.					
	6.2		Unique Row: Verify that each row is unique for the Results tab.					
7			Data Checker					
	7.1		Data Checker: Run file through data checker and resolve any issues. http://checker.cv.mpsl.mlml.calstate.edu/CVRDC/CVRDCUpload.php.					
8			Tracking					
	8.1		Counts: Compare counts in EDD to those in the MIS to ensure all organisms and endpoints are accounted for.					
	8.2		Tracking: Update MIS for count verification and review completion.					
9			Test Acceptability Criteria (TAccC) (DRMP Specific)					
	9.1		Check for TAccC					
		9.1.1	*H. azteca* (96 hr): ≥ 90% mean survival in controls					
		9.1.2	*H. azteca* (10 day): ≥ 80% mean survival in controls and measurable growth					
		9.1.3	*C. dilutes* (10 day): ≥ 80% mean survival in controls and an average of ≥ 0.60 mg ash-free dry weight for surviving individuals					

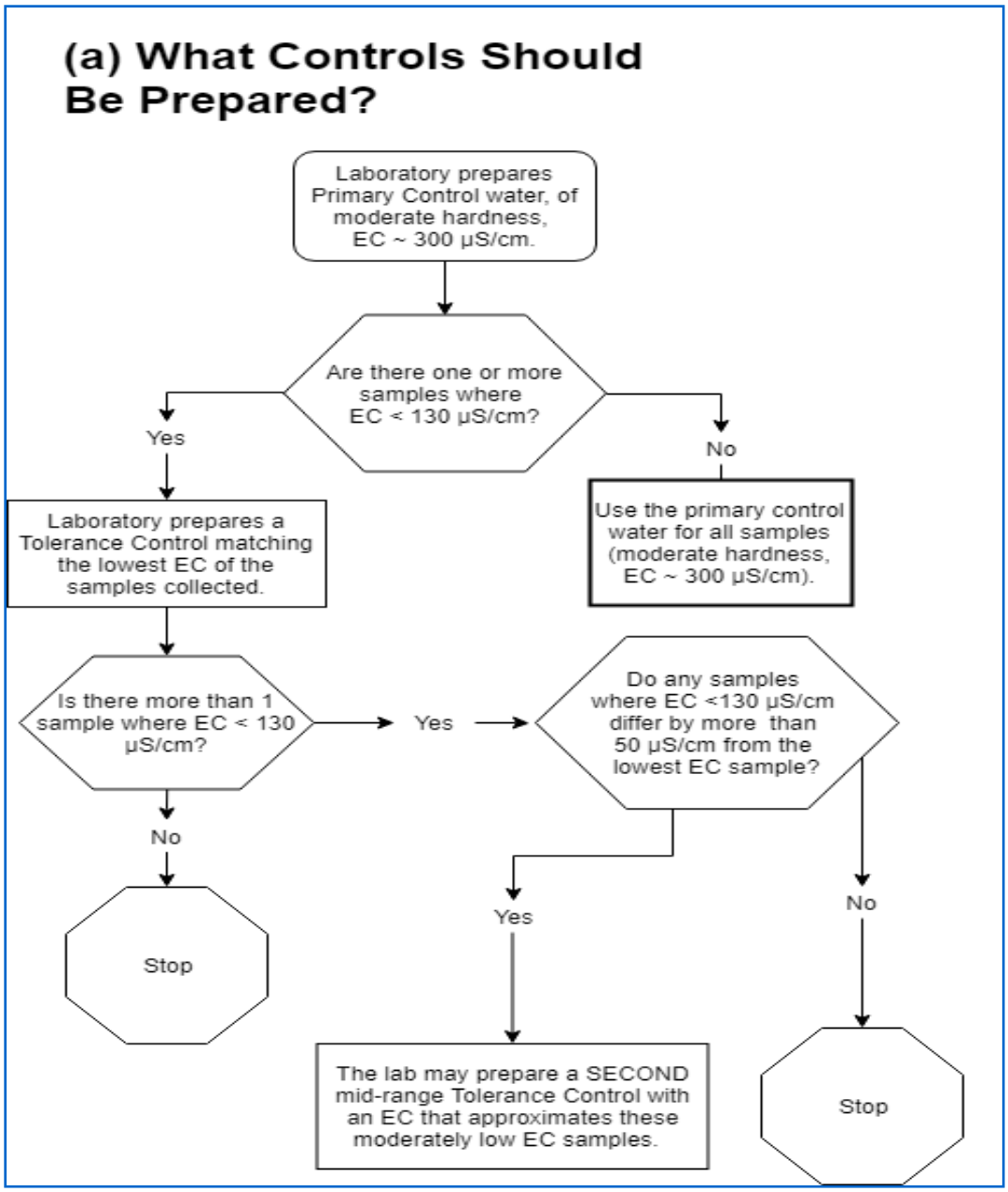
ITEM NO.			COMPONENT NAME	VERIFIED (NO	VERIFIED	FIXES NEEDED	NOT- APPLICABLE	COMMENTS
		9.1.4	*P. promelas* (7 day): ≥80% mean survival in controls and an average of ≥ 0.25 mg ash-free dry weight for surviving individuals					
		9.1.5	*C. dubia* (6-8 day): ≥80% control survival and 60% of the surviving control females must produce 3 broods with an average of 15 or more young per surviving female					
		9.1.6	*S. capricornutum* (96-hour): (without EDTA) mean cell density of at least $2x10^5$ cells/mL in controls and variability (CV%) among control replicates ≤20%					
10			Salinity (DRMP specific)					
	10.1		For *C. dubia*: if there is an environmental sample that has a conductivity of ≤ 130 µS/cm make sure that a low conductivity tolerance control is run (CNSL).					
	10.2		If a low conductivity tolerance control is run (CNSL), but it does not meet TAC, the sample is compared to the regular CNEG and the following comment applied: "Tolerance control based on sample conductivity did not meet test acceptability criteria; percent effect based on comparison with standard control. Effects may include response to low EC in sample." QACode: TW (Water quality parameters outside recommended test method ranges)					
	10.3		If the specific conductance is > 2,500 µS/cm, *C. dubia* should not be tested. *H. azteca* can be used instead if samples are not already being tested for *H. azteca* toxicity.					

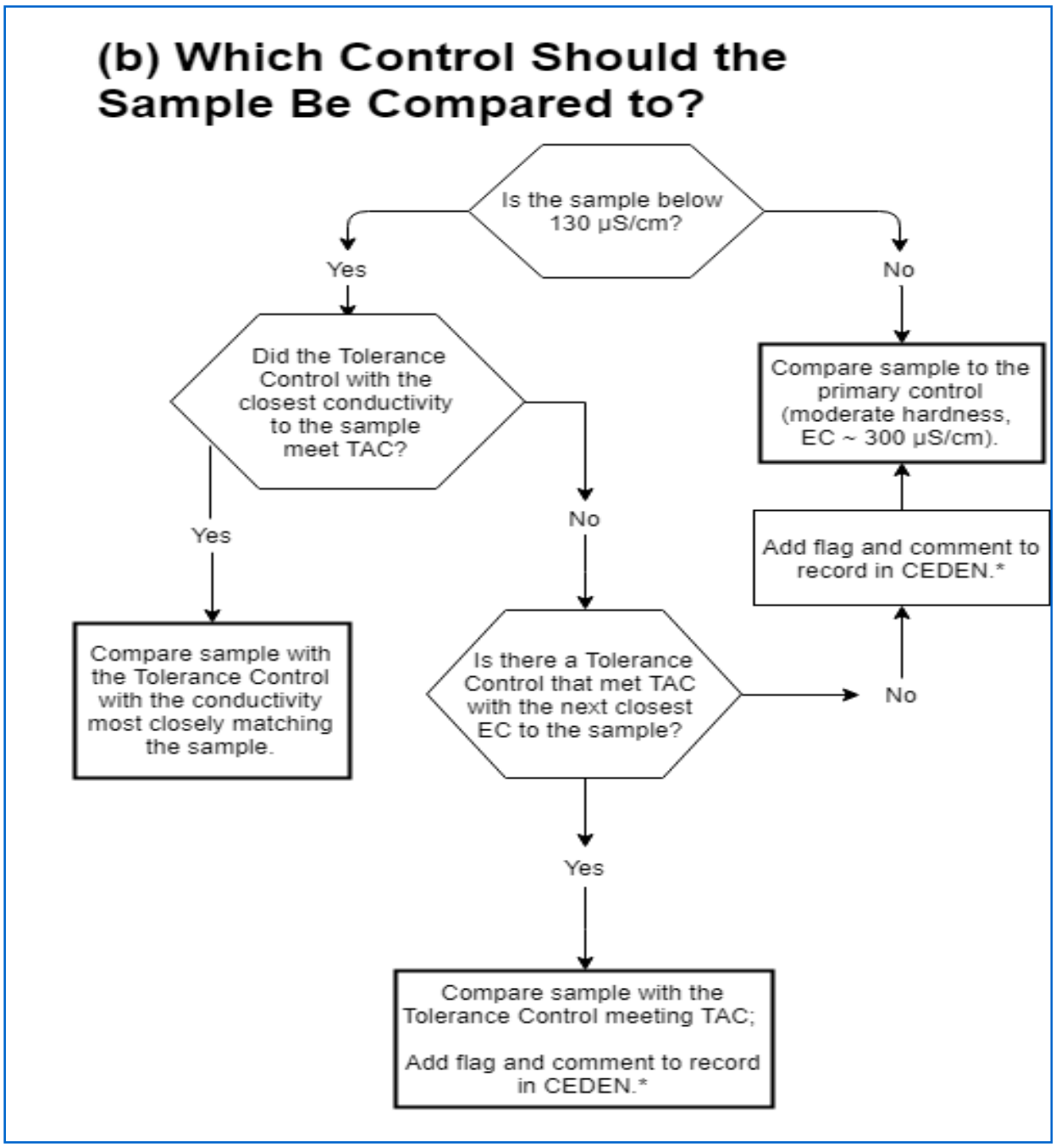
Salinity Controls

The Delta RMP performs toxicity testing and data management following SWAMP guidance and associated information. There are some specific situations when additional negative controls are performed, and associated data will need to be flagged either on the result and/or batch level.

CONTROL DECISION TREES

The following decision trees were developed by the Delta RMP Pesticide Subcommittee to provide guidance on when a tolerance control should be performed, what kind of tolerance control should be created, and which samples should be compared to which controls.





FLAGGING BUSINESS RULES

The following image reflects the scenarios and flagging combinations that have been discussed and agreed upon by the Delta RMP Pesticide Subcommittee; these rules will be followed to ensure consistency in flagging and comments across project years.

Table 12 is used to illustrate scenarios for combinations of passed and failed TAccC for CNEG and CNSL controls in a tox test batch. Batches with conductivity above tolerance range (requiring a CNSL high sample instead, or in addition) would be flagged similarly to the CNSL low cases.

The most notable is case 2, where the CNEG fails (-), but the CNSL passes (+). Even though the CNSL passes and could hypothetically be used as a control for significance testing versus low conductivity samples, those tests for samples are deemed "R" "rejected" due to failure of the CNEG.

Another notable situation is case 3, where the CNEG passes, but the CNSL fails. The standard procedure is to use the CNEG as the control against which samples (even those outside of tolerance range) are compared, but there may be cases where the apparent toxic response and the CNSL failure are very similar.

Table 12. QACodes Applied to Control and Test Samples for Possible CNEG and CNSL pass/fail Combinations.

Case	CNEG	CNSL low	BatchVerCode	Batch ComplianceCode	Control used for samples in tolerance range	QACode on CNEG	QACode on samples in tolerance range	Control used for samples below tolerance range	QACode on CNSL	QACode on samples below tolerance range
1: CNEG+ CNSL+	pass TAccC	pass TAccC	VAC	Com	CNEG	None	None	CNSL low	TAC	TAC,TCI
2: CNEG- CNSL+	fail TAccC	pass TAccC	VAC,VCN	Rej	-- N/A	R	R	NA	R,TCF	R,TCI
3: ##CNEG + CNSL-	pass TAccC	fail TAccC	VAC,VMD	Qual (only applied to low conductivity samples and CNSL)	CNEG	None	None	CNEG	TCF	TCI
4: CNEG- CNSL-	fail TAccC	fail TAccC	VAC,VCN	Rej	-- N/A	R	R	NA	R,TCF	R,TCI

Batch Verification Code Scenarios

Toxicity batches are assigned batch verification codes based on the quality control of samples within the batch using CEDEN codes. There have been unique situations during the history of the Delta RMP where the batch verification code needs to reflect a minor deviation (VMD), a serious deviation (VSD), or rejection (VR). The following instances are example situations where these codes have been applied to date. The assignment of a batch verification code when deviations occur should be reported to the Delta RMP Technical Program Manager and the Pesticide TAC. This table may be added to or revised over time based on guidance from the Pesticide TAC and State Board.

Table 12. Examples of instances where the batch verification code reflects data with minor deviations, serious deviations, or are rejected.

Instance: Samples outside of organism tolerance range, CNSL either not run or fails TAccC, statistical tests (for low or high conductivity samples) run against CNEG instead
BatchVerification Code: VSD (serious deviation)
Rationale: With the absence of a CNSL similar to low or high conductivity samples, whether any apparent toxic effect (for those samples out of tolerance range) is entirely or partly due to that parameter is unknown; for test batches where the CNSL is run but fails TAccC, the failure of the CNSL itself may indicate the influence of being outside of the tolerance range, and any apparent toxicity may include that confounding factor. VSD is to caveat potential data users that the deviations may not be "minor", which may be misinterpreted as equivalent to having "insignificant" effect.
Date added: 2021/03/09
Instance: Test condition "recommended" ranges deviations within 2x of the accepted range (e.g., for temperature outside of 25 ± 1°C recommendation, but still within 25 ± 2°C)
BatchVerification Code: VMD (minor deviation)
Rationale: Many method recommendations include a margin of safety, or show negligible or smaller degrees of effect where deviations are only slightly beyond target ranges. This table may be edited or refined for parameters with sharper cutoffs where notable effects are observed with smaller deviations outside of the range.
Date Added: 2021/03/09
Instance: Test condition "recommended" ranges deviations well outside of the accepted range (e.g., for 25 ± 1°C recommendation, may be outside of 25 ± 2°C)
BatchVerification Code: VSD (serious deviation)
Rationale: Deviations well outside of a recommended range have a higher probability of exceeding any margin of safety built into a method, and may show effects. VSD is to qualify data deviations may not be "minor", t. If there are parameters that are identified as being less sensitive to deviations, specific exceptions or handling rules for those may be added at a later date.
Date Added: 2021/03/09
Instance: Test condition "REQUIRED" are not met
BatchVerification Code: VR (rejected)
Rationale: Deviations outside of method "requirements" are presumed to be extremely serious, sufficient to warrant rejection of data in most cases. This table may be edited or refined for parameters where notable effects are not expected or observed, in cases rejection might be too extreme, and would otherwise remove data that might be useful for more limited purposes (e.g., if a VSD were applied instead).
Date Added: 2021/03/09
Instance:
BatchVerification Code:
Rationale:
Date Added:

ATTACHMENT D. MLJ ENVIRONMENTAL TISSUE ANALYSIS REVIEW CHECKLIST

MLJ Tissue Analysis Checklist

Item No.		Component Name	Verified (No	Verified	Fixes Needed	Not Applicable	Comments
1		Fish Composite Check (If applicable)					
1.1		Sample and Collection Verification					
	1.1.1	Lab Sample Details: Compare sample collection information from the database to the EDD to verify they are the same.					
1.2		Organism Checks					
	1.2.1	TisSource = NA					
	1.2.2	OrganismID is in a consistent format.					
	1.2.3	Fork Length < Total Length.					
	1.2.4	Project Specific: Check that the difference between the smallest fish length compared to the largest fish length is not more than 20%.					
	1.2.5	Review for outliers: fork length, total length and weight of fish.					
1.3		Tissue Checks					
	1.3.1	TissueID consistent format.					
	1.3.2	Project Specific: TissueName = fillet, PartsPrepPreservationName = Skin off					
	1.3.3	Review for outliers: tissue weight and weight of fish. Create a pivot table to review that the tissue weights are each less than the fish weights (or that they are similar values if using the whole fish).					
1.4		Composite Checks					
	1.4.1	Check the CompositeID is in a consistent format. CompositeIDs should usually include the StationCode, SampleDate and Organism reference. If program has individual vs composite samples typically "I" or "C" are referenced in the CompositeID.					
	1.4.2	Check that the CompositeType, CompositeReplicate, CompositeWeight, UnitCompositeWeight, HomogDate, OrganismGroup, ComAgencyCode are the same for each CompositeID.					
	1.4.3	Review for outliers: use the pivot table to check the individual organism weights against the CompositeWeight.					
2		Bivalve Composite Check (If applicable)					
2.1		Sample and Collection Verification					
	2.1.1	Lab Sample Details: Compare sample collection information from the database to the EDD to verify they are the same.					
2.2		Organism Checks					
	2.2.1	TisSource = "Resident" or "Transplant"					
	2.2.2	OrganismID is in a consistent format.					
	2.2.3	Check that individual bivalve measurements are provided (unless the QAPP specifically allows average measurements).					
	2.2.4	Review for outliers: use the pivot table to check for consistent values for ShellLength, ShellWidth and LengthWidthType					

Item No.			Component Name	Verified (No	Verified	Fixes Needed	Not Applicable	Comments
	2.3		Tissue Checks					
		2.3.1	TissueIDs are in a consistent format.					
		2.3.2	Project Specific: TissueName = soft tissue without gonads, PartsPrepPreservationName = None					
		2.3.3	Review for outliers: use the pivot table to check tissue weight against organism weight (if reported).					
	2.4		Composite Checks					
		2.4.1	Check the CompositeID is in a consistent format. CompositeIDs should usually include the StationCode, SampleDate and Organism reference. If program has individual vs composite samples typically "I" or "C" are referenced in the CompositeID.					
		2.4.2	Check the CompositeType, CompositeReplicate, CompositeWeight, UnitCompositeWeight, HomogDate, OrganismGroup, ComAgencyCode are the same for each CompositeID.					
		2.4.3	Review for outliers: use the pivot table to check the individual organism weights against the CompositeWeight.					
3			Super Composite Check (If applicable)					
	3.1		Composite Checks					
		3.1.1	CompositeSourceID matches ID from original composite worksheet					
		3.1.2	SuperCompositeID is in a consistent format.					
		3.1.3	Check the CompositeType, CompositeReplicate, CompositeWeight and UnitCompositeWeight are the same for each SuperCompositeID					
		3.1.4	CompositeType = super					
4			Results Check					
	4.1		Verify Results with the PDF					
		4.1.1	Check 10% of the results. Filter on the sample information to ensure that the sample information lines up with the results. If the 10% check is all correct, then proceed with processing the EDD. If errors are found, check all results against the PDF.					
		4.1.2	Check the case narrative in each PDF for important information about reanalysis, hold time violations, or anything that appears out of the ordinary that could affect specific samples or the entire batch. Paste snips of pertinent information into the LaboratoryQuestions tab, and update LabResultsComments if necessary.					
		4.1.3	Check the CompositeID matches corresponding composite worksheet CompositeID.					
		4.1.4	OrganismGroup = correct composite grouping.					
5			Sample Information					
	5.1		Coalition Samples (Grab, field duplicates, field blanks, matrix spikes)					
		5.1.1	SampleTypeCode = Composite (for normal samples)					

Item No.			Component Name	Verified (No	Verified	Fixes Needed	Not Applicable	Comments
6			Processing and Analysis Information					
	6.1		Lab Batches					
		6.1.1	Batch names should conform to the CV RDC batch naming guidelines, stored here: X:\P_CV_RDC\Management_Documentation\2_Documentation_EntryManuals\File-BatchName (or online at CV RDC batch naming conventions).					
		6.1.2	Batches are defined by Method. Each batch should have same Units (excluding surrogates) and Analysis Date. Analysis Dates in a batch should be within 24 hours of each other; if there is a Digest Date then digests/extractions should all be within 24 hours.					
	6.2		Method Name, Analyte Name, Fraction Name, Unit, MDL and RL					
		6.2.1	Each method, analyte, fraction and unit has correct Preparation & Digestion. Review eQAPP to verify.					
	6.3		ExpectedValue					
		6.3.1	All MS, LCS, CRM or Surrogate samples have an expected value.					
	6.4		LabSampleComments					
		6.4.1	LabReplicates of 2 should have an RPD (Relative Percent Difference) recorded (excluding surrogate samples).					
		6.4.2	All LCS and MS have a PR (Percent Recovery) recorded					
		6.4.3	Check the correct format for PR and RPD was applied: use “PR XX” or “RPD XX”; when in combination (such as for an MSD), use “PR XX, RPD XX” (e.g., PR 99, RPD 5)					
	6.5		Submitting Agency					
		6.5.1	Submitting Agency is MLJ Environmental					
	6.6		BatchVerificationCode					
		6.6.1	Populate BatchVerificationCode column with VAC if all checks in this checklist are performed.					
7			QA Checks					
	7.1		Batch Amount Check: Verify laboratory batches have the correct amount of QC required by the QAPP; if QC is missing batch is appropriately flagged with a LabSubmissionCode of QI and a lab batch comment is included. (Verify with lab first as to why it is missing)					
	7.2		Hold Time Check: Check extraction/analysis occurred within the appropriate holding times; if holding times were not met the batch is appropriately flagged and a lab batch comment is included.					

Item No.			Component Name	Verified (No	Verified	Fixes Needed	Not Applicable	Comments
	7.3		Laboratory QC Check: Laboratory QC (MS, LCS, MSD, Lab Blank, Lab Duplicates) Verify samples are within the eQAPP requirements; if QC is outside of requirements the batch is appropriately flagged and a lab batch comment is included. Verify LabBlanks, Matrix Spikes, Lab duplicates and LCS's and any other specific MQO's according to eQAPP.					
	7.4		LabBatch Comments Check: Once all QACodes are applied use a pivot table to verify that LabBatch comments reflect all QACodes in the Results tab. (Make sure to refresh pivot table before check and use the Standardized LabBatchComments.) Check that all QC issues explained at beginning of report are recorded in EDD with either a QACode or in the batch comment. Standardized LabBatchComments excel file is located here: W:\P_ILRP\2.3_DataMgmt\6_ReviewEDDs\EDDChecking					
	7.5		Project Specific: Look at LabReplicates: if either lab results are ND, the RPD values should be NA. Change the value the lab has calculated to RPD NA if either rep 1 or rep 2 has a result of ND.					
	7.6		LabSubmissionCode Check: If the batch has any QACode other than "None", labbatch CANNOT be "A"; should be "A,MD" with a batch comment explaining the code; note that there is NO space between the "A," and "MD".					
	7.7		Lab Report qualifiers: double check PDF lab report and make sure any appropriate qualifiers are added to either the result or batch comments					
8			Unique Row Check					
	8.1		Unique Row: Verify that each row is unique. Sample and database unique.					
9			Data Checker					
	9.1		Data Checker: Run file through data checker and resolve any issues. http://checker.cv.mpsl.mlml.calstate.edu/CVRDC/CVRDCUpload.php. When errors are found run through data checker again until all applicable items are resolved. For CEDEN template use: http://ceden.org/CEDEN_checker/Checker/CEDENUpload.php					
	9.2		LabBatch naming convention changed. Verify less than 50 characters (max for the database). The data checker will show an error for anything over 35 characters, which is ok. No action necessary to change if under 50 characters.					
10			Tracking					
	10.1		Counts: Refresh pivot table for counting analytes for each environmental sample. Update analysis count in MIS ensure all analytes expected were received.					

ITEM NO.			COMPONENT NAME	VERIFIED (NO VERIFIED	FIXES NEEDED	NOT APPLICABLE	COMMENTS
	10.2		Tracking: Update MIS, LaboratoryDataProcessing group, qry2_ReportEDDProcessing with date EDD is complete and your name.					

APPENDIX III – LABORATORY SOPS

Proprietary – Do Not Distribute

The following SOPs are on kept file and only available for regulatory review and approval of this QAPP.

SECTION	REFERENCE	SOP	TITLE
A. USGS-OCRL	A.1	SOP - OCRL-WATER-PEST_05	Standard Operating Procedure: Water Extraction Using HLB SPE and Analysis via LC-MS/MS and GC-MS/MS
B. Babcock Laboratories	B.1	SOP - Organic Carbon by SM 5310 B	Organic Carbon, Total (Nonpurgeable), and Dissolved (Combustion)
	B.2	SOP - Nitrate +Nitrite by EPA 353.2	Nitrate+Nitrite (as N) by Cadmium Reduction, Automated
	B.3	SOP - TKN by EPA 351.2	Automated Kjeldahl Nitrogen; EPA 351.2
	B.4	SOP - Trace Elements by EPA 200.8	Determination of Trace Elements in Waters and Wastes By Inductively Coupled Plasma – Mass Spectrometry
	B.5	SOP - Cations by EPA 200.7	EPA 200.7
C. PER *The listed PER SOPs have been reviewed and are retained by the State Board Quality Assurance Officer; these SOPs are not attached to this QAPP*	C.1	SOP - Chronic *S. capricornutum* Growth	Standard Operating Procedure for Selenastrum capricornutum Algal Growth Bioassay – Revision #11
	C.2	SOP - Chronic *C. dubia* Survival and Reproduction	Standard Operating Procedure for Ceriodaphnia dubia Chronic Survival and Reproduction Bioassay – Revision #9
	C.3	SOP - Chronic *P. promelas* Survival and Growth	Standard Operating Procedure for Pimephales promelas Chronic Survival and Growth Bioassay – Revision #12
	C.4	SOP - Acute H. azteca Survival	Standard Operating Procedure for Hyalella azteca Acute Bioassay – Revision #4
	C.5	SOP - Chronic *C. dilutus* Survival and Growth	Standard Operating Procedure for 10-day Chironomus dilutus Survival & Growth Water Toxicity Test – Revision #4

SECTION	REFERENCE	SOP	TITLE
	C.6	SOP - Centrifuge Use for TIEs	Standard Operating Procedure for Centrifuge Use and Preventative Maintenance – Revision #4
	C.7	SOP - TIE by Carboxylesterase and BSA Addition	Standard Operating Procedure TIE: Carboxylesterase and BSA Addition – Revision #3
	C.8	SOP - TIE by EDTA Addition	Standard Operating Procedure TIE: EDTA Addition – Revision #2
	C.9	SOP - TIE by PBO Addition	Standard Operating Procedure TIE: PBO Addition – Revision #3
	C.10	SOP - TIE by Reversed-Phase SPE	Standard Operating Procedure for TIE: Reversed-Phase Solid Phase Extraction – Revision #3
	C.11	SOP - TIE by Ion Exchange SPE	Standard Operating Procedure for TIE: Ion Exchange Solid Phase Extraction – Revision #1