

**Municipal Water Quality Investigations Program
Work Plan
January - December 2022**

APPROVED WORK PLAN

State of California
Natural Resources Agency
DEPARTMENT OF WATER RESOURCES

Municipal Water Quality Investigations Program Work Plan January – December 2022

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Table of Contents

1.	MISSION STATEMENT.....	4
2.	INTRODUCTION.....	4
	2.1 MWQI Program Background.....	4
	2.2 MWQI Program – Program Partners.....	4
	2.3 MWQI Program Core Elements.....	5
3.	PROGRAM FUNDING NEEDS.....	6
	3.1 MWQI Funding Agreement and MWQI Specific Project Agreement.....	6
	3.2 Explanation of Program Element Costs for Work Plan Projects.....	7
4.	WORKLOAD ASSESSMENT.....	8
5.	WATER QUALITY ASSESSMENT.....	9
	5.1 Discrete Monitoring Program.....	10
6.	REAL-TIME DATA AND FORECASTING COMPREHENSIVE PROGRAM.....	11
	6.1 MWQI Program Real Time Stations.....	12
	6.2 Real Time Station Office Activities.....	13
	6.3 RTDF-CP Information Management and Data Dissemination.....	13
	6.4 RTDF-CP Water Quality Forecasting.....	14
7.	SPECIAL STUDIES.....	17
	7.1 Chlorophyll Study.....	17
	7.2 Endothall Monitoring.....	17
	7.3 North Valley Regional Recycled Water Program.....	18
	7.4 Fluorescence of Dissolved Organic Matter (FDOM) Project.....	18
	7.5 Data Display and Review.....	18
8.	ADMINISTRATIVE WORK.....	19
	8.1 General Required Program Costs.....	19
	8.2 Field Unit Office Work.....	19
9.	OTHER PROGRAM COSTS.....	20

Municipal Water Quality Investigations Program, January – December 2022 Work Plan

List of Acronyms and Terms

BDO	Department of Water Resources Bay Delta Office
CCWD	Contra Costa Water District
CDEC	California Data Exchange Center
CVP	Central Valley Project
CY	Calendar Year
DISE	Division of Integrated Science and Engineering
DMC	Delta-Mendota Canal
DO	Dissolved Oxygen
DOC	Dissolved Organic Carbon
DSM2	Delta Simulation Model 2
DWR	California Department of Water Resources
EC	Specific Electric Conductivity
EMP	DISE Environmental Monitoring Program
FDOM	Fluorescence of Dissolved Organic Matter
FY	Fiscal Year
IC	Ion Chromatography
IO	Internal Order number
MEO	Mobile Equipment Office
MWQI	Municipal Water Quality Investigations
MWQI SPC	Municipal Water Quality Investigations Specific Projects Committee
Na	Sodium
NEMDC	Natomas East Main Drainage Canal
O&M	DWR Division of Operations and Maintenance
O&M EAB	Division of Operations and Maintenance Environmental Assessment Branch
OC	Organic Carbon
OCO	Operation Controls Office (DWR O&M)
OE&E	Operating Expenses and Equipment
P/G	Pumping/Generation
PY	Position Year
QA/QC	Quality Assurance/Quality Control
QC	Quality Control
RA	Resource Agreement
RTDF	Real-time Data and Forecasting Program
RTDF-CP	Real-time Data and Forecasting – Comprehensive Program
RTM	Real Time Monitoring
SOP	Standard Operating Procedure
SPC	Specific Project Committee
SWP	State Water Project
TBD	To Be Determined
TOC	Total Organic Carbon
WDL	California Water Data Library

1. MISSION STATEMENT

The mission of the Municipal Water Quality Investigations (MWQI) Program is to:

1. Support the effective and efficient use of the State Water Project (SWP) as a source water supply for municipal purposes through monitoring, forecasting, and reporting of Sacramento-San Joaquin Delta and the SWP water quality;
2. Provide early warning of changing conditions in source water quality used for municipal purposes;
3. Provide data and knowledge-based support for operational decision-making on the SWP; and
4. Provide scientific support to the Department of Water Resources (DWR), the State Water Contractors (SWC) MWQI Specific Project Committee (MWQI SPC), participating SWP Contractors, and other governmental entities.

2. INTRODUCTION

2.1 MWQI Program Background

The MWQI Program monitors and evaluates water quality in the Sacramento-San Joaquin Delta (Delta) to produce a comprehensive information base for State Water Contractors and other interested parties. MWQI generated data, incorporated with non-program data, are disseminated via daily and weekly reports at the Real-Time Data and Forecasting–Comprehensive Program (RTDF-CP) web site located at: <http://rtdf.info/>

DWR staff also represent MWQI interests when interacting with external organizations such as the State Water Resources Control Board (SWRCB), the Central Valley Regional Water Quality Control Board (CVRWQCB), the CVRWQCB's Nutrient Stakeholder and Technical Advisory Group (STAG) and the Delta Regional Monitoring Program (RMP).

Finally, MWQI staff support database infrastructure management, and the administration of essential program management activities mandated by DWR, including the development of quality assurance to ensure data are of a known and documented quality and efforts to ensure workplace health and safety.

2.2 MWQI Program – Program Partners

The MWQI Program has program partners who work in the Division of Operations and Maintenance's Environmental Assessment Branch (EAB), Bay-Delta Office, and the Operations Control Office (OCO). The MWQI Program and its program partners use resource agreements to manage workloads, staff resources, and budgets across DWR Divisions. Each resource agreement (RA) is prepared, reviewed, approved, and kept on-file by the program managers involved in the agreement. Typically, the duration of a RA is one year, and agreements are renewed when workloads change. For this work

Municipal Water Quality Investigations Program, January – December 2022 Work Plan

plan cycle, MWQI Program has in place resource agreements that have been approved through fiscal year 2022-2023 (July 1, 2022 through June 30, 2023) for the following Program Partners:

O&M - Environmental Assessment Branch
OCO - Regulatory Compliance & Reporting
BDO – Modeling Support Branch

2.3 MWQI Program Core Elements

MWQI Program core elements will receive priority, though staff time may occasionally shift away from the work described in this work plan. Examples include work on the Delta Smelt cage study, biological monitoring, and D-1641 compliance monitoring. If it becomes apparent that core elements will be affected, adjustments will be made to keep the program moving forward.

Core elements of the MWQI Program include:

1. Real-time water quality monitoring
2. Modeling duties associated with producing short-term water quality forecasts and performing historical updates of existing models.
3. Production and dissemination of daily and weekly RTDF reports.
4. Data management activities pertaining to database infrastructure enhancement and improvement of long-term RTDF data storage and retrieval.
5. Program management activities listed in the MWQI funding agreement and those mandated by DWR health and safety. This includes RTDF Steering Committee meetings, budget updates, Bulletin 132 updates, and support to department emergency, drought, and O&M programs.
6. Other required Program activities mandated by DWR or essential to the MWQI Program (i.e. purchasing, contracts, budgeting, safety and policy training, specific meetings, and conferences).

3. PROGRAM FUNDING NEEDS

3.1 MWQI Funding Agreement and MWQI Specific Project Agreement

The MWQI Funding Agreement, signed by DWR, SWC, and MWQI SPC, provides the funding authority for the MWQI Program costs. MWQI Program costs include salaries and benefits of DWR staff, operating expenses and equipment, and DWR overhead expenses. These MWQI Program costs are funded through the annual statement of charges of the SWP Contractors participating in the MWQI Program. The MWQI Funding Agreement is in effect from January 1, 2020 to December 31, 2022, which covers the timeframe of this calendar year (CY) based annual work plan.

The State Water Contractors MWQI Program Specific Project Agreement (MWQI Specific Project Agreement) establishes an independent, supplemental funding authority to support the objectives of the MWQI Program. SWP Contractors who are signatories to the MWQI Specific Project Agreement collectively form the MWQI Specific Project Committee (MWQI SPC) which carries out the work. Funds collected from the participating contractors are held in the MWQI SPC Account. The MWQI SPC Fund is generally used to pay for MWQI Program related costs that are not administered by DWR. These costs include hiring and retaining consultants, special studies or investigations, administrative and related costs, and if emergency or urgent needs warrant, the purchase of equipment or supplies for the MWQI Program or facilities.

The CY 2022 MWQI Program contract budget total is \$3.1 million, with \$1,845,180 assigned to the DWR MWQI Program, and the remaining portion for the MWQI SPC fund.

The estimated budget expenses for the 2022 work plan are shown in Table 1 and is followed by an explanation of MWQI Program expenditures in Table 2.

Municipal Water Quality Investigations Program, January – December 2022 Work Plan

Table 1. January – December 2022 Program Element Costs for MWQI Program

Workplan Element	Program Element	2022 IO#	Labor Hours	Labor Cost	Contracts	OE&E	Total Cost
5	Water Quality Assessment						
5.1	Discrete Monitoring Program	VWQASSMENT13	720	\$100,800		\$15,000	\$115,800
6	RTDF-Comprehensive Program						
6.1	RTM Stations	VRTMONITOR13	1160	\$162,400	\$61,000	\$160,000	\$383,400
6.2	RTM Office Tasks	VGIANNELLI13	1700	\$238,000			\$238,000
6.3	RTM Distribution and Reporting	VRTDDISRPT13	816	\$114,240			\$114,420
6.4	RTDF Modeling	VRTOCOMODL13	2667	\$480,060			\$480,060
7	Special Studies						
7.1	Chlorophyll Study	VMWQSPCSTD19	180	\$25,200		\$27,000	\$52,200
7.2	Endothall Monitoring Activities	VMWQSPCSTD19	184	\$25,760			\$25,760
7.3	North Valley Regional Recycled Water Program	VMWQSPCSTD19	124	\$17,360			\$17,360
7.4	FDOM Study	VMWQSPCSTD19	150	\$21,000			\$21,000
7.5	Data Display and Review	VMWQSPCSTD19	80	\$11,200			\$11,200
8	Overhead Activities						
8.1	Administration Work	VDWRRQDDPC13	1520	\$212,800		\$20,000	\$232,800
8.2	Field Unit Office Work	VFUOFCWORK13	344	\$48,160		\$100,000	\$63,160
9	Other Program Costs						
9.1	MEO Insurance, Fuel, & Maintenance	n/a				\$15,000	\$15,000
	Total		9,645	\$1,447,180	\$61,000	\$337,000	\$1,845,180

* DWR assessments are equally charged to programs to cover costs of Departmental overhead expenses. For example, administration, legal, and executive offices.

**The MWQI Program includes 3.5 PY for staff and 2.0 PY's for program partners in OCO, BDO, and O&M. Hourly labor rates are estimated at: MWQI Program Staff - \$140; OCO/BDO Staff - \$180/hour; EAB Staff- \$140

3.2 Explanation of Program Element Costs for Work Plan Projects

Table 2 provides further detail on the planned 2022 OE&E and Contract expenses that are generally covered in Table 1.

Table 2. January – December 2022 MWQI Program Contract and Operating Expenses & Equipment (OE&E) Costs

Program element:		Description	Justification	Cost
5.1	WQ Assessment	Discrete Monitoring Program - calibration equipment & consumables	required for sample collection and to meet QA guidelines	\$15,000
6.1	RTDF	MWQI Real Time Stations - equipment & filter replacement	consumables	\$70,000
6.1	RTDF	YSI replacement probes	consumables	\$50,000
6.1	RTDF	YSI new EXO sondes	end of life replacement, plus a few additional to meet new QA guidelines	\$40,000
6.1	RTDF	2 New Sievers M5310 TOC instruments	end of life replacement (Jones & Vernalis)	\$60,000
6.1	RTDF	Thermo-Fisher service contract for 4 Dionex IC analyzers	Annual maintenance and repair	\$36,000
6.1	RTDF	Suez/Sievers - service contract for 4 organic carbon analyzers	Annual maintenance and repair	\$25,000
7.1	Special Studies	Chlorophyll Study- Contract Lab Analysis Costs	Study requires contract lab analysis for comparison to Turner and YSI algal sensors	\$27,000
8.1	MWQI Administration	Meetings, conferences, training for MWQI staff	Conferences and training fees and per diem	\$20,000
8.2	Field Unit Office Duties	Facility Maintenance	Annual maintenance, construction, and repair	\$40,000
9.1	Mobile Equipment Office	Vehicle maintenance, fuel, and insurance		\$15,000
		TOTAL Contract & OEE COSTS:		\$398,000

4 WORKLOAD ASSESSMENT

The workload assessment is a vital tool in managing staff workloads, project status, and impacts to the MWQI budget. This assessment covers staff in the MWQI Program, BDO, OCO and O&M. The assessment assumes that staff have 1778 hours of production time during the year. The assessment does not use the total hours in a year (2080) because total hours include vacation, holidays, sick, etc., where staff do not produce work. The workload assessment has proved to be a vital tool in managing staff workloads, shifts in workloads, and impacts to the MWQI budget. Table 3 lists the current workload assessment

Municipal Water Quality Investigations Program, January – December 2022 Work Plan

Table 3. Workload Assessment for CY2022

Table 3. Work Load Assessment for CY2022	IO#	MWQI Staff					Non-MWQI Staff			Total Hours	Total Pys @1778 hrs
		Jeremy Del Cid	Arin Corner	Travis Brown	Steven San Julian	Mark Bettencourt	O&M EAB - Chris Gray	BDO - Various Staff	OCO - Various Staff		
5.0 Water Quality Assessment											
5.1 Discrete Monitoring Program	VWQASSMENT13	335	335	50	0	0	0	0	0	720	0.4
6.0 Real Time Data Forecasting											
6.1 RTM Stations	VRTMONITOR13	270	270	270	0	0	350	0	0	1160	0.7
6.2 RTM Office Tasks	VGIANNELLI13	300	300	300	0	500	300	0	0	1700	1.0
6.3 RTM Distribution and Reporting	VRTDDISRPT13	60	60	60	0	576	60	0	0	816	0.5
6.4 RTDF Modeling	VRTOCOMODL13	0	0	0	0	0	0	1778	889	2667	1.5
7.0 Special Studies											
7.1 Chlorophyll Study	VMWQSPCSTD19	80	0	0	100	0	0	0	0	180	0.10
7.2 Endothall Monitoring Activites	VMWQSPCSTD19	80	80	24	0	0	0	0	0	184	0.10
7.3 North Valley Regional Recycled Program	VMWQSPCSTD19	40	40	24	20	0	0	0	0	124	0.07
7.4 FDOM Study	VMWQSPCSTD19	150	0	0	0	0	0	0	0	150	0.08
7.5 Data Display and Review	VMWQSPCSTD19	20	20	20	0	20	0	0	0	80	0.04
8.0 Overhead Activities											
8.1 Administration Work--Training/meetings	VDWRRQDDPC13	80	80	40	1200	120	0	0	0	1520	0.9
8.2 Field Unit Office Work	VFUOFCWORK13	80	80	40	64	80	0	0	0	344	0.2
Totals		1495	1265	828	1384	1296	710	1778	889	9645	5.4

5. WATER QUALITY ASSESSMENT

Water quality assessment has been a key feature of the MWQI Program since its inception in 1990. MWQI’s monitoring data are used by many groups, including DWR, the MWQI SPC, non-governmental organizations, and by the public. MWQI monitoring data are used in drinking water supply studies, to identify long-term trends in drinking water quality, and to help DWR and other agencies research and mitigate drinking water issues in Delta waters and the SWP. Additionally, in collaboration with O&M EAB, and OCO, monitoring data are used to further develop an “early warning” system that provides advance notice to Delta water users of possible drinking water quality problems. Monitoring data are collected by two different monitoring strategies; 1) discrete grab samples, and 2) continuous real-time monitoring via remotely located instrumentation. This section focuses on discrete monitoring for January-December 2022. Section 6 focuses on continuous, remote real-time monitoring.

Municipal Water Quality Investigations Program, January – December 2022 Work Plan

See Table 4 for the list of 2022 monitoring locations, with associated analytes.

Table 4. MWQI Program’s 2022 Discrete Sampling Stations

#	Stations Name	WDL Stations (ID)	Analytes Collected (M= Monthly, Q=Quarterly, S=Seasonal, F=Flow Based)														
			Std Minerals	Std Nutrients	TOC	DOC	Anions	Chlorophyll	Metals	PTOX Cyanobacteria	Total Suspended Solids	Purgeable Organics	Tate & Odor	Radiological	Pesticides	Herbicides	
1	Sacramento River at Hood	B9D82211312	M	M	M	M	M	M	M								
2	Old River @ Rancho Del Rio (D28A) (EMP collecting)	B9D75821344	M	M	M	M	M	M									
3	Banks Pumping Plant at Headworks (MWQI, O&M Collecting)	KA000331	M	M	M	M	M	M	M	S	M	M	W	Q	Q	Q	
4	Rock Slough at CCWD Fish Screen (NCRO collecting)	B9C75861385	M	M	M	M	M	M									
5	Jones Pumping Plant at DMC	B9C74781351		M	M	M	M	M									
6	Gianelli Pumping/Generating Plant	ON003050		M	M	M	M	M									
7	Lisbon Weir (Yolo Bypass East Toe Drain) (AES Collecting)	B9D82851352	S	S	S	S	S	S			S						
8	Sacramento River @ Chipps Island- D10 (EMP collecting)	B9D80281551	M	M	M	M	M	M			M						
9	Old River at Clifton Court (EMP collecting)	B9D74981334	M	M	M	M	M	M			M						
10	San Joaquin River near Vernalis	B9D74051159	M	M	M	M	M	M	M		M						
11	Natomas East Main Drainage Canal	A0V83671280	F	F	F	F	F	F									
12	American River at E.A. Fairbairn WTP Intake	A0714010	M	M	M	M	M	M									
13	Sacramento River at West Sacramento WTP Intake	A0210451	M	M	M	M	M	M									
14	Old River at Station 9	B9D75351342	M	M	M	M	M	M									
15	Middle River at Union Point	B9D75351292	M	M	M	M	M	M									
16	Colusa Ag Drain nr. Sacramento River	A0294500	M	M	M	M	M	M			M						

Physical Parameters collected at all sites: Temperature, pH, Turbidity, Dissolved Oxygen, and Specific Conductance

5.1 Discrete Monitoring Program

The number of routine monitoring locations has been reduced from 28 to 10. The reduction in discrete monitoring sites is primarily due to the completion of the Cache Slough and Delta Boundary Inputs monitoring, and the elimination of six routine monitoring sites. Monitoring continues at a monthly interval. For RTDF station quality control (Section 6), discrete samples are collected once per month at the Banks Pumping Plant, Jones Pumping Plant, Gianelli Pumping Plant, Hood, and Vernalis stations. These river and canal samples are collected to examine instrument

performance and are also used as discrete data representative of the sample location. Discrete sample data are available through DWR's Water Data Library (WDL).

6. REAL-TIME DATA AND FORECASTING COMPREHENSIVE PROGRAM

The RTDF-CP focuses on providing real-time water quality data and related information gathered from multiple sources. This enables water managers to make operational decisions based on observed and forecasted changes in water quality. The RTDF-CP includes a network of real-time water quality monitoring stations that provide current water quality conditions and a modeling component that provides both historical and predictive water quality characterizations. Monitoring performed by the RTDF-CP encompasses the Delta, watersheds of the Delta, the SWP, and portions of the federal Central Valley Project (CVP). In addition, funded positions within the MWQI Program are also found within DWR's OCO and O&M Environmental Assessment Branch.

The RTDF-CP Consists of Three Principle Activities:

1. Remote instrumentation that provides real-time water quality data
2. Modeling that provides historical water quality fingerprints and water quality forecasting
3. Information management and data dissemination

These three activities are guided by the RTDF Steering Committee, a group of technical experts composed of MWQI Program staff, CCWD staff, and participating MWQI SPC agencies.

Real-Time Monitoring

The real-time monitoring section of the RTDF-CP produces water quality data that supports the development of water quality forecasting tools, provides current and advanced notice of water quality conditions, provides information for water quality and water supply planning studies, and can be used by drinking water treatment plant operators to make informed operational decisions.

This program element is comprised of:

1. Instrumentation installed at key remote locations in and around the Delta
2. Field operations that provide timely repair and maintenance of all station equipment
3. Timely dissemination of real-time data
4. Standard Operating Procedure documentation and instrument QA/QC documentation
5. Implementation and documentation of data QA/QC.

6.1 MWQI Program Real Time Stations

The RTDF-CP operates five remote real-time monitoring stations; four located in the Delta and one south of the Delta (Table 5). The Delta stations include Hood, located on the Sacramento River near the town of Hood, Banks Pumping Plant, located at the head of the SWP and Jones Pumping Plant, located at the head of the Delta-Mendota Canal (part of the CVP) and Vernalis, located on the San Joaquin River near the town of Vernalis. The southern station, at Gianelli Pumping Plant, is located within O&M’s San Luis Field Division on O’Neill Forebay below San Luis Reservoir.

Sacramento River at Hood station:

The TOC/DOC real-time analyzer at the Hood station will be operated through, at least, July 1, 2022, to evaluate if FDOM is a valid proxy for TOC/DOC. Targeted discrete sampling will be employed at Hood during rain events during winter 2021-22 and spring 2022 to capture high TOC/DOC concentrations, which should improve the FDOM to TOC/DOC relationship. A decision on switching from the organic carbon analyzer to FDOM will be made by DWR staff and the contractors in spring/early summer 2022. The decision will be made on factors, such as the ability the FDOM sensor to accurately capture TOC/DOC peaks and a retrospective analysis of the short-term Delta and Aqueduct forecasts. The retrospective analysis will evaluate if using proxy TOC/DOC data has a significant effect on the Delta and Aqueduct models. If DWR staff and the contractors decide not to switch to FDOM at Hood, then DWR will run the organic carbon analyzers for the remainder of 2022.

Table 5 summarizes station locations, MWQI Program and non-MWQI Program water quality parameters, and the automated analyzers used by the MWQI Program RTM element.

Table 5. MWQI Program Real-Time station locations, parameters, and equipment

MWQI Program Station/CDEC Station	MWQI Program Parameters & Instruments	Non-MWQI Program Parameters
Sacramento River at Hood (CDEC = SRH)	TOC, DOC (Suez, Sievers 900)	Water: chlorophyll, EC, DO, pH, temperature, nitrate, and turbidity. Atmospheric: solar radiation, temperature, wind speed and direction.
San Joaquin River near Vernalis (CDEC = SJR)	TOC, DOC (Suez, Sievers 5310) bromide, chloride, nitrate, sulfate, (Thermo-Fisher Dionex ICS-2100)	Water: chlorophyll, DO, EC, pH, river flow and stage, temperature, and turbidity. Atmospheric: solar radiation, temperature, wind speed and direction
Banks Pumping Plant - Delta Headworks (CDEC = HRO)	TOC, DOC (Suez, Sievers 5310), bromide, chloride, nitrate, sulfate, (Thermo-Fisher Dionex ICS-2100), YSI EXO Sonde (EC, Temp, DO, pH, FDOM, Algal Fluorescence) and Turner C3 Fluorometer (Algal Fluorescence)	Water: EC, fluorescence, pH, pump discharge, temperature, turbidity Atmospheric: temperature, wind speed and direction.

Municipal Water Quality Investigations Program, January – December 2022 Work Plan

Jones Pumping Plan (CDEC = TRP)	TOC, DOC, (Suez, Sievers 5310), bromide, chloride, nitrate, sulfate, (Thermo-Fisher Dionex ICS-2100), and YSI EXO Sonde (EC, Temp, DO, pH, FDOM, Algal Fluorescence)	Water: EC, pump discharge, temperature.
Gianelli P/G Plant (CDEC = ONG)	TOC, DOC (Suez, Sievers 5310), EC, temp, turbidity, DO, pH (YSI 6600) bromide, chloride, nitrate, sulfate (Thermo-Fisher Dionex ICS-2100), and YSI EXO Sonde (EC, Temp, DO, pH, FDOM, Algal Fluorescence)	Pump and Generation discharge

6.2 Real Time Station Office Activities

To track time and expenditures related to the office activities required to operate the real time stations, a separate IO is used to track this part of the program.

Field office labor associated with real-time monitoring (RTM) includes:

1. Ordering RTM supplies, phone consultation with instrument manufacturers
2. Creation of RTM Quality Control (QC) sampling runs
3. Creation of instrument-specific chemical standards, solutions and reagents
4. Repairs to station peripheral components
5. Maintenance of equipment used on RTM field runs
6. Analysis of all RTM data
7. Remote operation of instruments.
8. Updating stations manuals, standard operating procedures, and quality assurance project plans

6.3 RTDF-CP Information Management and Data Dissemination

This program element includes data dissemination and information management tasks associated with the synthesis of real-time data and related information that is derived from the RTDF-CP and a variety of federal and state water quality monitoring programs. The element produces, gathers, organizes and disseminates this information via the WDL (<http://wdl.water.ca.gov/>), the California Data Exchange Center (CDEC) (<http://cdec.water.ca.gov/>) and the RTDF-CP web page: <http://rtdf.info/>

In addition, daily and weekly summary emails containing a subset of information including real time data, Delta commentary, weather updates and hydrological conditions are sent to interested parties. (This information is also posted on the RTDF-CP web site.) Information provided on the RTDF-CP web page gives users a single location to search for related water quality information.

RTDF Data Dissemination and Reporting

In this workplan the scope of activities being billed to this element has been expanded to better track all station lead responsibilities that directly relate to the creation and reporting of information to the RTDF committee. Aside from this, information

Municipal Water Quality Investigations Program, January – December 2022 Work Plan

management and data dissemination tasks performed by MWQI and the Technical Consultant, TetraTech include:

1. Continued refinement of the WDL data set
2. Continued refinement of the MWQI Program database
3. Continued development and enhancement of online tools for editing, evaluating, and interpreting MWQI Program water quality data (QA/QC and data visualization).
4. Improve means to distribute daily and weekly water quality reports via the internet
5. Improve database functionality

Tasks for the data dissemination portion of the RTDF program are shown below in Table 6.

Table 6. Information Management and Data Dissemination Deliverables and Timelines

Task	Participants	Start Date	Ongoing
Improve/Upgrade database infrastructure A) Continue to implement updates and patches as appropriate. B) Continued enhancement of manual and automated QA/QC processes C) Continue to develop the station journal database and applications. D) Continue to develop desktop data management tools, enhance plotting capabilities, link time series and QA/QC. E) Continue to document and maintain infrastructure. F) Add new sensors to the database as needed	MWQI Program	A) Began Jan 2009 B) Began Jan 2009 C) Began Jan 2010 D) Began Jan 2010 E) Began Jul 2009 F) Began Jan 2010	A) Ongoing B) Ongoing C) Ongoing D) Ongoing E) Ongoing F) Ongoing
Improve Field Data Communications A) Continue to develop, test and enhance intranet/ internet components. B) Develop and implement as feasible procedures, practices and standards for supporting the reliability of field data systems.	MWQI Program	A) Began Jan 2011 B) Began Jul 2011	A) Ongoing B) Ongoing
Development and enhancement of RTDF data dissemination products A) As needed, add new stations & sensors to the website or daily summary table. B) As needed, enhance the website presentation. C) Enhance procedures for emailing the daily summary report.	MWQI Program	A) N/A B) N/A C) N/A	A) Ongoing as needed B) Ongoing as needed C) Ongoing as needed

6.4 RTDF-CP Water Quality Forecasting

The modeling/forecasting component of the RTDF-CP continues to update and improve existing models to further develop their capabilities. The objective of this effort is to bet-

ter incorporate modeling insight with water quality monitoring to maximize the use of modeling results by water quality managers.

The modeling effort will continue to focus on Historical representations (fingerprints) and Short-Term Delta and Aqueduct Forecasts. These efforts are scheduled to continue through this work plan cycle.

BDO Modeling

BDO staff, the model mechanics, periodically work on MWQP/RTDF model issues and special projects as needed. They will continue to be involved when model issues arise, and the models require adjustment. (This includes potential work to incorporate aqueduct turn-in water into the short-term aqueduct model. The goal being to see how model output is affected by this water.) New projects may also be added to this task, with further discussion between MWQP staff and the MWQI SPC.

BDO staff will work on a Delta Salinity Constituent Relationships project, which is a continuation of work previously conducted by Richard Denton on developing constituent relationships between salinity, and chloride, and bromide. The scope of work includes:

Project Description

The purpose of the proposed scope of work is to build upon the effort documented in Denton (2015) as well as the follow-up work conducted by Tetra Tech most recently (Tetra Tech, 2021); the proposed work aims to develop machine learning-based models to estimate constituent concentrations (including chloride, bromide, sodium, calcium, sulfate, and total dissolved solids, among others) from a given salinity level (represented by Electrical Conductance (EC)) value at several key locations in the Delta. The proposed models are expected to provide more accurate estimations than the simplified methods previously applied. Deliverables from the proposed scope of work should be published and maintained on a regular basis by DWR to provide a single authoritative source of information on this topic.

Tasks

- Task 1 – Conduct a pilot study to develop machine learning models to develop regressions between various constituents and EC, given additional information on Delta hydrology, water quality, and timing information. A small set of grab sample data (e.g., 2018-2020) collected by NCRO for seven South Delta locations can be applied for this purpose.
- Task 2 – Expand the pilot study described in Task 1 using the grab sample data assembled and quality-controlled by Tetra Tech (2021) and DSM2-generated volumetric fingerprints to develop regressions based on observed EC and observed constituent in grab samples for:
 - Each specific location where data is available

Municipal Water Quality Investigations Program, January – December 2022 Work Plan

- Small regions in the Delta for which regressions are similar (approximately 12)
 - A singular Delta-wide regression.
- Task 3 – Generate regressions as under item (II) in Taks 2 using DSM2-generated EC fingerprints.
- Task 4 – Repeat Task 2 and Task 3 above using DSM2-simulated EC instead of sampled EC.
- Task 5 – Develop three progress reports (for Task 1, Task 2, Tasks 3 and 4, respectively) and a final project report. The draft report will be submitted to MWQI for comment.
- Task 6 (optional) – Develop two to three manuscripts for possible publication in peer-reviewed journals. The primary purpose of this task is to strengthen the credibility of the work and increase its visibility among the stakeholder community.

Project Schedule & Budget

Proposed Schedule

Task ID	2021 Jul-Dec	2022 Jan-Jun	2022 Jul-Dec	2023 Jan-Jun	2023 Jul-Dec	2024 Jan-Jun
Task 1	X					
Task 2		X	X			
Task 3			X			
Task 4				X	X	
Task 5	X			X	X	X
Task 6		X		X		X

Proposed Labor Hours

	Hours Subtotal:
FY 21-22 Planned Labor Hours	1778
FY 22-23 Planned Labor Hours	1778
FY 23-24 Planned Labor Hours	1778
Total	5334

Deliverables

- Source code to be applying in data downloading, processing, model development, and result analysis
- Progress and final project reports
- Manuscripts submitted to peer-reviewed journals (optional)

References

Denton, R. (2015). Delta Salinity Constituent Analysis, prepared for the State Water Project Contractors Authority, February.

DWR (1986). Salinity Unit Conversion Equations, interoffice memorandum from Kamyar Guivetchi, June 24.

OCO Modeling

OCO staff, the model operators, continue to produce weekly Delta forecasts, short-term aqueduct forecasts and monthly historical fingerprints. Working with the BDO modelers, if need be, they continue to update and work on improving model reliability. If updates or changes are made to any of the models, such as the updated short-term DOC forecasts, OCO will provide a justification for the alternative methodology and will complete additional calibration with more DOC data.

In 2022, OCO will validate the new alkalinity short-term modeling forecasts by comparing the model data to discrete data at multiple sites, including Banks, Check 13, and South Bay Pumping Plant.

7. SPECIAL STUDIES

Studies that fall outside the scope of RTDF are outlined below and will be worked on this year by existing staff.

7.1 Chlorophyll Study

Principal Investigator – Steve San Julian
Project Partner – Atlasi Daneshvar

The primary objectives of this study: 1) compare chlorophyll *a* data collected by two different instruments, *Turner Designs* and YSI, at Banks; and 2) study correlation between phycocyanin-specific fluorescence measured by *Turner Designs* probe and cyanobacterial biomass at Banks and Pacheco Pumping Plant. Although the data collection phase of this was originally intended to go for one algal season, the decision was made to extend data collection through late 2021. MWQI plans to continue paying for contract lab analysis costs during the extension. Current projection is \$27,000 for lab costs.

7.2 Endothall Monitoring

Project Partners – Steven San Julian (MWQI) & Leslie Palencia (SWC)

MWQI collaborated with O&M and the MWQI SPC to monitor Endothall at Clifton Court Forebay and O'Neil Forebay in 2019 - 2021. Applications in the SWP have been effective in treating aquatic vegetation, but endothall degradation is complex and affected by environmental conditions, such as water temperature of aquatic vegetation biomass. If endothall does not breakdown or is not completely absorbed by plant material, it can adversely affect human health; the drinking water MCL for Endothall is 0.1 mg/L.

Monitoring is planned to assess chemical degradation in the treatment forebays and adjacent waterways. O&M will likely treat again in 2022. If treatment occurs, MWQI plans to support O&M monitoring efforts by supplying field staff, autosamplers, and other resources, as needed.

7.3 North Valley Regional Recycled Water Program

Principal Investigator – Leslie Palencia

The Central Valley Regional Water Quality Control Board adopted a discharge permit in February 2016 that permits the cities of Modesto and Turlock to discharge up to 59,000 acre-feet of recycled tertiary treated wastewater into the Central Valley Project Delta Mendota Canal (DMC). The recycled water will be transferred to the Del Puerto Water District and to the Central Valley Project Improvement Act. The city of Modesto began discharging recycled water into the DMC in December 2017, while the city of Turlock started discharging into the DMC in March 2020. A limited monitoring study was implemented by the city of Turlock in December 2016 to assess if there are water quality effects as the result of the addition of recycled water into the DMC. MWQI has been supporting the MWQI SPC to investigate CECs being introduced into the DMC as result of the discharge. To date, MWQI has collected samples for five sampling sessions and it is anticipated to collect four additional sampling sessions in 2022.

A spreadsheet with the constituent graphs and a short summary of any notable data and trends will be provided to the contractors bi-annually.

7.4 Fluorescence of Dissolved Organic Matter (FDOM) Project

Principal Investigator – Jeremy Del Cid

Project Partner – Steven San Julian

The goal of the study is to use FDOM as a proxy for organic carbon measurements. For current work, FDOM sensors have been installed at different locations to 1) determine how the FDOM responds to different water sources, 2) to determine how YSI FDOM probes compare to the *Turner* probe used in the 2020 FDOM Final Report, and 3) to build a regression equation between the FDOM and discrete data, which will be compared to the continuous organic carbon data. Staff will be working on a draft report in June 2022, with a final report estimated to complete by June 2023.

7.5 Data Display and Review

Principal Investigator – Shaun Philippart

Project Partner – Steven San Julian

This project involves generating water quality graphs that follow the Sanitary Survey format.

MWQI staff will produce real-time and discrete data graphs for the RTDF stations (Banks, Jones, Gianelli, Vernalis, and Hood) that follow the Sanitary Survey format for the following constituents: specific conductance, total organic carbon, bromide, turbidity, total phosphorus, and total nitrogen. The objective of this task is to ensure the MWQI program reviews the data it collects on an annual basis and to produce graphs that can be used in the Sanitary Survey. The graphs for each station will be presented to the contractors by no later than June 1, 2022.

8. ADMINISTRATIVE WORK

8.1 General Required Program Costs

The majority of time billed to this IO covers most of the line-level program management costs for the MWQI program (Steven San Julian's time). This includes supervisory level duties, meetings, schedule development, coordination with various program partners, oversight and assistance on MWQI programs and projects, etc. For staff, the Administrative Work IO is used for time and fees associated with meetings, conferences, trainings and various other Department level events. MWQI staff are also occasionally requested to support other DWR activities. For example, staff may be asked to provide technical assistance, review and revise plans, or provide support that improves workplace safety practices. Such assistance may directly or indirectly benefit the MWQI Program stakeholders and the MWQI SPC, and therefore will be charged to the MWQI budget. If these activities are directly related to specific projects that have an IO, those IOs will be billed, but the default billing for these instances will fall to the Administrative Work IO.

MWQI Program staff will continue to inform the RTDF Steering Committee and MWQI SPC about work related to these tasks. MWQI will achieve this by providing updates during the RTDF meetings, in monthly expenditure reports, and by providing details in this and future work plans.

8.2 Field Unit Office Work

MWQI program staff work mainly out of the Bryte Field Facility, located in West Sacramento. There are costs associated with the maintenance, upkeep, and restoration of the MWQI part of the facility for which MWQI is responsible. Since MWQI is required to provide a charge number for such costs, it makes sense for those charges to be separated out from the normal *Administration Costs* associated with Section 7.1. The MWQI program is responsible to bear the cost associated with unallocated labor; and so, activities deemed unrelated to other projects will be billed to 7.2. This means that some of the time billed to this IO is time that could be available to work on other MWQI projects. Any such expenditures will be addressed in RTDF meetings prior to allocation.

9. OTHER PROGRAM COSTS

In this workplan, *Other Program Costs* are all charges billed to overhead. There are many categories of charges that fall under overhead, but the largest are charges associated with mobile equipment. DWR's Mobile Equipment Office (MEO) provides insurance, fuel, and vehicle maintenance and repair for MWQI vehicles and vessels.