

**Municipal Water Quality Investigations Program  
Work Plan  
January - December 2018**

**FINAL APPROVED WORK PLAN**

State of California  
Natural Resources Agency  
**DEPARTMENT OF WATER RESOURCES**

March 28, 2018

# Municipal Water Quality Investigations Program, January – December 2018 Work Plan

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# **Municipal Water Quality Investigations Program Work Plan January – December 2018**

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# Municipal Water Quality Investigations Program, January – December 2018 Work Plan

## List of Acronyms and Terms

BDO	Department of Water Resources Bay Delta Office
BOD	Biological Oxygen Demand
CBOD	Chemical Biological Oxygen Demand
CCWD	Contra Costa Water District
CDEC	California Data Exchange Center
CVP	Central Valley Project
CY	Calendar Year
DES	Division of Environmental Services
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
EPA	U.S. Environmental Protection Agency
FDOM	Fluorescence of Dissolved Organic Matter
FRPA	Fish Restoration Program Agreement
FY	Fiscal Year
HAAFP	Haloacetic Acid Formation Potential
IC	Ion Chromatography
IEP	Interagency Ecological Program
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 WQ	Division of Operations and Maintenance Water Quality Section
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
SBA	South Bay Aqueduct
SCWA	Solano County Water Agency
SLDMWA	San Luis and Delta-Mendota Water Authority
SOP	Standard Operating Procedure
SPC	Specific Project Committee
SWP	State Water Project
SWPCA	State Water Project Contractors Authority
TBD	To Be Determined
THMFP	Trihalomethane formation potential
TOC	Total (dissolved and suspended particulate) 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 Project Contractors Authority (SWPCA) MWQI Specific Project Committee (MWQI SPC), participating SWP Contractors, and other governmental entities.

## ***2. INTRODUCTION***

### **2.1 MWQI Program Background**

The MWQI Program continues to study and monitor water quality in the Sacramento-San Joaquin Delta (Delta). MWQI generated data are incorporated with other data sources to produce a comprehensive information base that provides State Water Contractors and other interested parties with details related to source water conditions as water makes its way to their facilities. The information is disseminated via daily and weekly reports, and the Real-Time Data and Forecasting – Comprehensive Program (RTDF-CP) web site located at:

<https://www.water.ca.gov/Programs/Environmental-Services/Water-Quality-Monitoring-And-Assessment/RTDF-Summary>

MWQI managers, supervisors, and staff participate in various activities external to the Program. Examples include, involvement with regulatory activities that occur in the Delta through the SWRCB, and/or the Central Valley Regional Water Quality Control Board (CVRWQCB), participation in the CVRWQCB's Nutrient Stakeholder and Technical Advisory Group (STAG) which is determining whether nutrient objectives are needed for the Delta, and assisting with pathogen and nutrient monitoring under the Delta Regional Monitoring Program (RMP). MWQI staff also assist with the Delta smelt related turbidity transect study, Oroville Dam response, and may help support new Fish Restoration Program monitoring stations as they come online.

Finally, MWQI staff support database infrastructure management, the administration of essential program management activities mandated by DWR's policies and procedures

including implementing quality control measures, and efforts to ensure the health and safety of workplace staff.

## **2.2 MWQI Program – Program Partners**

The MWQI Program has several Program Partners who work in other DWR Divisions (see the organization chart below) including O&M's Environmental Assessment Branch (EAB), the Operations Control Office (OCO), the Bay-Delta Office (BDO), and Quality Assurance Quality Control (QA/QC) Support Services. MWQI Program and its Program Partners use Resources Agreements to manage workloads, staff resources, and budgets across DWR Divisions. Each Resources Agreement (RA) is prepared, reviewed, approved, and kept on-file by program managers involved in the agreement. Typically, the duration of a RA is one to three years and agreements are renewed when workloads change. For this work plan cycle, MWQI Program has in place 3-year resource agreements for the following Program Partners:

O&M - Environmental Assessment Branch  
OCO - Regulatory Compliance & Reporting  
BDO - Delta Modeling Section

## **2.3 MWQI Program Core Elements**

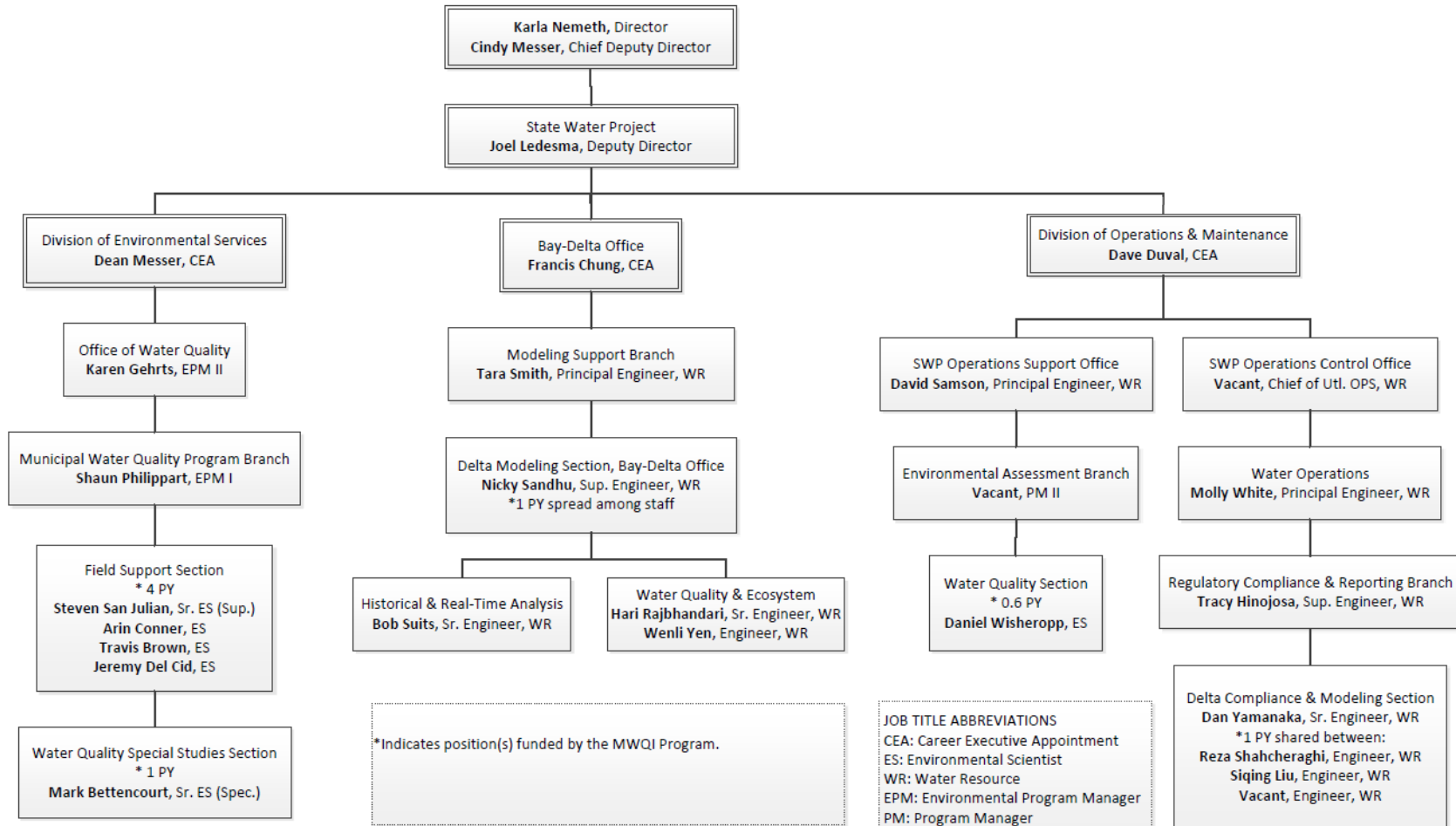
Although MWQI Program core elements will receive priority, staff time may shift occasionally from work described in this work plan. Examples include work on drought activities, CA WaterFix, EcoRestore, or Oroville Spillway recovery efforts. If it becomes apparent that core elements will be affected, adjustments will be made to keep the program moving forward.

Core elements are listed in priority of importance to the MWQI SPC:

1. Water quality monitoring (both real-time and discrete) at existing stations and sites
2. Modeling duties associated with producing short term and seasonal 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 monthly 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, 2018 DWR Environmental Scientist Workshop, safety and policy training, specific meetings and conferences).

## 2.4 DWR MWQI Program Organization Chart

Figure 1. DWR org chart showing positions funded by MWQI Program funds.





### ***3. PROGRAM FUNDING NEEDS***

#### **3.1 MWQI Agreement and MWQI Specific Project Agreement**

The Municipal Water Quality Investigations Agreement (MWQI Agreement) between the Department of Water Resources, the State Water Project Contractors Authority (SWPCA), and 16 participating SWP Contractors who receive municipal and industrial (M&I) water from the SWP provides the funding authority for DWR's MWQI Program costs. DWR's MWQI Program costs include salaries, benefits and overhead of DWR staff working for the MWQI Program, and equipment, supplies and operating expenses associated with the Program. These DWR MWQI Program costs are funded through the annual statement of charges of those SWP Contractors who participate in the MWQI Program. The current MWQI Agreement is in effect from January 1, 2017 to December 31, 2019 which covers the timeframe of this calendar year (CY) based annual work plan.

The State Water Project Contractors Authority 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 form the MWQI SPC Account. In addition, the Contra Costa Water District which is not a SWP Contractor and not a signatory to the MWQI Specific Project Agreement provides some funding to help with MWQI Program expenses. 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 current MWQI Specific Project Agreement is in effect from January 1, 2017 through December 31, 2019.

The CY 2018 MWQI Program budget total is \$3.1 million with \$2,620,443 (\$2,318,743 of which is allocated in the 2018 workplan – see Table 1) assigned to the DWR MWQI Program, and the remaining portion for the MWQI SPC fund. The MWQI SPC will continue to budget on a FY basis.

The estimated budget expenses for this work plan CY are shown in Table 1.

This work plan covers January to December 2018. The 12-month budget is presented in Table 1 below, and is followed by an explanation of MWQI Program expenditures in Table 2. Partner staffing in this budget reflects 1 Position Year (1 PY = 1778 hours/year = 221 working days) each for the BDO and OCO, and 0.6 PY for the Division of O&M EAB.

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**Table 1. January – December 2018 Program Element Costs for MWQI Program**

Work Plan Element	Program Element	2018 IO#	Labor Hours	Labor Cost	Contracts	OE&E	Total Cost
5	Water Quality Assessment						
5.1	Routine Monitoring Program	VWQASSMENT13	2257	\$277,914		\$150,000	\$427,914
5.2	Short-term Monitoring (included with 5.1)	VWQASSMENT13					
5.2.1	DSM2 Nutrient Study	VWQASSMENT13	190	\$30,290			\$30,290
5.2.2	Cache Slough Baseline Monitoring	VWQASSMENT13	200	\$32,200			\$32,200
6	RTDF-Comprehensive Program						
6.1	6.1.1 MWQI Real Time Stations	VRTMONITOR13	2755	\$338,631	\$42,939	\$140,000	\$521,570
	6.1.2 Gianelli WQ Station	VGIANNELLI13	950	\$97,928	\$13,042	\$20,000	\$130,970
6.2	6.2.1 Bay Delta Office Modeling	VRTBDOMODL13	1628	\$258,852			\$258,852
	6.2.2 Operations Control Office Modeling	VRTOCOMODL13	1438	\$228,642			\$228,642
	6.2.3 Improve Aqueduct Pump-In Dynamics	VPUMPINDYN15	300	\$44,500			\$44,500
	6.2.4 Compare WQ Forecasts to Actual Conditions	VCOMPAREWQ15	200	\$28,600			\$28,600
6.3	RTDF-CP Information Management and Data Dissemination	VRTDDISRPT13	800	\$82,946			\$82,946
7	Special Studies						
7.1	FDOM Project	VFDOMPOCS013	100	\$10,313			\$10,313
8	Other MWQI Funded Program Activities						
8.1	Administration Work	VDWRRQDDPC13	2628	\$348,946		\$48,000	\$396,946
9	Other Required Program Costs						
9.1	MEO Insurance & Fuel & Maintenance					\$5,000	\$5,000
9.2	MEO New Boat and New Truck					\$120,000	\$120,000
	<b>Total</b>		<b>13,446</b>	<b>\$1,779,762</b>	<b>\$55,981</b>	<b>\$483,000</b>	<b>\$2,318,743</b>

\* 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 5 PY for staff and 2.6 PY's for program partners in OCO, BDO, and O&M. Labor rates are estimated at: ES - \$103/hour, Sr ES Spec - \$119/hour, Sr ES Sup - \$161/hour, WR Engineer - \$159/hour

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**3.2 Explanation of Program Element Costs for Work Plan Projects**

**Table 2. January – December 2018 MWQI Program Contract and Operating Expenses & Equipment (OE&E) Costs**

Program element:		OEE for the WP	Justification	CY2018 Cost
5.1	WQ Assessment	Routine Monitoring Program	See Section 5.1	\$80,000
5.2	WQ Assessment	Short-Term Monitoring - contract lab costs		\$70,000
6.1.1	RTDF	MWQI Real Time Stations - equipment & filter replacement		\$50,000
6.1.1	RTDF	YSI EXO2 Sondes with chlorophyll and FDOM probes	See Section 6.4	\$90,000
6.1.1	RTDF	All Cal Services - portable toilet at Hood real time station		\$1,040
6.1.1	RTDF	Thermo-Fisher service contract for 3 Dionex IC analyzers (Banks, Vernalis, Jones)		\$23,022
6.1.1	RTDF	GE/Sievers - service contract for 4 organic carbon analyzers (Hood, Banks, Jones, Vernalis)		\$18,877
6.1.2	Gianelli WQ Station	Thermo-Fisher service contract for 1 Dionex IC analyzers (Gianelli)		\$8,323
6.1.2	Gianelli WQ Station	GE/Sievers - service contract for 1 organic carbon analyzers (Gianelli)		\$4,719
6.1.2	Gianelli WQ Station	Equipment repairs and replacement, filters, reagents, etc.		\$20,000
8.1	MWQI Administration	Facility Maintenance, meetings, conferences, training for MWQI staff		\$40,000
8.1	MWQI Administration	4 new computers		\$8,000
9.1	Mobile Equipment Office	Replacement Truck, new	See Section 9	\$40,000
9.1	Mobile Equipment Office	Replacement Boat, new	See Section 9	\$80,000
9.1	Mobile Equipment Office	Vehicle maintenance, fuel, and insurance		\$5,000
		<b>TOTAL Contract &amp; OEE COSTS:</b>		<b>\$538,981</b>

#### ***4. WORKLOAD ASSESSMENT***

For this work plan cycle, January 1-December 31, 2018, MWQI Program management conducted a workload assessment to determine whether staff had enough work to occupy 100% of their time. This assessment is based on 8 staff members which includes MWQI Program staff and our MWQI Program funded partner staff in OCO, BDO, 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 includes 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.

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**Table 3. Workload Assessment**

Draft MWQP Branch Staff Labor Plan CY2018 MWQI Work Plan																		
		Routine Monitoring Program (VWQASSMENT13)	Short-term Monitoring (VWQASSMENT13)	DSM2 Nutrient Study (VWQASSMENT13)	Cache Slough Report and Presentation (VWQASSMENT13)	MWQI Real Time Stations (VRTMONITOR13)	Gianelli WQ Station (VGIANNELLI13)	BDO - Bay Delta Office Modeling (VRTBDOMODL13)	OCO - Operations Control Office Modeling (VRTOCOMODL13)	Improve Aqueduct Pump-In Dynamics (VPUMPINDY15)	Compare WQ Forecasts to Actual Conditions (VCOMPAREWQ15)	RTDF Data Dissemination and Reporting (VRTDDISRPT13)	Fluorescence of Dissolved Organic Matter (FDOM) (VFDOMPOCS013)	Administration work/training/RTDF/Modeling meetings (VDWRRQDDPC13)	Non-MWQI Funded Program Support; (Drought, Barriers, BDCP, MeHg, Water PIE, etc.)	Staff Hours Committed (1778 work hours/year = 221 days. 2080 hours /year includes vacation, holidays, sick, etc.)	Staff Hours Available	percent allocated
Work Plan Element	5.1	5.2	5.2.1	5.2.2	6.1.1	6.1.2	6.2.1	6.2.2	6.2.3	6.2.4	6.3.1	7.1	8.1	9.1	Total	Total		
MWQI Field Section	combined																	
Arin Conner	659		0	0	709	0	0	0	0	0	10	0	400	0	1778	0	100%	
Travis Brown	664		0	0	714	0	0	0	0	0	0	0	400	0	1778	0	100%	
Jeremy DeL Cid	614		0	0	664	0	0	0	0	0	0	100	400	0	1778	0	100%	
Steven San Julian	210		40	200	0	0	0	0	0	0	0	0	1328	0	1778	0	100%	
RTDF-CP & Data Dissemination																		
Mark Bettencourt	60		0	0	668	0	0	0	80	80	790	0	100	0	1778	0	100%	
Non-MWQP Staff																		
Daniel Wisheropp	50		0	0	0	950	0	0	0	0	0	0	0	0	1000	778	56%	
OCO - Liu/Shahcheraghi	0		0	0	0	0	0	1438	220	120	0	0	0	0	1778	0	100%	
BDO - Yin/Rajbhandari	0		150	0	0	0	1628	0	0	0	0	0	0	0	1778	0	100%	
Total Hours	2257		190	200	2755	950	1628	1438	300	200	800	100	2628	0	13446	778		
PYs	1.269		0.107	0.112	1.549	0.534	0.916	0.809	0.169	0.112	0.450	0.056	1.478	0.000				

## **5. WATER QUALITY ASSESSMENT**

Water quality assessment has been a key feature of the MWQI Program since its inception in 1983. MWQI's monitoring data are used by many groups including DWR and other agencies, 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 the BDO, O&M EAB, and OCO, monitoring data are used to further develop the "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 or 'grab sample' monitoring for January-December 2018. Section 6.1 focuses on continuous, remote real-time monitoring.

Discrete monitoring in this work plan remains unchanged from the previous work plan. Twelve of the existing MWQI monitoring locations are part of the MWQI's long-term, routine monitoring program (Section 5.1). The other 16 monitoring sites are associated with short-term modeling support and other approved special studies. Table 4 lists all 28 monitoring locations with associated analytes, Figure 2 is a map of the discrete and real-time sampling sites, and Table 5 lists the routine and special project discrete grab sample deliverables and timelines.

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**Table 4. MWQI Program’s Discrete and Grab Sampling Stations**

#	Stations	WDL Stations (ID)	Analytes Collected	Frequency	Study
1	Natomas East Main Drainage Canal	NATOMAS EMDC at EL CAMINO RD (A0V83671280)	Std. Mineral, nutrients, TOC, DOC, bromide, metals	Monthly	Routine
2	American River at E.A. Fairbairn WTP Intake	American River at W.T.P. (A0714010)	Std. Mineral, nutrients, TOC, DOC, bromide	Monthly	Routine
3	Sacramento River at West Sacramento WTP Intake	Sacramento River at W. Sac Intake Structure (A0210451)	Std. Mineral, nutrients, TOC, DOC, bromide, metals	Monthly	Routine
4	Sacramento River at Hood	Sacramento R A Hood (B9D82211312)	Std. Mineral, nutrients, TOC, DOC, bromide, Manganese	Twice per month	Routine, RTDF
5	Sacramento River at Mallard Island1	Sacramento River at Mallard Island (E0B80261551)	Std. Mineral, nutrients, TOC, DOC, bromide, CBOD, BOD, Chlorophyll	Twice per month1	Routine, DSM2 Nutrient
6	San Joaquin River near Vernalis	San Joaquin R. nr. Vernalis (B0702000)	Std. Mineral, nutrients, TOC, DOC, bromide, Manganese, CBOD, BOD, Chlorophyll	Twice per month	Routine, RTDF, DSM2 Nutrient
7	Old River at Bacon Island	Old River at Bacon Island (B9D75811344)	Std. Mineral, nutrients, TOC, DOC, bromide	Monthly	Routine
8	Old River at Station 9	Old R. nr. Bryon (St 9) (NEAR HWY 4 BRIDGE) (B9D75351342)	Std. Mineral, nutrients, TOC, DOC, bromide, Manganese	Monthly	Routine
9	Banks Pumping Plant at Headworks	Delta P.P. Headworks at H.O. Banks PP (KA000331)	Anions, TOC, DOC (MWQI); Std. Mineral, turbidity, UVA, TOC, DOC, bromide, total phosphorous, total suspended solids, phytoplankton, purgeable organics, taste and odor (MIB & geosim), asbestos, and radiological, pesticides and herbicides (O&M)	Monthly  Monthly or quarterly	Routine, RTDF
10	Contra Costa Canal @ Rock Slough	Contra Cost Canal at Rock Slough Fish Screen (B9C75861385)	Std. Mineral, nutrients, TOC, DOC, and bromide	Monthly	Routine
11	Middle River @ Union Point	Middle River A Union Point (B9D75351292)	Std. Mineral, TOC, DOC, Bromide, nutrients, Manganese	Monthly	Routine
12	Jones Pumping Plant at DMC	Eastside Delta Mendota Canal intake at Jones PP (B9C74781351)	Anions, TOC, DOC	Monthly	RTDF
13	Gianelli Pumping/Generating Plant	Gianelli WQ Station near Pumping Plant (ON003050)	Anions, TOC, DOC	Monthly	RTDF
14	Colusa Ag Drain near Sacramento River	Ag Drain on Colusa Basin Main Drain (A0294500)	Std. Mineral, nutrients, TOC, DOC, bromide, Suspended Solids	Monthly	Routine
15	Shag Sl. @ Liberty Island (Yolo Bypass West Toe Drain)	ShagSl@LibIsIBr (B9S81841416)	Std. Mineral and nutrients, TOC, DOC, suspended solids, chlorophyll, CBOD, BOD, THMFP, HAAFP	Twice per month	Cache Slough Complex; DSM2 Nutrient
16	Mokelumne River @ Benson’s Ferry	Benson’s Ferry (B9D81371295)	Std. Mineral, nutrients, TOC, DOC, bromide, suspended solids, chlorophyll, CBOD, BOD	Twice per month	DSM2 Nutrient

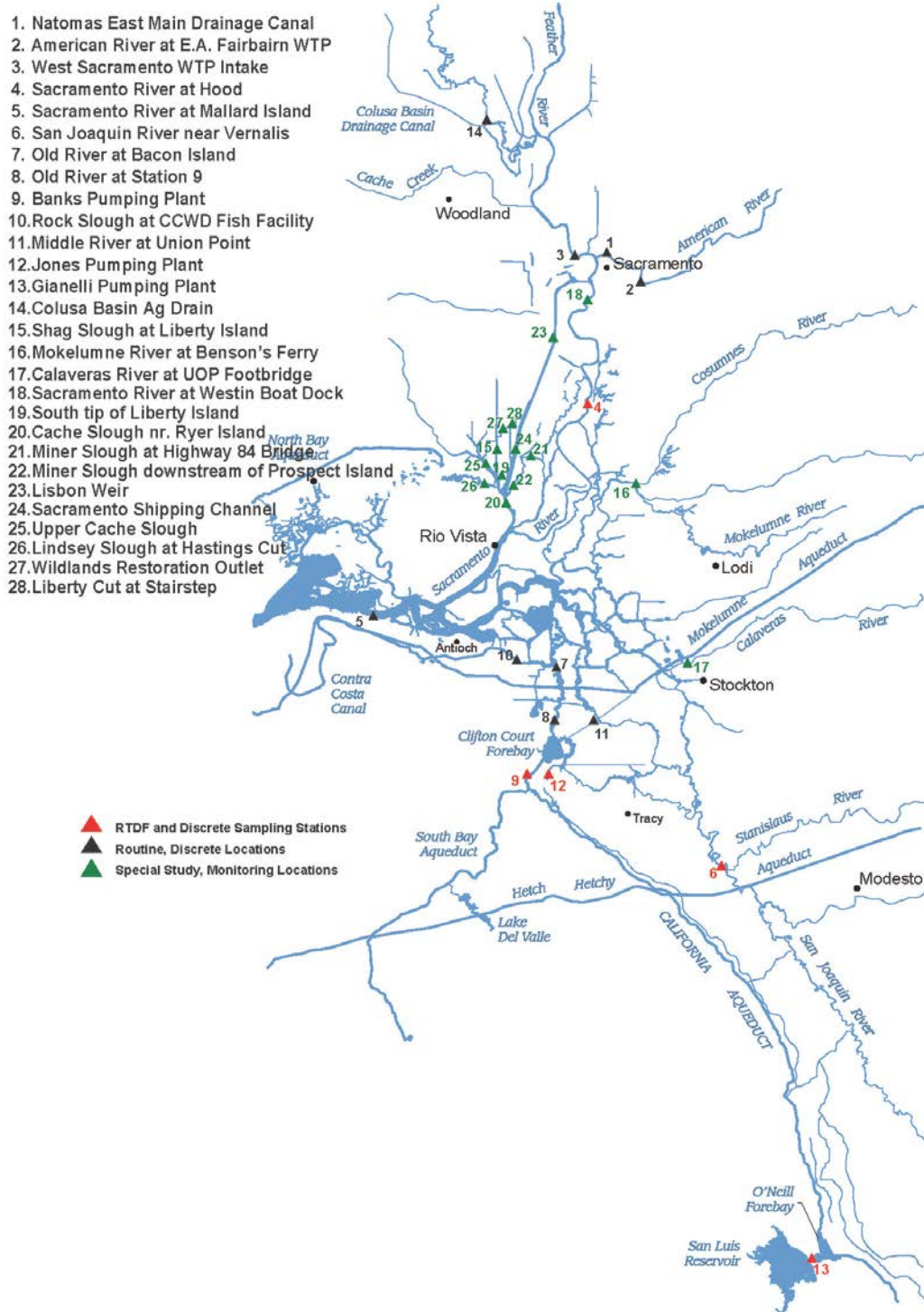
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#	Stations	WDL Stations (ID)	Analytes Collected	Frequency	Study
17	Calaveras River @ UOP Footbridge	Calaveras R @ UOP (B9D75851208)	Std. Mineral and nutrients, TOC, DOC, suspended solids, chlorophyll, CBOD, BOD	Twice per month	DSM2 Nutrient
18	Sacramento River @ Westin Boat Dock	SacR. @ Westin Bldg (B9D83221310) (past site: B9D832212010)	Std. Mineral and nutrients, TOC, DOC, suspended solids, chlorophyll, CBOD, BOD	Twice per month	DSM2 Nutrient
19	Southern tip of Liberty Island	S. Liberty Is. (B9D81461410)	Std. Mineral and nutrients, TOC, DOC, UVA, suspended solids, chlorophyll, THMFP, HAAFP	Twice per month	Cache Slough Complex
20	Cache Slough nr Ryer Island (Lower Cache Slough)	Cache Sl nr. Ryer Is (B9D81281401)	Std. Mineral and nutrients, TOC, DOC, UVA, suspended solids, chlorophyll, THMFP, HAAFP	Twice per month	Cache Slough Complex
21	Miner Slough above Prospect	Miner Sl @ Hwy84 Br (B9D81751379)	Std. Mineral and nutrients, TOC, DOC, UVA, suspended solids, chlorophyll, THMFP, HAAFP	Twice per month	Cache Slough Complex
22	Miner Slough below Prospect (but above Cache Sl.)	Miner Sl below P (B9D81410400) (past site: B9D814103910)	Std. Mineral and nutrients, TOC, DOC, UVA, suspended solids, chlorophyll, THMFP, HAAFP	Twice per month	Cache Slough Complex
23	Lisbon Weir (Yolo Bypass East Toe Drain)	YOLOBYLISBON (B9D82851352)	Std. Mineral and nutrients, TOC, DOC, UVA, suspended solids, chlorophyll, THMFP, HAAFP	Twice per month	Cache Slough Complex
24	Sacramento Shipping Channel above Prospect Island	SDWC (B9D81621397)	Std. Mineral and nutrients, TOC, DOC, UVA, suspended solids, chlorophyll, THMFP, HAAFP	Twice per month	Cache Slough Complex
25	Upper Cache Slough (below Ulatis Creek)	Upper Cache Sl (B9S81841416)	Std. Mineral and nutrients, TOC, DOC, UVA, suspended solids, chlorophyll, THMFP, HAAFP	Twice per month	Cache Slough Complex
26	Lindsey Slough at Hastings Island Bridge	Lindsey Sl. at Bridge (B9D81481421)	Std. Mineral and nutrients, TOC, DOC, UVA, suspended solids, chlorophyll, THMFP, HAAFP	Twice per month	Cache Slough Complex
27	Wildlands Restoration outfall at Stair-step	Wildlands B9D82011403	Std. Mineral and nutrients, TOC, DOC, UVA, suspended solids, chlorophyll, THMFP, HAAFP	Twice per month	Cache Slough Complex
28	Liberty Cut at Stair-step	LibertyCut at StairStep B9D82011400	Std. Mineral and nutrients, TOC, DOC, UVA, suspended solids, chlorophyll, THMFP, HAAFP	Twice per month	Cache Slough Complex

- 1 Mallard Island is a monthly routine monitoring location, but for the DSM2 Nutrient study samples are collected every two weeks.
- Physical Parameters collected at all sites: Temperature, pH, Turbidity, Dissolved Oxygen, and Specific Conductance
- Standard Mineral analysis includes: Ca, Mg, Na, K, B, Alkalinity, Chloride, Bromide, Nitrate, Sulfate, Dissolved Solids, Specific Conductance, Standard Nutrient analysis includes: Nitrate + Nitrite, Ammonia, Organic Nitrogen and Ammonia, Total Phosphorus (unfiltered), and Orthophosphate



Figure 2. MWQI Program’s Discrete and RTDF Monitoring Locations



## **5.1 Routine Monitoring Program**

Collection at long-term monitoring locations remains unchanged from the previous work plan. As part of real-time instrument quality control, discrete samples are collected once per month at the Banks Pumping Plant, Jones Pumping Plant, Gianelli Pumping Plant, and Hood and Vernalis river stations. These river and canal samples are collected to examine instrument performance, but can also be used as discrete data representative of the sample location. Discrete sample data are available through DWR's Water Data Library (WDL). Deliverables and timelines associated with discrete sample collection are shown in Table 5.

This year, we are providing funding support to Bryte Lab for the purchase of a new Gas Chromatography-Mass Spectrometer (GC-MS) analytical instrument. MWQI submits a myriad of samples to Bryte Lab for analysis, for which we do not directly pay (Bryte is on overhead). Providing funding is justified due to our long-standing relationship and use of the lab for analytical services, and our current ability to provide financial assistance. MWQI will benefit directly from this expenditure as we will submit samples to Bryte Lab that will be analyzed by this new instrument. MWQI's planned expense for the purchase of this instrument is \$40,000. The Division of Environmental Services – Environmental Water Quality and Estuarine Studies Branch is funding the rest of this purchase by providing \$100,000.

## **5.2 Short-term Monitoring**

Aside from MWQI's routine monitoring, other samples are collected for short-term monitoring projects. Current short-term projects are described below.

### **5.2.1 DSM2 Nutrient Study**

*Principle Investigator – Steven San Julian*

*Project Partners – Hari Rajbhandari & Leslie Palencia*

The Delta Simulation Model 2 (DSM2) nutrient monitoring study was originally included in MWQI's FY 13-14 work plan. The goal of this monitoring is to define water quality conditions at seven DSM2 nodes located at the boundaries of the Sacramento-San Joaquin Delta, so that the DSM2 nutrient model can be improved. BDO modelers and consultants identified key constituents to be monitored. MWQI Program staff have sampled the DSM2 locations (nodes) twice per month since September 2013. The key constituents include physical parameters, nutrients, biological oxygen demand (BOD), carbonaceous biological oxygen demand (CBOD), chlorophyll, and pheophytin. In some cases, a new monitoring location was added to the MWQI Program because monitoring had not previously been conducted at the node. In other cases, DSM2 constituents were simply added to existing node monitoring activities.

In this new work plan, field monitoring activities will continue. Steve San Julian will determine how long BDO needs MWQI to collect data for this project. Based on discussions with BDO, monitoring may be continued as is, cancelled completely, or altered to better suit current model needs.

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The DSM2 Nutrient Study project deliverables and timelines for the memorandum report are shown in Table 5.

### 5.2.2 Cache Slough Baseline Monitoring and Data Analysis

*Principle Investigator – Steven San Julian*

*Project Partners – Justin Pascual and Leslie Palencia*

In the coming years, numerous ecologically driven restoration projects are planned in the Cache Slough Complex. The Cache Slough Complex drains into the Sacramento River near Rio Vista, and includes the Yolo Bypass, Liberty Island, Sacramento Deep Water Ship Channel and other north-west Delta tributaries. Planned restoration projects are of varying sizes but cumulatively could total over 8000 acres. These restoration activities will have unknown impacts to in-stream drinking water quality; and therefore, may result in additional costs to drinking water municipalities treating thru-Delta water. The Fish Restoration Program Agreement (FRPA) is an agreement between DWR and the Department of Fish and Wildlife to implement habitat restoration actions for listed fish species under the Biological Opinions and Incidental Take Permit for SWP operations in the Delta. Due to the uncertainty regarding FRPA monitoring, and with the backing of the MWQI SPC, the MWQI Program will conduct monitoring of key locations in the Cache Slough Complex. See Figure 2 for map of locations and Table 4 for the constituent list.

This year, in addition to monitoring, MWQI will work with Solano County Water Agency to analyze the existing Cache Slough data in preparation for a presentation and possible report. The Bay-Delta conference is scheduled for Summer/Fall 2018 and we plan to present this analysis there.

The Cache Slough Complex Study deliverables and timelines are shown in Table 5.

**Table 5. Routine and Special Project Discrete Sample Deliverables and Timelines**

Deliverable	Participants	Start Date	Estimated Completion Date
Records of monthly and bi-weekly monitoring data.	MWQI	N/A	Currently available upon request
Records of periodic calibration of field monitoring equipment	MWQI	N/A	Currently available upon request
Records demonstrating consistent and timely application of QA/QC procedures	MWQI	N/A	Currently available upon request
Timely analysis and posting of results to the WDL	MWQI	N/A	Monthly, available on-line
DSM2 Nutrient Monitoring	MWQI	Sep 2013	Reassess Dec 2018
Cache Slough Complex Monitoring	MWQI	Sep 2013	Reassess Dec 2018
Analyze and present Cache Slough Complex Data at 2018 Bay Delta Conference	MWQI, SCWA	Jan 2018	October 2018?

N/A = not applicable or available

## **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 BDO, 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

Real-time monitoring, forecasting and data dissemination 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.

### **6.1 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.

#### **6.1.1 MWQI Program Real Time Stations**

The RTDF-CP continues to operate five remote real-time monitoring stations; four located in the Delta and one south of the Delta (Table 6). 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, 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. Table 7 summarizes the tasks associated with these real-time monitoring stations.

Table 6 summarizes station locations, MWQI Program and non-MWQI Program water quality parameters, and the automated analyzers used by the MWQI Program RTM element. Figure 2 shows the location of the RTM stations.

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.

**Table 6. 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 (GE Analytical, Sievers 900)	Water: chlorophyll, EC, DO, pH, temperature and turbidity. Atmospheric: solar radiation, temperature, wind speed and direction.
San Joaquin River near Vernalis (CDEC = SJR)	TOC, DOC (GE Analytical, 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 (GE Analytical, Sievers 5310), bromide, chloride, nitrate, sulfate, (Thermo-Fisher Dionex ICS-2100)	Water: EC, fluorescence, pH, pump discharge, temperature, turbidity Atmospheric: temperature, wind speed and direction.
Jones Pumping Plan (CDEC = TRP)	TOC, DOC, (GE Analytical, Sievers 5310), bromide, chloride, nitrate, sulfate, (Thermo-Fisher Dionex ICS-2100)	Water: EC, pump discharge, temperature.
Gianelli P/G Plant (CDEC = ONG)	TOC, DOC (GE Analytical, Sievers 5310), EC, temp, turbidity, DO, pH (YSI 6600) bromide, chloride, nitrate, sulfate (Thermo-Fisher Dionex ICS-2100)	Pump and Generation discharge

N/A = not applicable or available

### 6.1.2 Gianelli WQ Station

To track time and expenditures related to the Gianelli water quality station, a separate IO was created (VGIANNELLI13). Most of the funding for this station goes toward the salary of an Environmental Scientist position held within the O&M EAB (Environmental Assessment Branch). Responsibilities for this position are similar to those at the MWQI stations.

**Table 7. Real-Time Monitoring Tasks**

Deliverable	Participants	Estimated Start Date	Estimated Completion Date
Continue operation of automated stations at Hood, Banks, Jones, Vernalis, and Gianelli	MWQI Program, O&M Water Quality	Ongoing	Ongoing
A) Update SOPs: documenting maintenance, operation and QA/QC of all in-situ equipment.	MWQI Program, O&M Water Quality	N/A	A) Ongoing
B) Continue to work towards standardizing, streamlining, and consolidating DWR's in-situ equipment, data quality control, and data dissemination.	MWQI Program, O&M Water Quality, North Central Regional Office, and IEP	N/A	B) Ongoing
Evaluate the need and planning for other installations per the RTDF-CP (together with RTDF Steering Committee).	RTDF SC	Jul 2008	Ongoing

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

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

### 6.2.1. 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 seasonal and short-term aqueduct models. 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.

### 6.2.2. OCO Modeling

OCO staff, the model operators, continue to produce seasonal 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. (Since OCO staff run the models, they will also be involved with turn-in water model dynamics and work to incorporate this data.)

### **6.2.3. Improve Aqueduct Pump-in Dynamics in the MWQI Program Water Quality Forecasts**

*Principal Investigator – Dan Yamanaka’s (OCO) Staff Member is TBD and MWQI Program Staff is TBD*

*Project Partner – Tony Liudzius*

#### Short-Term Forecasts

Interested SWP contractors and MWQI Program staff will investigate whether scheduled near-term aqueduct pump-in (defined here as less than 2 months) data is available and whether obtaining this information on an ongoing basis is feasible. If this information is available, the effort will include establishing procedures for acquiring the information and determining if any support tools are needed to help automate and process the data. The goal would be to include accurate, up-to-date pump-in information in the MWQI Program short-term water quality forecasts.

#### Seasonal Forecasts

This task is the same as described above except that the desired pump-in information will be for the current year (or slightly longer) in order to conform to the timeframe used in the seasonal water quality forecasts.

### **6.2.4. Comparison of Water Quality Forecasts to Actual Conditions**

*Principal Investigator – Dan Yamanaka’s (OCO) Staff Member is TBD and Mark Bettencourt*

*Project Partner – Tony Liudzius*

Once forecasts are prepared, this project would compare short-term and long-term model output with actual water quality conditions over a specified time to gain a better understanding of model efficiency. The structure, goals and deliverables of this study and the specific time period to be examined will be established by the study work group. One possibility is to examine the first three to four months of 2014 when water quality conditions declined due to drought conditions. Eventual forecast comparisons may lead to model improvements due to adjustments that could more effectively assess water quality.

## **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:

<https://www.water.ca.gov/Programs/Environmental-Services/Water-Quality-Monitoring-And-Assessment/RTDF-Summary>

(Note: The address for the RTDF web page will be changing soon. More details to come.)

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.

### **6.3.1. RTDF Data Dissemination and Reporting**

Information management and data dissemination tasks performed by MWQI and the Technical Consultant, Dennis Huff (and his future replacement) 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 8.

## **6.4 Addition of YSI EXO Sondes to Real-Time Water Quality Stations**

To further enhance the capabilities of the real-time monitoring program, the RTDF section will be installing YSI EXO sondes at the Banks, Jones, and Gianelli water quality monitoring stations. These instruments will measure algal concentrations. Algal blooms can cause problems for drinking water contractors so monitoring will give treatment facilities an early warning when algal concentrations begin to increase. The sondes will also provide FDOM, turbidity, and any other constituent of interest that the probes are capable of monitoring. The cost of the three YSI X02s that were purchased is \$55,000, the remaining \$35,000 in OE&E will be held in reserve for probes or other equipment purchases that are deemed necessary.



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**Table 8. Information Management and Data Dissemination Deliverables and Timelines**

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

N/A = not applicable or available

## **7. SPECIAL STUDIES**

Although the special studies group has disbanded and new special studies are not planned, one hold over study is still active during the 2018 workplan cycle.

### **7.1 Fluorescence of Dissolved Organic Matter (FDOM) Project**

*Principal Investigator – Jeremy Del Cid*

*Project Partner – Alex Rabidoux/Justin Pascual/Steven San Julian*

The purpose of this project is to investigate the use of FDOM as a proxy for OC measurements. Literature reviews have shown significant relationships between FDOM and DOC and it may be possible to use FDOM as a proxy for DOC measurements. For this project, a fluorometer (Turner Designs Cyclops 7) was installed on the SWP at the Banks Pumping Plant (Banks).

In Early 2016, the two FDOM studies were reorganized into a single study. Phase 1 of the FDOM study, was renamed the FDOM Interim Report, and Phase 2 was renamed the FDOM Final Report. The FDOM Interim Report covered data collected between July 2013 and July 2014 and was completed July 2016. This report investigated the relationships between FDOM and DOC, and FDOM and UVA254.

The FDOM Final Report, expands on the relationships investigated in the interim report and encompasses the full set of data collected between July 2013 and September 2015. The final report will expand on the correlation between FDOM and DOC by including unfiltered and 100 micron filtered water along with the 0.45 filtered samples collected during the initial study phase. Final report completion date has been pushed back to June 2018 to allow the study lead time to complete analysis.

FDOM Study deliverables and timelines are shown in Table 9.

**Table 9. FDOM Study Deliverables and Timelines**

Deliverables	Participants	Estimated Start Date	Estimated Completion Date
Collect data	MWQI Program	Jul 2013	Sep 2015
Complete Interim Report	MWQI Program	---	July 2016
Analyze data for final report and provide final report to DWR Management and MWQI SPC for review	MWQI Program	Nov 2017	March 2018
Respond to comments and provide final report to DWR Editors for review	MWQI Program	April 2018	April 2018
Respond to comments and provide final report to DWR Management for review	MWQI Program	April 2018	May 2018
Respond to comments and approval to print	MWQI Program	May 2018	June 2018

## ***8. ADMINISTRATION WORK***

In general, time and budget expense that fall under the Administrative Work IO include repair and maintenance costs to office facilities; meetings, conferences and training attended by staff; and all non-project specific office duties that are billable to the MWQI program.

This year, a few 2017 IO's have been merged into Administration Work. This was done to simplify the billing process and to remove confusion caused by perceived overlap between these IOs. Also, some of these were used infrequently and so provided little value for budgeting discussions.

The previously used IOs merged into Administration Work are:

- Field Support Section Office Duties
- MWQI Program Annual Workplan
- DWR Bulletin 132, Chapter 4 – Water Quality
- Workplace Safety
- Emergency Response
- Miscellaneous Meetings Attended by Staff, and
- Program Management

Descriptions of what work products were covered in these sections can be found in the 2017 Workplan.

MWQI staff are 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.

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

## ***9. OTHER REQUIRED PROGRAM COSTS***

Other Required Program Costs are items not directly billed to MWQI program IOs. This includes Mobile Equipment Office charges and other costs that the MWQI program would be responsible to bear in the absence of other work.

Charges that MWQI is responsible to bear are unallocated labor hours and budget. The labor and money associated with this are available for work on other MWQI projects, non-MWQI funded projects (Section 10, below), and for the purchase of other equipment and supplies as required by the program. Any such expenditures would be run by the RTDF Steering Committee prior to allocation. For the time being, these available resources are being positioned in this section.

DWR's Mobile Equipment Office (MEO) provides insurance and fuel to support the vehicles used by the Field Support Section staff for their routine water quality assessment efforts. The MEO office staff will continue to support the MWQI Program by providing customer support through cost effective fleet management and maintenance of mobile equipment owned by DWR.

In addition to fuel & insurance, this cost allocation allows for the recommended annual services on each vehicle at 6K and 12K, for miscellaneous incidental costs (such as towing, flat repair, etc.), and includes an amount for catastrophic repairs that the older vehicles may require.

MEO expenditures are not assigned to any specific program element but are tracked and reported as MEO, line item 11.1, in the column entitled "Operating Equipment and Expenses" in Table 1, and on the monthly expenditure reports. These monthly expenditure report will be provided as handouts prior to the monthly RTDF Steering Committee meetings.

In 2018, the MWQI Field Section plans to purchase a new, replacement truck, and a new replacement boat. MWQI's current truck has reached the end of its useful life (according to DGS guidelines) and therefore needs to be exchanged for a new, replacement truck. The current MWQI boat also meets the DGS guidelines for replacement, but the main justification for boat replacement is the need for a larger boat for MWQI's

monitoring activities. The boat we currently possess is very small (~15 feet) and does not provide the space, or proper conditions for MWQI's monitoring activities. The new boat will be sized appropriately for our branch's work and to improve the safety of staff operating the field.

The process for such replacement can be lengthy but these costs are being budgeted in the 2018 CY with the hopes that the truck and boat will be replaced this year. If not, the funds associated with these purchases will likely fall to the 2019 CY. Estimated expenditure for these items are \$40,000 for a new truck, and \$80,000 for a new boat.

#### **10. *NON-MWQI FUNDED PROGRAM MANAGEMENT***

Since DWR is a matrix management organization, staff may be requested to assist with supporting various DWR activities by providing technical support, data analysis, timely document and plan reviews, and may occasionally attend meetings. Some of these support activities are not funded by the MWQI Program budget. For example, the MWQI Program staff who assist with the turbidity transects will charge their work time to the respective program's budget.

The amount of work time that staff spends on these types of non-MWQI funded activities is infrequent, but at times can impact normal workloads. MWQI Program staff members serve as DWR's technical drinking water quality experts. Work done on non-MWQI projects is beneficial to DWR and is indirectly beneficial to the MWQI stakeholders.