
Delta Regional Monitoring Program

Pesticides Field Sampling Report

Prepared for

Technical Advisory Committee
June 2017

By

Thomas Jabusch and Phil Trowbridge
Aquatic Science Center

TABLE OF CONTENTS

FIGURES

Tables

1. Introduction

The Delta Regional Monitoring Program (Delta RMP) has an approved Monitoring Design for pesticides. The first year of monitoring occurred from July 2015 – June 2016, which coincides with the fiscal year (FY15/16); water samples were collected monthly at five stations in the Sacramento-San Joaquin Delta. Of the 12 sampling events, the January and March 2016 site visits captured storm events[1]. Pesticide monitoring includes sample collection for chemical analyses of pesticides and ancillary parameters, toxicity testing, and field measurements.

The purpose of this report is to document the field sampling effort and any deviations from the field-sampling plan outlined in the Quality Assurance Project Plan (QAPP), and field conditions on the days of sampling. Laboratory results are presented in the Annual Monitoring Report Fy2016 – Pesticides.

2. Summary of Pesticide Field Sampling

2.1 Target Sampling Sites & Schedule

In the FY 15/16, surface water sampling for pesticides occurred at the five monitoring sites listed in Table 1. The monitoring sites for pesticide surface water sampling represent key inflows to the Delta (Figure 1).

Table 1. Target sampling sites and schedule

Site Name	Site Code	Target Latitude	Target Longitude	Sampling Frequency
Sacramento R @ Hood	510SACC3A	38.36691	-121.52037	Monthly
Mokelumne R @ New Hope Road	544SAC002	38.23611	-121.41889	Monthly
San Joaquin R @ Buckley Cove	544LSAC13	37.97667	-121.37889	Monthly
San Joaquin R @ Vernalis/Airport Way	541SJC501	37.67556	-121.26417	Monthly
Ulatis C @ Brown Rd	511ULCABR	38.30667	-121.79472	Monthly

[1] Wet weather sampling triggers and criteria are defined in the Delta RMP QAPP: goo.gl/ywQM6M

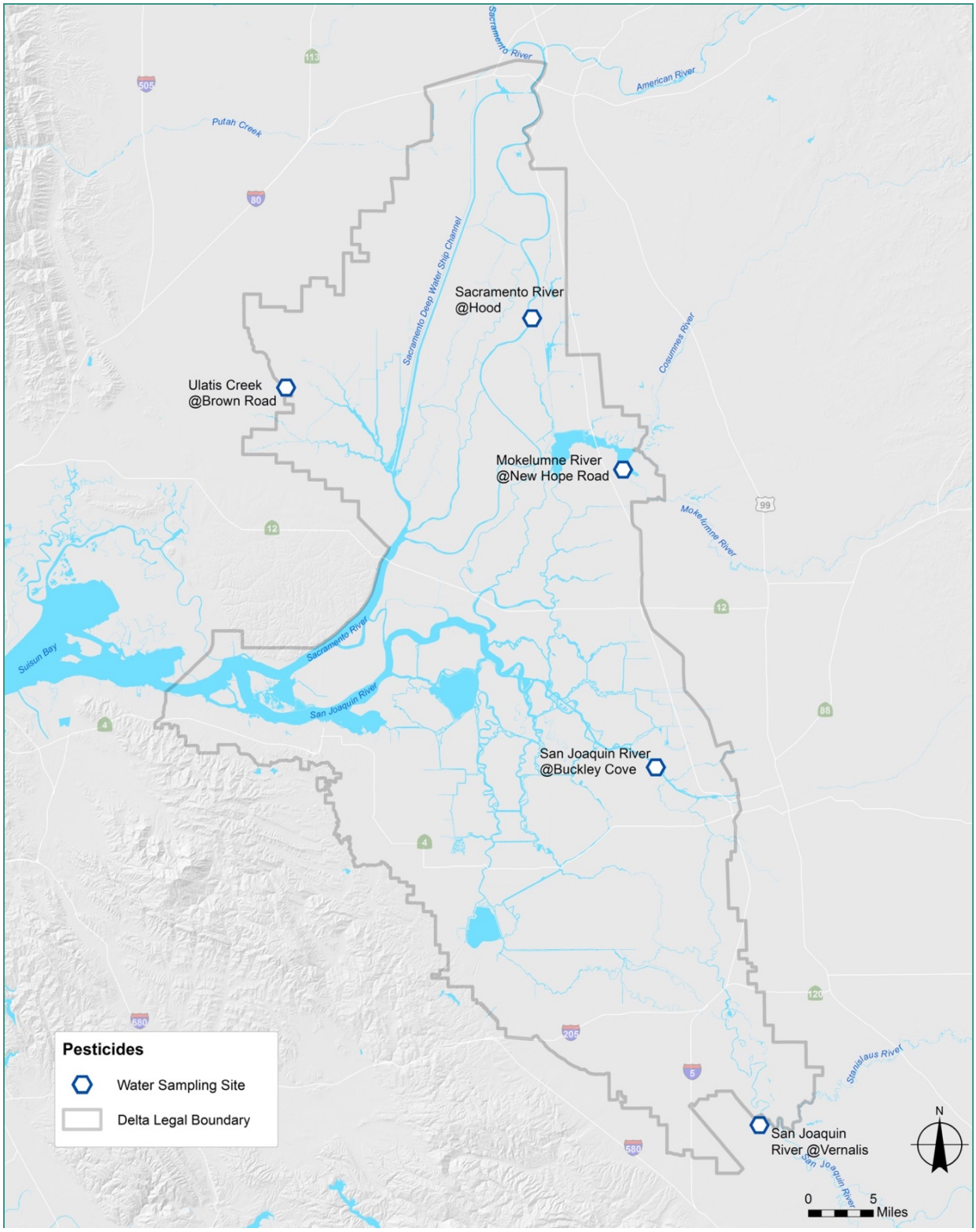

Figure 1. FY 15/16 Pesticide Water Sampling Sites.

2.2 Actual Sampling Sites & Schedule

Table 2 shows basic information for the sampling sites, schedule, and field QC sample collection. All anticipated samples (60) were collected. All QC samples required in the QAPP were collected (i.e. 5% of all field samples). The following additional QC samples were collected:

a) two additional matrix spike (MS) samples (i.e. 5 rather than 3 samples were collected) for each type of pesticide analysis method (GC-MS and LC-MS). The initial two matrix samples for each method were collected without a corresponding matrix spike duplicate (MSD).
b) two additional field duplicates for toxicity testing (five versus three required)
c) two field blanks for toxicity testing (collected by the field sampling team at beginning of projects to determine if any contamination is taking place during field activities).

There were 12 sampling events in total that included 10 scheduled monthly sampling events and2 storm sampling events.

Table 2. Actual sampling sites, schedule, coordinates, sampling location, depth, and QC sample information.

Date	Event Type	Station ID	Collection Time	Actual Latitude	Actual Longitude	Location Code	Collection Depth (m)	QC Sample Collected *(#/ # required)*
7/28/2015	Routine	510SACC3A	8:45	38.36798	-121.521343	Midchannel	0.5	Field Duplicate – Pesticides (GC-MS) *(1/3)*
		544SAC002	9:50	38.2365	-121.419208	Midchannel	0.5	Field Blank – Pesticides (LC-MS) *(1/3)*
		544LSAC13	11:10	37.97451	-121.37637	Bank	0.5	Field Duplicate – Pesticides (LC-MS) *(1/3)*
		541SJC501	12:15	37.67534	-121.26511	Midchannel	0.2	
		511ULCABR	14:20	38.30702	-121.79415	Midchannel	0.3	
8/18/2015	Routine	510SACC3A	8:40	38.36773	-121.52045	Midchannel	2[2]	
		544SAC002	9:50	38.23644	-121.41906	Midchannel	2	Field Blank- DOC/POC; Cu *(1/3)*
		544LSAC13	11:10	37.97451	-121.37634	Bank	0.5	Field Duplicate - Toxicity Testing (1/--[3])
		541SJC501	12:50	37.67531	-121.26521	Midchannel	0.5	
		511ULCABR	15:00	38.30699	-121.79402	Midchannel	0.5	Field Duplicate (2/3) + Matrix Spike (MS) (1/3) – Pesticides (LC-MS)
9/23/2015	Routine	510SACC3A	8:30	38.36758	-121.52032	Midchannel	0.5	Field Duplicate- DOC/POC (1/3)
		544SAC002	9:20	38.23645	-121.41918	Midchannel	0.5	
		544LSAC13	10:45	37.9745	-121.37632	Bank	0.5	Field Duplicate- Pesticides (GC-MS) (2/3)
		541SJC501	12:20	37.675346	-121.265245	Midchannel	0.5	Matrix Spike (MS) - Pesticides (GC-MS) (1/3)
		511ULCABR	14:15	38.307011	-121.794033	Midchannel	0.1	
10/21/2015	Routine	510SACC3A	8:00	38.367967	-121.521343	Midchannel	1	Field Duplicate (3/3) + Matrix Spike (MS) (2/3) – Pesticides (LC-MS); Field Duplicate- Cu (1/3)
		544SAC002	9:10	38.23639	-121.419167	Midchannel	1	

[2] Sampling at the 0.5m depth was not possible due to extreme high flow conditions. The sample was collected at 2m with the same collection method as the 0.5m samples collected at other times and locations.

[3] Not specified in Delta RMP QAPP but Required by SWAMP: 1 per 20 samples = 3 field duplicate samples per 60 toxicity samples per year.

Date	Event Type	Station ID	Collection Time	Actual Latitude	Actual Longitude	Location Code	Collection Depth (m)	QC Sample Collected *(#/ # required)*
		544LSAC13	10:50	37.975278	-121.376844	Bank	0.25	
		541SJC501	12:40	37.676041	-121.266329	Midchannel	0.5	Field Duplicate - Toxicity Testing (2/--)
		511ULCABR	15:00	38.307006	-121.795122	Midchannel	0.2	
11/10/2015	Routine	510SACC3A	8:45	38.367967	-121.521343	Midchannel	1.5	
		544SAC002	9:50	38.23639	-121.419167	Midchannel	1.5	Field Duplicate – Pesticides (GC-MS) (2/3)
		544LSAC13	11:10	37.975278	-121.376844	Bank	1.5	
		541SJC501	12:15	37.676041	-121.266329	Midchannel	1.5	
		511ULCABR	14:20	38.307006	-121.795122	Midchannel	1	Field Blank – Pesticides (GC-MS)(1/3); Cu (2/3)
12/15/2015	Routine	510SACC3A	8:40	38.367967	-121.521343	Midchannel	1	Field Duplicate – Toxicity Testing (3/--)
		544SAC002	9:50	38.23639	-121.419167	Midchannel	0.5	Field Blank- Cu (3/3)
		544LSAC13	11:10	37.975278	-121.376844	Bank	0.3	Field Blank – Pesticides (GC-MS) (2/3)
		541SJC501	12:50	37.676041	-121.266329	Midchannel	0.3	Field Duplicate- DOC/POC (2/3)
		511ULCABR	15:00	38.307006	-121.795122	Midchannel	0.3	Matrix Spike/Matrix Spike Duplicate (MS/MSD) – Pesticides (LC-MS)(3/3)/(1/3)
1/19/2016	Storm	510SACC3A	8:45	38.367967	-121.521343	Midchannel	0.5	Field Duplicate- DOC/POC (2/3)
		544SAC002	9:50	38.23639	-121.419167	Midchannel	0.5	
		544LSAC13	11:10	37.975278	-121.376844	Bank	0.2	
		541SJC501	12:15	37.676041	-121.266329	Midchannel	0.5	MS/MSD – Pesticides (GC-MS) (2/3)/(1/3)
		511ULCABR	14:20	38.307006	-121.795122	Midchannel	0.5	Field Duplicate Toxicity Testing (4/--)
2/17/2016	Routine	510SACC3A	8:40	38.367967	-121.521343	Midchannel	0.5	
		544SAC002	9:50	38.23639	-121.419167	Midchannel	0.5	
		544LSAC13	11:10	37.975278	-121.376844	Bank	0.2	MS/MSD – Pesticides (LC-MS) (4/3)/(2/3); Field Blank – Toxicity Testing (1/--)

Date	Event Type	Station ID	Collection Time	Actual Latitude	Actual Longitude	Location Code	Collection Depth (m)	QC Sample Collected *(#/ # required)*
		541SJC501	12:50	37.676041	-121.266329	Midchannel	0.5	
		511ULCABR	15:00	38.307006	-121.795122	Midchannel	0.5	Field Duplicate- Cu (2/3)
3/7/2016	Storm	510SACC3A	8:45	38.367967	-121.521343	Midchannel	0.5	Field Blank – Pesticides (GC-MS) (3/3); Cu (4/3)
		544SAC002	9:50	38.23639	-121.419167	Midchannel	1	
		544LSAC13	11:10	37.975278	-121.376844	Bank	0.2	
		541SJC501	12:15	37.676041	-121.266329	Midchannel	0.5	
		511ULCABR	14:20	38.307006	-121.795122	Midchannel	0.5	
4/19/2016	Routine	510SACC3A	8:40	38.367967	-121.521343	Midchannel	0.5	
		544SAC002	9:50	38.23639	-121.419167	Midchannel	0.5	
		544LSAC13	11:10	37.975278	-121.376844	Bank	0.5	Field Duplicate – Toxicity Testing (5/--); MS/MSD – Pesticides (GC-MS) (3/3)/(2/3)
		541SJC501	12:50	37.676041	-121.266329	Midchannel	0.5	Field Blank – Pesticides (LC-MS)(2/3); DOC/POC (2/3)
		511ULCABR	15:00	38.307006	-121.795122	Midchannel	0.25	
5/18/2016	Routine	510SACC3A	8:45	38.367967	-121.521343	Midchannel	0.5	
		544SAC002	9:50	38.23639	-121.419167	Midchannel	0.5	
		544LSAC13	11:10	37.975278	-121.376844	Bank	0.5	
		541SJC501	12:15	37.676041	-121.266329	Midchannel	0.5	Field Duplicate – Pesticides (LC-MS)(4/3)
		511ULCABR	14:20	38.307006	-121.795122	Midchannel	0.2	MS/MSD – Pesticides (GC-MS) (4/3)/(3/3)
6/15/2016	Routine	510SACC3A	8:10				0.5	MS/MSD – Pesticides (LC-MS)(5/3)/(3/3); Field Blank- DOC/POC (3/3)
		544SAC002	9:15				0.5	Field Blank – Toxicity Testing (2/--); Pesticides (LC-MS) (3/3)
		544LSAC13	10:50				0.5	
		541SJC501	12:40				0.5	Field Duplicate- Cu (3/3)
		511ULCABR	14:40				0.5	

(Note 1: The field data sheets for the samples collected on 6/15/16 were lost. The collection information was obtained from data sheets submitted to ASC.)

2.3 Sample Collection Methods

Field Measurements

Field parameters included water temperature, pH, dissolved oxygen (mg/L and % sat), specific conductance, and turbidity. To minimize discrepancy in field results and provide useful, accurate scientific data, all personnel participating in field sampling were required to follow the guidelines set out in the USGS National Field Manual for the Collection of Water-Quality Data.

Water Sample Collection Methods

All samples for pesticide analysis were collected as grab samples. Water samples for pesticide analysis and toxicity testing were collected in pre-cleaned combusted amber glass bottles (pesticides – 1L, toxicity testing – 4L). Water samples for copper (Cu) and Dissolved Organic Carbon/Particulate Organic Carbon (DOC/POC) analysis were collected in acid rinsed Teflon bottles (copper, DOC/POC – 3 liter). All samples were collected as grab samples by fully submerging all sample bottles approximately 0.5 meters below the water surface. Deviations in the actual sample collection depth (Table 2) were due to low water column depth or high flow conditions at the sampling sites. Sample bottles for dissolved copper and DOC/POC were rinsed three times with site water prior to filling, and containers were filled completely, leaving no headspace, to minimize volatilization. All samples were preserved with wet ice in the field.

Table 3. Sample container type and volume used for collection of water samples.

Program Element	Parameter Group - Analyte	Bottle type	Sample Volume/Site
Pesticides	Water toxicity	Amber glass	4L/bottle x 8 bottles
Pesticides	Pesticides	Amber glass	1L
Pesticides	Copper, DOC/POC	Teflon	3L

2.4 Summary of Field Observations and Conditions

For context, the weather conditions (air temperature and precipitation) and flow for the year are summarized in Figures 2 - 4. The sampling dates are marked on these graphs.

The field measurements made during sample collection are summarized in Table 5 - 16.

Table 4. Field parameter measurements in the following order: specific conductance, water temperature, pH, dissolved oxygen, turbidity. Yellow cells indicate missing data. Red cells indicate data outliers omitted from Figures 5-10. Blue cells indicate data outliers that were omitted from Figures 11-16 to avoid scaling issues.

Date	Station ID	Specific Conductance (µS/cm)	Water Temp (°C)	pH	DO (mg/L)	DO (%Sat)	Turbidity (NTU)
7/28/2015	510SACC3A	132	23.70	7.16	7.17		
	544SAC002	122	24.16	8.17	8.04		
	544LSAC13	1370	26.31	8.15	8.76		
	541SJC501	962	25.26	7.88	8.97		
	511ULCABR	695	25.18	7.87	7.06		
8/18/2015	510SACC3A	169	24.90	7.45	7.11	85.9	6.7
	544SAC002	130	25.14	7.94	7.91	96	11
	544LSAC13	1362	25.99	7.68	6.17	76.4	10
	541SJC501	668	26.62	7.83	8.6	107.3	6.6
	511ULCABR	763	24.00	7.99	8.21	97.7	14
9/23/2015	510SACC3A	172	20.87	7.45	8.12	91.2	7.6
	544SAC002	187	20.59	7.84	8.24	91.7	6.6
	544LSAC13	1414	23.61	7.65	7.5	90.5	12.5
	541SJC501	706	21.86	7.70	8.59	99	5
	511ULCABR	1053	20.92	7.79	7.16	80.4	16.3
10/21/2015	510SACC3A	160	18.89	7.28	8.48	93	6.6
	544SAC002	54	16.69	7.44		88.8	4.5
	544LSAC13	860	21.41	7.75	8.1	92.2	5.6
	541SJC501	453	18.7	7.45	7.51	80.7	12.5
	511ULCABR	930	18.24	7.69	5.56	58.6	14.4
11/10/2015	510SACC3A	178	13.44	7.05	9.23	88.5	5.9
	544SAC002	52	12.41	7.18	9.92	93	6.6
	544LSAC13	360	15.88	7.58	8.67	87.7	6.5
	541SJC501	294	13.4	7.26	8.27	79.2	7.2
	511ULCABR	1034	13.82	8.05	10.21	99	21.5
12/15/2015	510SACC3A	182	10.51	7.52	10.04	90.1	9.8
	544SAC002	57	9.06	7.74	10.59	91.7	3
	544LSAC13	592	11.13	7.88	11.13	10.9	22.5
	541SJC501	476	8.87	7.80	10.15	87.4	6.4

Date	Station ID	Specific Conductance (µS/cm)	Water Temp (°C)	pH	DO (mg/L)	DO (%Sat)	Turbidity (NTU)
	511ULCABR	805	7.3	7.3	9.8	82	8.4
1/19/2016	510SACC3A	142	9.8	7.3	10		90
	544SAC002	53	14.6	7.3	92		7.6
	544LSAC13	409	11.1	7.3	9.1		68
	541SJC501	449	12.3	7.4	8.4		24
	511ULCABR	134	12.9	7.7	8.7		730
2/17/2016	510SACC3A	190	13.4	7.5	9.6		14
	544SAC002	59	14.0	7.6	9.3	90	7.4
	544LSAC13	606	13.4	7.3	7.2	69	11
	541SJC501	975	15.5	7.6	8.7	88	12
	511ULCABR	1120	16.6	8.2	11	110	7.2
3/7/2016	510SACC3A	140	13.0	7.3	9.2	87	77
	544SAC002	55	13.6	7.6	9.3	89	
	544LSAC13	672	15.7	7.5	8.7	88	
	541SJC501	751	16.0	7.7	8	81	4.6
	511ULCABR	208	12.1	7.3	9.5	88	160
4/19/2016	510SACC3A	127	16.8	6.8	9.2		1
	544SAC002	52	17.9	7.2	8.4	89	830
	544LSAC13	878	20.6	7.5	9.4	110	0.1
	541SJC501	382	17.4	7.9	10		18
	511ULCABR	819	23.3	8.8	22		2.4
5/18/2016	510SACC3A	108	19.2	7.2	8.6	93	0
	544SAC002	52	19.0	7.4	8.3	89	0
	544LSAC13	276	21.0	7.5	8.7	97	6.6
	541SJC501	332	19.4	8.4	12	130	1.7
	511ULCABR	811	24.4	8.1	9	110	0
6/15/2016	510SACC3A	113	19.9	7.1	8.4	92	2.1
	544SAC002	53	18.2	7.2	8.4	89	0
	544LSAC13	624	23.7	7.3	7.8	92	4.8
	541SJC501	433	21.2	8.6	14	160	7
	511ULCABR	1040	19.0	8.2	9.4	100	11

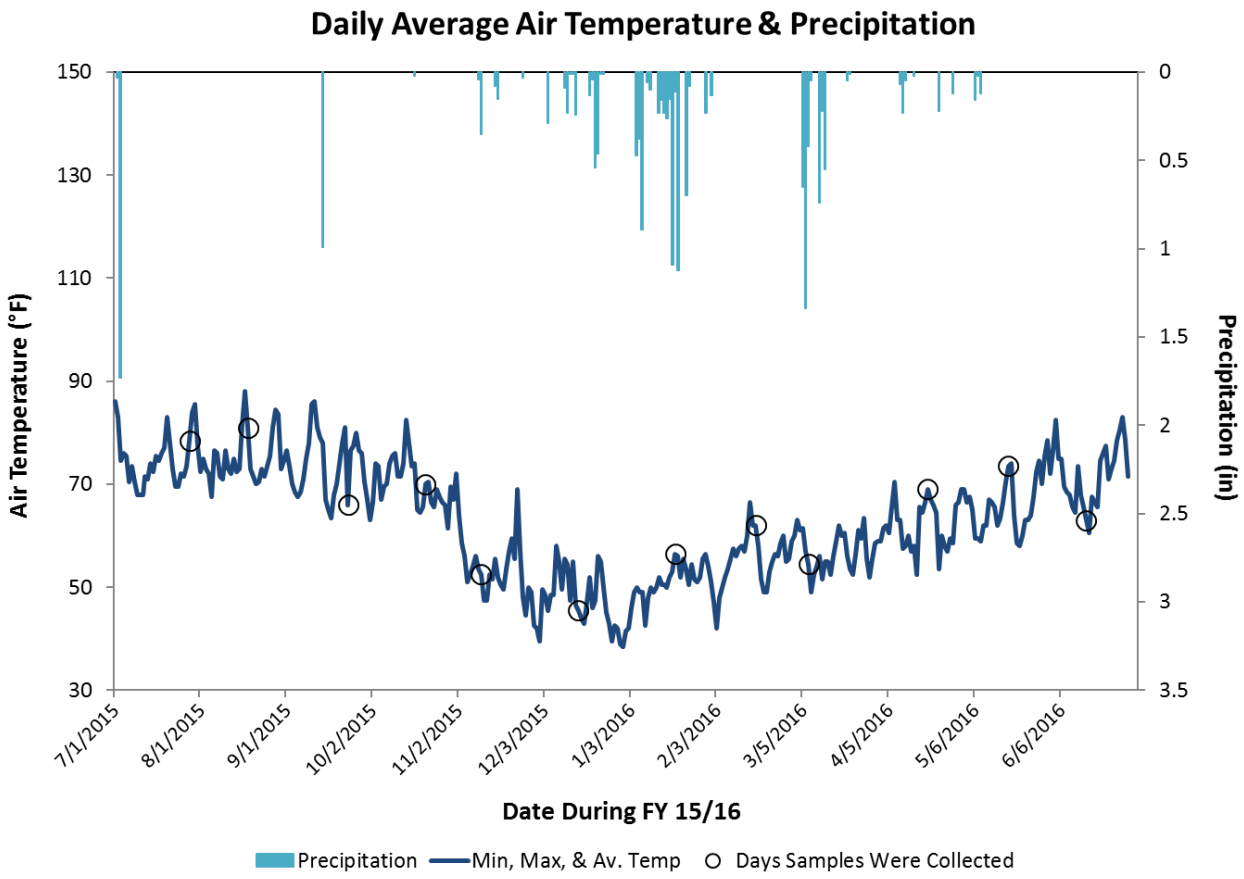

Figure 2. Daily air temperatures, daily rainfall measured at the Travis Filed Air Force Base weather observation station (Station ID: GHCND:USW00023202). The open circles indicate sampling days. Data from NOAA: *(http://www.ncdc.noaa.gov/cdo-web/datasets/GHCND/stations/GHCND:USW00023202/detail).*

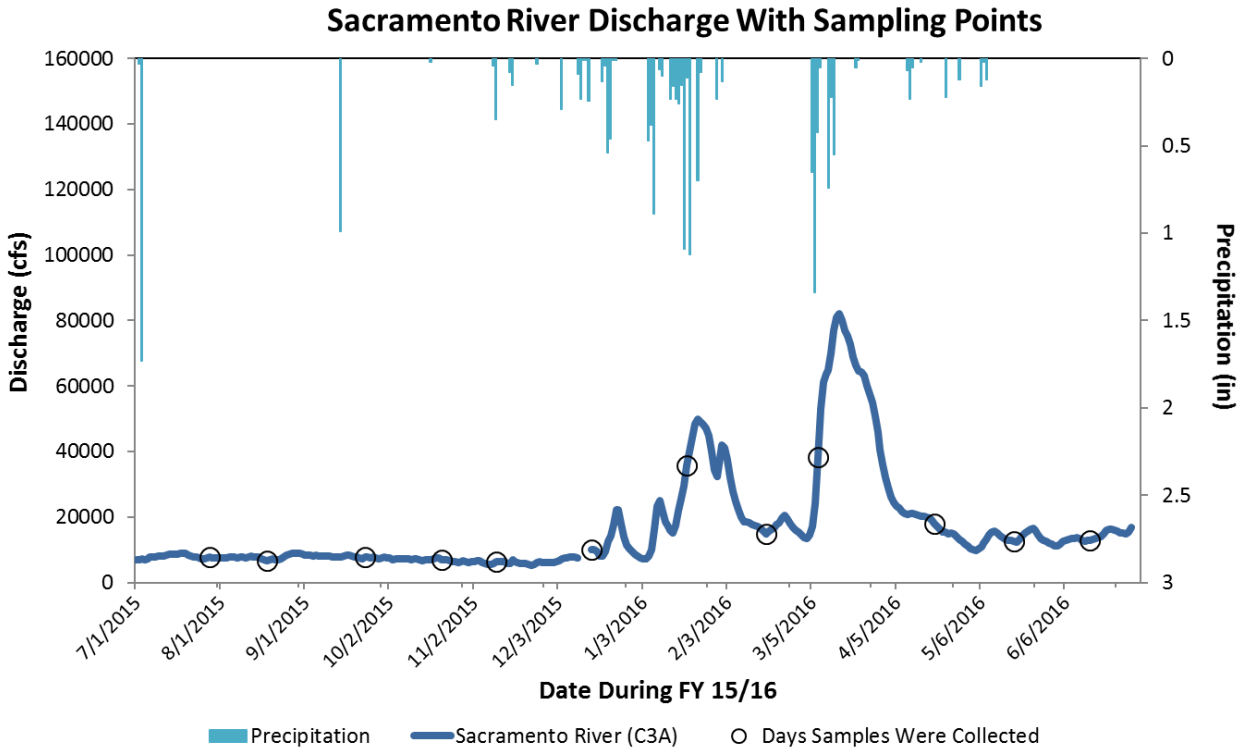

Figure 3. Delta flow and sampling days. The Sacramento River discharge data (are tide filtered. Sacramento River data are from the USGS flow station at Freeport (USGS 11447650;*http://waterdata.usgs.gov/ca/nwis/rt)*.

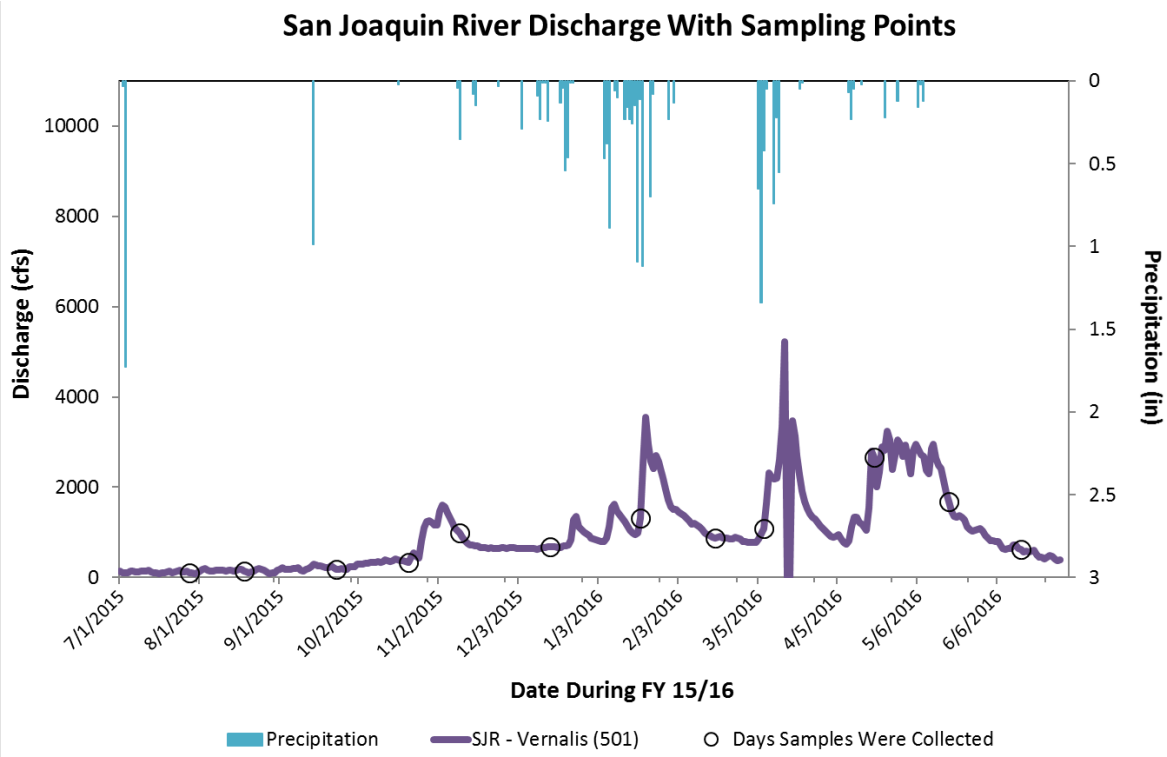

Figure 4. Delta flow and sampling days. San Joaquin River data taken from the USGS flow station at Vernalis *(*USGS 11303500; *http://waterdata.usgs.gov/ca/nwis/rt)*.

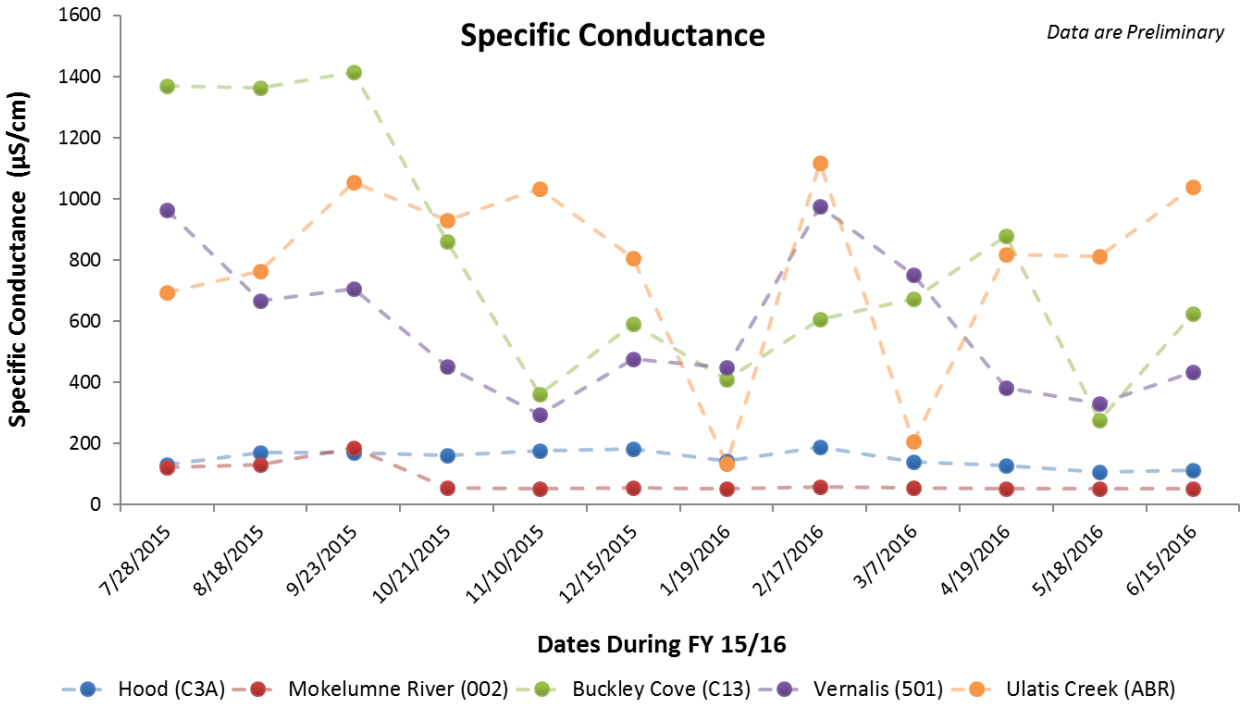

Figure 5. Line chart showing Specific Conductance field results over time. All data are preliminary until quality control is complete.

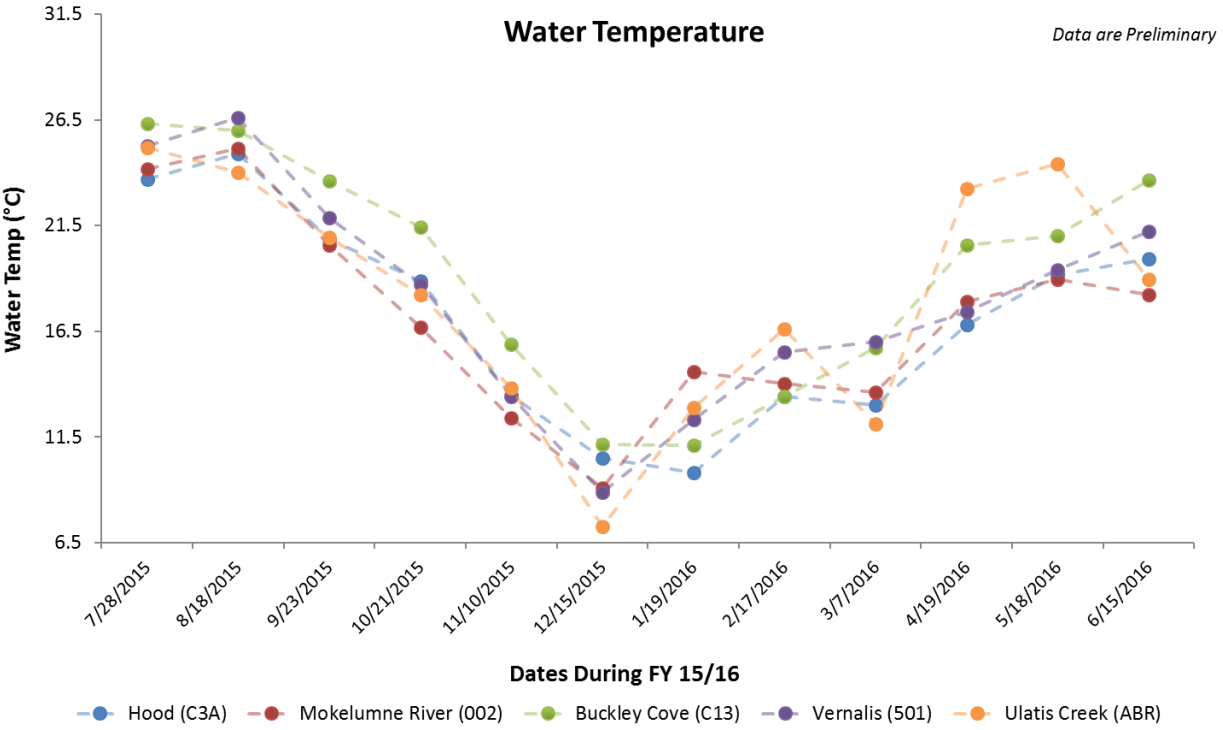

Figure 6. Line chart showing Water Temperature field results over time. All data are preliminary until quality control is complete.

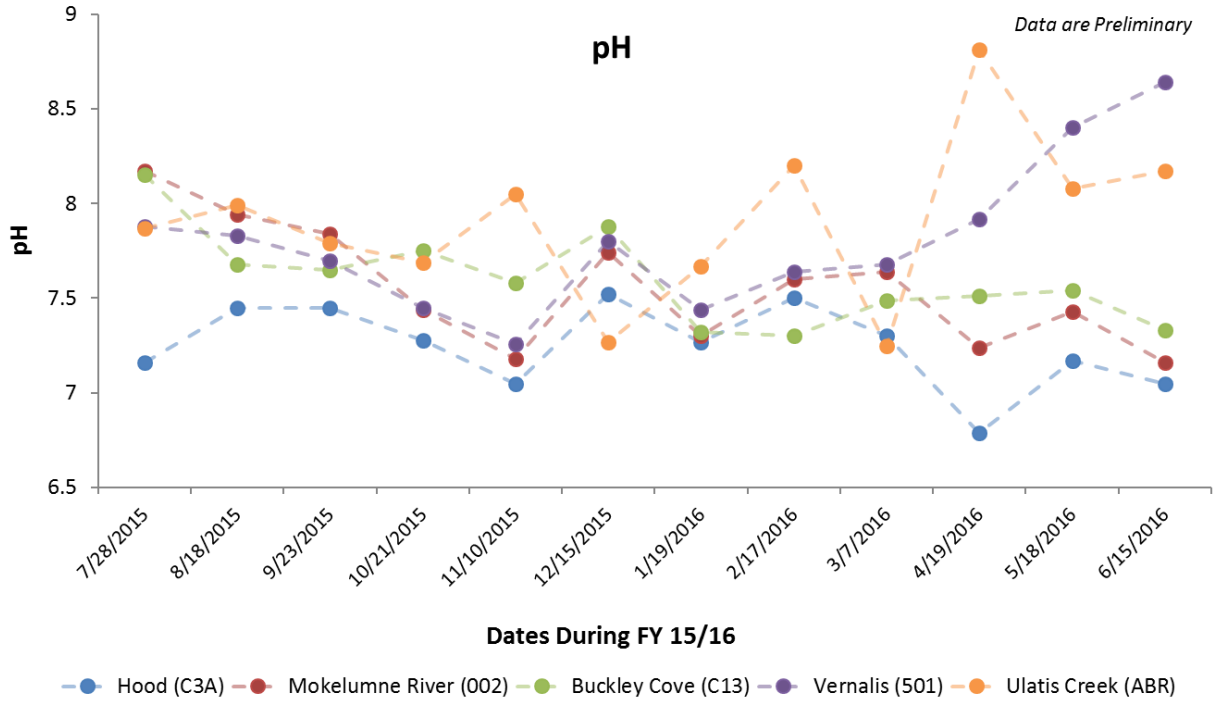

Figure 7. Line chart showing pH field results over time. All data are preliminary until quality control is complete.

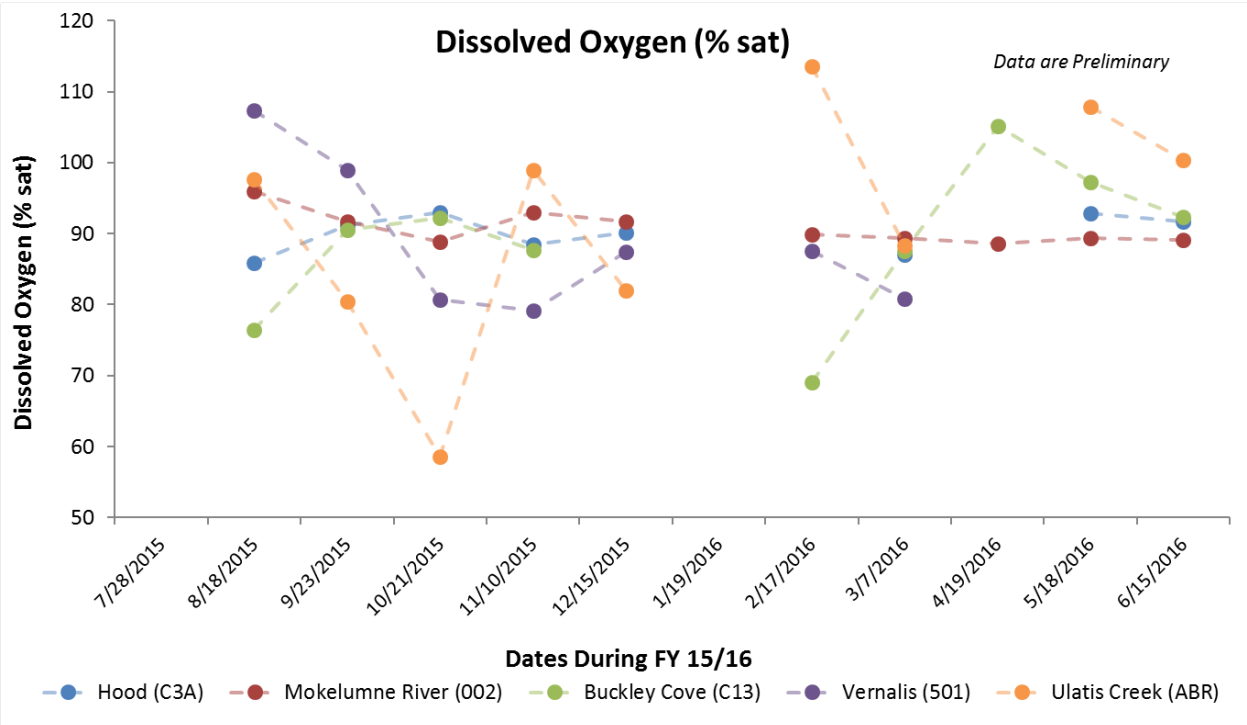

Figure 8. Line chart showing Dissolved Oxygen (% sat) field results over time. All data are preliminary until quality control is complete.

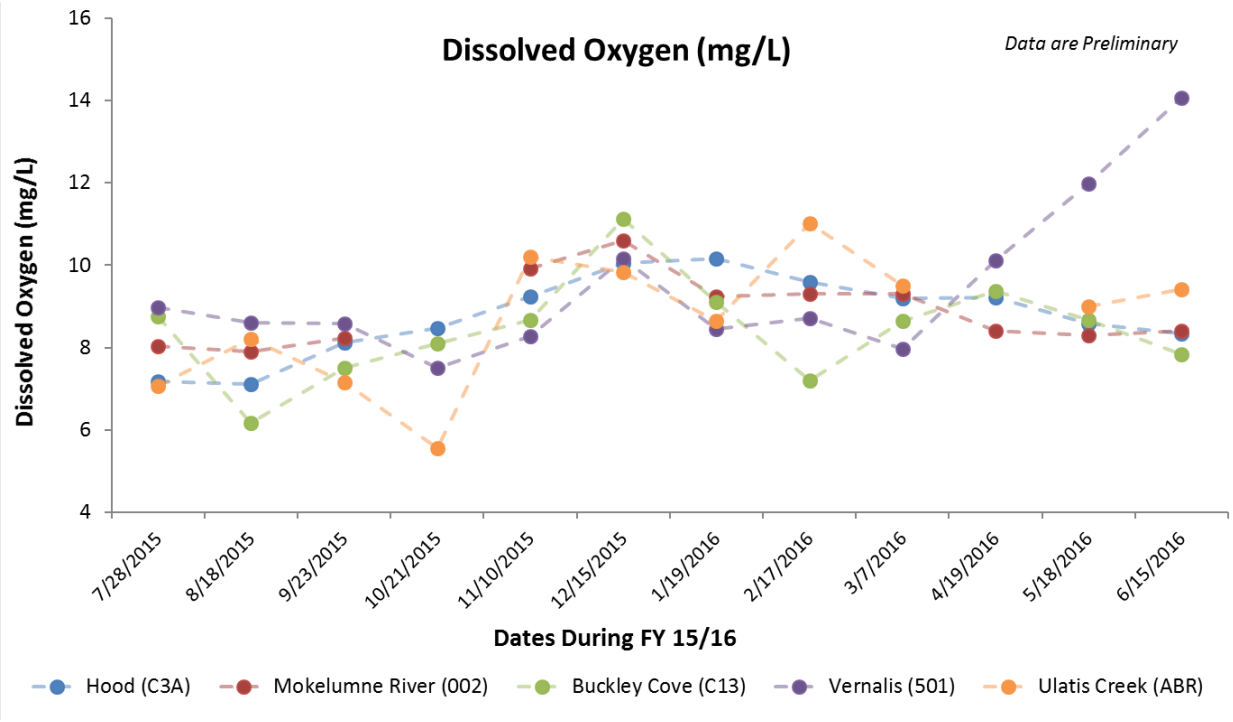

Figure 9. Line chart showing Dissolved Oxygen (mg/L) field results over time. All data are preliminary until quality control is complete.

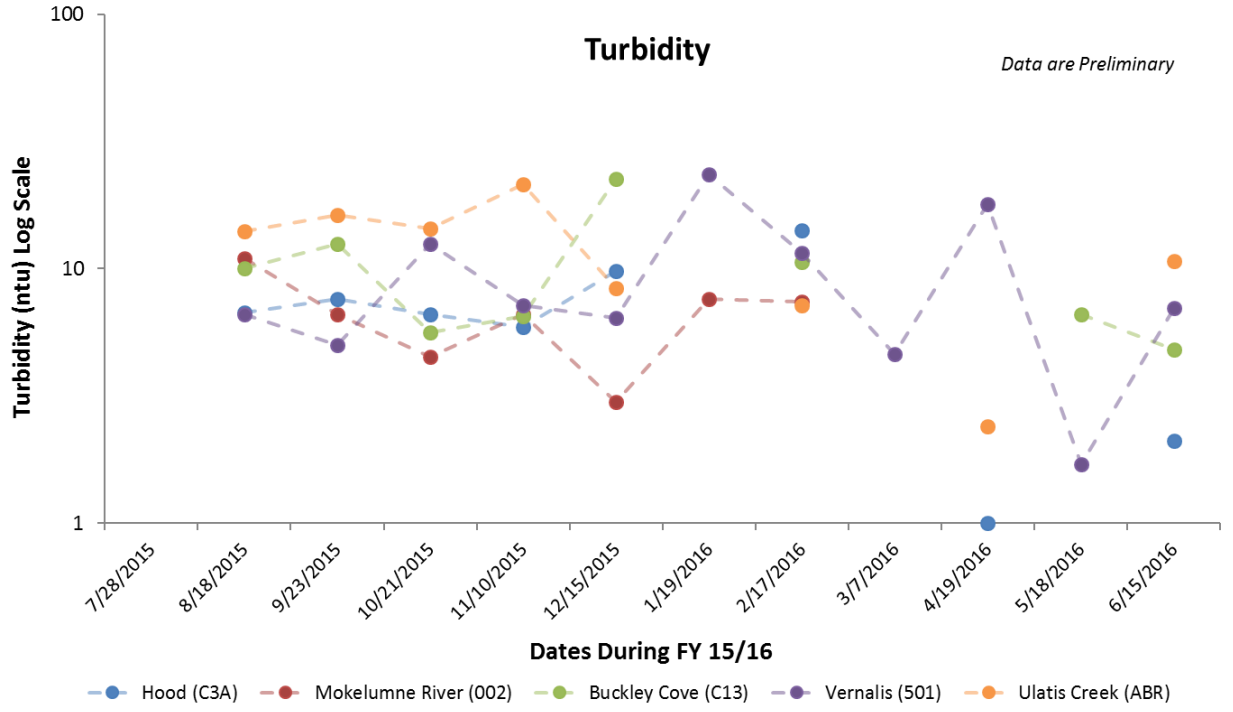

Figure 10. Line chart showing Turbidity field results over time. All data are preliminary until quality control is complete.

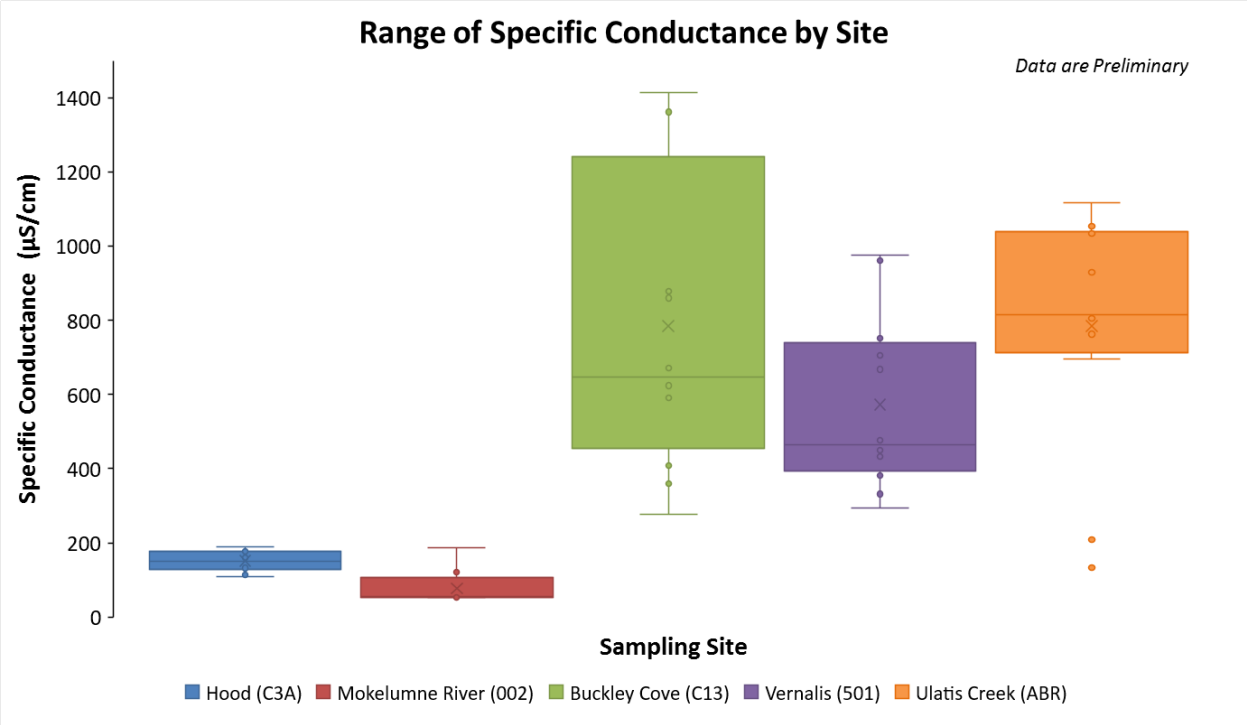

Figure 11. Box and whisker chart showing Specific Conductance field results by site. All data are preliminary until quality control is complete.

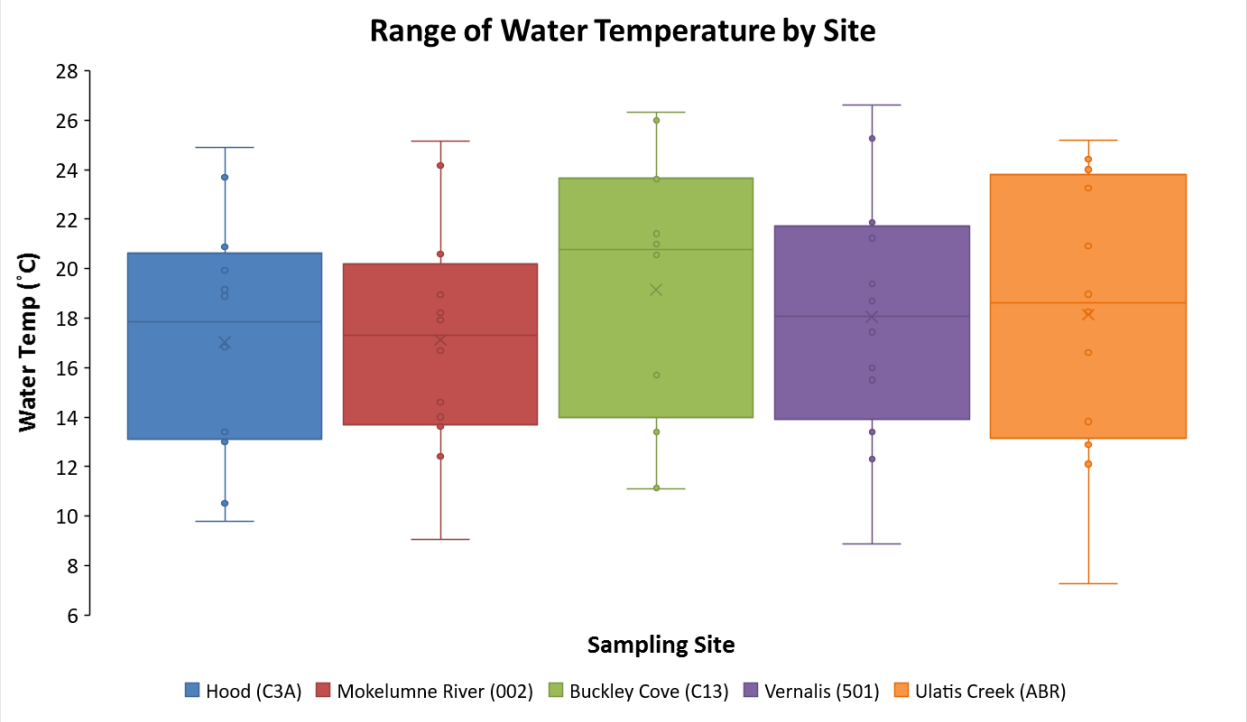

Figure 12. Box and whisker chart showing Water Temperature field results by site. All data are preliminary until quality control is complete.

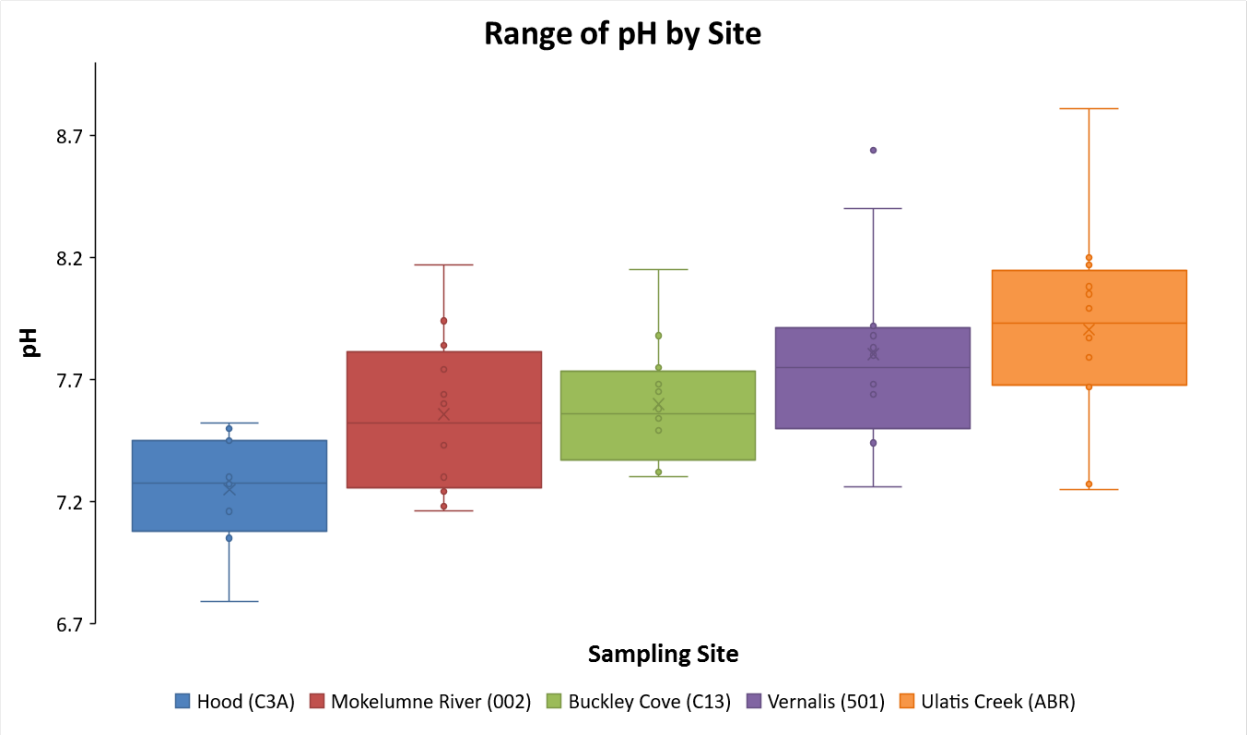

Figure 13. Box and whisker chart showing pH field results by site. All data are preliminary until quality control is complete.

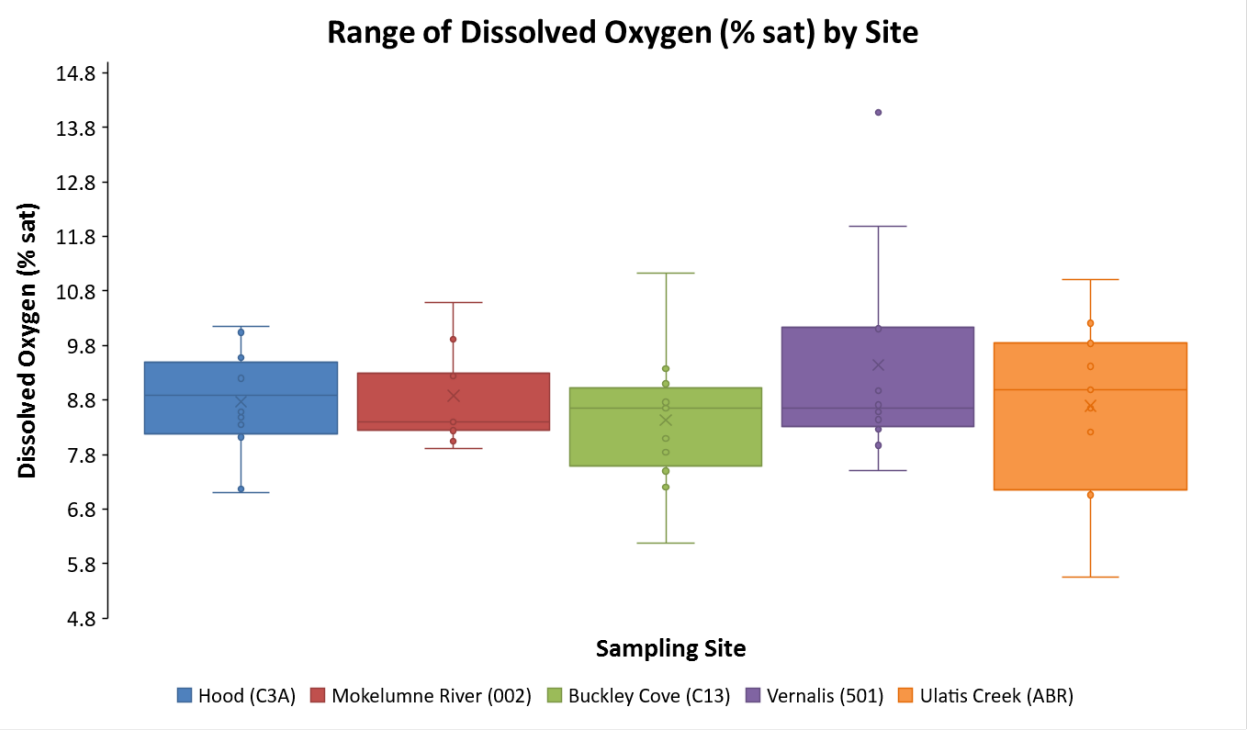

Figure 14. Box and whisker chart showing Dissolved Oxygen (% sat) field results by site. All data are preliminary until quality control is complete.

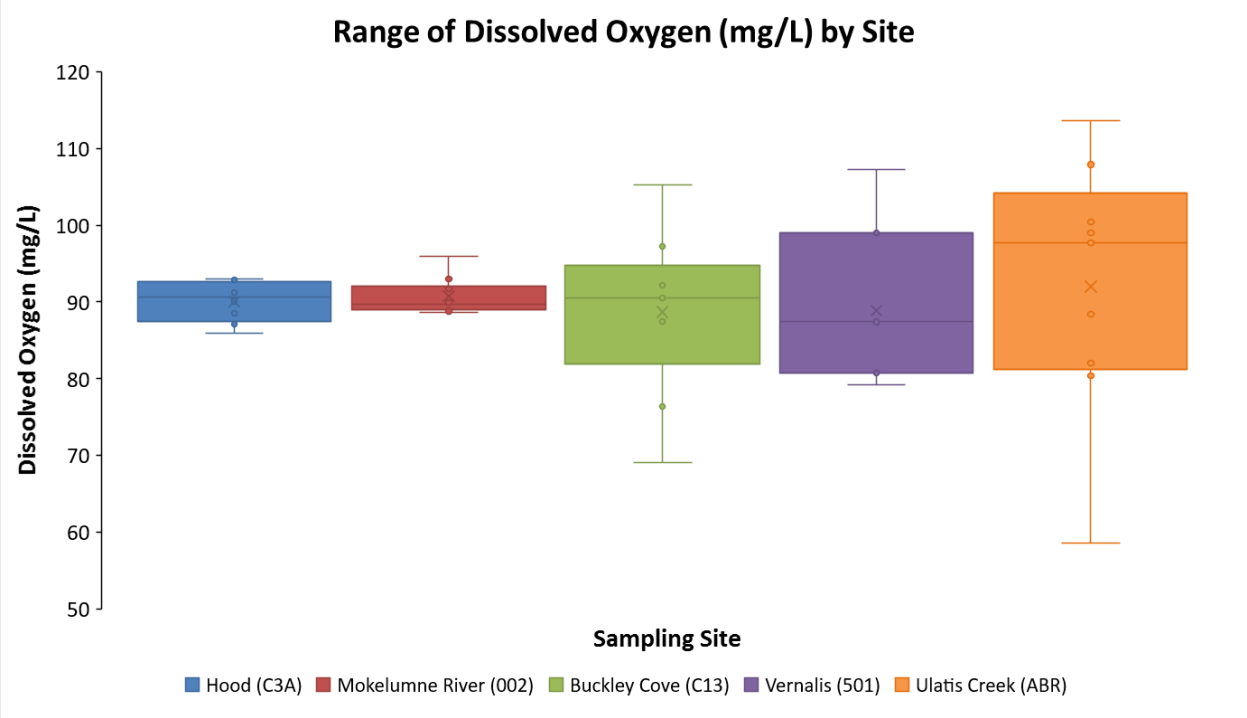

Figure 15. Box and whisker chart showing Dissolved Oxygen (mg/L) field results by site. All data are preliminary until quality control is complete.

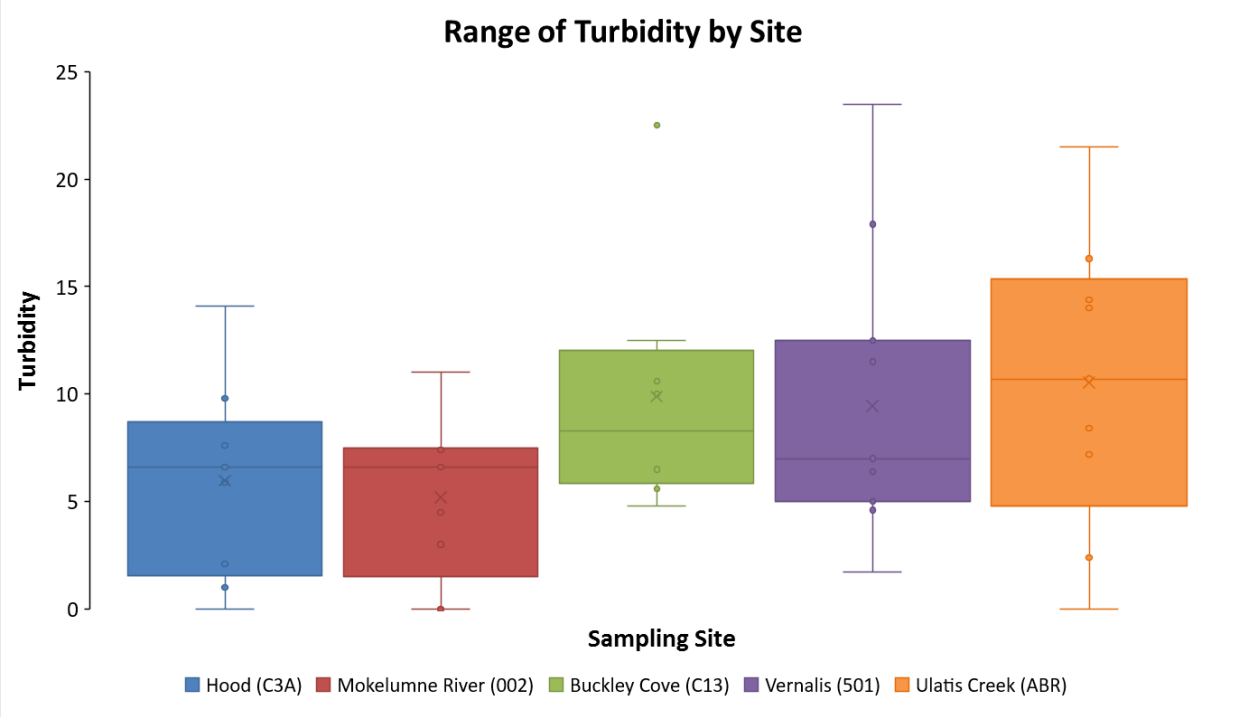

Figure 16. Box and whisker chart showing turbidity field results by site. All data are preliminary until quality control is complete.

2.5 Difficulties Encountered and Non-Conformances with the QAPP

Non-conformances should be considered during the quality assurance review of laboratory data and should be corrected to improve future sample collection efforts. The table also lists recommended corrective actions.

Table 5. Field sampling QA issues and QAPP deviations and recommended corrective actions.

No.	Pesticide Monitoring QA Issues and QAPP Deviations	Recommended Corrective Actions
1	The station visits where field duplicates and field blanks were collected are not well described on the SWAMP field sheets. In the future, it would be helpful for the field sheet to note the type of QC sample collected (e.g., blank or duplicate) and for which parameters. The information is recorded but currently spread across three different field sheets, because there are multiple laboratories involved with the project.	Field crews will note on SWAMP field sheets: a) presence/absence of QC sample collection/measurement, b) which parameters QC is being collected for, c) type of QC sample/measurement.
2	The SWAMP field sheets and Chain of Custody forms from the June 15, 2016 sampling event are missing.	SWAMP COC and field sheets from June 2016 event were found on 12/6/16. Corrective action: AHPL will scan COC and field sheets and email to USGS within 48-hr of receipt. AHPL will file sheets into a designated logbook after scanning.
4	The 0.5m sample "collection depth" used in Table 2.2 was an estimate used to indicate the target for a near surface (but not at the surface) grab sample.	At some sites and/or at certain times of the year it is not possible to sample at the 0.5m depth due to either extreme low or extreme high flow conditions. Reasons for deviating from the 0.5m sampling depth will be noted in the comments section of the SWAMP field form.
5	A number of field measurements are missing. Most of the missing results are for turbidity or dissolved oxygen saturation. o Dissolved Oxygen Saturation: ▪ Missing on 7/28/15 (all sites), 1/19/16 (all sites), and 2/17/16 (for Hood); ▪ Recording errors on 4/19/16 (for Hood, Vernalis, and Ulatis Creek) ▪ Dissolved oxygen (mg/L) data are available for all of these station visits.	Missing data were not collected in the field. Field crews have been instructed to collect all field parameter data that are requested on the SWAMP field sheet, even if some of these data types are not listed on other lab's field sheets. If a sensor malfunctions, it is also to be noted on the SWAMP field sheet.
6	o Dissolved Oxygen at the Mokelumne site on 10/21/15: A transcription error resulted in the absence of the dissolved oxygen (mg/L) result.	The correct value for DO at the Mokelumne site on 10/21/15 was 8.65 mg/L. The data were recorded correctly on the PFRG field sheet but not on the SWAMP sheet. Field personnel will double check their field form entries following sampling at each

No.	Pesticide Monitoring QA Issues and QAPP Deviations	Recommended Corrective Actions
		site, and verify that all field forms are filled out as completely as possible.
6	Turbidity at all sites on 7/28/15: Turbidity sensor was missing.	An appropriate YSI sonde with turbidity sensor was used for all subsequent sampling events.
7	Turbidity on 3/7/16: Turbidity at the Buckley Cove and Mokelumne River sites was low and out of the calibration range. The turbidity sensor was calibrated for storm event/high turbidity conditions.	The recommended future adjustment would be to calibrate the turbidity sensor for intermittent conditions, if a range of flow and turbidity conditions is expected.
8	7/28/15 at Hood: One 4L amber bottle for toxicity sampling was mislabeled and set aside.	Field personnel will double check that all sample bottles are labeled correctly following sampling at each site.
9	4/19/16 at Ulatis Creek: Two 4L amber bottles for toxicity sampling broke. Three 1L bottles were added instead.	In this case, field personnel made good use of the available resources to compensate for the lost sample bottles. In the future field personnel should take at least 2 spare 4L amber bottles in the field with them.

3. Appendices

List of Field Sheets

COCs and field sheets from June 15, 2016 are missing from the appendix.