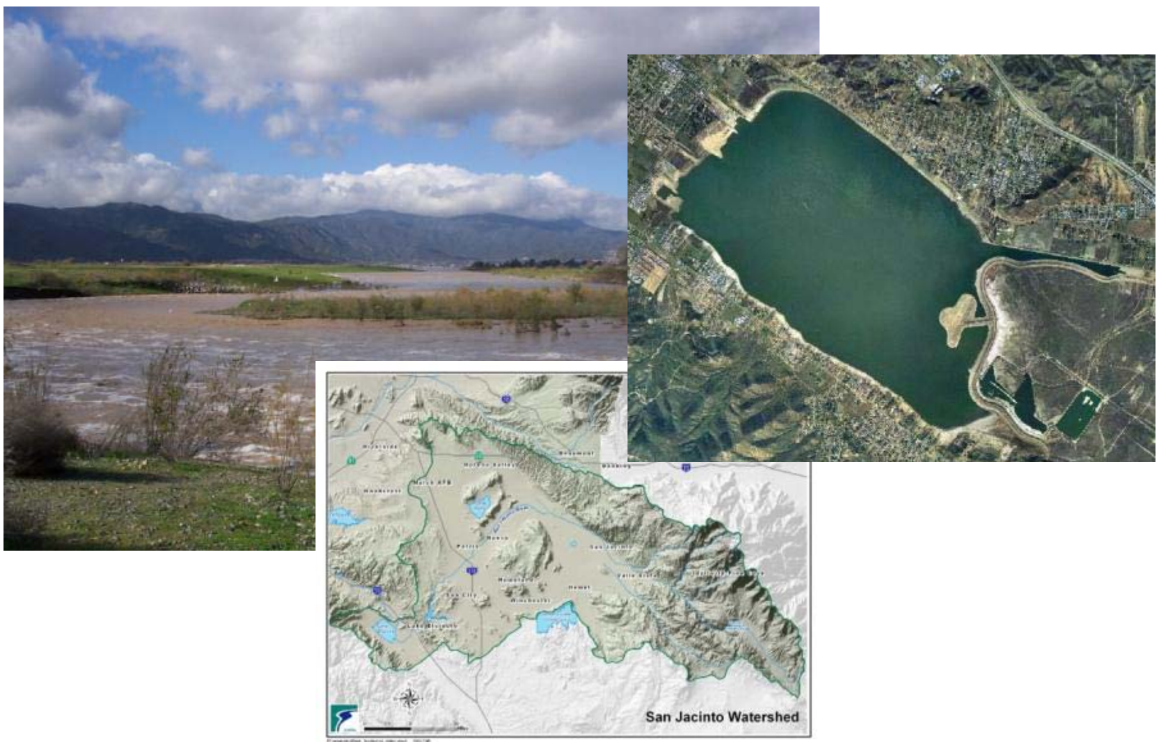
Lake Elsinore & Canyon Lake Nutrient TMDL Annual Water Quality Report

July 2009 – June 2010

Final Report



August 2010

Prepared for:
Santa Ana Regional Water Quality Control Board

Prepared by:
Lake Elsinore & Canyon Lake Nutrient TMDL Task Force

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1.0 Introduction

In 1994, 1998, and again in 2002, Lake Elsinore and Canyon Lake were identified by the California Regional Water Quality Control Board, Santa Ana Region (Regional Board) on its Clean Water Act Section 303(d) list of impaired waterbodies. Impairments identified for these waters included excessive levels of nutrients in both lakes, as well as, organic enrichment/low dissolved oxygen, sedimentation/siltation, and unknown toxicity in Lake Elsinore and high bacterial indicators in Canyon Lake. The Clean Water Act Section 303(d) requires for waters that do not or are not expected to meet water quality standards (beneficial uses, water quality objectives), a Total Daily Maximum Load (TMDL) be implemented. In 2000, the Regional Board initiated the development of TMDLs for nutrients for Lake Elsinore and Canyon Lake.

Since 2000, local stakeholders, in cooperation with the Regional Board, have been working to identify the source of nutrients impairing each lake, and evaluate the impacts to water quality and beneficial uses incurred from nutrient sources. Stakeholders have participated in watershed-wide annual stormwater quality and flow monitoring supported by Riverside County Flood Control and Water Conservation District (RCFC&WCD), as well as, water quality monitoring of Lake Elsinore and Canyon Lake supported by Elsinore Valley Municipal Water District (EVMWD) and the San Jacinto River Watershed Council (SJRWC). Available grant funding has assisted stakeholders in developing models of the lakes to better understand the lake characteristics, as well as a San Jacinto River Watershed model to simulate the wash off and transport of nutrients to the lakes. In addition, the Lake Elsinore & San Jacinto Watersheds Authority (LESJWA) has preformed numerous studies of each lake, and has started to implement projects that are expected to bring about improvements to in-lake water quality.

In 2004, the Regional Board prepared the Lake Elsinore and Canyon Lake Nutrient TMDL Report. This report framed the stakeholders' monitoring and modeling efforts to characterize in-lake water quality, while providing the basis for recommendations to the Regional Board to consider revisions to the Implementation Plan (Chapter 5 of the Water Quality Control Plan, Santa Ana River Basin 1995 by the Regional Board (Basin Plan)) for incorporating the nutrient TMDLs for Canyon Lake and Lake Elsinore. These recommendations outlined in Resolution No. RB8-2004-0037 required stakeholders to develop management plans and to conduct long-term monitoring and implementation programs aimed at reducing nutrient discharges to Lake Elsinore and Canyon Lake.

In December 2004, Resolution No. RB8-2004-0037 amended the Water Quality Control Plan for the Santa Ana River Basin to incorporate Nutrient Total Maximum Daily Loads for Lake Elsinore and Canyon Lake (Lake Elsinore and Canyon Lake TMDL Amendment). The Regional Board adopted the Resolution, and it was subsequently approved by the U.S. Environmental Protection Agency (US EPA) on September 30, 2005. In July 2006, local stakeholders formed a cost sharing partnership, the Lake Elsinore and Canyon Lake Nutrient TMDL Task Force (Task Force)[1].

[1] Lake Elsinore and Canyon Lake TMDL Task Force members include: the County of Riverside, the City of Beaumont, the City of Canyon Lake, the City of Hemet, the City of Lake Elsinore, the City of Moreno Valley, the City of Murrieta, the City of Perris, the City of Riverside, the City of San Jacinto, Riverside County Flood Control and Water Conservation District, Elsinore Valley Municipal Water District, Western Riverside County Agricultural Coalition acting on behalf of the Agricultural Operators and Dairy Operators in the San Jacinto River Basin, the California Department of Transportation (CalTrans), the California Department of Fish and Game, Eastern Municipal Water District, the U.S. Forest Service in the U.S. Department of Agriculture, March Air Reserve Base – Joint Powers Authority and the U.S. Air Force. Task Force organization and activities are coordinated by the LESJWA.

1.1 TMDL Monitoring and Reporting Requirement

Task 4 of the adopted Lake Elsinore and Canyon Lake TMDL Amendment required stakeholders to prepare and implement a Nutrient Monitoring Program. The program was to include the following:

1. A watershed-wide monitoring program to determine compliance with interim and/or final nitrogen and phosphorus allocations; compliance with the nitrogen and phosphorus TMDL, and load allocations (LAs), including waste load allocations (WLAs).

2. A Lake Elsinore nutrient monitoring program to determine compliance with interim and final nitrogen, phosphorus, chlorophyll *a*, and dissolved oxygen numeric targets. This program will evaluate and determine the relationship between ammonia toxicity and total nitrogen allocation to ensure that the total nitrogen allocation will prevent ammonia toxicity in Lake Elsinore.

3. Canyon Lake nutrient monitoring program to determine compliance with interim and final nitrogen, phosphorus, chlorophyll *a*, and dissolved oxygen numeric targets. The monitoring program will evaluate and determine the relationship between ammonia toxicity and the total nitrogen allocation to ensure that the total nitrogen allocation will prevent ammonia toxicity in Canyon Lake.

4. An annual report summarizing the data collected for the year and evaluating compliance with the TMDL, due August 15 of each year.

This report satisfies the obligation of Task Force stakeholders to submit an annual report summarizing the data collected for the year and evaluates compliance with the TMDL for the Canyon Lake and Lake Elsinore nutrient TMDLs.

1.2 Phased Monitoring Approach

LESJWA, in support of the Task Force, provided funding to meet this requirement by developing a single comprehensive nutrient monitoring plan, The Lake Elsinore and Canyon Lake Nutrient TMDL Monitoring Plan, included as Appendix A. This plan considered a phased monitoring approach, described in the following paragraphs, to account for significant gaps in information required to understand in-lake and watershed processes. Through this phased approach, the Task Force stakeholders were able to develop a priority schedule for addressing data gaps. This enabled stakeholders to focus on the most prominent data gaps and limitations to the nutrient TMDL calculation, while performing an agreed upon level of monitoring to remain consistent with the Basin Plan requirements to track compliance with TMDLs and associated LAs.

The Lake Elsinore and Canyon Lake Nutrient TMDL Monitoring Plan was approved by the Regional Board in March 2006, and was subsequently implemented by the TMDL Task Force. The Task Force is currently implementing Phase 1 of this approach.

Phase 1 – Intensive Lake Study

Phase 1 focuses on data issues regarding in-lake processes and the "linkage analysis" relating external pollutant loading to in-lake response and associated nutrient concentrations compared to numeric water quality targets. The TMDL calculation was not well understood, but was known to have a direct influence on the assessment of the required external load reductions to the lake. Due to the intricacies involved with this process, Phase 1 was scheduled to occur over a two- to three-year period, depending on the completion of in-lake studies and the amount of data collected. Since the implementation schedule of the Lake Elsinore and Canyon Lake Nutrient TMDL allows for re-evaluation of the TMDL once every three years, it is envisioned that the results of the Phase 1 Monitoring Program will be used to review and revise the Nutrient TMDL. As such, LAs to each lake cannot be adequately assessed until the completion of Phase 1. In accordance with the approved monitoring plan, once LAs are determined for each lake, a more intensive study for the watershed will be conducted as part of Phase 2.

Phase 2 – Intensive Watershed Study

Phase 2 accommodates use of available monetary and staffing resources for conducting an intensive study of the watershed that addresses compliance monitoring, as well as key data gaps needed in understanding external nutrient source contributions from the watershed. The data collection strategy, outlined in Phase 2, includes the incorporation of additional TMDL and flow monitoring stations to assist in addressing watershed data gaps. In allowing the opportunity to allocate resources as they become available, special studies that further address data gaps and advance understanding of hydrology, pollutant sources, and transport processes within the watershed can be pursued more feasibly. Completion of Phase 2 of the approved monitoring program will enable the prediction of more reliable internal and external watershed loading via the update of historical models.

Phase 3 – Compliance Monitoring

Phase 3, or the compliance monitoring phase, is proposed to begin upon completion of the intensive data collection efforts of Phases 1 and 2. It is proposed that this monitoring phase consist of an agreed upon base level of in-lake and watershed compliance monitoring determined after many of the data gaps have been addressed. For more information pertaining to the Phased Program, please refer to the Lake Elsinore and Canyon Lake Nutrient TMDL Monitoring Plan prepared by Tetra Tech, Inc.

2.0 San Jacinto River Watershed Nutrient TMDL Monitoring Program

In 2009-10, Brown and Caldwell supported the Task Force effort by coordinating and guiding the Phase 1 San Jacinto Watershed Monitoring Program sampling activities. Under their direction, samples are collected at four designated monitoring stations throughout the San Jacinto River Watershed, including Lake Elsinore and Canyon Lake, during mandated rain events[2].

March Air Reserve Base (March ARB) is currently working on an agreement with RCFC&WCD to monitor water quality at an outfall located on RCFC&WCD property immediately upstream of the base. This monitoring, however, is not scheduled to begin until Phase 2 of the Lake Elsinore and Canyon Lake Nutrient TMDL Monitoring Program.

In addition to this effort, the San Bernardino National Forest (SBNF), in accordance with their agreement for in-lieu obligations to the Lake Elsinore and Canyon Lake TMDL Task Force, conducts water sampling at the Cranston Guard Station site on the San Jacinto River. This work, also described in this report, is dependent on sufficient funds being allocated by Congress to complete the work.

The objectives of the Phase 1 San Jacinto River Watershed Monitoring Program are as follows:

1. Determine the total nutrient loads into Lake Elsinore and Canyon Lake from their tributaries (i.e., the San Jacinto River, Salt Creek, and Cottonwood Creek).

2. Determine the total nutrient load from various sources categorized by land use types, namely, agricultural, urban runoff, and open space sources. The sources drain into the above-mentioned tributaries. These tributaries drain into Canyon Lake and Lake Elsinore.

3. Provide water quality data for watershed model updates.

4. Provide water quality data to evaluate TMDL compliance with WLAs and LAs.

2.1 Revisions to the San Jacinto Watershed Monitoring Program

TMDL compliance monitoring for the San Jacinto Watershed follows the guidelines detailed in the 2008 Lake Elsinore and Canyon Lake TMDL Compliance Program, San Jacinto River Watershed Storm Water Sampling Analysis Plan prepared by Brown and Caldwell, included on CD as Appendix B and the Lake Elsinore and Canyon Lake Nutrient TMDL Monitoring Sampling and Analysis Plan prepared by the U.S. Forest Service (USFS), included on CD as Appendix C.

In order to coordinate with other monitoring program requirements and to minimize the number of RCFC&WCD staff deployed during sampling events, the sampling activities were coordinated by the outside consultant Brown and Caldwell (BC) for the reporting period of July 2009 through June 2010. Sampling activities involve the collection and analysis of a series of grab samples across the storm event hydrograph. Laboratory services were provided by Edward S. Babcock and Sons, Inc.

The monitoring plan sets a yearly goal of sampling at least three qualifying storm events. Ultimately, the weather determines the number of possible storm events.

[2] A mandated rain event is designated as any event sufficient enough to result in runoff during daylight hours.

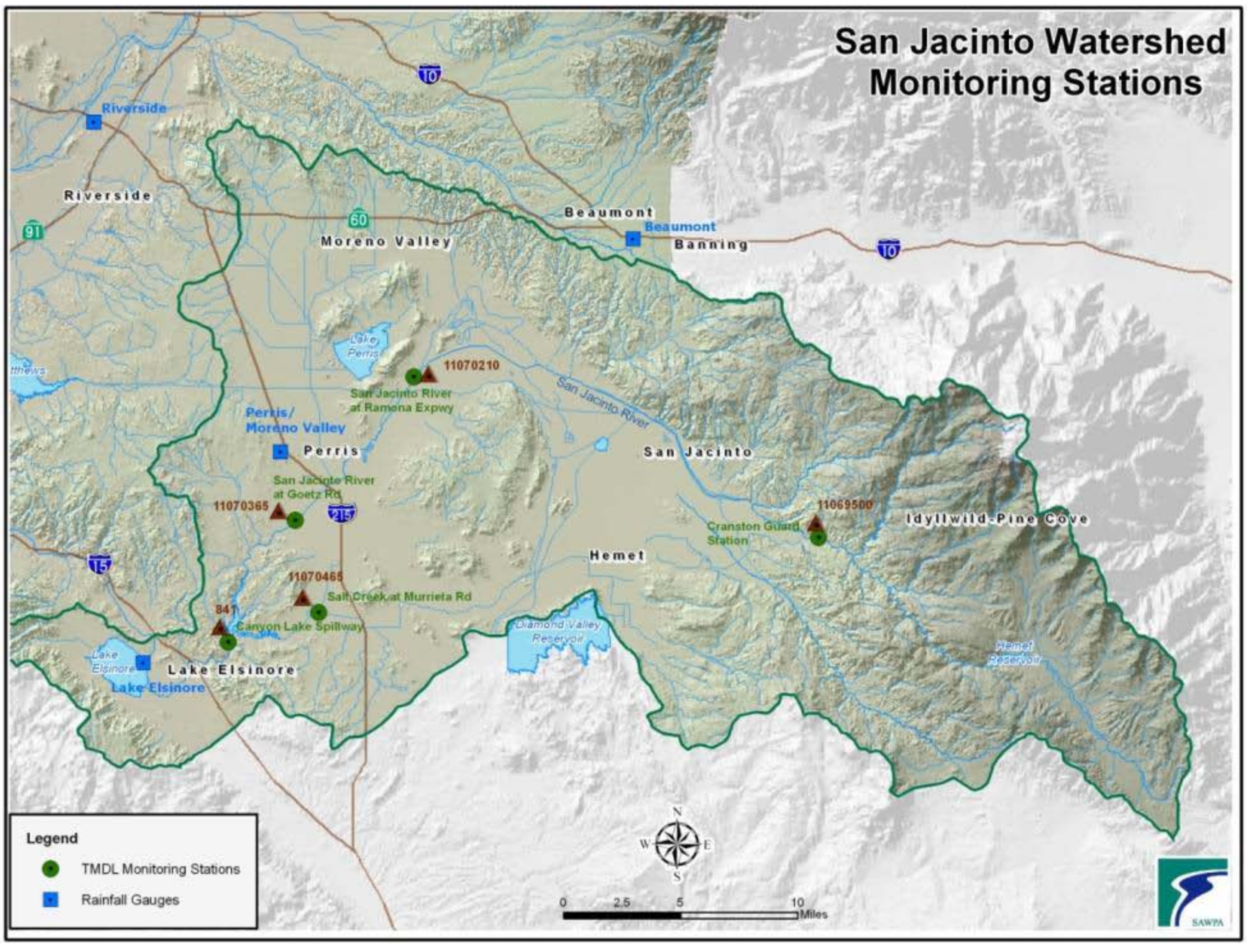
2.2 Sampling Stations

To monitor TMDL compliance, five sampling stations were carefully selected to reflect various types of land uses within the watershed. Sampling station locations were deliberately setup to be within the vicinity of United States Geological Survey (USGS) or RCFC&WCD stream gauge stations. The sampling stations are listed in **Table 2-1** below and shown on **Figure 2-1**.

Table 2-1. Phase 1 San Jacinto River Watershed Monitoring Stations

Station ID	Site Number and Location Description
745	Site 3 - Salt Creek at Murrieta Road
759	Site 4 - San Jacinto River at Goetz Road
741	Site 6 - San Jacinto River at Ramona Expressway
841	Site 30 - Canyon Lake Spillway
792	Site 1 - San Jacinto River at Cranston Guard Station

Figure 2-1. Phase I San Jacinto River Watershed Monitoring Stations



All samples collected from the sampling station at Canyon Lake Spillway (Station ID 841) will only be analyzed if the nearby upstream dam overflows. Likewise, all samples collected from the sampling station at San Jacinto River at Ramona Expressway (Station ID 741) will only be analyzed if the upstream Mystic Lake overflows. The sampling station at Cranston Guard Station (Station ID 792) was directly handled by the USFS.

A summary of the 2009-10 monitoring and lab analysis are presented in Section 2.6 for each station.

2.3 Stream Gauge Stations and Records

The USGS and RCFC&WCD monitor stream flow from a number of gauging stations in the San Jacinto River Watershed. Stream gauging stations maintained and operated for Phase 1 of the San Jacinto Watershed Monitoring Program are shown in **Figure 2-1** and identified in **Table 2-2**.

Table 2-2. Phase 1 Stream Gauge Stations

Station ID	Agency	Stream Gauge Proximity to Sampling Station
11070465	USGS	Site 3 - Salt Creek at Murrieta Road
11070365	USGS	Site 4 - San Jacinto River at Goetz Road
11070210	USGS	Site 6 - San Jacinto River at Ramona Expressway
11069500	USGS	Site 30 - Canyon Lake Spillway
841 or 11070500	RCFC&WCD or USGS	Site 1 - San Jacinto River at Cranston Guard Station

The data record captured per USGS stream gauge is publicly available at the following website:

http://nwis.waterdata.usgs.gov/ca/nwis/dv/

A summary of the stream gauge data recorded at each of these five stations for the monitoring period of July 1, 2009 through June 30, 2010 is presented in **Table 2-3** and visually presented in **Figure 2-2**. Most of the data provided by the USGS is presented as provisional data. This data is reviewed periodically to ensure accuracy. The USGS station 11070210 stopped recording data after September 30, 2009 as the single measurable parameter (flow) was consistently zero. The appropriate figure presents the cessation of data recording by the abrupt ending of the Daily Mean Discharge.

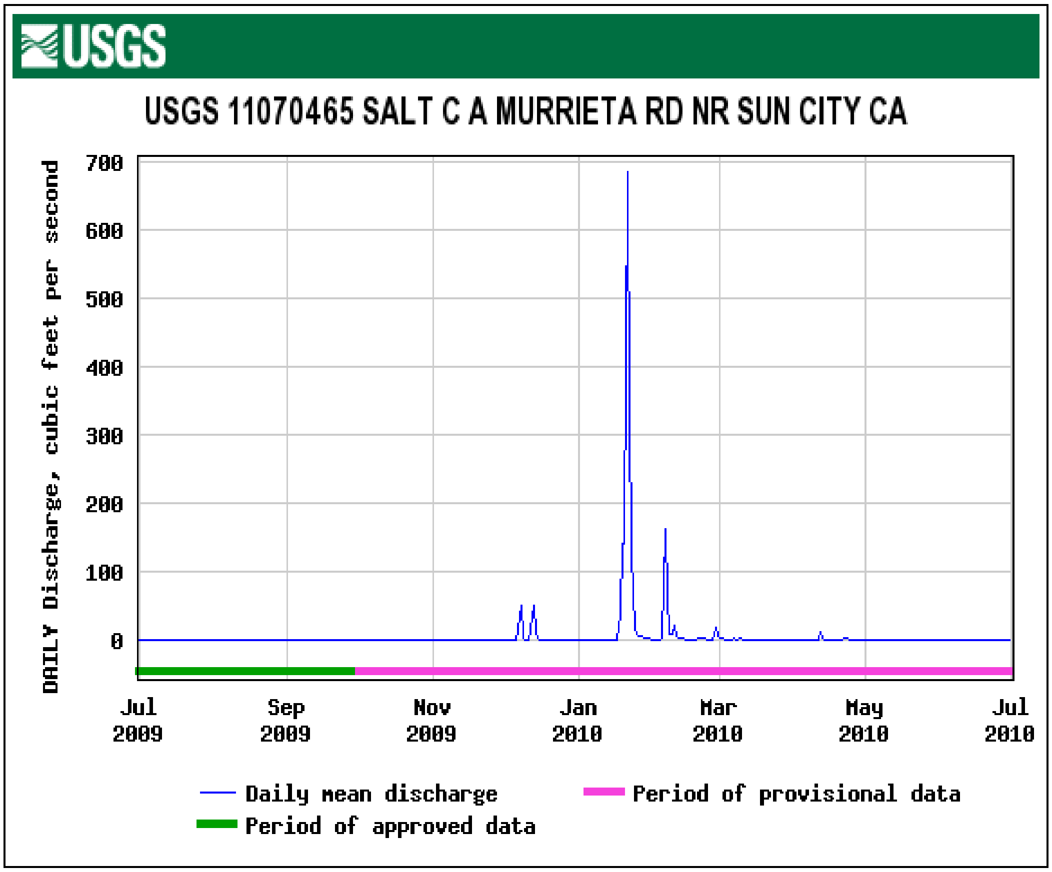
The complete set of stream gauge data is included on CD as Appendix D.

Table 2-3. Summary – Stream Gauge Data (July 2009 to June 2010)

Mean Monthly Flow (cfs)	11070465	11070365	11070210	11069500	11070500
Jul	0.00	0.00	0	0.05	0.01
Aug	0.00	0.00	0	0.01	0.00
Sep	0.00	0.00	0	0.08	0.00
Oct	0.00*	0.00*	Station stopped recording data for the yearly water period.	0.05*	0.31*
Nov	0.00*	0.00*		0.01*	0.58*
Dec	5.19*	9.39*		7.22*	1.43*
Jan	49.96*	113.51*		21.18*	196.26*
Feb	10.99*	10.12*		47.70*	13.92*
Mar	0.31*	0.50*		29.67*	4.20*
Apr	0.54*	2.49*		30.71*	1.00*
May	0.00*	0.00*		17.39*	0.53*
Jun	0.00*	0.00*		4.83*	0.29*
Mean Annual Flow (cfs)	**5.58**	**11.33**	**0.00**	**13.24**	**18.21**

* Data reported as provisional.

Figure 2-2. Daily Stream Gauge Records (July 2009 to June 2010)



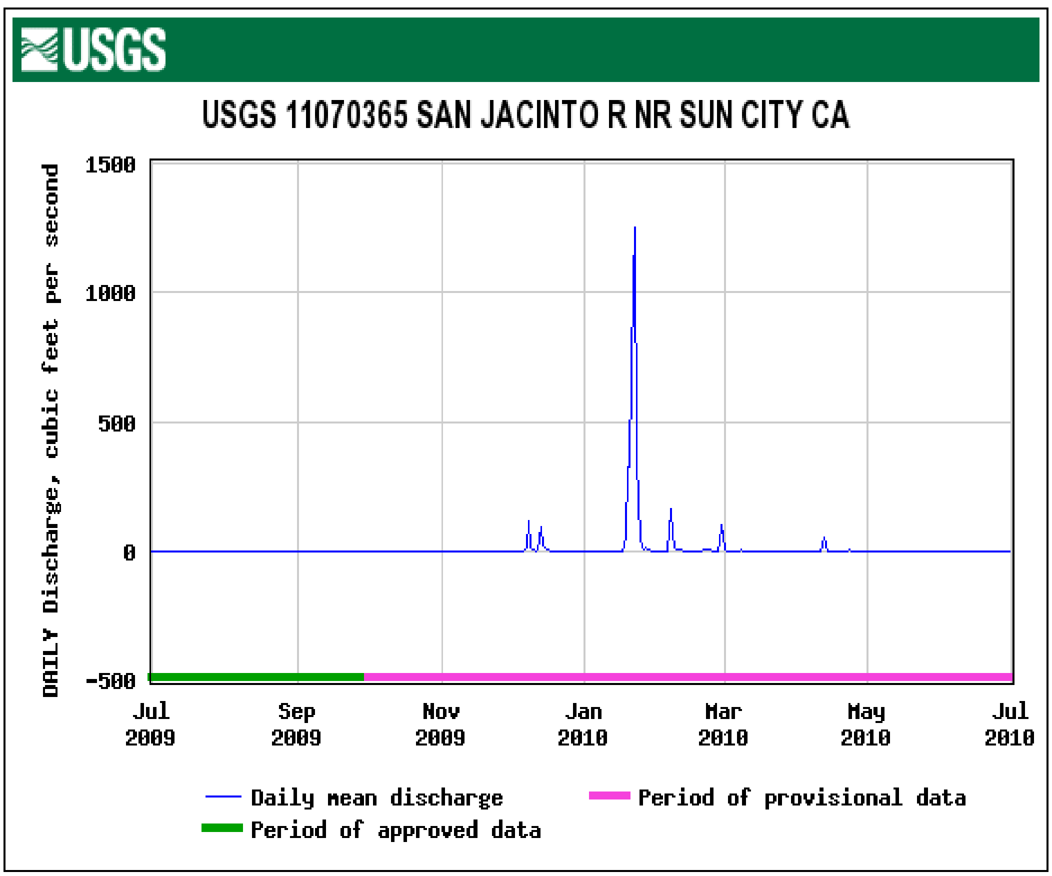
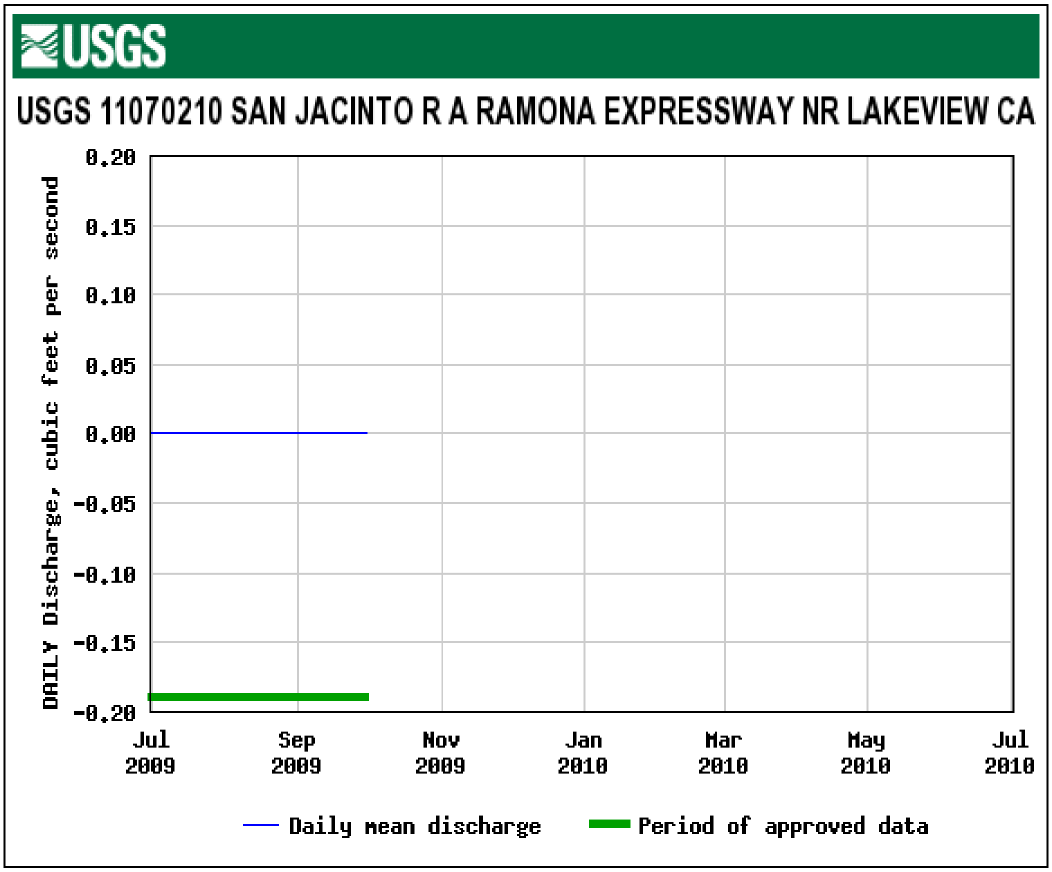
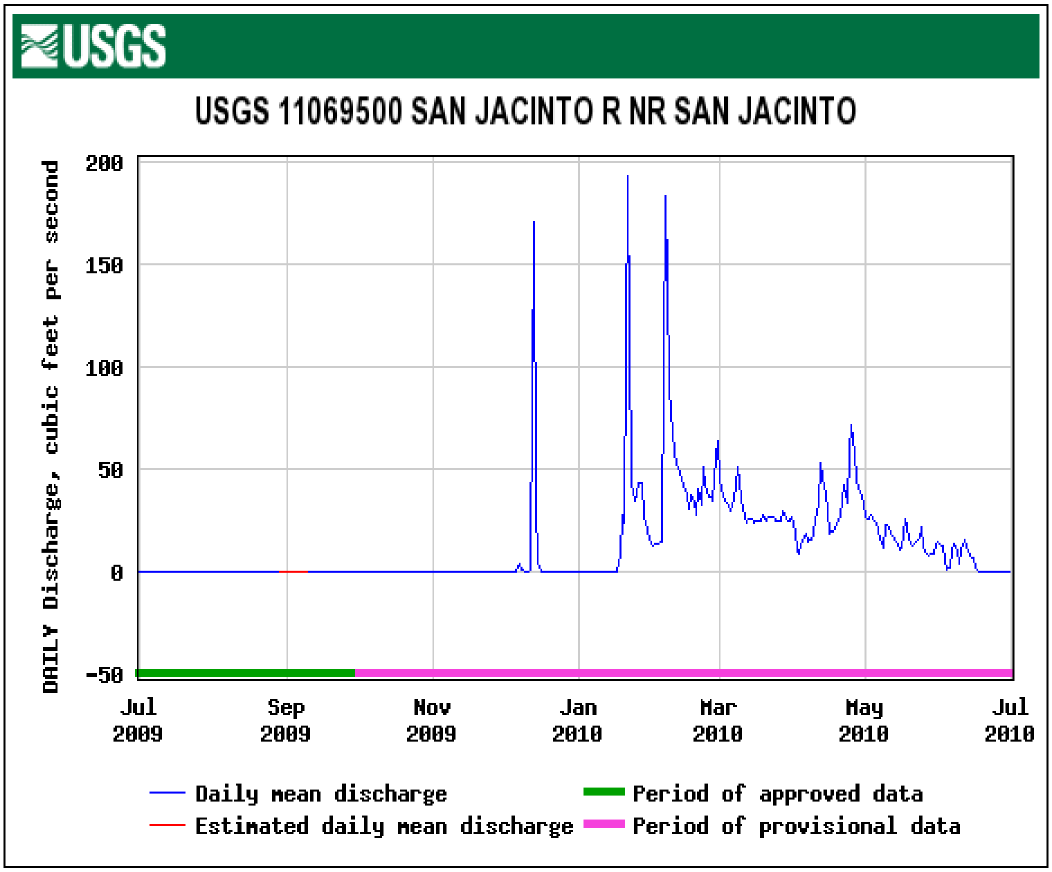


Figure 2-2 cont. Daily Stream Gauge Records for July 2009 to June 2010





2.4 Sampling Strategy

The sampling strategy is intended to result in the collection of at least eight samples collected across the entire spectrum of the storm event hydrograph. Eight to twelve representative samples collected during both the rising and falling limbs of the hydrograph are sent to the laboratory for analysis.

The following protocols were applied:

- Sampling commences once flow is established in the channel.
- Automatic samplers at utilized at all stations except San Jacinto River at Ramona Expressway (Station ID 741). The time-based frequency of grab samples are estimated and programmed into the device prior to the storm event time-based programmed, depending on the forecasted size of the storm event. Some of the sampling sites may convey flow for extended periods due to the hydrologic response of large tributary drainage areas, resulting in a lengthy period for the falling limb of the hydrograph. Monitoring at these sites may involve collecting samples over longer intervals, for example, every 12 hours over a period of two days or more, to properly distribute the samples across the storm hydrograph.
- In the event a storm event becomes larger than forecasted, such that too many samples are collected, extra samples can be discarded (e.g., analyze every other sample to recover 8 to 12 samples from across the entire hydrograph).

2.4.1 Assessment Review of Sampling Strategy

Sample collection times are plotted across each representative storm hydrograph for visual analysis per each station summary in Section 2.6. The visual assessment concludes that the majority of events successfully obtained at least four samples for each side of the hydrograph. Decisions regarding when to stop sampling were made through discussions with staff at the RCFC&WCD.

2.5 San Jacinto Watershed Monitoring Events

The July 2009 through June 2010 reporting period provided a series of strong storm events. BC staff were able to sample three qualifying storm events to fulfill the mandated goal of three events per year.

The first BC monitoring event occurred from December 12th through the 15th. Peak flows observed by USGS and field staff occurred on December 13th for all stations. Peak flows ranged between 93 cubic feet per second (cfs) recorded at San Jacinto River at Goetz Road (Station ID 759) and 128 cfs at Salt Creek at Murrieta Road (Station ID 745). There were no significant flows recorded at either the San Jacinto River at Ramona Expressway (Station ID 741) or Canyon Lake Spillway (Station ID 841) stations. There were no flows exiting Canyon Lake as a result of this storm.

The second BC monitoring event occurred from January 17th through the 25th. Peak flows observed by USGS and field staff varied per station, peaking at 688 cfs on January 21st for Salt Creek at Murrieta Road (Station ID 745), peaking at 1282 cfs on January 22nd for San Jacinto River at Goetz Road (Station ID 759) and peaking at 832 cfs on January 22nd for Canyon Lake Spillway (Station ID 841). The spill elevation (1381.6 ft) at Canyon Lake Dam was reached during the storm and began spilling on January 20th. Measurable flows were witnessed at San Jacinto River at Ramona Expressway (Station ID 741); however, the field crew determined that the flow did not originate from Mystic Lake, and so did not warrant further sample collection or analysis.

The first USFS monitoring event occurred from January 17th through the 25th, peaking at 172 cfs on January 21st for the Cranston Guard Station (Station ID 792).

The third BC monitoring event occurred from February 5th through the 8th. Peak flows observed by USGS and field staff occurred on February 6th for all stations. Peak flows ranged between 153 cfs recorded at San Jacinto River at Goetz Road (Station ID 759) and 162 cfs at Salt Creek at Murrieta Road (Station ID 745). The spill elevation (1381.6 ft) at Canyon Lake Dam was reached during the storm and began spilling on February 5th. As such, sample collection occurred at the Canyon Lake Spillway (Station ID 841). There were no significant flows recorded at the San Jacinto River at Ramona Expressway (Station ID 741).

2.6 San Jacinto Watershed Annual Water Quality Summary

As described in the previous section, water quality is measured for storm events at the five Phase 1 watershed compliance monitoring locations for the San Jacinto River Watershed. A summary of water quality monitoring data for each of the five monitoring locations for the period July 1, 2009 through June 30, 2010, is presented below. The complete set of water quality data for the period July 2009 through June 2010 is included on CD as Appendix D.

Included per each station summary, and when available flow data exist, is an estimate of annual nutrient loadings (total nitrogen and total phosphorus). For this report, nutrient loadings were estimated based upon the mean nutrient concentration (range) and an estimate of the annual storm volume passing through the respective stream gauge. The total annual flow volumes were estimated by multiplying each daily flow (cfs) during the monitoring period by 24 hours for a daily volume (gallons), and calculating the summation of all daily volumes over the course of the monitoring year.

2.6.1 Summary of Monitoring Data – Salt Creek at Murrieta Road

Water quality was measured for three storm events at the Salt Creek at Murrieta Road (Station ID 745). Data for the first storm event are presented in **Table 2-4** and **Figure 2-3,** data for the second storm event are presented in **Table 2-5** and **Figure 2-4**, and data for the third storm event are presented in and **Table 2-6** and **Figure 2-5**. The figures were developed based on daily flow values provided by the nearby USGS stream gauge (ID# 11070465), and peak hours determined by observations of the automatic equipment installed at the site. Total annual flow at this gauge was estimated using a total average flow of 1,983 cfs or 1,282 million gallons.

Mean storm concentrations for nutrients estimated for the three storm events range from 1.54 to 1.9 mg/L for total nitrogen, and 0.61 to 0.99 milligrams per liter (mg/L) for total phosphorus. As such, the estimated annual nutrient loadings ranging between 16,477 to 20,328 lbs. of nitrogen and 6,526 to 10,592 lbs. of phosphorus.

The second storm event caused severe erosion to the foundation of the equipment station. Neither the equipment nor the foundations were damaged. As a temporary fix, BC field personnel used surrounding stones, gravel and soil to prevent further erosion. Additionally, a large tree became caught at the bridge inlet. This did not affect the automatic sampling intake.

January 22, 2010 – Tree debris at bridge and severe erosion to foundation.

Figure 2-3. December 12 through 14 Sampling Event - Salt Creek at Murrieta Road

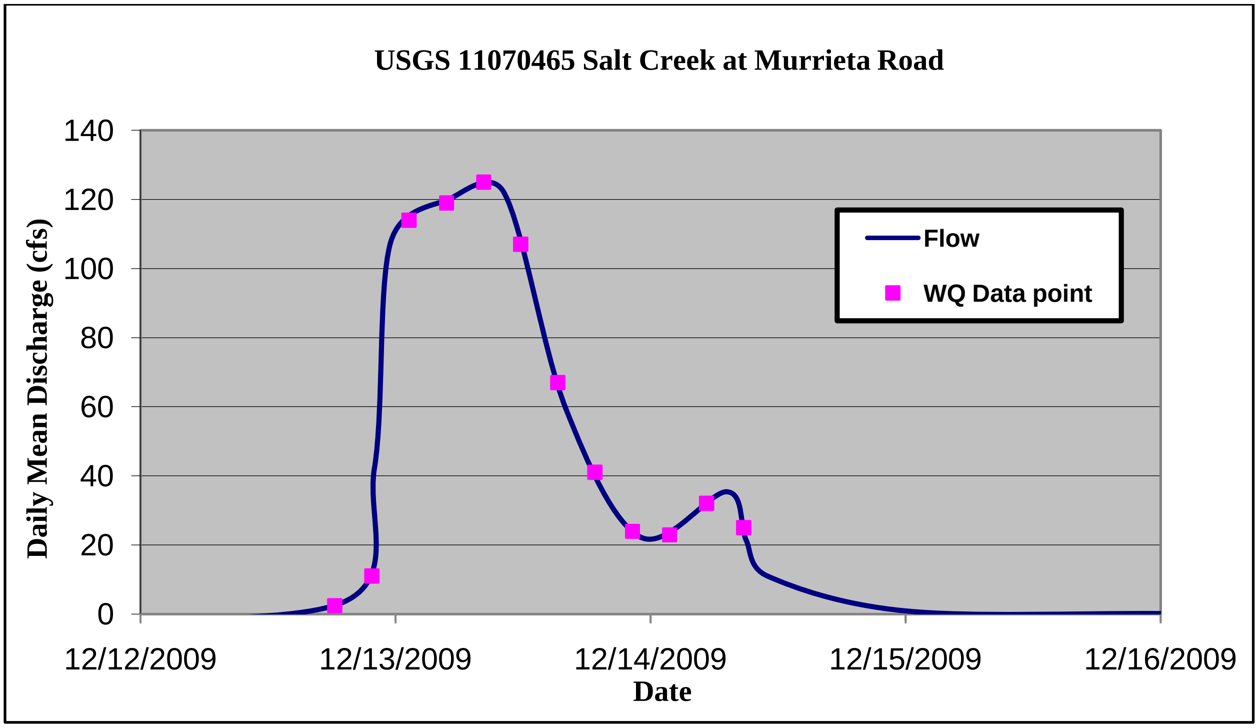


Table 2-4. Salt Creek at Murrieta Road Water Quality Data – First Storm Event

Parameters	units	Avg	Std Dev	count	First Storm Event Sampled (12/12/09 through 12/14/09)											
					12/12	12/12	12/13	12/13	12/13	12/13	12/13	12/13	12/13	12/14	12/14	12/14
					18:16	21:46	01:16	04:46	08:16	11:46	15:16	18:46	22:16	01:46	05:16	08:46
Total Hardness	mg/L	**194**	**68**	12	87	87	76	220	260	240	240	230	230	230	220	210
Calcium (Ca)	mg/L	**50**	**17**	12	24	23	20	55	64	60	60	59	60	58	58	55
Magnesium (Mg)	mg/L	**16.8**	**6.3**	12	6.7	6.9	6.1	20	23	21	21	20	20	20	19	18
nitrate nitrogen (NO3-N)	mg/L	**0.77**	**0.10**	12	1.0	0.69	0.59	0.83	0.75	0.74	0.75	0.78	0.80	0.71	0.80	0.81
total dissolved solids (TDS)	mg/L	**453**	**159**	12	210	210	160	500	590	550	550	540	540	530	530	530
total suspended solids (TSS)	mg/L	**74**	**61**	12	10	36	85	170	210	110	63	36	47	38	40	38
chemical oxygen demand (COD)	mg/L	**67**	**31**	12	130	45	58	110	27	53	53	96	51	51	47	78
Turbidity	NTU	**59**	**22**	12	33	37	58	120	63	61	49	43	61	60	64	58
Nitrite nitrogen (NO2-N)	mg/L	**0.05**	**0.02**	12	0.05	0.03	0.04	0.09	0.05	0.050	0.05	0.05	0.04	0.050	ND	0.040
Ammonia nitrogen (NH4-N)	mg/L	**0.44**	**0.15**	12	0.25	0.2	0.28	0.73	0.58	0.52	0.46	0.46	0.42	0.43	0.43	0.53
Inorganic nitrogen (Calculation)	mg/L	**1.3**	**0.2**	12	1.3	0.9	0.9	1.7	1.4	1.3	1.3	1.3	1.3	1.2	1.2	1.4
Kjeldahl nitrogen	mg/L	**1.9**	**0.5**	12	1.6	1.3	1.5	3.2	2.2	2.0	1.9	2.0	2.1	1.8	1.6	1.4
Soluble reactive phosphorus (SRP/ortho-P)	mg/L	**0.44**	**0.13**	12	0.27	0.25	0.39	0.77	0.54	0.45	0.43	0.46	0.44	0.44	0.43	0.43
Total phosphorus (TP)	mg/L	**0.61**	**0.17**	12	0.38	0.4	0.47	1.0	0.78	0.65	0.60	0.62	0.60	0.59	0.60	0.59
biochemical oxygen demand (BOD)	mg/L	**11**	**-**	1	-	-	-	-	-	11	-	-	-	-	-	-
pH (Field Test)	pH Units	**8.36**	**0.18**	12	8.84	8.48	8.4	8.11	8.20	8.24	8.32	8.36	8.26	8.33	8.35	8.37
Temperature (Field Test)	ºC	**11.7**	**0.3**	12	11.4	11.6	11.6	11.7	11.9	12.1	12.1	12.1	11.7	11.1	11.4	11.5
Conductivity (Field Test)	mS/cm	**0.752**	**0.271**	12	0.365	0.328	0.268	0.809	0.916	0.990	1.000	0.990	0.782	0.869	0.862	0.850
Dissolved Oxygen (Field Test)	mg/L	**6.69**	**0.07**	12	6.54	6.77	6.68	6.74	6.71	6.74	6.7	6.59	6.75	6.68	6.71	6.71

Figure 2-4. January 20 through 22 Sampling Event - Salt Creek at Murrieta Road

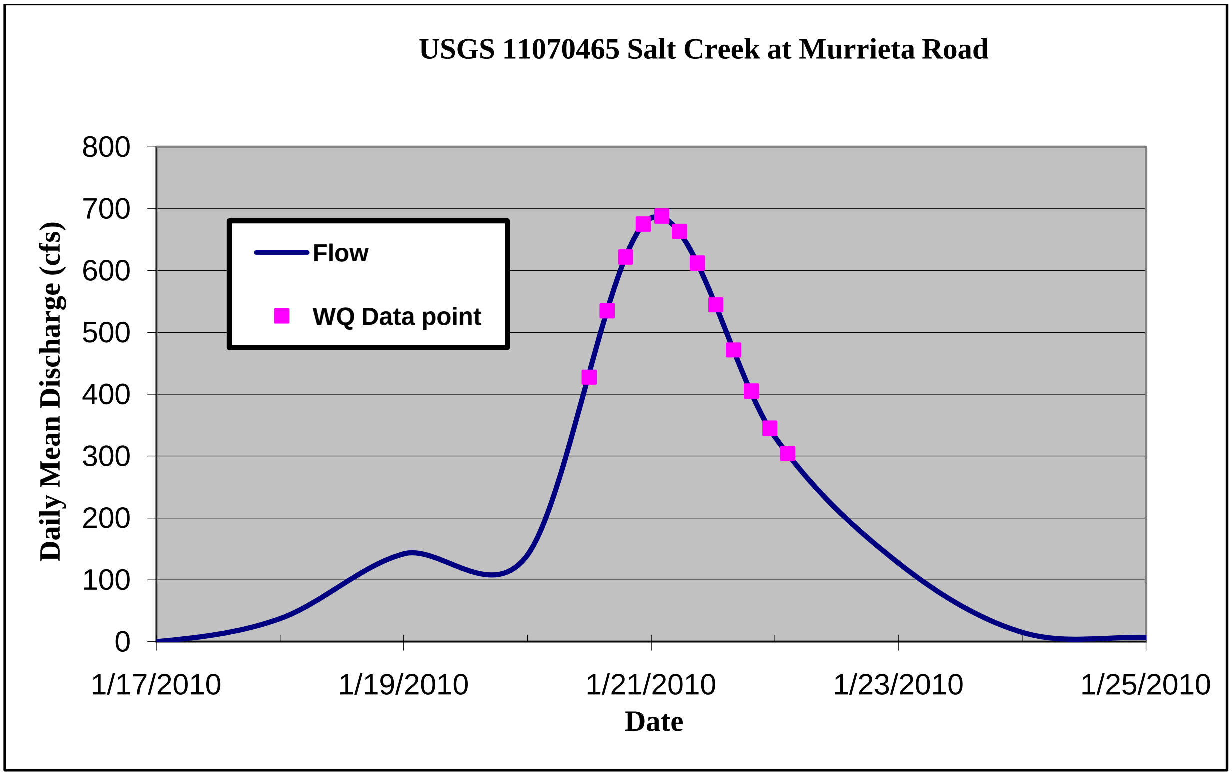


Table 2-5. Salt Creek at Murrieta Road Water Quality Data – Second Storm Event

Parameters	units	Avg	Std Dev	count	Second Storm Event Sampled (1/20/10 through 1/22/10)											
					1/20	1/20	1/20	1/20	1/21	1/21	1/21	1/21	1/21	1/21	1/21	1/22
					12:00	15:30	19:00	22:30	02:00	05:30	09:00	12:30	16:00	19:30	23:00	02:30
Total Hardness	mg/L	**135**	**48**	12	180	170	47	110	180	140	93	62	190	170	150	130
Calcium (Ca)	mg/L	**33**	**11**	12	46	43	12	26	43	36	23	16	44	40	33	28
Magnesium (Mg)	mg/L	**13**	**5**	12	16	15	4.2	10	16	13	8.2	5.4	19	18	16	13
nitrate nitrogen (NO3-N)	mg/L	**0.59**	**0.14**	12	0.68	0.86	0.43	0.68	0.63	0.70	0.54	0.45	0.59	0.45	0.43	0.68
total dissolved solids (TDS)	mg/L	**273**	**108**	12	410	360	86	250	380	310	200	100	400	300	250	230
total suspended solids (TSS)	mg/L	**258**	**164**	12	670	130	130	300	150	140	120	110	340	350	310	350
chemical oxygen demand (COD)	mg/L	**69**	**34**	12	58	42	38	80	67	42	53	44	160	67	85	87
Turbidity	NTU	**227**	**128**	12	210	220	110	220	220	180	120	110	430	380	450	70
Nitrite nitrogen (NO2-N)	mg/L	**0.02**	**0.02**	12	0.040	0.070	0.020	0.040	0.020	0.030	0.030	ND	ND	ND	ND	ND
Ammonia nitrogen (NH4-N)	mg/L	**0.12**	**0.07**	12	0.083	0.13	0.15	0.26	0.14	0.14	0.17	0.15	0.14	ND	ND	ND
Inorganic nitrogen (Calculation)	mg/L	**0.7**	**0.2**	12	0.8	1.1	0.6	1.0	0.8	0.9	0.7	0.6	0.7	0.5	0.4	0.7
Kjeldahl nitrogen	mg/L	**1.64**	**0.89**	12	1.3	1.2	0.650	2.6	2.0	1.2	1.5	1.1	4.0	1.6	1.2	1.3
Soluble reactive phosphorus (SRP/ortho-P)	mg/L	**0.44**	**0.17**	12	0.37	0.34	0.21	0.68	0.52	0.41	0.42	0.32	0.80	0.36	0.32	0.50
Total phosphorus (TP)	mg/L	**0.99**	**0.57**	12	0.75	0.62	0.40	1.3	1.0	0.77	0.67	0.58	2.6	1.0	0.98	1.2
biochemical oxygen demand (BOD)	mg/L	**10**	**-**	1	-	-	-	-	10	-	-	-	-	-	-	-
pH (Field Test)	pH Units	**8.50**	**0.14**	12	8.38	8.34	8.81	8.48	8.43	8.48	8.57	8.60	8.31	8.44	8.54	8.57
Temperature (Field Test)	ºC	**9.3**	**1.3**	12	10.9	10.4	10.3	10.5	10.1	10.1	10.4	7.7	7.5	8.0	8.1	8.1
Conductivity (Field Test)	mS/cm	**0.392**	**0.152**	12	0.584	0.521	0.129	0.328	0.532	0.458	0.303	0.174	0.571	0.461	0.345	0.302
Dissolved Oxygen (Field Test)	mg/L	**5.49**	**0.06**	2	-	-	-	-	-	-	5.44	-	-	-	-	5.53

Figure 2-5. February 5 through 8 Sampling Event - Salt Creek at Murrieta Road

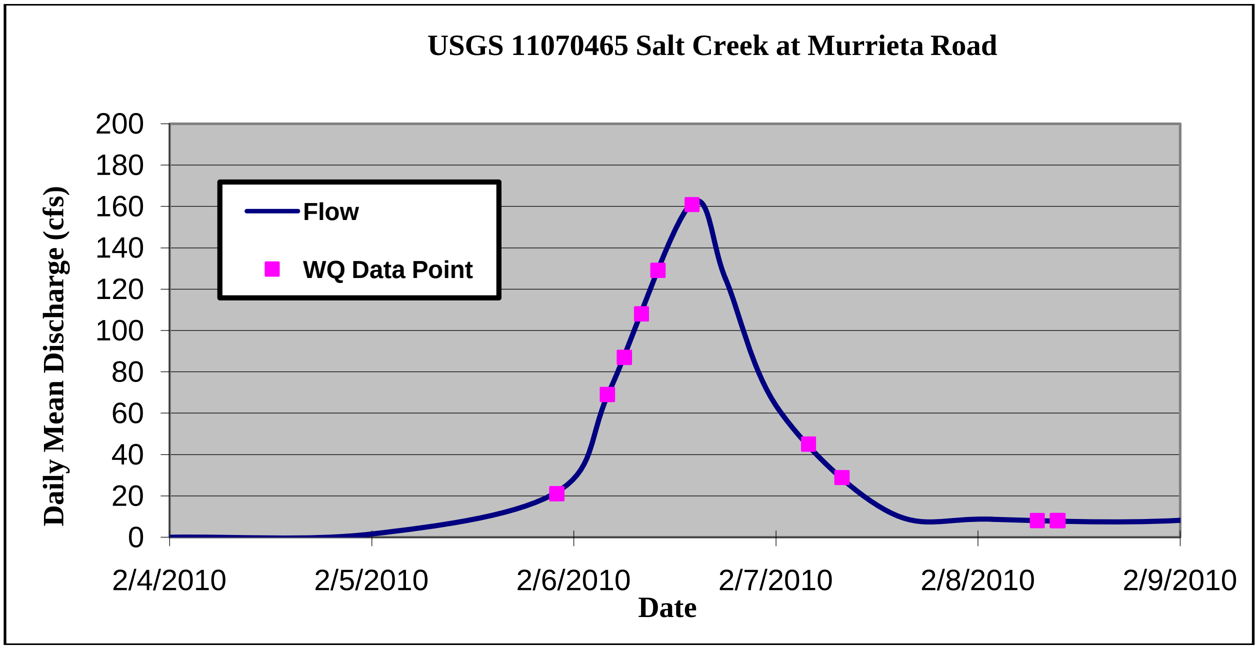


Table 2-6. Salt Creek at Murrieta Road Water Quality Data – Third Storm Event

Parameters	units	Avg	Std Dev	count	Third Storm Event Sampled (2/5/10 through 2/8/10)									
					2/5	2/6	2/6	2/6	2/6	2/6	2/7	2/7	2/8	2/8
					22:00	04:00	06:00	08:00	10:00	14:00	03:50	07:50	07:50	09:25
Total Hardness	mg/L	**121**	**52**	10	48	67	76	65	140	200	160	150	150	150
Calcium (Ca)	mg/L	**30**	**13**	10	13	17	18	17	36	49	40	38	37	37
Magnesium (Mg)	mg/L	**11**	**5**	10	3.7	5.7	7.2	5.6	13	18	15	14	13	13
nitrate nitrogen (NO3-N)	mg/L	**0.56**	**0.14**	10	0.90	0.70	0.56	0.50	0.56	0.50	0.41	0.43	0.54	0.52
total dissolved solids (TDS)	mg/L	**265**	**116**	10	96	130	180	140	300	400	390	360	320	330
total suspended solids (TSS)	mg/L	**165**	**128**	10	130	290	260	130	310	360	24	44	51	50
chemical oxygen demand (COD)	mg/L	**60**	**19**	10	89	71	56	35	67	87	62	47	38	47
Turbidity	NTU	**142**	**66**	10	120	210	230	110	180	230	52	64	110	110
Nitrite nitrogen (NO2-N)	mg/L	**0.04**	**0.06**	10	0.020	0.060	0.20	0.030	0.040	0.030	ND	ND	ND	0.020
Ammonia nitrogen (NH4-N)	mg/L	**0.26**	**0.16**	10	0.56	0.38	0.31	0.37	0.27	0.35	0.069	0.076	0.11	0.14
Inorganic nitrogen (Calculation)	mg/L	**0.9**	**0.3**	10	1.5	1.1	0.9	0.9	0.9	0.9	0.5	0.5	0.7	0.7
Kjeldahl nitrogen	mg/L	**1.54**	**0.32**	10	1.8	1.9	1.4	1.1	1.9	1.9	1.3	1.6	1.2	1.3
Soluble reactive phosphorus (SRP/ortho-P)	mg/L	**0.40**	**0.14**	10	0.15	0.53	0.42	0.33	0.48	0.66	0.35	0.34	0.35	0.34
Total phosphorus (TP)	mg/L	**0.77**	**0.21**	10	0.48	0.92	0.87	0.54	0.87	1.2	0.67	0.76	0.68	0.70
biochemical oxygen demand (BOD)	mg/L	**ND**	**-**	1	-	-	-	-	-	ND	-	-	-	-
pH (Field Test)	pH Units	**8.06**	**0.52**	6	8.49	8.35	8.35	8.36	7.45	7.34	pH Meter Broke			
Temperature (Field Test)	ºC	**12.0**	**1.1**	10	12.6	12.5	11.8	12.2	12.7	13.3	10.8	11.0	10.0	12.7
Conductivity (Field Test)	mS/cm	**0.424**	**0.190**	10	0.161	0.218	0.212	0.195	0.495	0.648	0.565	0.555	0.538	0.539
Dissolved Oxygen (Field Test)	mg/L	**4.15**	**0.0**	2	-	-	-	-	-	4.15	-	-	-	4.14

2.6.2 Summary of Monitoring Data – San Jacinto River at Goetz Road

Water quality was sampled for three storm events at the San Jacinto River at Goetz Road (Station ID 759). Data for the first storm event are presented in **Table 2-7** and **Figure 2-6,** data for the second storm event are presented in **Table 2-8** and **Figure 2-7** and data for the third storm event are presented in **Table 2-9** and **Figure 2-8**. The figures were developed based on daily flow values provided by the nearby USGS stream gauge (ID# 11070365), and peak hours determined by observations of the automatic equipment installed at the site. Total annual flow at this gauge was estimated using a total average flow of 4,148 cfs or 2,681 million gallons.

Mean storm concentrations for nutrients estimated for the three storm events range from 1.45 mg/L to 3.22 mg/L for total nitrogen and 0.46 mg/L to 1.22 mg/L for total phosphorus. This resulted in estimated annual nutrient loadings of 32,443 to 72,046 lbs. of nitrogen and 10,292 to 27,297 lbs. of phosphorus.

Additional work was performed at this site in January 2010 due to a buildup of vegetation and trash deposits at the sampling intake. Though the equipment was able to continue sample collection while the area was either saturated or still underwater, the deposits compacted upon itself once the storm was over. The average depth of deposit ranged near 4 feet, with a maximum 6 feet at the center bridge column. BC field personnel obtained an encroachment permit from the City of Perris to remove the deposits in order to have a working sampling intake. The combination of a large first storm event and upstream vegetation removal during the dry months of 2009 are the principal causes of the debris deposits.

Visual comparison of pre and post site conditions from the December 12, 2009 storm event.

The second storm event ultimately flooded the bridge along Goetz Road. Vegetation debris was observed wrapped around both guard rails. The monitoring equipment was installed at a lower elevation, and was subsequently overturned within the security box. Though the equipment was not damaged, and continued to function underwater, all of the samples collected during the night were mixed, and thus unusable.

January 22, 2010 – The size and duration of the storm overwhelmed the equipment.

Figure 2-6. December 12 through 14 Sampling Event – Goetz Road

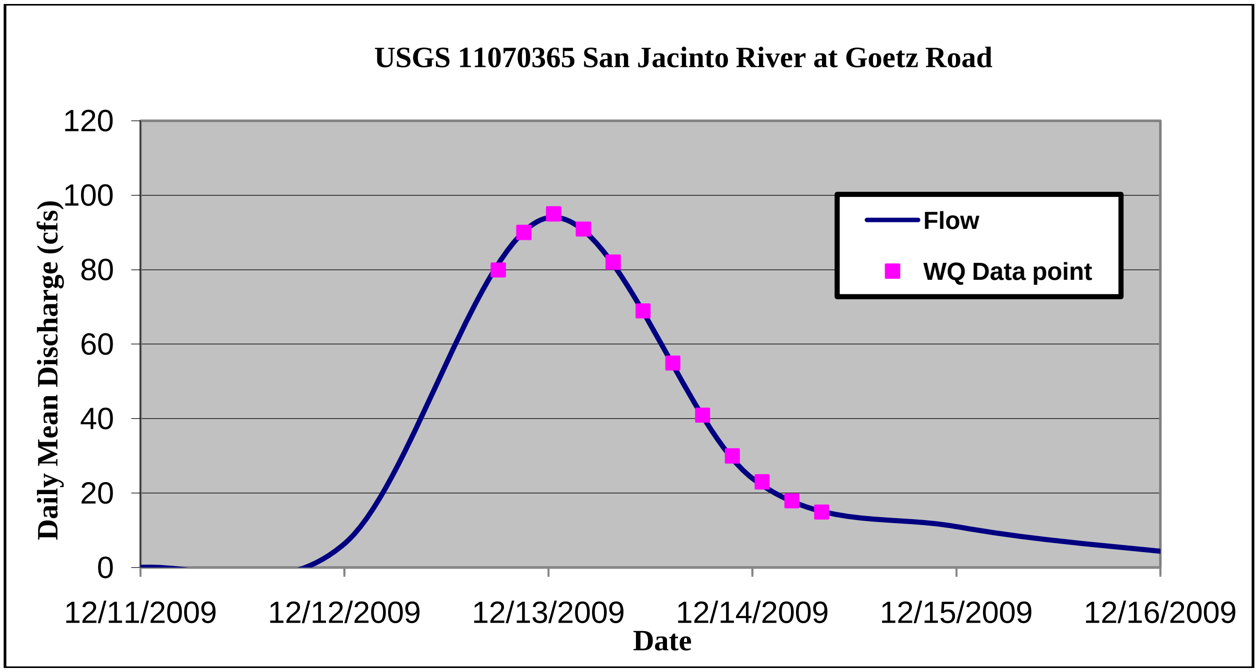


Table 2-7. San Jacinto River at Goetz Road Water Quality Data – First Storm Event

Parameters	units	Avg	Std Dev	count	First Storm Event Sampled (12/12/10 through 12/14/10)											
					12/12	12/12	12/13	12/13	12/13	12/13	12/13	12/13	12/13	12/14	12/14	12/14
					18:06	21:06	00:36	04:06	07:36	11:06	14:36	18:06	21:36	01:06	04:36	08:06
Total Hardness	mg/L	**102**	**16**	12	140	120	95	85	86	91	98	100	100	110	110	90
Calcium (Ca)	mg/L	**30**	**5**	12	40	36	26	23	24	27	29	30	31	33	32	27
Magnesium (Mg)	mg/L	**6.7**	**1.3**	12	10	8.2	7.3	6.6	6.1	5.8	6.1	6.1	5.9	6.3	6.4	5.6
nitrate nitrogen (NO3-N)	mg/L	**0.44**	**0.24**	12	0.82	0.47	0.73	0.67	0.58	0.53	0.34	0.26	0.14	ND	0.22	0.45
total dissolved solids (TDS)	mg/L	**203**	**26**	12	240	230	180	150	180	200	200	210	190	240	210	200
total suspended solids (TSS)	mg/L	**77**	**69**	12	240	160	130	110	60	29	44	40	29	22	28	28
chemical oxygen demand (COD)	mg/L	**62**	**13**	12	69	78	76	69	47	42	51	67	56	67	74	47
Turbidity	NTU	**80**	**47**	12	120	93	170	150	98	57	65	60	43	31	34	39
Nitrite nitrogen (NO2-N)	mg/L	**0.05**	**0.04**	12	0.080	0.14	0.060	0.050	0.040	0.080	0.050	0.040	ND	ND	ND	0.040
Ammonia nitrogen (NH4-N)	mg/L	**0.05**	**0.05**	12	0.17	0.12	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Inorganic nitrogen (Calculation)	mg/L	**0.5**	**0.3**	12	1.1	0.7	0.8	0.7	0.6	0.6	0.3	0.3	ND	ND	0.2	0.5
Kjeldahl nitrogen	mg/L	**1.5**	**0.3**	12	1.9	2.0	1.7	1.8	1.2	1.2	1.4	1.4	1.3	1.4	1.4	1.1
Soluble reactive phosphorus (SRP/ortho-P)	mg/L	**0.20**	**0.05**	12	0.27	0.27	0.24	0.22	0.21	0.22	0.16	0.16	0.14	0.16	0.15	0.23
Total phosphorus (TP)	mg/L	**0.46**	**0.14**	12	0.70	0.62	0.68	0.55	0.45	0.38	0.37	0.37	0.33	0.36	0.36	0.32
biochemical oxygen demand (BOD)	mg/L	**8**	**-**	1	-	8	-	-	-	-	-	-	-	-	-	-
pH (Field Test)	pH Units	**8.22**	**0.13**	12	8.11	8.22	8.4	8.51	8.29	8.29	8.22	8.16	8.19	8.09	8.04	8.15
Temperature (Field Test)	ºC	**12.8**	**0.3**	12	13.1	12.7	12.8	13.0	13.4	13.0	12.9	12.6	12.4	12.3	12.6	13.3
Conductivity (Field Test)	mS/cm	**0.292**	**0.041**	12	0.358	0.352	0.251	0.215	0.252	0.290	0.291	0.282	0.303	0.325	0.301	0.280
Dissolved Oxygen (Field Test)	mg/L	**4.84**	**0.46**	12	5.26	5.18	5.28	5.24	5.20	4.98	5.13	4.92	4.22	4.24	4.22	4.26

Figure 2-7. January 20 through 22 Sampling Event – Goetz Road

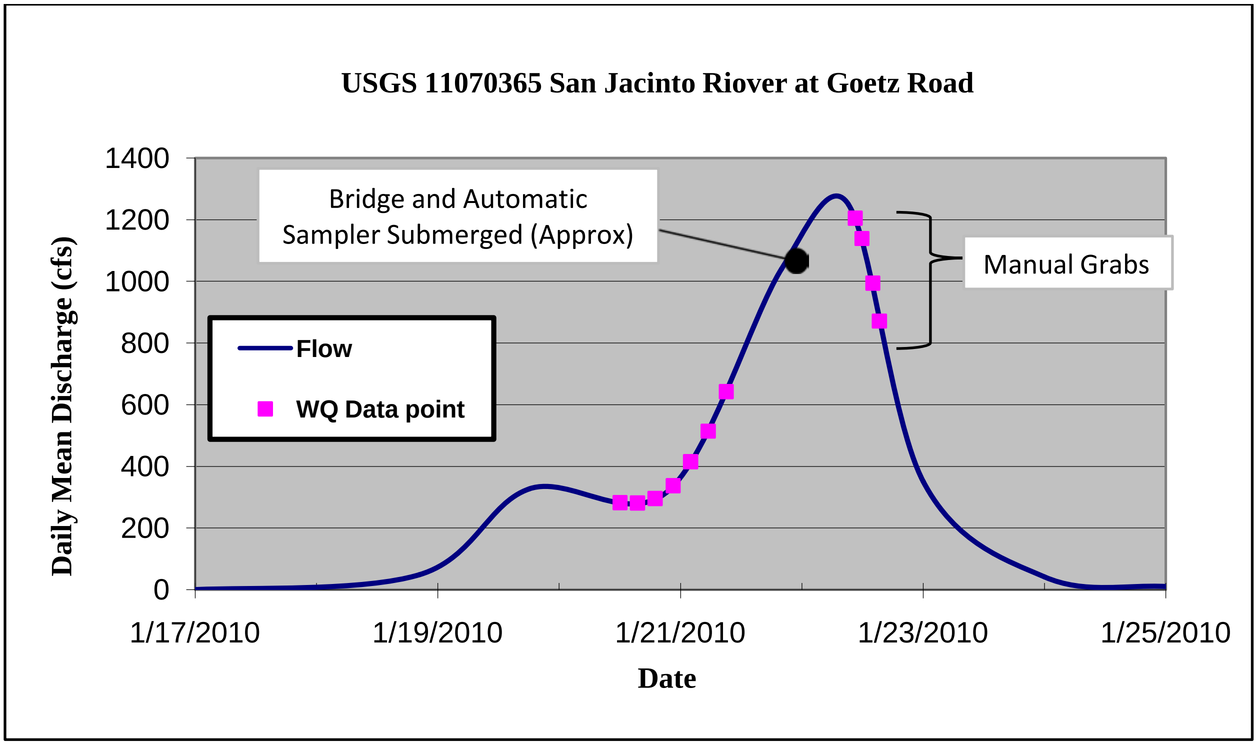


Table 2-8. San Jacinto River at Goetz Road Water Quality Data – Second Storm Event

Parameters	units	Avg	Std Dev	count	Second Storm Event Sampled (1/20/10 through 1/22/10)										
					1/20	1/20	1/20	1/20	1/21	1/21	1/21	1/22	1/22	1/22	1/22
					12:00	15:30	19:00	22:30	02:00	05:30	09:00	10:30	11:50	14:00	15:20
Total Hardness	mg/L	**111**	**24**	11	120	100	130	170	91	94	88	120	100	110	100
Calcium (Ca)	mg/L	**24**	**5**	11	26	23	29	36	20	21	21	26	21	23	22
Magnesium (Mg)	mg/L	**12**	**3**	11	13	10	14	20	9.7	10	8.5	14	12	12	12
nitrate nitrogen (NO3-N)	mg/L	**6.41**	**18.77**	11	0.86	0.90	0.97	0.70	063	0.74	0.84	0.59	0.59	0.65	0.65
total dissolved solids (TDS)	mg/L	**157**	**39**	11	220	190	210	150	130	150	180	110	98	140	150
total suspended solids (TSS)	mg/L	**575**	**245**	11	510	260	660	970	310	380	280	840	770	750	590
chemical oxygen demand (COD)	mg/L	**90**	**22**	11	56	71	89	89	74	76	74	110	110	130	110
Turbidity	NTU	**650**	**181**	11	620	520	830	750	400	470	370	820	820	830	720
Nitrite nitrogen (NO2-N)	mg/L	**0.01**	**0.01**	11	0.020	ND	0.020	0.020	ND	ND	ND	ND	ND	ND	ND
Ammonia nitrogen (NH4-N)	mg/L	**0.09**	**0.04**	11	0.14	0.059	0.081	0.12	0.13	0.13	0.12	0.083	0.064	ND	0.068
Inorganic nitrogen (Calculation)	mg/L	**0.9**	**0.2**	11	1.0	1.0	1.1	0.8	0.8	0.9	1.0	0.7	0.7	0.7	0.7
Kjeldahl nitrogen	mg/L	**1.45**	**0.31**	11	1.5	1.7	1.9	1.8	1.1	1.2	1.1	1.6	1.7	1.2	1.1
Soluble reactive phosphorus (SRP/ortho-P)	mg/L	**0.35**	**0.07**	11	0.27	0.32	0.30	0.27	0.29	0.33	0.35	0.4	0.43	0.44	0.43
Total phosphorus (TP)	mg/L	**1.22**	**0.41**	11	0.70	0.94	1.1	0.75	1.1	1.0	1.0	1.7	1.8	1.8	1.5
biochemical oxygen demand (BOD)	mg/L	**17**	**-**	1	-	-	-	-	17	-	-	-	-	-	-
pH (Field Test)	pH Units	**8.75**	**0.31**	11	8.48	8.32	8.53	8.60	8.72	8.69	8.65	9.43	8.97	9.09	8.72
Temperature (Field Test)	ºC	**9.0**	**1.1**	11	9.8	9.9	9.7	9.8	9.8	9.5	9.7	7.8	7.6	7.5	7.8
Conductivity (Field Test)	mS/cm	**0.167**	**0.038**	11	0.190	0.210	0.207	0.212	0.150	0.167	0.201	0.118	0.119	0.133	0.132
Dissolved Oxygen (Field Test)	mg/L	**5.54**	**0.29**	5	-	-	-	-	-	-	5.06	5.46	5.69	5.67	5.80

Figure 2-8. February 5 through 8 Sampling Event – Goetz Road

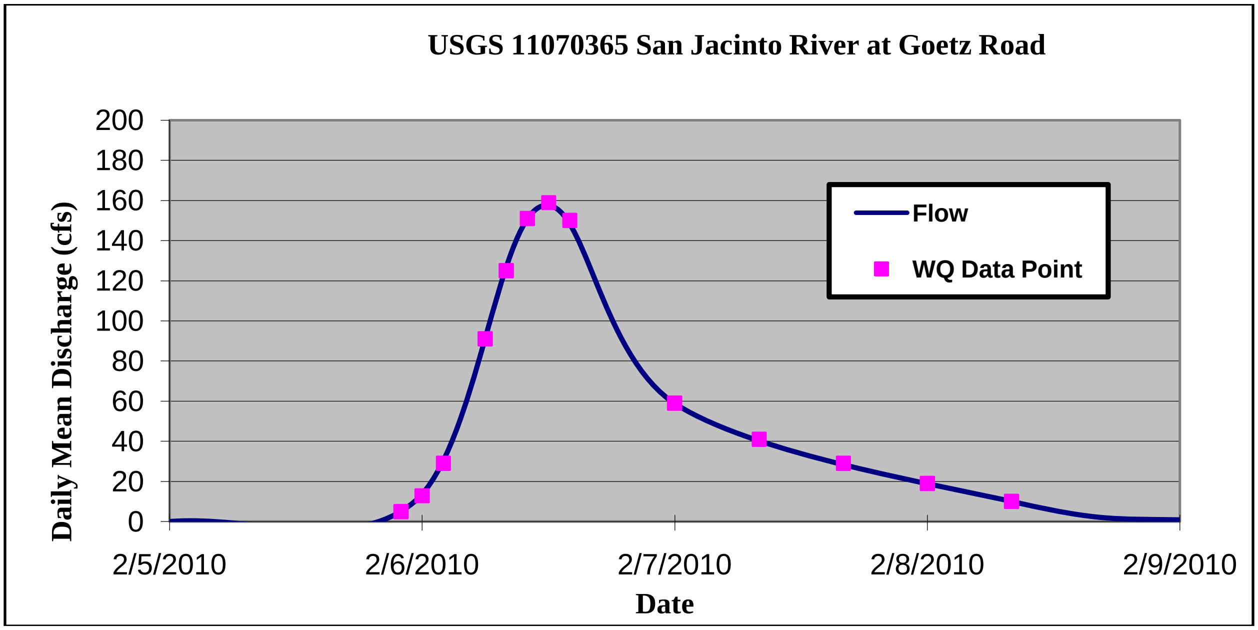


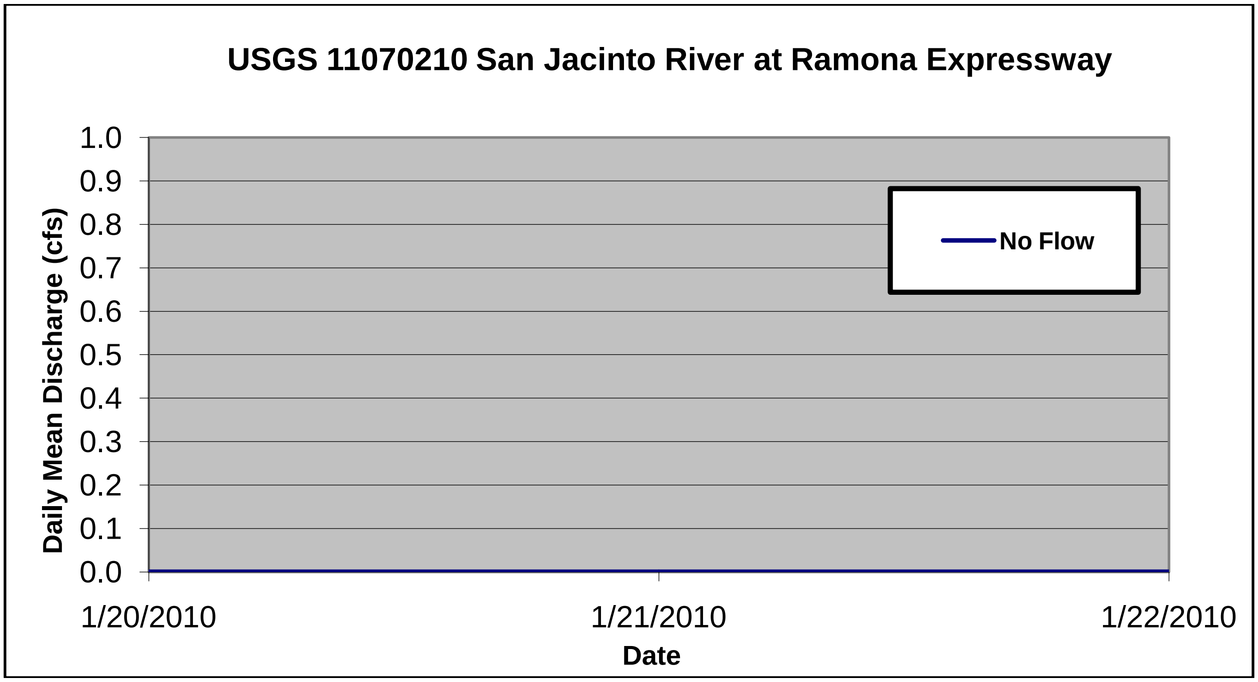
Table 2-9. San Jacinto River at Goetz Road Water Quality Data – Third Storm Event

Parameters	units	Avg	Std Dev	count	Third Storm Event Sampled (2/5/10 through 2/8/10)												
					2/5	2/6	2/6	2/6	2/6	2/6	2/6	2/6	2/7	2/7	2/7	2/8	2/8
					22:00	00:00	02:00	06:00	08:00	10:00	12:00	14:00	00:00	08:00	16:00	00:00	08:00
Total Hardness	mg/L	**159**	**115**	13	310	410	340	100	95	160	130	92	79	78	91	88	94
Calcium (Ca)	mg/L	**44**	**38**	13	97	130	100	29	23	35	29	20	20	21	23	22	24
Magnesium (Mg)	mg/L	**12**	**5**	13	17	22	19	7.6	9.2	19	14	10	7.0	6.5	7.8	7.8	8.4
nitrate nitrogen (NO3-N)	mg/L	**0.72**	**1.07**	13	ND	ND	4.2	0.16	0.63	0.90	0.54	0.43	0.50	0.47	0.36	0.52	0.54
total dissolved solids (TDS)	mg/L	**265**	**206**	13	460	700	640	220	170	200	150	100	160	140	20	260	230
total suspended solids (TSS)	mg/L	**237**	**183**	13	200	150	120	200	280	630	580	380	150	100	120	80	96
chemical oxygen demand (COD)	mg/L	**156**	**152**	13	420	520	260	100	130	120	110	83	35	44	98	58	49
Turbidity	NTU	**272**	**113**	13	110	140	140	220	320	480	430	360	210	210	300	310	310
Nitrite nitrogen (NO2-N)	mg/L	**0.02**	**0.02**	13	ND	0.080	ND	ND	0.030	0.040	ND	ND	ND	0.020	ND	0.020	ND
Ammonia nitrogen (NH4-N)	mg/L	**0.25**	**0.28**	13	0.44	1.0	0.53	ND	0.14	0.44	0.11	0.12	0.14	0.066	0.098	0.062	0.10
Inorganic nitrogen (Calculation)	mg/L	**1.0**	**1.2**	13	0.4	1.1	4.7	ND	0.8	1.4	0.47	0.6	0.6	0.6	0.5	0.6	0.6
Kjeldahl nitrogen	mg/L	**3.22**	**2.03**	13	5.0	3.6	4.3	2.0	2.5	2.7	2.0	2.2	1.3	8.7	1.4	4.3	1.9
Soluble reactive phosphorus (SRP/ortho-P)	mg/L	**0.30**	**0.13**	13	0.54	0.19	0.25	0.29	0.24	0.14	0.15	0.16	0.25	0.38	0.40	0.46	0.45
Total phosphorus (TP)	mg/L	**1.20**	**0.45**	13	2.3	2.0	1.2	1.0	1.2	1.2	0.94	0.96	0.76	0.74	1.0	1.2	1.1
biochemical oxygen demand (BOD)	mg/L	**6**	**-**	1	-	-	-	-	-	6	-	-	-	-	-	-	-
pH (Field Test)	pH Units	**6.50**	**0.03**	6	6.45	6.51	6.52	6.52	6.50	6.47	pH Meter Broke						
Temperature (Field Test)	ºC	**12.5**	**0.5**	13	12.7	12.7	12.5	12.2	12.8	12.9	11.5	12.9	13.2	12.6	12.4	11.7	12.6
Conductivity (Field Test)	mS/cm	**0.341**	**0.276**	13	0.619	0.852	0.945	0.280	0.183	0.268	0.167	0.128	0.183	0.184	0.203	0.201	0.217
Dissolved Oxygen (Field Test)	mg/L	**3.78**	**0.21**	2	-	-	-	-	-	-	-	3.93	-	-	-	-	3.63

2.6.3 Summary of Monitoring Data – San Jacinto River at Ramona Expressway

There were no significant flows at the San Jacinto River at Ramona Expressway (Station ID 741); thus, no samples were collected during the 2009-2010 monitoring year. A summary of this data is presented in **Figure 2-9**. The figure data is based on Daily Data provided by the USGS stream gauge (ID# 11070210).

Figure 2-9. January 20 through 22 Sampling Event – Ramona Expressway



January 21, 2010 – Field Investigation of Mystic Lake

While a large amount of discharge was observed entering into Mystic Lake, there were no observations of overflow downstream.

2.6.4 Summary of Monitoring Data – Cranston Guard Station

The United States Forest Service (USFS) delivered the January 2010 water samples to Edward S. Babcock and Sons, Inc (Babcock) in order to maintain consistency with other TMDL sampling throughout the watershed. Storm sampling only occurs if the Cranston gauge station reaches 300 cfs, as per the direction of the County Flood Control District. Levels below 300 cfs infiltrate prior to reaching the Mystic Lake area, and therefore, are less of an influence on nutrient loading to Canyon Lake and Lake Elsinore. During the reporting period, a series of storms continually inundated San Jacinto River well over a week. Though the flow levels never reached 300 cfs, the continual daily influx of rain at large flow levels (150 cfs and above) saturated the area and could no longer infiltrate the majority of stormwater. As such, water quality was measured for a single storm event at the Cranston Guard Station (Station ID 792). Data for the first storm event are presented in **Table 2-10** and **Figure 2-10**.

The field equipment was not setup to collect either dissolved oxygen or conductivity water quality parameters. Additionally, hazardous conditions prevented the collection of water quality parameters during the fourth and fifth samples.

The figure was developed based on daily flow values provided by the nearby USGS stream gauge (ID# 11069500), and peak hours determined by observations of the automatic equipment installed at the site. Total annual flow at this gauge was estimated for the single surcharged storm event using a total average flow of 396 cfs over the course of ten days (January 22-31) or 7 million gallons. The remaining influx of stormwater observed by the USGS station is assumed to have infiltrated.

Mean storm concentrations for nutrients estimated for the single storm events are 6.46 mg/L for total nitrogen and 10.13 mg/L for total phosphorus. This resulted in estimated annual nutrient loadings of 377 lbs. of nitrogen and 592 lbs. of phosphorus.

The high total nitrogen and total phosphorus concentrations are the result of two samples having statically variant data at values magnitude different from the other six samples captured during the storm event. These two samples were collected within a small two-hour time frame, suggesting that a local episode occurred, such as a landslide. The high water quality parameters ceased before the next sample, only six hours later, and were not seen for the remainder of the storm event.

Figure 2-10. January 20 through 27 Sampling Event – Cranston Guard Station

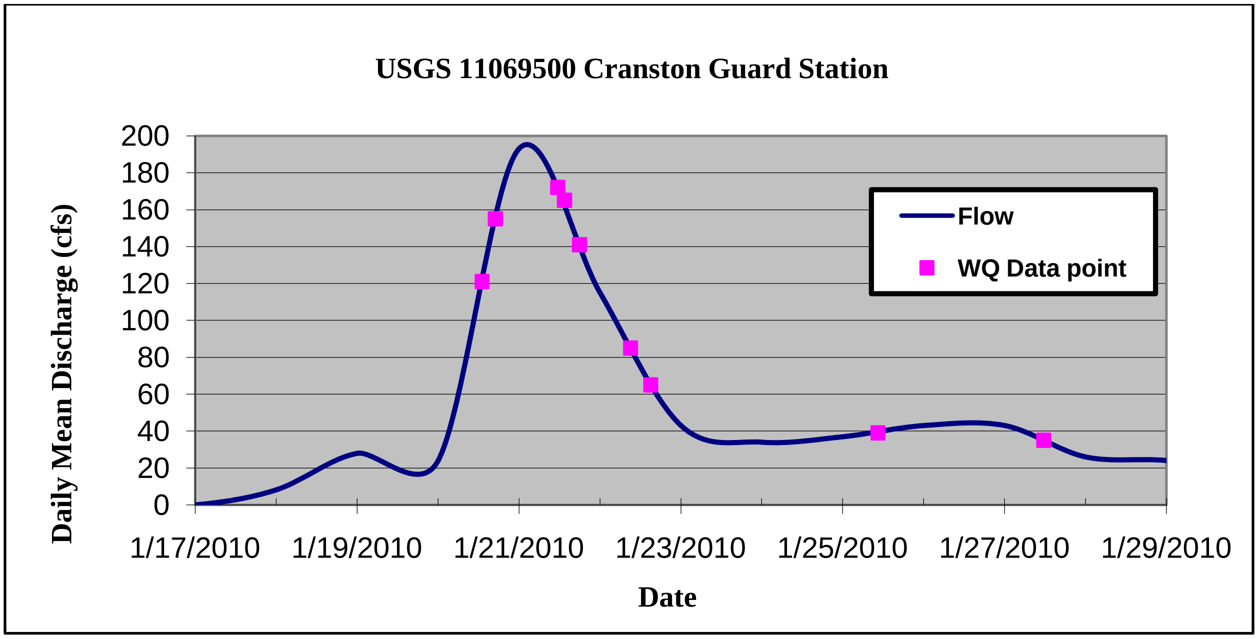


Table 2-10. Cranston Guard Station Water Quality Data – First Storm Event

Parameters	units	Avg	Std Dev	count	First Storm Event Sampled (1/20/10 through 1/27/10)								
					1/20	1/20	1/21	1/21	1/21	1/22	1/22	1/25	1/27
					13:00	17:00	11:30	13:30	18:00	09:00	15:00	10:20	11:30
Total Hardness	mg/L	**285**	**364**	8	160	130	1100	700	120	110	120	68	55
Calcium (Ca)	mg/L	**71**	**92**	8	37	33	280	170	29	24	27	20	17
Magnesium (Mg)	mg/L	**26**	**33**	8	15	12	99	63	12	11	13	4.2	3.1
nitrate nitrogen (NO3-N)	mg/L	**0.32**	**0.27**	8	ND	ND	0.68	0.65	0.38	0.43	0.50	ND	ND
total dissolved solids (TDS)	mg/L	**186**	**45**	8	210	180	280	220	160	150	150	180	140
total suspended solids (TSS)	mg/L	**12,965**	**23,666**	8	1400	1500	59,000	50,000	2500	840	1200	180	66
chemical oxygen demand (COD)	mg/L	**323**	**571**	8	100	62	1800	500	150	94	78	87	40
Turbidity	NTU	**339**	**307**	8	410	340	> 4,000	> 4,000	930	290	370	25	8.0
Nitrite nitrogen (NO2-N)	mg/L	**0.01**	**0.00**	8	ND	ND	ND	ND	ND	ND	ND	ND	ND
Ammonia nitrogen (NH4-N)	mg/L	**0.18**	**0.20**	8	0.19	0.14	0.50	0.52	0.11	ND	ND	ND	ND
Inorganic nitrogen (Calculation)	mg/L	**6.6**	**10.5**	8	1.8	1.2	27	23	3.1	1.3	1.3	0.56	0.23
Kjeldahl nitrogen	mg/L	**6.46**	**10.33**	8	1.6	1.1	27	22	3.0	1.3	1.3	0.6	0.2
Soluble reactive phosphorus (SRP/ortho-P)	mg/L	**0.18**	**0.17**	8	0.12	0.12	0.50	0.46	0.16	0.11	0.12	0.060	ND
Total phosphorus (TP)	mg/L	**10.13**	**18.32**	8	1.4	1.6	48	36	1.4	1.1	1.4	0.19	0.08
biochemical oxygen demand (BOD)	mg/L	**10**	**9**	8	22	ND	22	19	10	ND	ND	ND	ND
pH (Field Test)	pH Units	**8.3**	**0.2**	8	8.2	8.2	8.7	Due to hazardous conditions, no field tests were conducted at these times.		8.15	8.1	-	-
Temperature (Field Test)	ºC	**9.2**	**2.2**	8	11.6	10.2	10.4			6.4	7.5	-	-
Conductivity (Field Test)	mS/cm	**-**	**-**	8	-	-	-			-	-	-	-
Dissolved Oxygen (Field Test)	mg/L	**-**	**-**	8	-	-	-			-	-	-	-

Notes: Most of the water quality parameters from the third (11:30) and fourth (13:30) samples are statistically deviant from the overall storm event. The data suggests a local episode, such as a landslide, occurred over a 2-hour timeframe (at least), and ceased before the fifth sample (18:00).

2.6.5 Summary of Monitoring Data – Canyon Lake Spillway

Water quality was measured for two storm events at the Canyon Lake Spillway (Station ID 841). Data for the first storm event are presented in **Table 2-11** and **Figure 2-11** and data for the second storm event are presented in **Table 2-12** and **Figure 2-12**.

The figures were developed based on elevation–discharge relationship data provided by EVMWD. The spillway height of the railroad canyon dam is at 1381.76'. Spillage elevation is uniform across the dam structure similar to a weir. Since the geometry of the dam spillway is known, the depth of water behind the dam can be converted to a rate of flow. This discharge data provides a greater degree of accuracy than the USGS stream gauge (ID# 11070500). Total annual flow at this gauge was estimated using a total average flow of 2,342 cfs over the course of fifteen days (when the dam spilled) or 62.2 million gallons.

Mean storm concentrations for nutrients estimated for the two storm events range from 0.71 mg/L to 1.25 mg/L for total nitrogen and 0.58 mg/L to 0.80 mg/L for total phosphorus. This resulted in estimated annual nutrient loadings of 369 to 649 lbs. of nitrogen and 301 to 415 lbs. of phosphorus.

January 22, 2010 – Spillage across Railroad Canyon Dam

Figure 2-11. January 20 through 22 Sampling Event – Canyon Lake Spillway

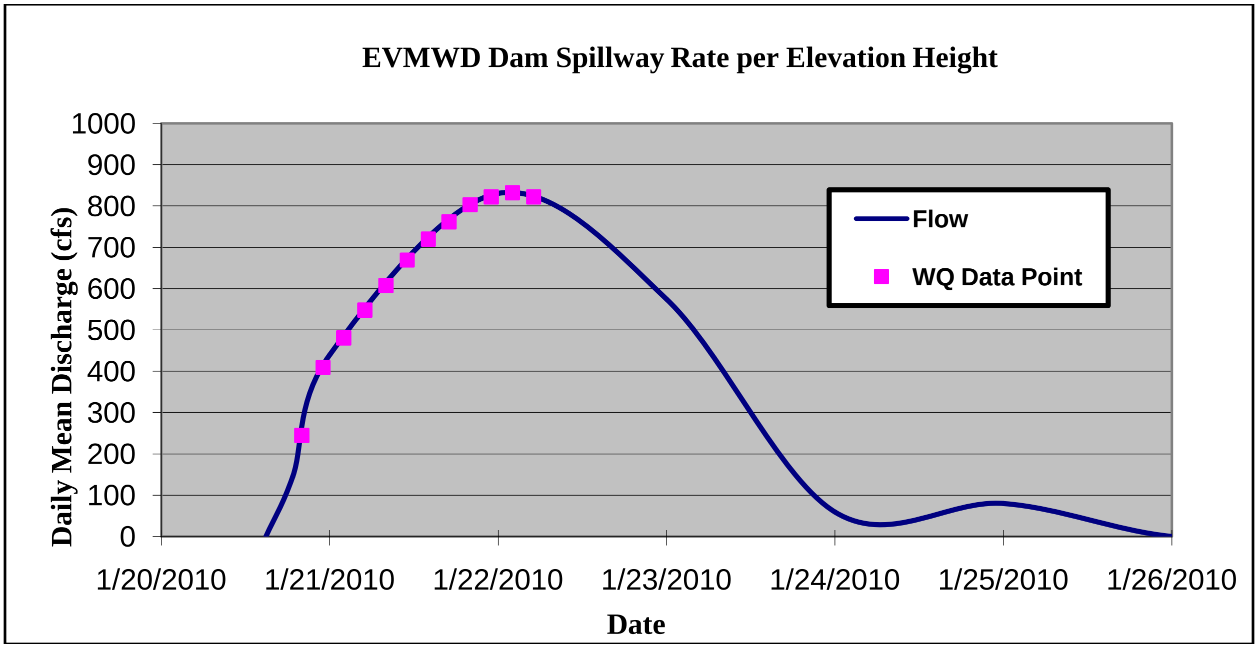


Table 2-11. Canyon Lake Spillway Water Quality Data – First Storm Event

Parameters	units	Avg	Std Dev	count	First Storm Event Sampled (1/20/10 through 1/22/10)											
					1/20	1/20	1/21	1/21	1/21	1/21	1/21	1/21	1/21	1/21	1/22	1/22
					20:00	23:00	02:00	05:00	08:00	11:00	14:00	17:00	20:00	23:00	02:00	05:00
Total Hardness	mg/L	**318**	**87**	12	170	180	510	350	330	350	360	330	310	310	310	300
Calcium (Ca)	mg/L	**78**	**23**	12	39	43	130	86	82	85	88	81	77	77	77	74
Magnesium (Mg)	mg/L	**30**	**7**	12	18	17	45	33	31	33	33	31	29	29	28	27
nitrate nitrogen (NO3-N)	mg/L	**0.48**	**0.12**	12	0.74	0.68	0.34	0.41	0.41	0.47	0.50	0.50	0.43	0.41	0.43	0.45
total dissolved solids (TDS)	mg/L	**665**	**160**	12	360	390	960	750	750	640	700	740	710	670	670	640
total suspended solids (TSS)	mg/L	**140**	**153**	12	500	270	330	69	30	150	24	130	110	26	18	20
chemical oxygen demand (COD)	mg/L	**54**	**21**	12	87	85	87	58	49	44	38	47	35	35	35	42
Turbidity	NTU	**99**	**157**	12	520	300	140	21	13	76	12	21	23	17	17	23
Nitrite nitrogen (NO2-N)	mg/L	**0.20**	**0.14**	12	ND	ND	0.070	0.44	0.43	0.29	0.31	0.18	0.19	0.17	0.19	0.16
Ammonia nitrogen (NH4-N)	mg/L	**0.09**	**0.04**	12	0.14	0.088	0.16	0.072	0.077	ND	ND	ND	0.066	0.13	0.11	0.098
Inorganic nitrogen (Calculation)	mg/L	**0.8**	**0.1**	12	0.9	0.8	0.6	0.9	0.9	0.8	0.8	0.7	0.7	0.7	0.7	0.7
Kjeldahl nitrogen	mg/L	**1.25**	**0.41**	12	0.74	0.62	2.3	1.4	1.2	1.0	1.2	1.3	1.3	1.3	1.2	1.4
Soluble reactive phosphorus (SRP/ortho-P)	mg/L	**0.35**	**0.06**	12	0.44	0.45	0.23	0.38	0.39	0.34	0.35	0.34	0.33	0.32	0.33	0.32
Total phosphorus (TP)	mg/L	**0.58**	**0.12**	12	0.80	0.82	0.67	0.59	0.53	0.60	0.50	0.52	0.48	0.48	0.50	0.47
biochemical oxygen demand (BOD)	mg/L	**8**	**-**	1	-	-	-	-	-	-	-	-	-	8	-	-
pH (Field Test)	pH Units	**8.34**	**0.21**	12	8.80	8.62	8.36	8.47	8.51	8.14	8.13	8.18	8.20	8.22	8.22	8.23
Temperature (Field Test)	ºC	**8.9**	**0.9**	12	9.7	9.8	9.8	9.9	10.1	7.8	8.1	8.2	8.3	8.4	8.4	8.3
Conductivity (Field Test)	mS/cm	**1.180**	**0.325**	12	0.500	0.558	1.63	1.35	1.32	1.23	1.37	1.30	1.26	1.23	1.23	1.18
Dissolved Oxygen (Field Test)	mg/L	**5.40**	**0.08**	2	-	-	-	-	5.45	-	-	-	-	-	-	5.34

Figure 2-12. February 5 through 8 Sampling Event – Canyon Lake Spillway

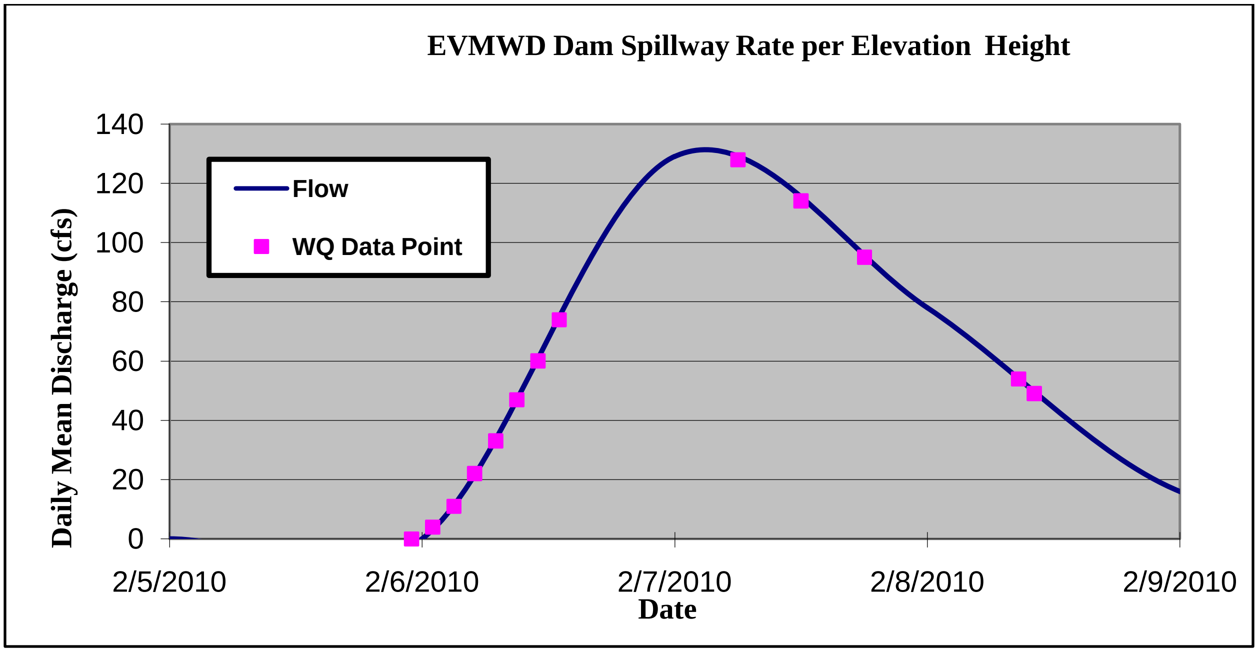


Table 2-12. Canyon Lake Spillway Water Quality Data – Second Storm Event

Parameters	units	Avg	Std Dev	count	Second Storm Event Sampled (2/5/10 through 2/8/10)												
					2/5	2/6	2/6	2/6	2/6	2/6	2/6	2/6	2/7	2/7	2/7	2/8	2/8
					23:00	01:00	03:00	05:00	07:00	09:00	11:00	13:00	06:00	12:00	18:00	08:40	10:10
Total Hardness	mg/L	**188**	**83**	13	440	120	210	190	140	150	130	150	170	220	230	150	150
Calcium (Ca)	mg/L	**47**	**21**	13	110	29	51	48	34	36	31	36	42	55	64	39	40
Magnesium (Mg)	mg/L	**17**	**7**	13	39	11	20	17	12	14	12	15	15	20	23	13	13
nitrate nitrogen (NO3-N)	mg/L	**0.58**	**0.16**	13	0.81	0.25	0.79	0.61	0.41	0.54	0.45	0.56	0.52	0.54	0.61	0.70	0.70
total dissolved solids (TDS)	mg/L	**384**	**139**	13	790	240	390	390	320	310	280	290	400	440	480	320	340
total suspended solids (TSS)	mg/L	**243**	**251**	13	36	310	650	450	250	350	280	730	38	19	16	11	15
chemical oxygen demand (COD)	mg/L	**76**	**36**	13	38	83	160	100	87	110	69	100	58	60	44	51	24
Turbidity	NTU	**243**	**238**	13	30	220	760	440	230	230	280	650	120	62	48	47	47
Nitrite nitrogen (NO2-N)	mg/L	**0.01**	**0.00**	13	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.020	0.020
Ammonia nitrogen (NH4-N)	mg/L	**0.08**	**0.10**	13	ND	ND	ND	ND	ND	ND	ND	ND	0.13	0.38	0.089	0.12	0.10
Inorganic nitrogen (Calculation)	mg/L	**0.6**	**0.2**	13	0.8	0.3	0.8	0.6	0.4	0.5	0.5	0.6	0.7	0.9	0.7	0.8	0.8
Kjeldahl nitrogen	mg/L	**1.75**	**0.71**	13	0.71	1.8	2.9	2.7	1.9	2.0	2.2	2.6	1.4	0.93	1.4	1.1	1.1
Soluble reactive phosphorus (SRP/ortho-P)	mg/L	**0.29**	**0.08**	13	0.21	0.25	0.24	0.23	0.26	0.29	0.35	0.3	0.26	0.24	0.22	0.44	0.44
Total phosphorus (TP)	mg/L	**0.80**	**0.30**	13	0.36	0.67	1.5	0.87	0.72	0.82	0.81	1.3	0.72	0.56	0.52	0.72	0.78
biochemical oxygen demand (BOD)	mg/L	**5**	**-**	1	-	-	5	-	-	-	-	-	-	-	-	-	-
pH (Field Test)	pH Units	**8.54**	**0.08**	8	8.39	8.64	8.55	8.48	8.58	8.59	8.53	8.54	pH Meter Broke				
Temperature (Field Test)	ºC	**11.8**	**2.0**	13	13.4	13.4	13.3	12.8	12.9	13.2	13.2	13.6	8.8	8.7	8.9	10.4	10.8
Conductivity (Field Test)	mS/cm	**0.598**	**0.275**	13	1.43	0.383	0.602	0.575	0.483	0.438	0.432	0.392	0.529	0.677	0.788	0.522	0.521
Dissolved Oxygen (Field Test)	mg/L	**4.54**	**0.04**	3	-	-	-	-	-	4.58	-	4.53	-	-	-	4.50	-

2.7 San Jacinto Watershed Rainfall Records

The RCFC&WCD maintains rainfall records for rain gauges located within or near the San Jacinto Watershed as shown in **Table 2-13**.

Table 2-13. San Jacinto River Watershed Rainfall Gauges

Station ID	Station Description
152	Perris
248	Winchester
67	Lake Elsinore
186	Hemet / San Jacinto
155	Perris / Moreno Valley – Pigeon Pass

Rainfall data recorded at these five stations for the period July 1, 2009, through June 30, 2010, are summarized in **Table 2-14**. The complete set of rainfall gauge data is included on the CD as Appendix D.

Table 2-14. Summary Rainfall Data (July 2009 to June 2010)

Monthly Rainfall (inches)	Perris	Winchester	Elsinore	Hemet/SJ	Perris/MV
Jul	0	0	0	0	0
Aug	0	0	0	0	0
Sep	0	0	0	0	0
Oct	0.07	0.01	0.09	0.07	0.06
Nov	0.02	0.25	0.04	0.39	0.24
Dec	1.64	2.19	1.90	2.74	2.34
Jan	5.45	4.69	6.06	4.64	6.58
Feb	1.64	2.32	2.20	2.34	2.98
Mar	0.14	0.07	0.10	0.31	0.42
Apr	1.00	0.74	0.92	0.74	1.82
May	0.01	0	0.02	0.20	0.03
Jun	0	0	0	0	0
Annual Rainfall (Inches)	**9.96**	**10.2**	**11.3**	**11.4**	**14.4**
% of Normal	**87%**	**69%**	**103%**	**89%**	**119%**

3.0 Lake Elsinore Nutrient TMDL Monitoring Program

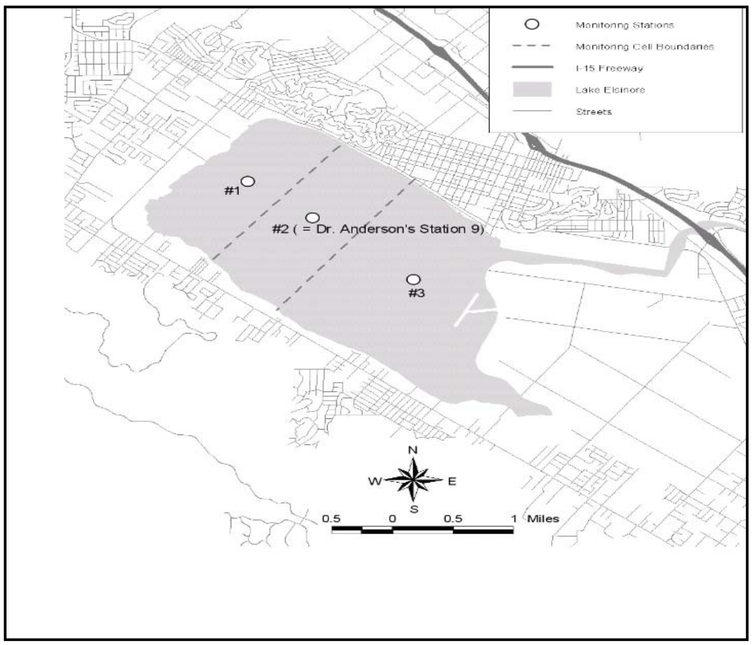
Elsinore Valley Municipal Water District (EVMWD) supports the Task Force effort by conducting the Phase 1 Lake Elsinore Monitoring Program sampling and analysis. This work is preformed in coordination with EVMWD's NPDES compliance program (Order No. R8-2005-0003 for NPDES No. CA8000027 for the Regional Water Reclamation Plant, Lake Elsinore, Riverside County approved March 4, 2005).

EVMWD's NPDES compliance monitoring program for Lake Elsinore was initiated in April 2006. For the July 2009 to June 2010 period, Lake Elsinore TMDL compliance monitoring was conducted by a team led by Dr. James Noblet, California State University San Bernardino (CSUSB).

Sampling Station Locations

To characterize water quality conditions in Lake Elsinore, three polygons/cells were defined, with a sampling site in the approximate center of each cell (**Figure 3-1**). All sampling sites were located and referenced using global positioning system (GPS) units with surface buoys. The middle of the three open water sampling stations (Site 2 in this program) overlaps with Site 9 of the pilot discharge sampling program (2002 – 2004). For select dates, dissolved oxygen data from a permanent monitoring station maintained by EVMWD are referenced (buoy 1313, located in the general vicinity of Site 2).

Figure 3-1. Lake Elsinore Monitoring Cell Locations



Sampling Schedule

The TMDL monitoring plan calls for monthly sampling October to May and biweekly sampling June to September (16 sampling events). The CSUSB team collected samples on a total of 21 dates. The exact dates of sampling were dependent upon student class schedule, local weather conditions, and other factors.

Revisions to the Monitoring Plan

Aside from the additional sampling dates, there were no revisions made to the Lake Elsinore Nutrient TMDL Monitoring Plan. TMDL compliance monitoring for Lake Elsinore follows the April 2007 – March 2008 Lake Elsinore Water Quality Monitoring Plan to Evaluate the Efficacy of the In-Lake Nutrient Reduction Facilities (Aeration and Mixing) for Lake Elsinore prepared by EVMWD, included on CD as Appendix E. As referenced, dissolved oxygen data collected from EVMWD buoy 1313 are reported for select dates.

Fish Kills and Algae Blooms

During the July 2009 – June 2010 monitoring period a significant algae die-off in Lake Elsinore occurred from July 20th to 26th 2010. This was followed by a significant fish kill on July 26th, where approximately two large fish per surface acre and 2-3% of the Threadfin Shad (baitfish) population died. Lake-wide these losses equate to approximately 6,000 large fish and about 1-million Shad minnows. A second significant fish kill occurred between August 13th and 16th , where Lake Elsinore City Staff estimated that approximately half of the starting Threadfin Shad minnows population at over 30-million minnows died due to low oxygen levels.

Recycled Water Input to Lake Elsinore

Recycled water addition to Lake Elsinore from the EVMWD Regional Plant began on June 26, 2007. Inputs through June 2010 are summarized in **Table 3-1.**

Table 3-1. Summary of EVMWD Regional Plant Recycled Water Input to Lake Elsinore

Month	**Recycled Water Input to Lake Elsinore (millions of gallons)**	**Nitrogen Input in Recycled Water (pounds)**	**Phosphorus Input in Recycled Water (pounds)**
July 2007	99	1,739	364
August 2007	112	1,962	449
September 2007	146	3,778	488
October 2007	131	2,952	886
November 2007	100	4,190	453
December 2007	161	6,163	589
January 2008	130	2,502	479
February 2008	185	4,175	371
March 2008	176	5,135	704
April 2008	156	3,245	454
May 2008	148	3,096	344
June 2008	133	2,775	532
2007/2008 FY Totals	**1,678**	**41,711**	**6,114**
July 2008	137	3,091	298
August 2008	133	1,775	244
September 2008	136	2,374	543
October 2008	132	2,513	364
November 2008	136	4,062	250
December 208	145	7,238	277
January 2009	175	5,109	730
February 2009	168	3,636	475
March 2009	173	3,460	404
April 2009	140	8,851	594
May 2009	142	2,125	390
June 2009	151	1,888	428
2008/2009 FY Totals	**1,768**	**46,122**	**4,997**

Table 3-1 cont. Summary of EVMWD Regional Plant Recycled Water Input to Lake Elsinore

Month	Recycled Water Input to Lake Elsinore (millions of gallons)	Nitrogen Input in Recycled Water (pounds)	Phosphorus Input in Recycled Water (pounds)
July 2009	149	2,357	347
August 2009	148	2,353	322
September 2009	147	2,577	294
October 2009	149	2,972	396
November 2009	133	2,439	211
December 2009	116	2,418	232
January 2010	153	2,933	230
February 2010	177	12,252	428
March 2010	161	14,762	282
April 2010	142	3,005	433
May 2010	164	3,152	576
June 2010	142	2,486	485
2009/2010 FY Totals	**1,781**	**53,706**	**4,236**
Annual Wasteload Allocation for Supplemental Water		**16,407**	**8,203**

3.1 Lake Elsinore Annual Water Quality Summary

Lake Elsinore monitoring results for the period July 1, 2009 through June 30, 2010 are summarized in **Table 3-2**.

Table 3-2. Summary – Lake Elsinore Water Quality Data (July 2009 to June 2010)

Parameter	Basin Plan Objectives including TMDL Targets	Date TMDL Objective to be Attained	2009 – 2010 Results			
			Number of Sampling Events	Range of Daily Averages	Annual Mean	Standard Deviation
Dissolved Oxygen (mg/L) (Station 2, depth profile)	Not less than 5 mg/L as a depth average	2015	21	0.3 – 8.7	5.3	2.4
	Not less than 5 mg/L 1 meter above lake bottom	2020	21	0.2 – 6.9	3.7	2.6
pH (3 stations, depth profile)	6.5 - 8.5	---	21	8.71 – 9.53	9.08	0.22
Ammonia N (NH_4-N) (mg/L) (3 stations, integrated samples)	Toxicity stds	2020	20	0.031 – 0.718	0.185	0.22
Toxicity (comparison to ammonia data; 3 stations; surface, integrated, and bottom samples)	Acute: 1-hr avg not to exceed CMC more than once every 3 yrs on avg	2020	No observed exceedence of the Criteria Maximum Concentration (CMC) or acute criterion at the range of pH conditions measured.			
	Chronic: 30-day avg not to exceed CCC more than once every 3 yrs on avg		Exceedence of the Criteria Continuous Concentration (CCC) or chronic criterion under observed pH and temperature conditions on: ➢ 7/29/09 – all 3 sample locations ➢ 8/19/09 – all 3 sample locations ➢ 8/26/09 – all 3 sample locations ➢ 9/11/09 – all 3 sample locations ➢ 9/25/09 – all 3 sample locations ➢ 10/21/09 – E2 ➢ 12/4/09 – all 3 sample locations ➢ 6/9/10 – all 3 sample locations Exceedence of CCC observed 27% of the time (48 out of 180 ammonia readings).			
Total Nitrogen (TN) (mg/L) (3 stations, integrated samples)	Annual average 0.75 mg/L	2020	18	2.6 – 4.6	3.7	0.6
Total Phosphorus (TP) (mg/L) (3 stations, integrated samples)	Annual average 0.1 mg/L	2020	20	0.12 – 0.32	0.19	0.05

Parameter	Basin Plan Objectives including TMDL Targets	Date TMDL Objective to be Attained	2009 – 2010 Results			
			Number of Sampling Events	**Range of Daily Averages**	**Annual Mean**	**Standard Deviation**
Chlorophyll *a* (µg/L) (3 stations, surface samples 0-2 m, April to Sept)	Summer average no greater than 40 µg/L	2015	12	44.7 – 161.7	103.5 (summer mean)	36.1
Chlorophyll *a* (µg/L) (3 stations, integrated samples, April to Sept)	Summer average no greater than 25 µg/L	2020	12	46.0 – 150.3	101.2 (summer mean)	31.5
Secchi Depth (cm) (3 stations)	---	---	20	30 - 76	46	11.5
Total Dissolved Solids (mg/L) (3 stations, integrated samples)	2000 mg/L	---	20	1405 - 1967	1643	200.5

Notes:

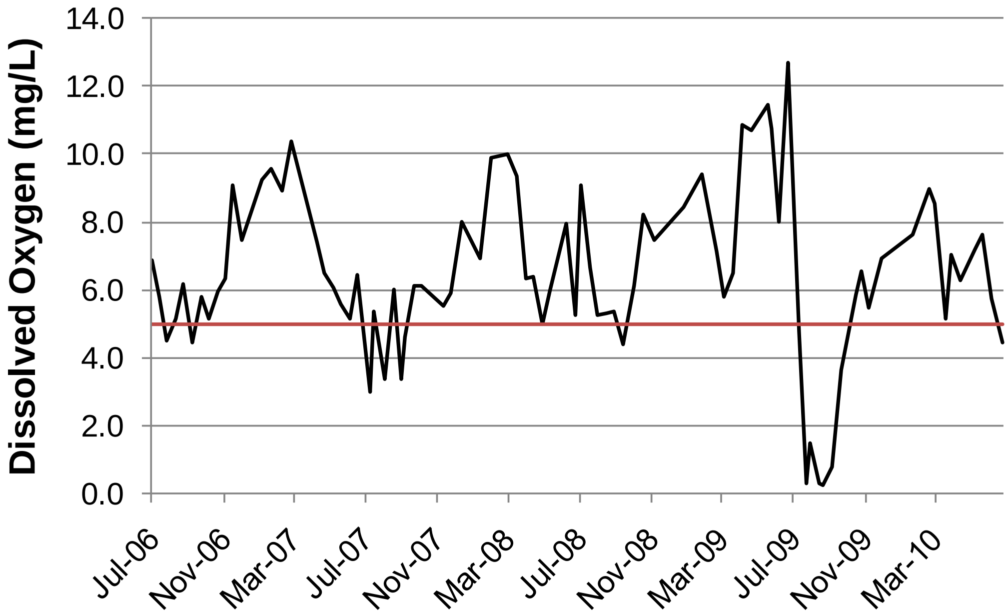
CMC = Criteria Maximum Concentration or acute criterion

CCC = Criteria Continuous Concentration or chronic criterion

Dissolved Oxygen - Buoy 1313 data used for April 10 – August 19, 2009.

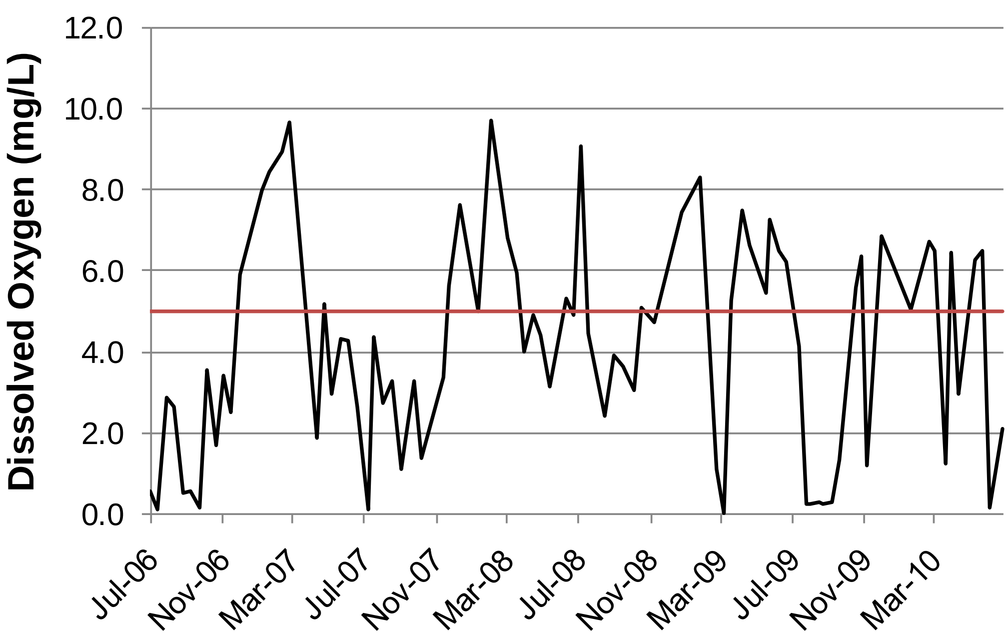
Annual trends for dissolved oxygen, total nitrogen, total phosphorus and chlorophyll are presented in the figures below.

Figure 3-2. Lake Elsinore Dissolved Oxygen (mg/L)
Station E2 Depth Average - July 2006 to June 2010



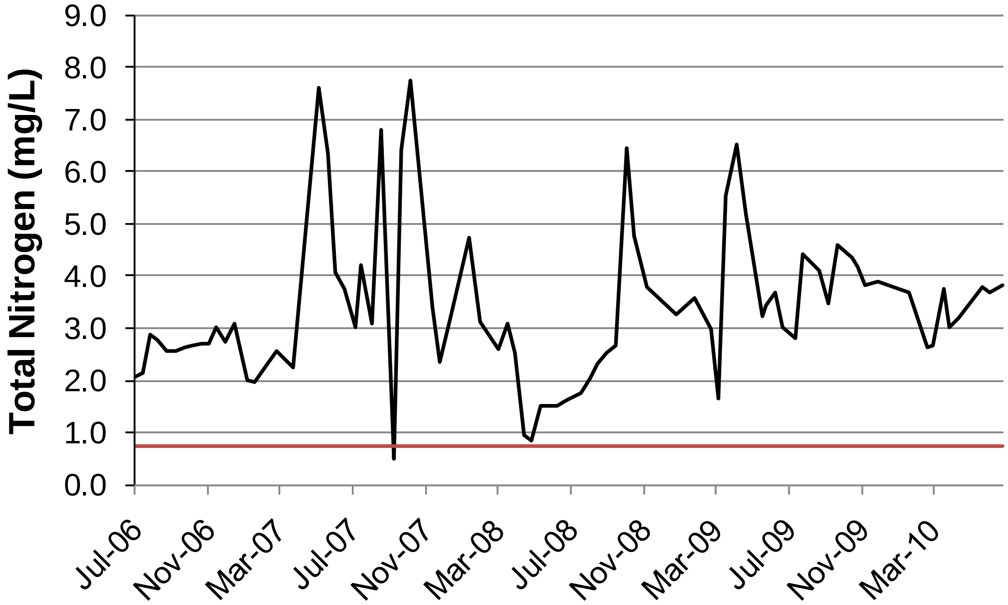
Note: TMDL 2015 Dissolved Oxygen objective is 5 mg/L as a depth average. Buoy 1313 data used for April 10 – August 19, 2009.

Figure 3-3. Lake Elsinore Dissolved Oxygen (mg/L)
Station E2 1 m from the Lake Bottom - July 2006 to June 2010



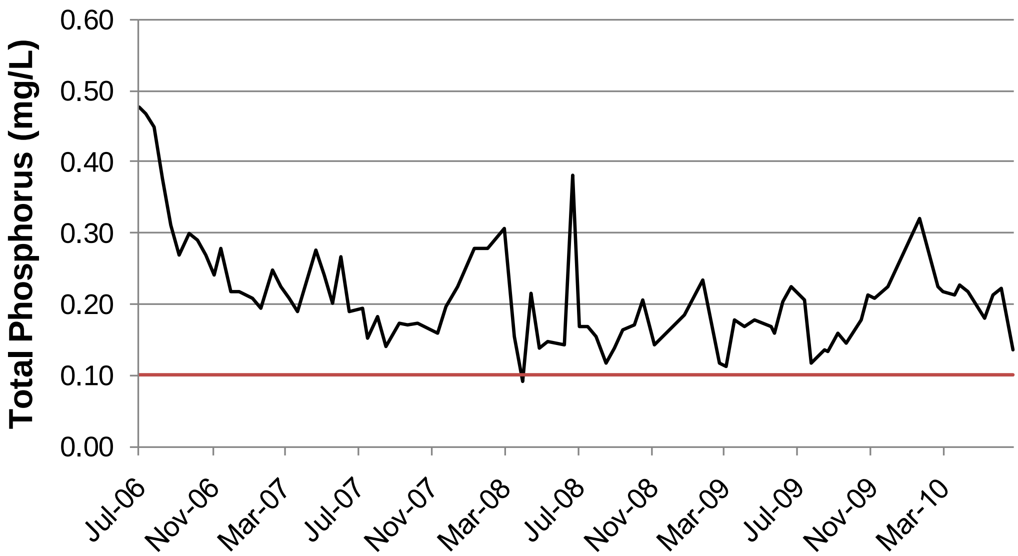
Note: TMDL 2020 Dissolved Oxygen objective is 5 mg/L 1 meter above the lake bottom. Buoy 1313 data from 5.5 m used for April 10 – August 19, 2009.

Figure 3-4. Lake Elsinore Total Nitrogen (mg/L)
3 Stations Integrated Samples - July 2006 to June 2010



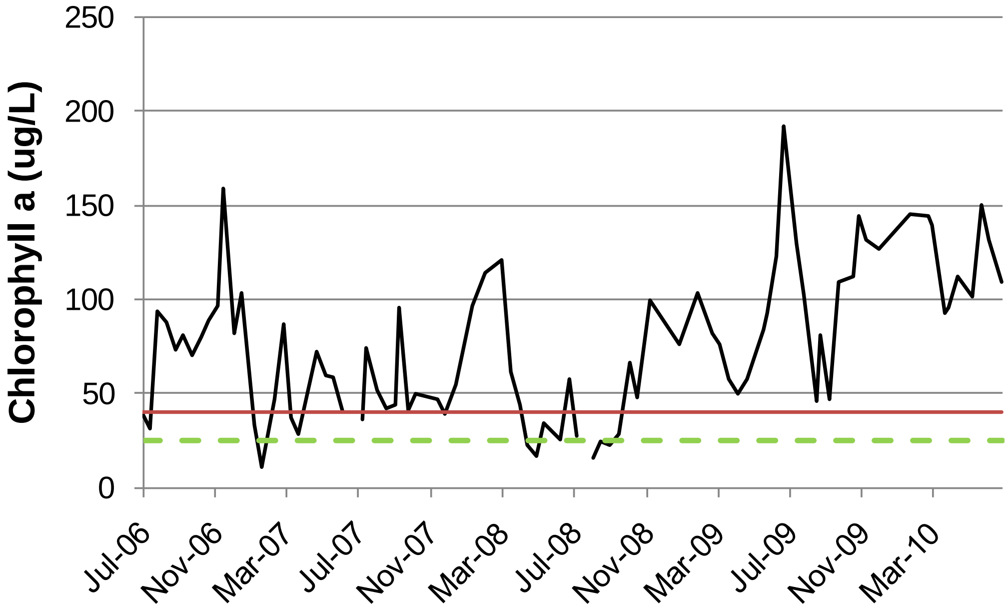
Note: TMDL 2020 Total Nitrogen objective is annual average 0.75 mg/L.

Figure 3-5. Lake Elsinore Total Phosphorus (mg/L)
3 Stations Integrated Samples - July 2006 to June 2010



Note: TMDL 2020 Total Phosphorus objective is annual average 0.1 mg/L.

Figure 3-6. Lake Elsinore Chlorophyll a (ug/L)
3 Stations Integrated Samples - July 2006 to June 2010



Note: TMDL 2015 Chlorophyll a objective is summer average 40 µg/L and the 2020 objective is summer average 25 µg/L.

A complete description of Lake Elsinore water quality analyses and results from July 2009 through June 2010 is available through the quarterly reports of the Lake Elsinore Monitoring and Evaluation Program included on CD as Appendix F. The complete set of Lake Elsinore Water Quality Data is included on CD as Appendix D.

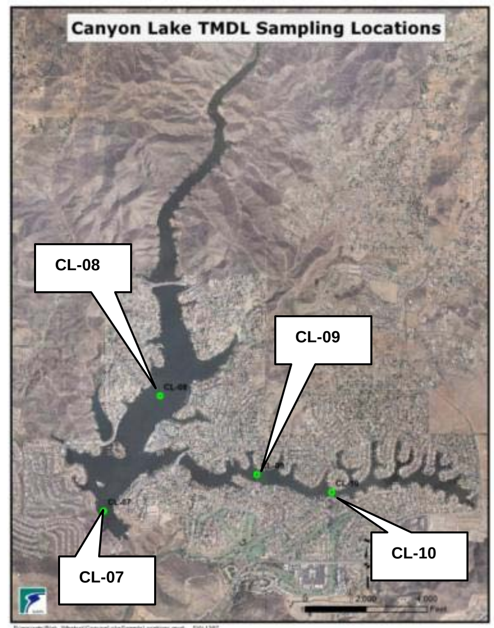
4.0 Canyon Lake Nutrient TMDL Monitoring Program

EVMWD supports the Task Force effort by conducting the Phase 1 Canyon Lake Monitoring Program sampling and analysis. For the July 2009 to June 2010 period, Canyon Lake monitoring was conducted by a team led by Dr. James Noblet, CSUSB. During this period, the Canyon Lake Marine Patrol provided watercraft and pilots for the sampling team.

Sampling Station Locations

Field measurements consisted of Hydrolab casts and water column sampling at four sites on Canyon Lake (**Figure 4-1**). The sites in the main basin (C7 and C8) were deeper than those in East Bay (C9 and C10).

Figure 4-1. Canyon Lake Monitoring Locations



- **Station (C7) -** at the deepest part of the lake near the dam. The site is generally strongly stratified during the summer. The nutrient content of the lake in this area is important because any dam overflows would first discharge into the San Jacinto River and flow down to Lake Elsinore.
- **Station (C8) -** Centrally located, this station is most reflective of conditions in the Lake.
- **Stations (C9 and C10) -** shallow sites within East Bay that receive some local nuisance runoff and also receive discharges from Salt Creek during periods of rainfall and runoff.

Sampling Schedule

The TMDL monitoring plan calls for monthly sampling October to May and biweekly sampling June to September (16 sampling events). The CSUSB team collected samples on a total of 19 dates. The exact dates of sampling were dependent upon student class schedule, local weather conditions, and other factors.

Revisions to the Monitoring Plan

Aside from the additional sampling dates, there were no revisions made to the Canyon Lake Nutrient TMDL Monitoring Plan. TMDL compliance monitoring for Canyon Lake is described in the Canyon Lake Nutrient TMDL Monitoring Plan prepared by EVMWD, and included on CD as Appendix G. Although dissolved oxygen data were collected on all sample dates; data are not reported for dates were the probe was malfunctioning.

Fish Kills and Algae Blooms

During the July 2009 – June 2010 monitoring period a fish kill was reported for Canyon Lake on October 29, 2010. The reported fish kill was of approximately 50 to 100 Shad on Sunset Beach.

4.1 Canyon Lake Annual Water Quality Summary

Canyon Lake monitoring results for the period July 1, 2009 through June 30, 2010 are summarized in Table 4-1.

Table 4-1. Summary – Canyon Lake Water Quality Data (July 2009 to June 2010)

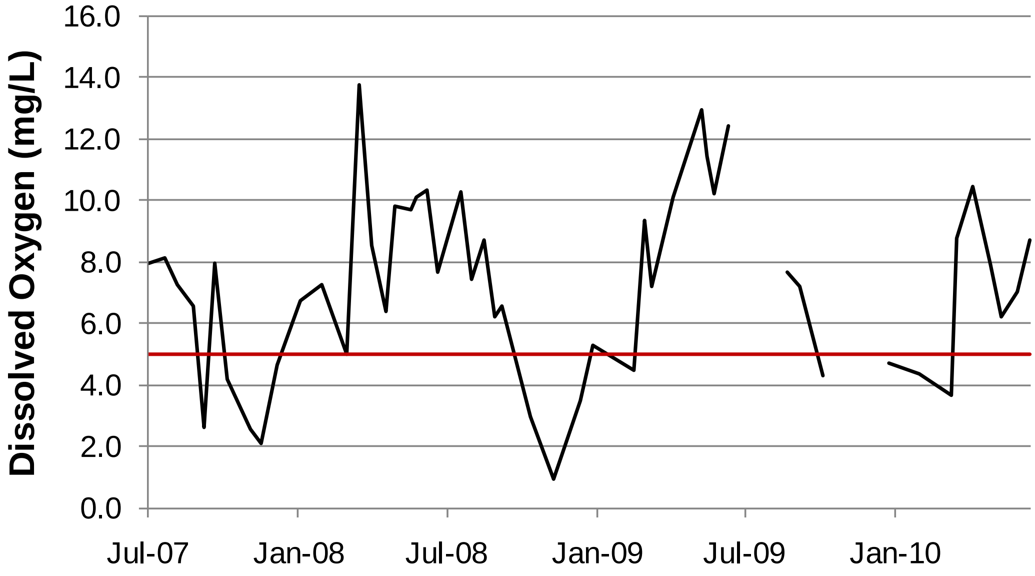
Parameter	Basin Plan Objectives including TMDL Targets	Date TMDL Objective to be Attained	2009 – 2010 Results							
			Main Basin Results				East Bay Results			
			Number of Sampling Events	Range of Daily Averages	Annual Mean	Standard Deviation	Number of Sampling Events	Range of Daily Averages	Annual Mean	Standard Deviation
Dissolved Oxygen (mg/L) Station 7 for Main Basin (deepest station) Stations 9 and 10 for East Bay	Not less than 5 mg/L above the thermocline	2015	12	3.64 – 10.43 (avg readings below TMDL objective observed on 4 sample dates) (4 dates out of 12, or 33%)	6.75	2.13	12	5.18 – 9.26 (avg readings below 5 mg/L observed on 0 sample dates)	6.99	1.15
	Not less than 5 mg/L daily average in hypolimnion	2020	12	0.10 – 3.57 (avg readings below TMDL objective observed on 12 sample dates) (12 dates out of 12, or 100%)	0.60	1.06				
pH (Stations 7 and 8 for Main Basin; 9 and 10 for East Bay)	6.5 - 8.5	---	19	7.69 – 8.92	8.13	0.37	19	7.84 – 9.44	8.49	0.47
Ammonia N (NH_4-N) (mg/L) (Stations 7 and 8 for Main Basin; 9 and 10 for East Bay)	See Toxicity stds, below	2020	19	0.09 – 1.65	0.60	0.40	19	0.05 – 0.96	0.29	0.29

Parameter	Basin Plan Objectives including TMDL Targets	Date TMDL Objective to be Attained	2009 – 2010 Results							
			Main Basin Results				East Bay Results			
			Number of Sampling Events	Range of Daily Averages	Annual Mean	Standard Deviation	Number of Sampling Events	Range of Daily Averages	Annual Mean	Standard Deviation
Toxicity (calculated CMC and CCC to ammonia data)	Acute: 1-hr avg not to exceed CMC more than once every 3 yrs on avg	2020	Exceedences of the Criteria Maximum Concentration (CMC) or acute criterion: ➢ none ➢ Exceedence observed 0% of the time (0 out of 114 ammonia readings)				Exceedences of the Criteria Maximum Concentration (CMC) or acute criterion: ➢ none ➢ Exceedence observed 0% of the time (0 out of 114 ammonia readings)			
	Chronic: 30-day avg not to exceed CCC more than once every 3 yrs on avg	2020	Exceedences of the Criteria Continuous Concentration (CCC) or chronic criterion under the pH and temperature conditions observed on: ➢ C7 Hypolimnion on 7/1/09 ➢ C7 Hypolimnion on 7/24/09 ➢ C7 Hypolimnion on 5/10/10 ➢ C7 Hypolimnion on 6/28/10 ➢ Exceedences observed 4% of the time (4 out of 114 samples)				Exceedences of the Criteria Continuous Concentration (CCC) or chronic criterion under the pH and temperature conditions observed on: ➢ C9 Integrated on 7/24/09 ➢ C10 on 11/30/09 (all samples) ➢ C9 Hypolimnion on 6/11/10 ➢ C9 Hypolimnion and C10 Surface on 6/28/10 ➢ Exceedences observed 6% of the time (7 out of 114 ammonia readings)			
Total Nitrogen (TN) (mg/L)	Annual average 0.75 mg/L	2020	19	1.12 – 2.88	2.07	0.52	19	0.84 – 3.10	1.82	0.56
Total Phosphorus (TP) (mg/L)	Annual average 0.1 mg/L	2020	19	0.47 – 0.98	0.60	0.11	19	0.14 – 0.74	0.46	0.18

Parameter	Basin Plan Objectives including TMDL Targets	Date TMDL Objective to be Attained	2009 – 2010 Results							
			Main Basin Results				East Bay Results			
			Number of Sampling Events	Range of Daily Averages	Annual Mean	Standard Deviation	Number of Sampling Events	Range of Daily Averages	Annual Mean	Standard Deviation
Chlorophyll *a* (µg/L) (surface samples 0-2 m)	Annual average no greater than 40 µg/L	2015	19	1.5 – 138.3	29.0	32.1	19	12.1 – 133.7	42.4	31.1
Chlorophyll *a* (µg/L) (integrated samples)	Annual average no greater than 25 µg/L	2020	19	1.0 – 171.8	34.9	40.3	19	9.7 – 112.6	50.8	30.7
Secchi Depth (cm)	---	---	20	30 - 301	138	58.7	19	45- 231	108	45.3
Total Dissolved Solids (mg/L) (integrated samples)	700 mg/L	---	19	202 - 901	569	210	19	367 - 969	661	187

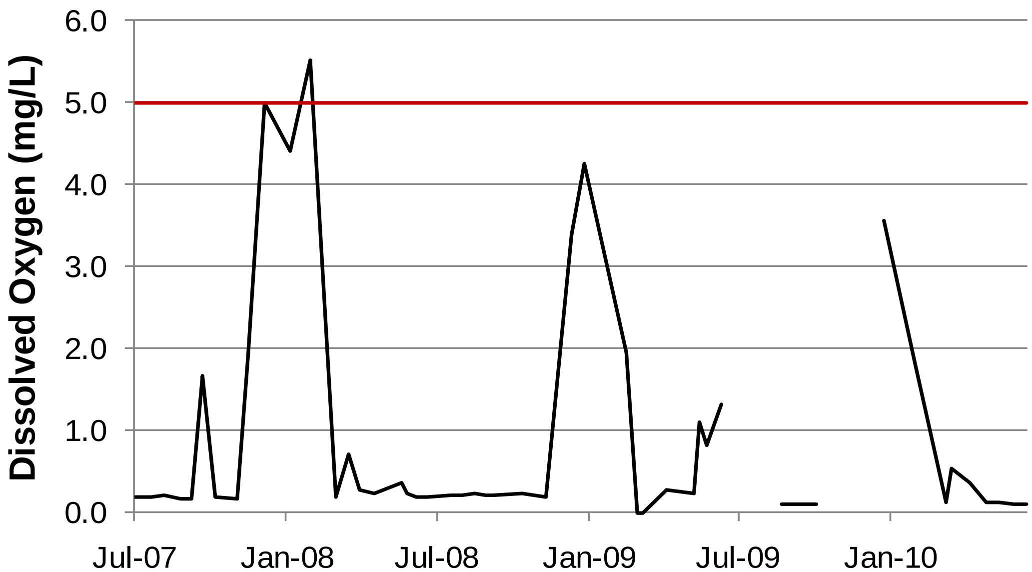
Notes:
Dissolved Oxygen: Main Body count, range, mean and standard deviation calculated from the daily averages for 12 sampling days. For stations C7 and C9, data for upper waters reflect results from above the thermocline when lake was stratified, readings from all depths when the lake was mixed. Average values for the hypolimnion were calculated from all readings below the thermocline for dates when the lake was stratified and from the four deepest readings when the lake was mixed. East Bay station C10 count, range, mean and standard deviation calculated from the daily averages for 12 sampling days; all readings, all depths.
pH: Count, range, mean and standard deviation calculated from daily averages for 19 sampling days.
Ammonia, Total Nitrogen: Mean calculated using integrated water column sample for dates when the lake was mixed and from an average of available epilimnion, thermocline, and hypolimnion samples from dates when the lake was stratified. Annual trends for dissolved oxygen, total nitrogen, total phosphorus and chlorophyll a are presented in the figures below.

Figure 4-2. Canyon Lake Dissolved Oxygen (mg/L)
Station C7 Above the Thermocline - July 2007 to June 2010



Notes: On dates without noted thermocline, DO readings from all depths used for averaging. Red line indicates TMDL 2015 Objective of 5 mg/L.

Figure 4-3. Canyon Lake Dissolved Oxygen (mg/L)
Station C7 Hypolimnion - July 2007 to June 2010



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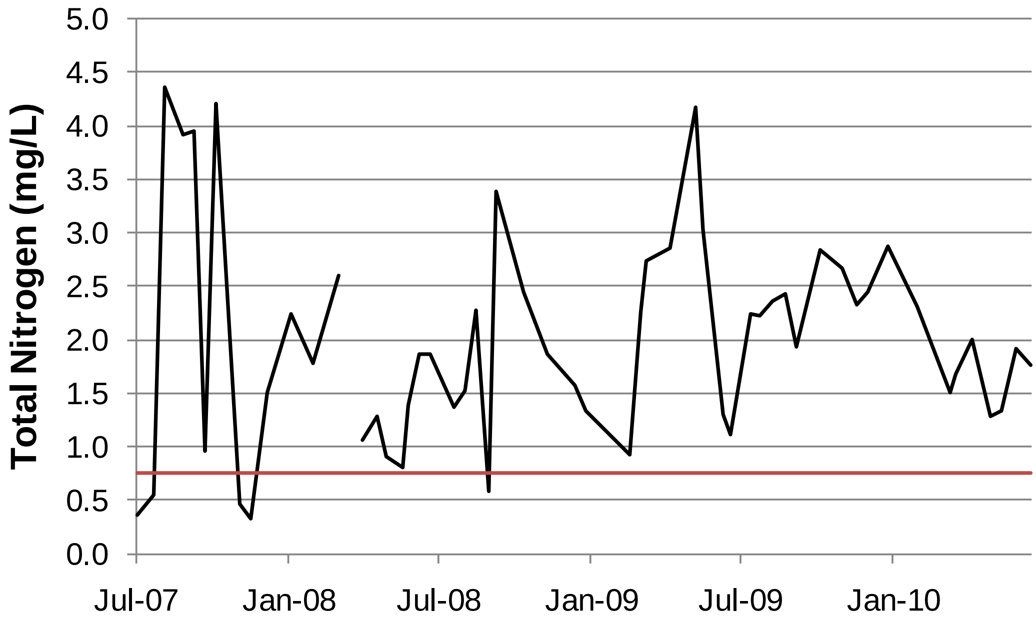
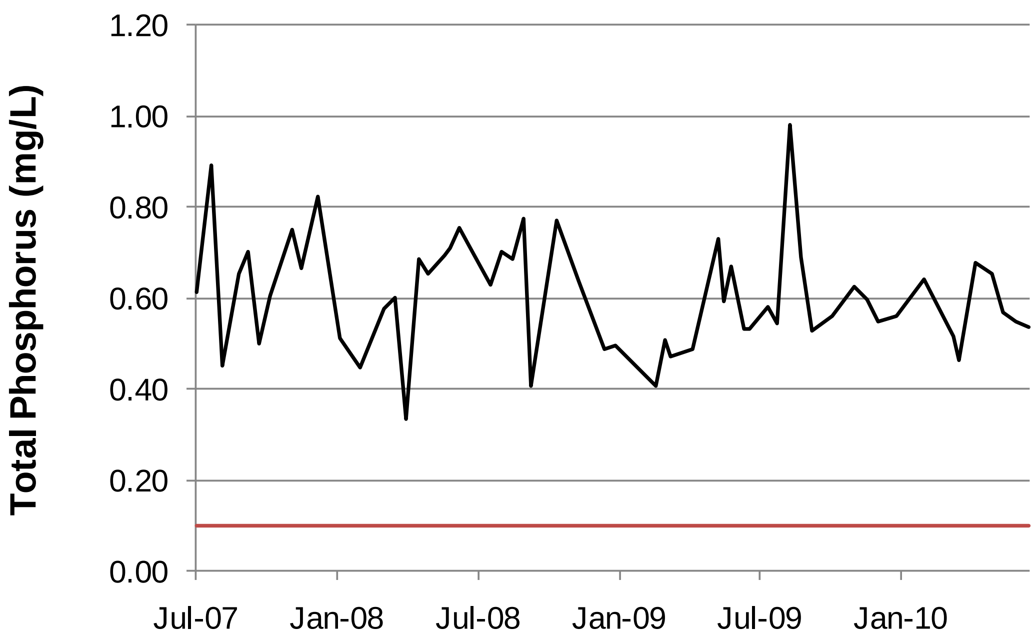
Notes: On dates without noted thermocline, four deepest DO readings used for averaging. Red line indicates TMDL 2020 Objective of 5 mg/L.

Figure 4-4. Canyon Lake Total Nitrogen (mg/L)
Stations C7 and C8 (Main Body) - July 2007 to June 2010



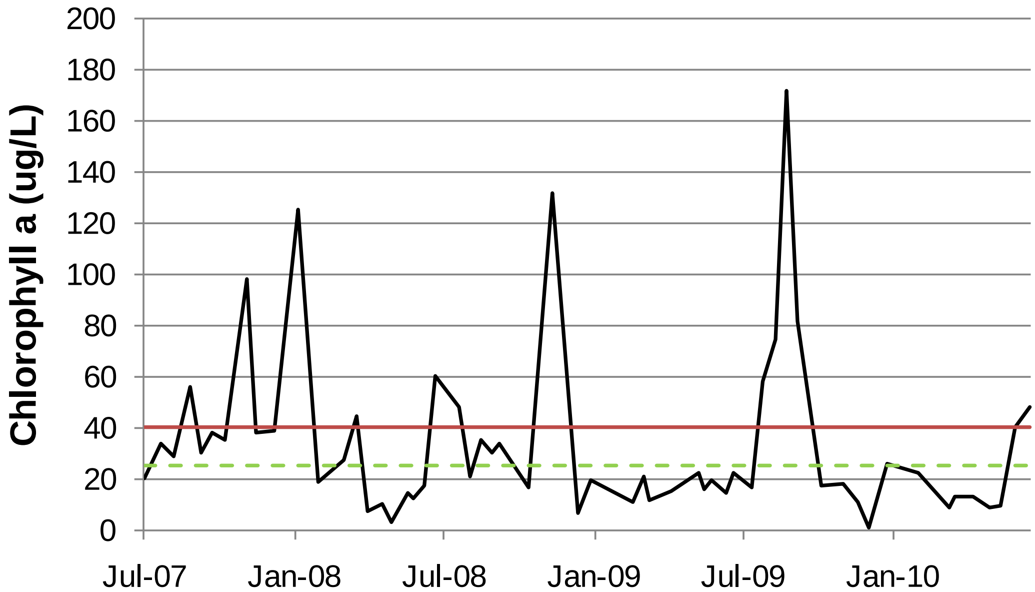
Note: Red line indicates TMDL 2020 Objective of 0.75 mg/L.

Figure 4-5. Canyon Lake Total Phosphorus (mg/L)
Stations C7 and C8 (Main Body) - July 2007 to June 2010



Note: Red line indicates TMDL 2020 Objective of 0.1 mg/L.

Figure 4-6. Canyon Lake Chlorophyll a (ug/L)
Stations C7 and C8 (Main Body) Integrated Samples - July 2007 to June 2010



Note: Red line indicates TMDL 2015 objective of 40 ug/L and green line indicates TMDL 2020 objective of 25 ug/L.

A complete description of Canyon Lake water quality analyses and results from July 2009 through June 2010 is available in the annual report prepared by MWH (included on CD as Appendix H). The complete set of Canyon Lake Water Quality Data is included on CD as Appendix D.

5.0 Data Management

LESJWA, on behalf of Task Force, oversees the management and storage of water quality samples and field analyses data for projects associated with the Lake Elsinore and Canyon Lake Nutrient TMDLs following the guidelines established in the Lake Elsinore, Canyon Lake and San Jacinto Watershed Monitoring Quality Assurance Protection Plan, which is included on CD as Appendix I.

5.1 Management of TMDL Data

Persons responsible for maintaining records for the individual components of the "The Lake Elsinore and Canyon Lake Nutrient TMDL Monitoring Plan" are as follows.

> The San Jacinto Watershed Quality Assurance Manager, (Steve Clark/RCFC&WCD) maintains all San Jacinto Watershed Nutrient Monitoring Program sample collection records, sample transport records, chain of custody and field analyses forms, and all records submitted by contract laboratories associated with the San Jacinto Watershed nutrient monitoring program.
>
> The Lake Elsinore Quality Assurance Manager, (Sarah Garber/MWH) maintains all Lake Elsinore Nutrient Monitoring Program sample collection records, sample transport records, chain of custody and field analyses forms, and all records submitted by contract laboratories associated with the Lake Elsinore nutrient monitoring program.
>
> The Canyon Lake Quality Assurance Manager, (Dr. James Noblet, CSUSB) maintains all Canyon Lake Nutrient Monitoring Program sample collection records, sample transport records, chain of custody and field analyses forms, and all records submitted by contract laboratories associated with the Canyon Lake nutrient monitoring program collected from July 2008 – June 2009.
>
> Each laboratory contracted by the Task Force has appointed a Quality Assurance Manager to maintain the laboratory's records.

LESJWA oversees the actions of these persons and will maintain the Lake Elsinore and Canyon Lake nutrient TMDL database, which includes all sample analyses results that have passed all QA processes as defined in the QAPP. LESJWA will also arbitrate any issues relative to records retention and any decisions to discard records.

All records are passed to the Regional Board as required by in the Lake Elsinore, Canyon Lake and San Jacinto Watershed Monitoring Quality Assurance Protection Plan. Copies of the chemical monitoring records are maintained by the appropriate Program Quality Assurance Manager and each laboratory contracted by the Task Force for five years after project completion then discarded, except for the database, which are maintained by LESJWA without discarding. Copies of other monitoring records are being maintained by the appropriate Program Quality Assurance Manager for five years after project completion then discarded.

5.2 Storage of TMDL Data

LESJWA has an existing database of laboratory and field measurement data from previous studies. This database, along with all future data, is maintained by LESJWA under the direction of LESJWA. Beginning in June 2007, all laboratory and field measurement data submitted to LESJWA for inclusion in the Santa Ana Watershed Data Management System (SAWDMS) database follow the guidelines and formats established by SWAMP (http://www.waterboards.ca.gov/swamp/qapp.html).

Data are transmitted to LESJWA in a standard electronic format and uploaded to the database through batch set electronic means. All contract laboratories maintain a record of transferred records and will periodically assess their record of transferred records against those actually held by the Task Force. Prior to upload, QA/QC tools check new data against existing data in the database for completeness, validity of analytical methods, validity of sample locations, validity of sample dates, and data outliers. Data not passing QA/QC tests are returned to the originating laboratory or generator for clarification and/or correction. When all data within a batch set have passed QA/QC, the data are uploaded to the database. A unique batch number, date loaded, originating laboratory and the person who loaded the data are recorded in the database so that data can be identified and removed in the future if necessary.

The Task Force's database is backed up using built-in software backup procedures. In addition, all data files are backed up on tape on a weekly basis as part of LESJWA's SOP for disaster recovery. Backup tapes are kept for a minimum of four weeks before they are written over. Tapes are rotated off-site for separate storage on a monthly (or more frequent) basis, in accordance with SAWPA Information Systems SOPs. Each back up session validates whether the files on tape are accurate copies of the original. The Task Force also maintains an access log showing who accessed the database, when, and what was done during the session. All changes to the database are stored in a transaction database with the possibility of rollback, if necessary.

Data are stored on a Windows 2003 Server with a 2Ghz + CPU and 2Gb RAM with a failsafe RAID 5 configuration. The server checks for operating system updates daily and downloads and installs patches and service packs as necessary. The current server is two years old, and as per LESJWA's policy, will be replaced after a maximum of 4 years of service. The server is also protected with Norton Anti-Virus software which is updated daily. The database software is Microsoft Access 2003. The database is modeled after the SWAMP Template provided by the State Water Resources Control Board and Moss Landing Marine Laboratories. The database is backed up on a weekly basis according to LESWJA's SOP for disaster recovery.

TMDL data are uploaded to the database quarterly to twice per year. Data can be exported to a SWAMP compatible data exchange format using pre-made queries in the database. The exported data are sent to the SWRCB IM Coordinator for processing into the SWAMP database.