# Lake Elsinore and Canyon Lake Nutrient TMDL Annual Water Quality Report

# Final Report

**Prepared For:**

**Santa Ana Regional Water Quality Control Board**

**August 5, 2015**


Lake Elsinore & San Jacinto Watersheds Authority

City of Lake Elsinore • City of Canyon Lake • County of Riverside
Elsinore Valley Municipal Water District • Santa Ana Watershed Project Authority

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**Santa Ana Regional Water Quality Control Board**

**Prepared By:**

**Lake Elsinore and Canyon Lake Nutrient TMDL Task Force**

August 5, 2015

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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 sources 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 performed 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

## 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 concentrations and total nitrogen allocation to ensure that the total nitrogen allocation will prevent ammonia toxicity in Lake Elsinore.

3. A nutrient monitoring program in Canyon Lake to determine compliance with interim and final nitrogen, phosphorus, chlorophyll *a*, and dissolved oxygen numeric targets. The monitoring program will also evaluate and determine the relationship between ammonia concentrations 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, which may be found at:

http://www.sawpa.org/wp-content/uploads/2012/08/1TMDLmonitoringPlan02_0011.pdf

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

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.

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 completing Phase 1 of this approach.

**Phase 1 – Intensive Lake Study**

Phase 1 focuses on data gaps related to 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.

In December 2010, the Task Force, in consultation with the Regional Board, revised the Phase 1 monitoring program for Lake Elsinore and Canyon Lake. The revised Phase 1 program decreases the number of sample locations in these waterbodies. The watershed monitoring program was not revised. During fiscal year 2014-2015, the stakeholders continued the existing Phase I watershed monitoring program while pausing the in-lake monitoring programs to ensure that resources were dedicated to facilitating in-lake BMPs.

In April 2015, the Task Force submitted the Lake Elsinore & Canyon Lake Nutrient TMDL Compliance Monitoring Work Plan to the Regional Board, which addresses the compliance monitoring requirement of the Lake Elsinore & Canyon Lake Nutrient TMDL, as well as the Riverside County MS4 Permit (Regional Board Order R8-2010-0033). The Task Force prepared this Compliance Monitoring Work Plan to reassess the current conditions and establish a monitoring framework to assess trends towards meeting TMDL targets. Implementation of Phase II will begin in fiscal year 2015-2016.

# 2.0 SAN JACINTO RIVER WATERSHED NUTRIENT TMDL MONITORING PROGRAM

The primary 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 which drain into the above-mentioned tributaries.

3. Provide water quality data for watershed model updates.

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

To achieve these objectives, the Task Force coordinated the yearly goal of sampling at least three qualifying storm events with the collection of at least eight discrete samples across an anticipated storm hydrograph at each monitoring station. 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 consultant Weston Solutions, Inc. (Weston) for the reporting period of July 2014 through June 2015. Laboratory services were provided by Edward S. Babcock and Sons, Inc. (Babcock).

## 2.1 Summary of 2014-2015 Watershed Monitoring and Nutrient Loads

A summary of the water quality monitoring data for each of the five monitoring locations for the period of July 1, 2014 through June 30, 2015, is presented in Table 2-1 below. A more detailed account, including storm hydrographs and event loads are presented in Section 2.7 for each monitoring location. The complete set of water quality data, including water quality measurements for discrete grab samples is included in Appendix A.

**Table 2-1. Summary of 2014-2015 Monitoring**

| Number and Location Description | Total Annual Flow*(Mgal) | Event Mean Storm Concentration (mg/L) | | Estimated Annual Load (kg) | |
|---|---|---|---|---|---|
| | | Total Nitrogen (min/max) | Total Phosphorus (min/max) | Total Nitrogen | Total Phosphorus |
| Site 3 - Salt Creek at Murrieta Road (USGS 11070465) | 511 | 1.86/2.62 | 0.29/0.79 | 4,661 | 1,257 |
| Site 4 - San Jacinto River at Goetz Road (USGS 11070365) | 570 | 1.57/1.95 | 0.33/0.56 | 3,932 | 1,041 |
| Site 6 - San Jacinto River at Ramona Expressway (USGS 11070210) | 0 | 0 | 0 | - | - |
| Site 30 - Canyon Lake Spillway (USGS 11070500) | 196 | Not Measured | Not Measured | Not Measured | Not Measured |
| Site 1 - San Jacinto River at Cranston Guard Station (USGS 11069500) | 222 | Not Measured | Not Measured | Not Measured | Not Measured |

* Flow data are from USGS and are considered provisional for dates after 6/1/2015 for Sites 3 and 4 and after 6/2/2015 for Sites 1 and 30 in this report. All data for Site 6 is accepted data by the USGS.

## 2.2 Monitoring Strategy

Phase 1 TMDL Monitoring of the San Jacinto Watershed follows the guidelines detailed in the following documents, including the San Jacinto River Watershed Storm Water Sampling Analysis Plan:

http://www.sawpa.org/wp-content/uploads/2012/05/Final-Sampling-and-Analysis-Plan-08-09.pdf ;

and the Lake Elsinore and Canyon Lake Nutrient TMDL Monitoring Sampling and Analysis Plan prepared by the U.S. Forest Service (USFS):

http://www.sawpa.org/wp-content/uploads/2012/05/LECL-Nutrient-TMDL-Monitoring-USFS-SAP1.pdf

The sampling technique utilizes a fixed station sampling approach. A fixed station sampling approach provides for the collection of samples at regular sites on a continuous basis. It also enables the examination of water quality trends. Weston supported the Task Force effort by coordinating and guiding the Phase 1 San Jacinto Watershed Monitoring Program sampling activities during the 2014-15 monitoring period. Under their direction, samples are collected at the designated monitoring stations throughout the San Jacinto River Watershed, including Lake Elsinore and Canyon Lake.

In addition to this effort, the San Bernardino National Forest (Forest Service), in accordance with their agreement for in-lieu obligations to the Lake Elsinore and Canyon Lake TMDL Task Force, conducted water sampling at the Cranston Guard Station site on the San Jacinto River between 2007 and 2011. This work, however, was dependent on sufficient funds being allocated by

Congress to complete the work. In 2012, the Forest Service pulled out of the task force and will no longer provide monitoring at the Cranston site.

## 2.3 Monitoring Stations and Stream Gauge Locations

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 set up to be within the vicinity of United States Geological Survey (USGS) or RCFC&WCD stream gauge stations. The sampling stations are listed in Table 2-2 below and shown on Figure 2-1.

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

| Station ID | USGS Station ID | Agency | Site Number and Location Description |
|---|---|---|---|
| 745 | 11070465 | USGS | Site 3 - Salt Creek at Murrieta Road |
| 759 | 11070365 | USGS | Site 4 - San Jacinto River at Goetz Road |
| 741 | 11070210 | USGS | Site 6 - San Jacinto River at Ramona Expressway |
| 841 | 841 or 11070500 | USGS | Site 30 - Canyon Lake Spillway |
| 792 | 11069500 | RCFC&WCD or USGS | Site 1 - San Jacinto River at Cranston Guard Station |

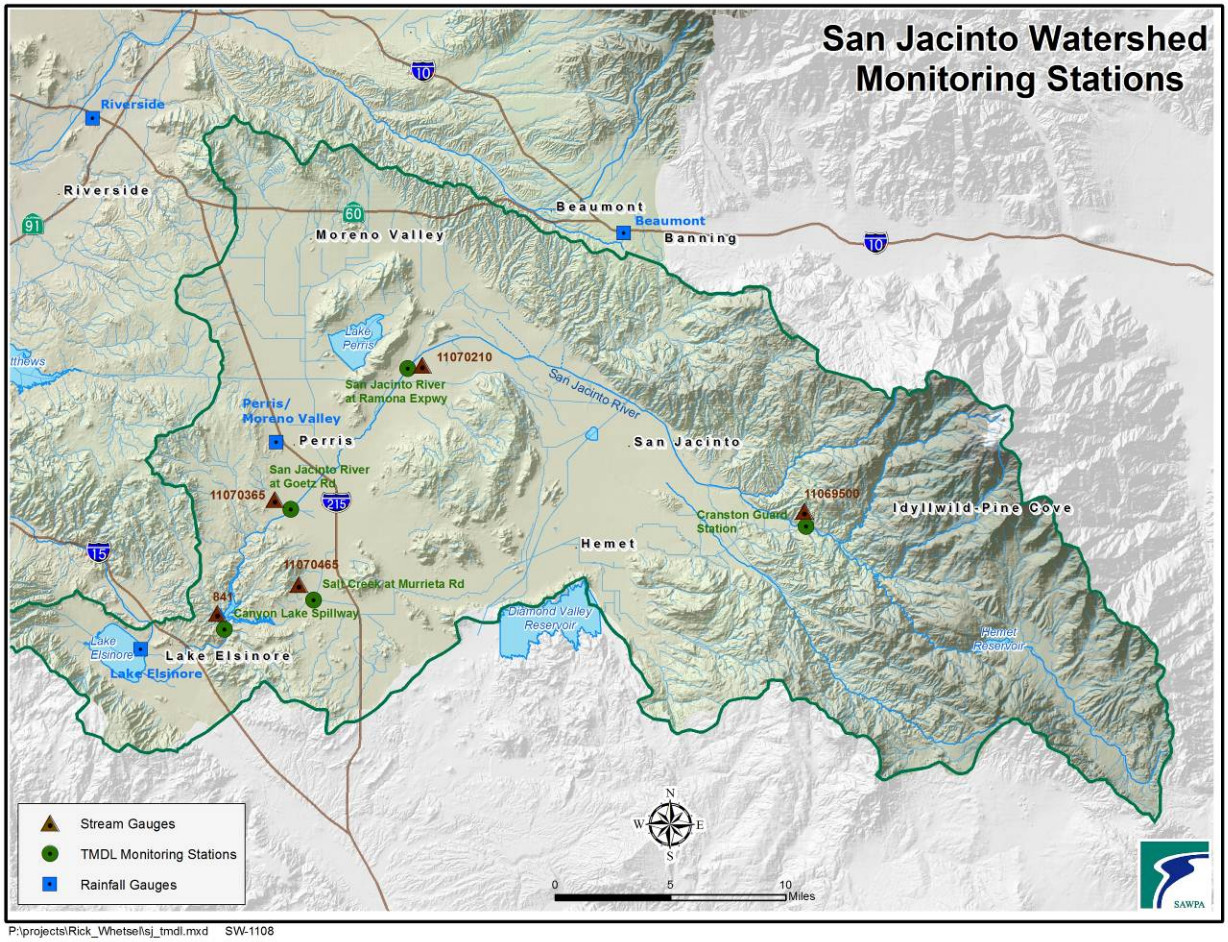


**Figure 2-1. Phase I San Jacinto River Watershed Monitoring Stations**

## 2.4 Stream Gauge 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.

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

http://waterdata.usgs.gov/ca/nwis/current/?type=flow

A summary of the stream gauge data recorded at each of the stations with measured flow for the monitoring period of July 1, 2014 through June 30, 2015 is presented in Table 2-3 and visually presented in Figure 2-2 through Figure 2-5. The mean monthly flows reported in Table 2-3 characterize the average instantaneous flow rate at the USGS station during both dry and wet weather conditions. The flow data are downloaded from the USGS website. Some of the flow data is initially marked as provisional. The provisional data provided by the USGS are subject to change and are not citable until reviewed and approved by the USGS. Flow data presented in this report are considered provisional for dates after June 1, 2015 for Sites 3 and 4 and after June 2, 2015 for Sites 1 and 30. All data for Site 6 is accepted data by the USGS. The complete set of stream gauge data is included as Appendix A.

**Table 2-3. Summary of Stream Gauge Data (July 2014 through June 2015)**

| July 2014-June 2015 Mean Monthly Flow (cfs)* | Site 3 - Salt Creek at Murrieta Road (11070465) | Site 4 - San Jacinto River at Goetz Road (11070365) | Site 6 - San Jacinto River at Ramona Expressway** (11070210) | Site 30 - Canyon Lake Spillway (11070500) | Site 1 - San Jacinto River at Cranston Guard Station (11069500) |
|---|---|---|---|---|---|
| July | 0.00 | 0.00 | - | 0.04 | 0.00 |
| August | 0.92 | 6.73 | - | 0.09 | 0.02 |
| September | 0.00 | 0.00 | - | 0.20 | 2.07 |
| October | 0.00 | 0.00 | - | 0.30 | 0.01 |
| November | 0.00 | 0.00 | - | 0.53 | 0.33 |
| December | 22.37 | 19.57 | - | 2.06 | 8.98 |
| January | 0.18 | 0.56 | - | 1.56 | 0.31 |
| February | 0.25 | 0.74 | - | 1.30 | 0.47 |
| March | 1.31 | 0.44 | - | 1.10 | 0.25 |
| April | 0.00 | 0.00 | - | 0.58 | 0.19 |
| May | 0.84 | 0.49 | - | 1.60 | 0.44 |
| June | 0.00 | 0.00 | - | 0.62 | 0.10 |
| **Mean Annual Flow (cfs)** | **2.20** | **2.42** | **-** | **0.83** | **1.01** |

* This value characterizes the average instantaneous flow rate at the USGS station during both dry and wet weather conditions in a given month. Flow data after 6/01/2015 for Sites 3 and 4 and after 6/2/2015 for Sites 1 and 30 are provisional and may be subject to change.
**No flow data were reported for Site 6 for the monitoring period.

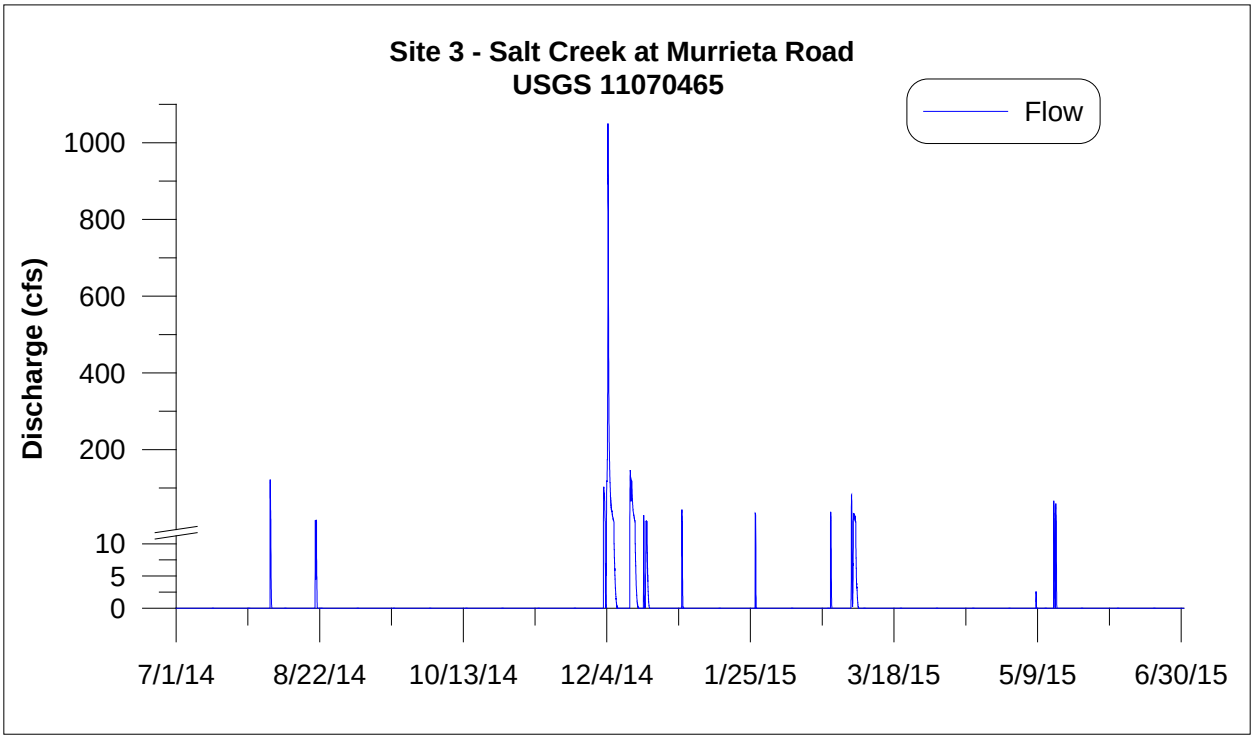


**Figure 2-2. Site 3 – Salt Creek at Murrieta Road – Daily Stream Gauge Records**

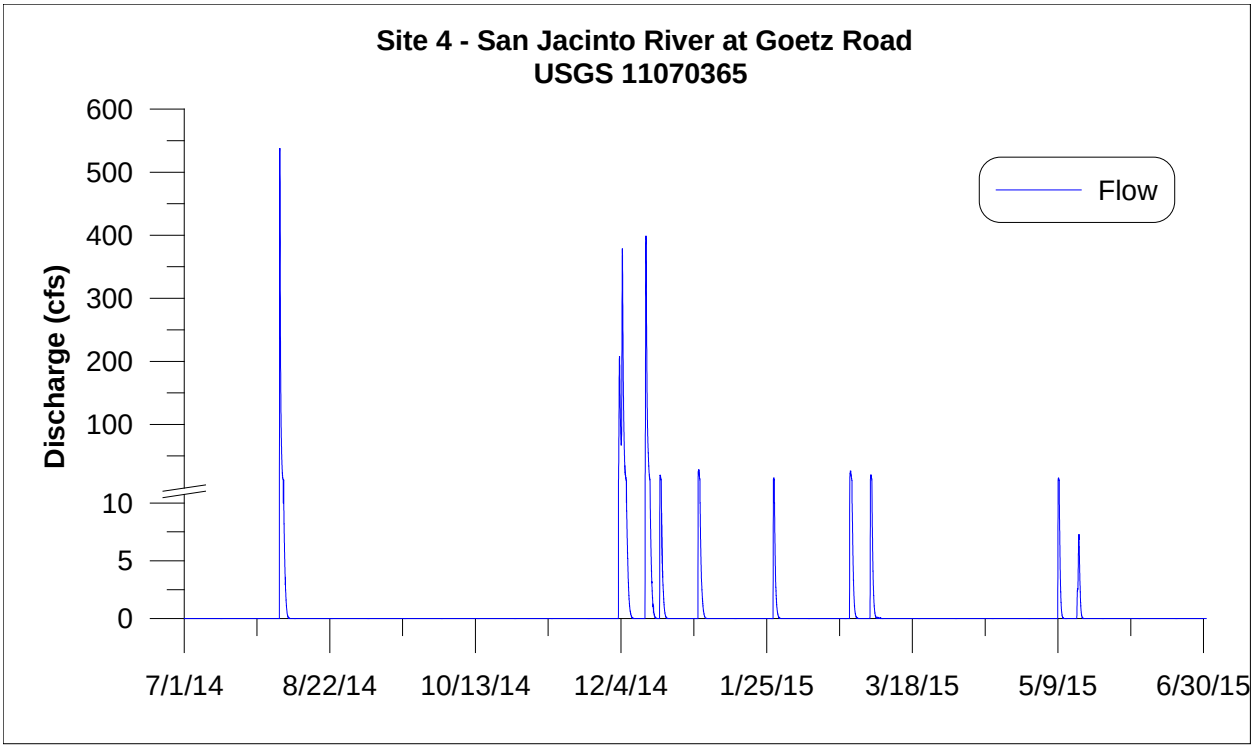


**Figure 2-3. Site 4 – San Jacinto River at Goetz Road – Daily Stream Gauge Records**

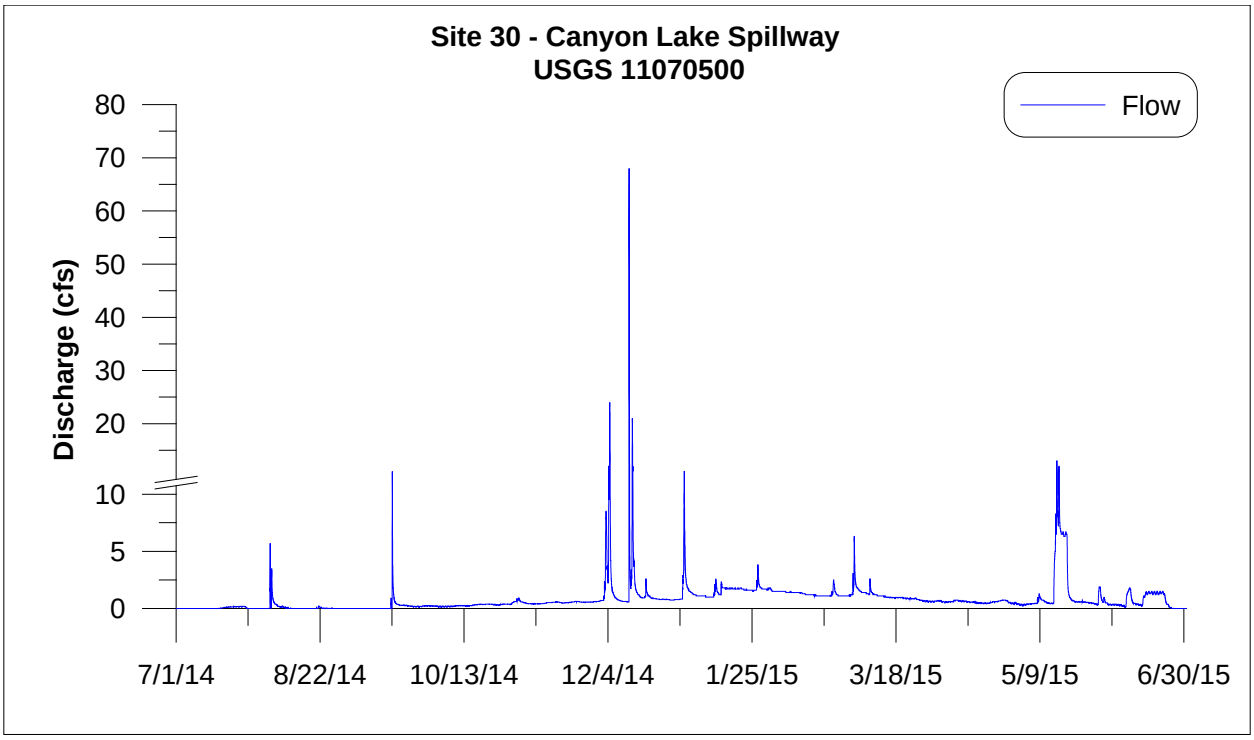


**Figure 2-4. Site 30 – Canyon Lake Spillway – Daily Stream Gauge Records**

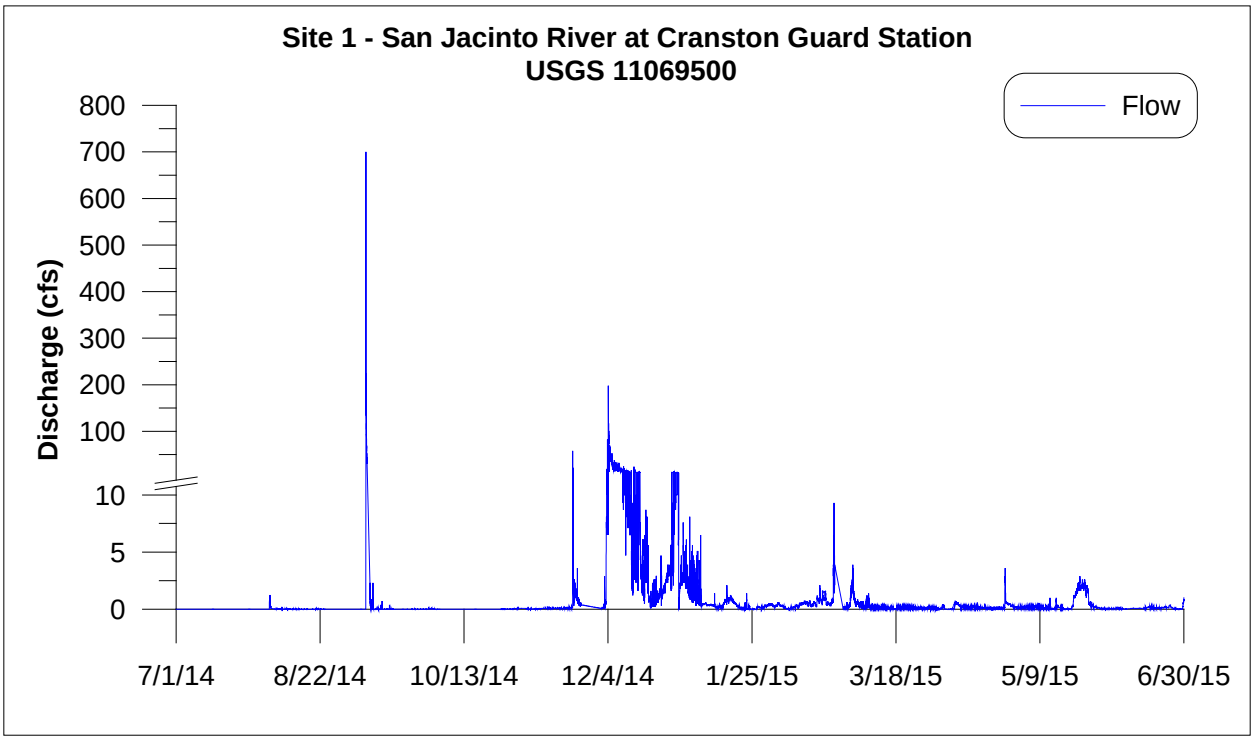


**Figure 2-5. Site 1 – San Jacinto River at Cranston Guard Station – Daily Stream Gauge Records**

## 2.5 Sampling Strategy

The sampling strategy is intended to result in the collection of at least eight samples 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 are utilized at all stations except San Jacinto River at Ramona Expressway (Station ID 741). The time-based frequency of grab samples is estimated and programmed into the device prior to the storm event, 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.
- Sample collection for chemical analysis at the Canyon Lake Spillway (Station ID 841) only performed if the nearby upstream dam overflows. The dam did not overflow during storm events that met the project mobilization criteria in the 2014-2015 wet weather season.
- Sample collection for chemical analysis at San Jacinto River at Ramona Expressway (Station ID 741) only performed if the upstream Mystic Lake overflows. Mystic Lake did not overflow during the 2014-2015 wet weather season.
- The sampling station at Cranston Guard Station (Station ID 792) is directly handled by the USFS.
- 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).
- Decisions regarding when to begin and stop sampling were made through discussions with staff at the RCFC&WCD.

## 2.6 San Jacinto Watershed Monitoring Events

The July 2014 through June 2015 reporting period provided two qualifying storm events to fulfill the goal of three events per year. The watershed-wide wet weather monitoring period was October 1, 2014 to April 30, 2015.

The mobilization criteria for event monitoring requires a National Weather Service quantitative precipitation forecast greater than an 1.0 inch forecast within 24 hours from November to January, and greater than an 0.5 inch forecast within 24 hours from January to May. Two storm events between November and April 30 met the mobilization criteria and occurred on December 2- 4, 2014 and March 2-4, 2015. Nine storm events occurred during this period that did not meet the mobilization criteria and were on the following dates: November 1, 2014, November 21,

2014, December 12, 2014, December 16, 2014, December 31, 2014, January 11, 2015, January 26, 2015, February 23, 2015, and April 24, 2015.

For the first monitoring event that occurred on December 2, 2014 through December 4, 2014, peak flows were observed by the USGS gauging stations on December 4, 2014 at all stations. Peak flows were recorded at 1,050 cubic feet per second (cfs) at Salt Creek at Murrieta Road (Station ID 745) and 377 cfs at San Jacinto River at Goetz Road (Station ID 759). While localized flow was recorded at the USGS gauging station located downstream of the Canyon Lake Spillway (Station ID 841) station, no flows exited Canyon Lake as a result of this storm (i.e. the water level in Canyon Lake did not crest the spillway) (Appendix B [actual versus projected lake elevation graph can be found at http://www.evmwd.com/depts/admin/public_affairs/lake_levels/default.asp ] ).
There were no flows recorded at the San Jacinto River at Ramona Expressway (Station ID 741).

For the second monitoring event that occurred from March 2, 2015 through March 4, 2015, peak flows observed by USGS gauging stations occurred on March 2, 2015 at Salt Creek at Murrieta Road (Station ID 745) with a flow of 81 cfs. Peak flows at San Jacinto River at Goetz Road (Station ID 759) were recorded at 20 cfs on March 3, 2015. While localized flow was recorded at the USGS gauging station located downstream of the Canyon Lake Spillway (Station ID 841) station, no flows exited Canyon Lake as a result of this storm (i.e. the water level in Canyon Lake did not crest the spillway) (Appendix B). There were no flows recorded at the San Jacinto River at Ramona Expressway (Station ID 741).

Another viable storm event meeting the mobilization criteria did not occur during the 2014-2015 wet weather monitoring period; thus a third monitoring event was not conducted.

## 2.7 San Jacinto Watershed Annual Water Quality Summary

As described in the previous section, water quality was measured for two storm events at two of 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, 2014 through June 30, 2015, is presented below. The complete set of water quality data for the period July 2014 through June 2015 is included as Appendix A.

Included with each summary of the monitoring data are the individual event mean concentrations (EMC) for each analyte. Also included are the estimated event loads and annual loads for each analyte.

### 2.7.1 Summary of Monitoring Data – Salt Creek at Murrieta Road

Water quality was measured for two storm events at the Salt Creek at Murrieta Road (Station ID 745). A total of 14 discrete samples were analyzed across the hydrograph to develop the EMCs for the first storm event, and 12 samples were analyzed for the second storm event. Data for the EMC of each analyte are presented in Table 2-4. Event and annual loads for each analyte are presented in Table 2-5. Photos taken during each storm event are provided in Figure 2-6 and Figure 2-7. Hydrographs with water quality sample times are provided in Figure 2-8 and Figure 2-9. The figures were developed based on flow data provided by the nearby USGS stream gauge (ID# 11070465). Total annual flow at this gauge was estimated at 68,316,102 cubic feet (cf) or 511 million gallons (Mgal).

**Figure 2-6. Storm Event at Salt Creek at Murrieta Road (December 2-December 4, 2014)**

**Figure 2-7. Storm Event at Salt Creek at Murrieta Road (March 2-March 4, 2015)**

EMCs for nutrients for the two storm events range from 1.86 to 2.62 milligrams per liter (mg/L) for total nitrogen, and 0.29 to 0.79 mg/L for total phosphorus (Table 2-4). The estimated annual nutrient load was calculated to be 4,661 kg for total nitrogen and 1,257 kg for total phosphorus (Table 2-5).

**Table 2-4. Water Quality EMCs at Salt Creek at Murrieta Road**

| Analyte | Units | EMC Event 1 | EMC Event 2 | Mean EMC |
|---|---|---|---|---|
| Ammonia-Nitrogen | mg/L | 0.65 | 0.09 | 0.37 |
| Kjeldahl Nitrogen | mg/L | 1.8 | 1.6 | 1.7 |
| Nitrate as N | mg/L | 0.82 | 0.29 | 0.56 |
| Nitrite as N | mg/L | 0.031 | 0.023 | 0.027 |
| Organic Nitrogen | mg/L | 1.1 | 1.5 | 1.3 |
| Ortho Phosphate Phosphorus | mg/L | 0.27 | 0.12 | 0.20 |
| Total Dissolved Solids | mg/L | 536 | 373 | 454 |
| Total Hardness | mg/L | 274 | 188 | 231 |
| Total Nitrogen | mg/L | 2.62 | 1.86 | 2.24 |
| Total Phosphorus | mg/L | 0.79 | 0.29 | 0.54 |
| Total Suspended Solids | mg/L | 257 | 54 | 156 |

**Table 2-5. Water Quality Event and Annual Loads at Salt Creek at Murrieta Road**

| Analyte | Units | Load Event 1* | Load Event 2* | Annual Load |
|---|---|---|---|---|
| Ammonia-Nitrogen | kg | 620 | 8.3 | 953 |
| Kjeldahl Nitrogen | kg | 1,709 | 147 | 3,348 |
| Nitrate as N | kg | 791 | 26.7 | 1,309 |
| Nitrite as N | kg | 30.2 | 2.1 | 56.4 |
| Organic Nitrogen | kg | 1,095 | 141 | 2,414 |
| Ortho Phosphate Phosphorus | kg | 261 | 11.3 | 446 |
| Total Dissolved Solids | kg | 514,241 | 34,248 | 949,398 |
| Total Hardness | kg | 262,774 | 17,266 | 483,777 |
| Total Nitrogen | kg | 2,514 | 171 | 4,661 |
| Total Phosphorus | kg | 755 | 26.6 | 1,257 |
| Total Suspended Solids | kg | 246,770 | 4,968 | 389,043 |

*Event load based on monitored volume.

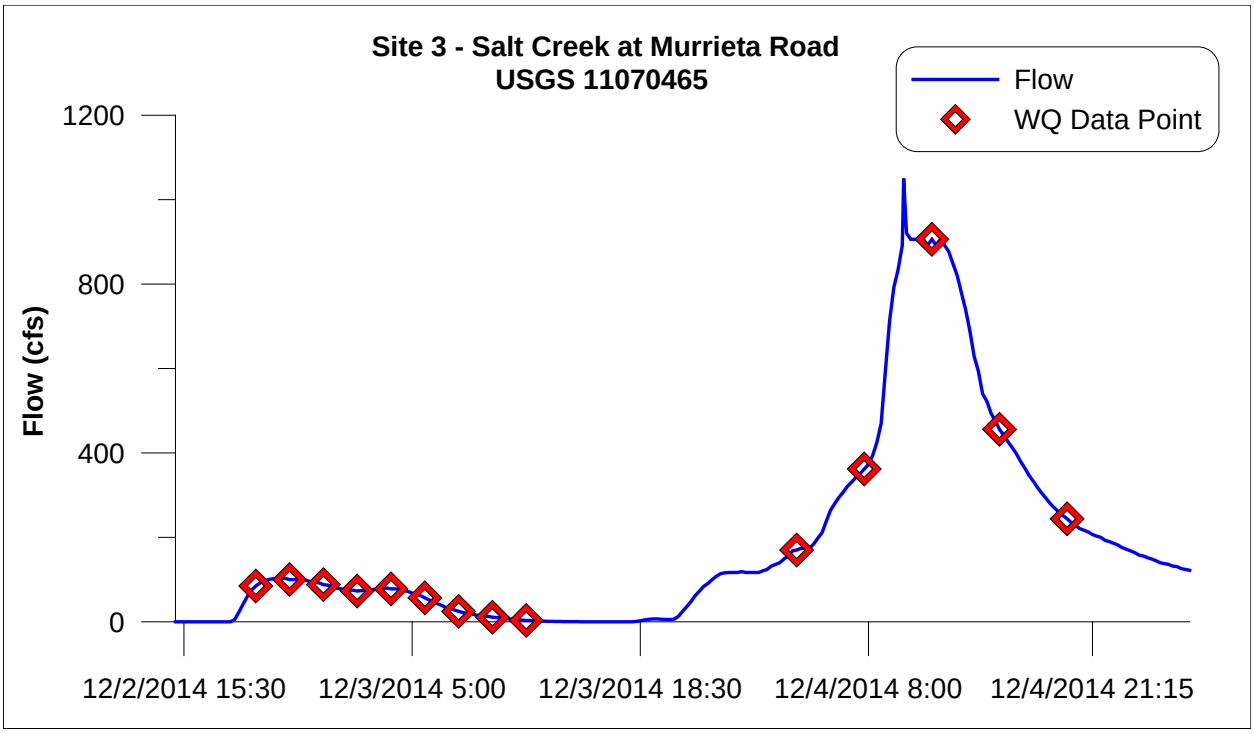


**Figure 2-8. Hydrograph of First Storm Event at Salt Creek at Murrieta Road (December 2-December 4, 2014)**

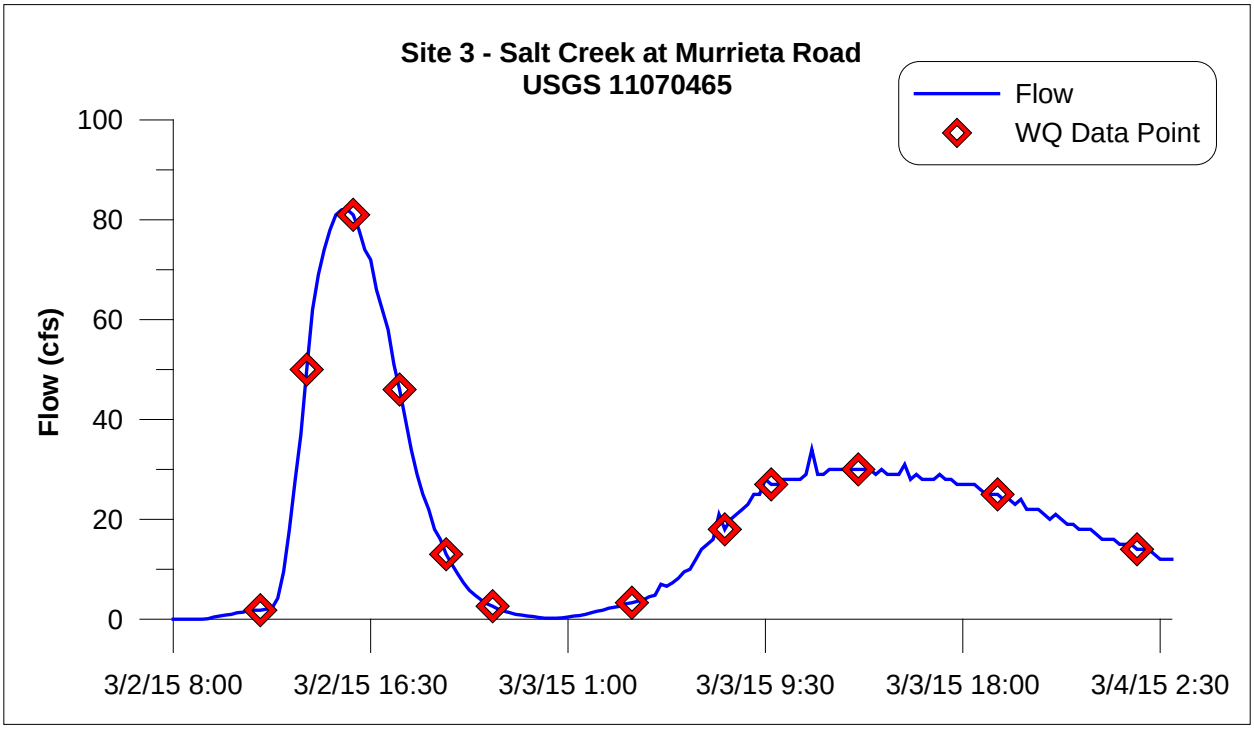


**Figure 2-9. Hydrograph of Second Storm Event at Salt Creek at Murrieta Road (March 2-March 4, 2015)**

### 2.7.2 Summary of Monitoring Data – San Jacinto River at Goetz Road

Water quality was sampled for two storm events at the San Jacinto River at Goetz Road (Station ID 759). For this station, a total of 12 discrete samples were analyzed across the hydrograph to develop the EMCs for the first storm event, and 10 samples were analyzed for the second storm event. Data for the EMCs of each analyte are presented in Table 2-6. Event and annual loads for each analyte are presented in Table 2-7. Photos taken during each storm event are provided in Figure 2-10 and Figure 2-11. Hydrographs with water quality sample times are provided in Figure 2-12 and Figure 2-13. The figures were developed based on flow data provided by the nearby USGS stream gauge (ID# 11070365). Total annual flow at this gauge was estimated at 76,248,630 cf or 570 Mgal.

**Figure 2-10. Storm Event at San Jacinto River at Goetz Road (December 3-December 4, 2014)**

**Figure 2-11. Storm Event at San Jacinto River at Goetz Road (March 2-March 4, 2015)**

EMCs for nutrients for the two storm events range from 1.57 to 1.95 milligrams per liter (mg/L) for total nitrogen, and 0.33 to 0.56 mg/L for total phosphorus (Table 2-6). The estimated annual nutrient load was calculated to be 3,932 kg for total nitrogen and 1,041 kg for total phosphorus (Table 2-7).

**Table 2-6. Water Quality EMCs at San Jacinto River at Goetz Road**

| Analyte | Units | EMC Event 1 | EMC Event 2 | Mean EMC |
|---|---|---|---|---|
| Ammonia-Nitrogen | mg/L | 0.08 | 0.07 | 0.08 |
| Kjeldahl Nitrogen | mg/L | 1.2 | 0.9 | 1.0 |
| Nitrate as N | mg/L | 0.76 | 0.66 | 0.71 |
| Nitrite as N | mg/L | 0.038 | 0.027 | 0.032 |
| Organic Nitrogen | mg/L | 1.1 | 0.8 | 1.0 |
| Ortho Phosphate Phosphorus | mg/L | 0.20 | 0.11 | 0.15 |
| Total Dissolved Solids | mg/L | 141 | 165 | 153 |
| Total Hardness | mg/L | 76 | 81 | 78 |
| Total Nitrogen | mg/L | 1.95 | 1.57 | 1.76 |
| Total Phosphorus | mg/L | 0.56 | 0.33 | 0.44 |
| Total Suspended Solids | mg/L | 142 | 63 | 102 |

**Table 2-7. Water Quality Event and Annual Loads at San Jacinto River at Goetz Road**

| Analyte | Units | Load Event 1* | Load Event 2* | Annual Load |
|---|---|---|---|---|
| Ammonia-Nitrogen | kg | 60.9 | 2.3 | 164 |
| Kjeldahl Nitrogen | kg | 914 | 29.0 | 2,330 |
| Nitrate as N | kg | 594 | 21.1 | 1,563 |
| Nitrite as N | kg | 29.5 | 0.9 | 73.5 |
| Organic Nitrogen | kg | 863 | 26.9 | 2,189 |
| Ortho Phosphate Phosphorus | kg | 153 | 3.5 | 361 |
| Total Dissolved Solids | kg | 110,284 | 5,284 | 320,351 |
| Total Hardness | kg | 59,623 | 2,594 | 167,428 |
| Total Nitrogen | kg | 1,526 | 50.3 | 3,932 |
| Total Phosphorus | kg | 438 | 10.4 | 1,041 |
| Total Suspended Solids | kg | 111,219 | 2,026 | 250,737 |

*Event load based on monitored volume.

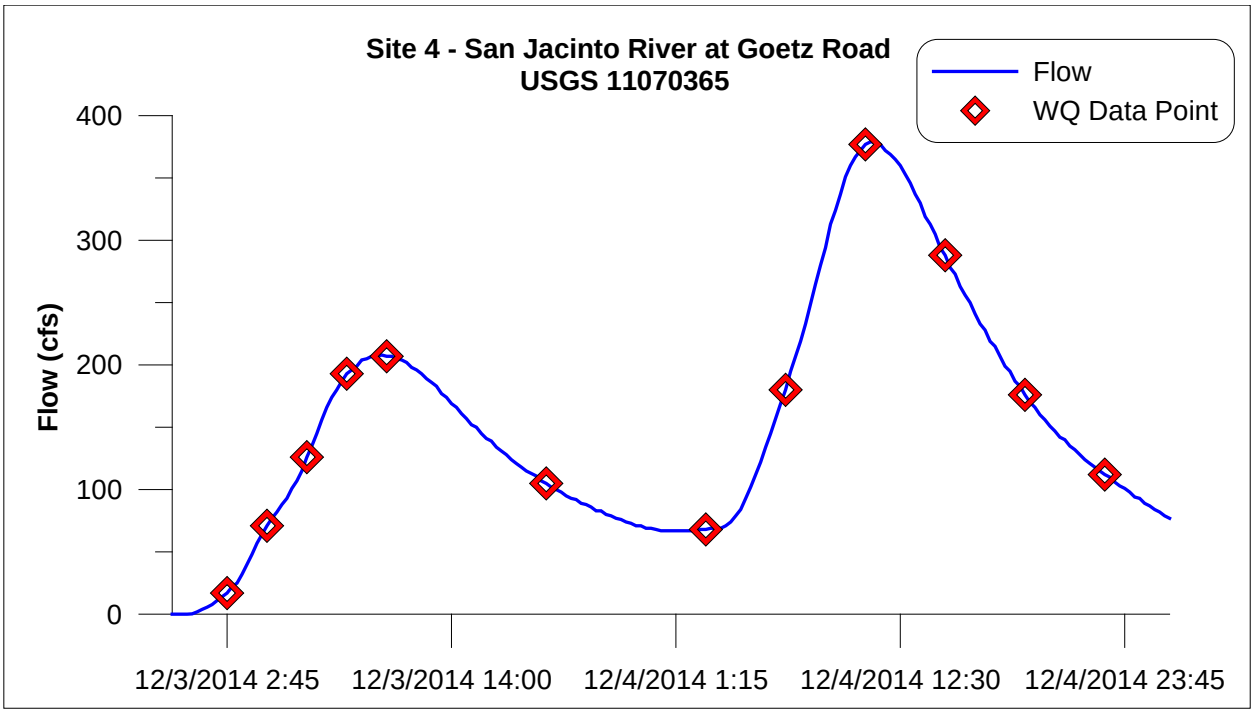


**Figure 2-12. Hydrograph of First Storm Event at San Jacinto River at Goetz Road (December 2-December 4, 2014)**

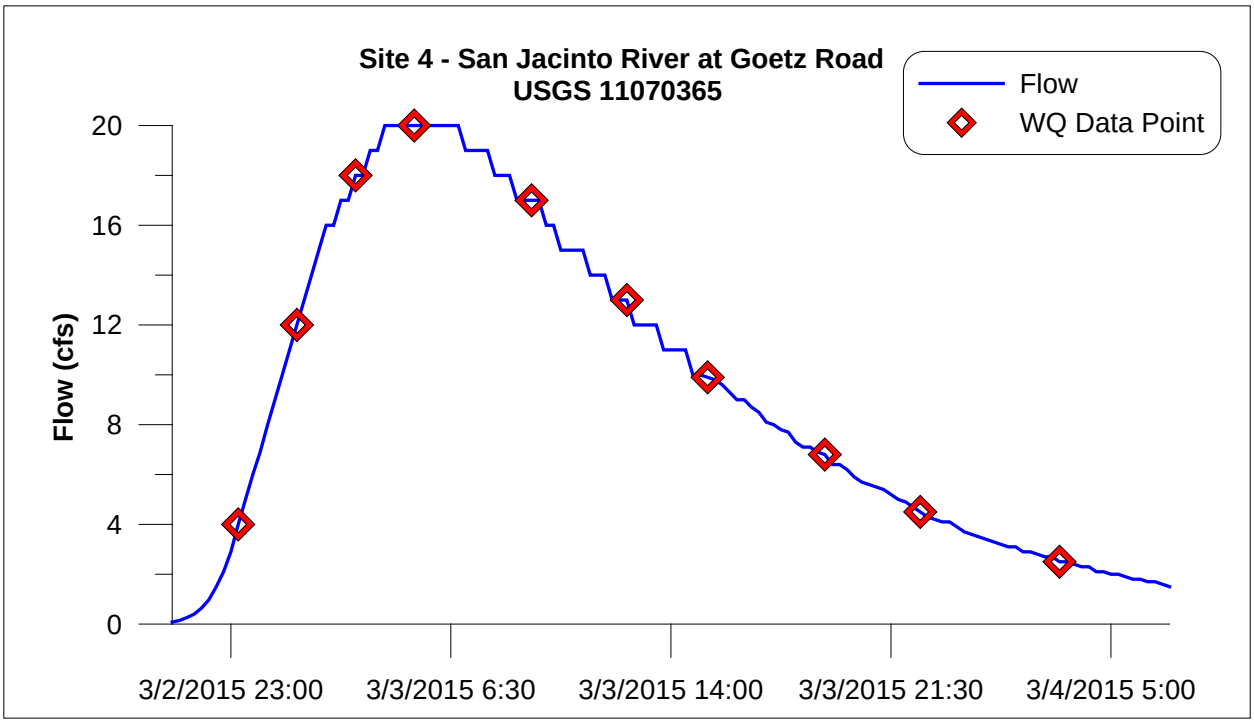


**Figure 2-13. Hydrograph of Second Storm Event at San Jacinto River at Goetz Road (March 2-March 4, 2015)**

### 2.7.3 Summary of Monitoring Data – San Jacinto River at Ramona Expressway

There were no flows at the San Jacinto River at Ramona Expressway (Station ID 741); thus, no samples were collected during the 2014-2015 monitoring year.

### 2.7.4 Summary of Monitoring Data – Cranston Guard Station

The United States Forest Service (USFS) 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 storm monitoring period, there were no flows at the Cranston Guard Station (Station ID 792) which exceeded 300 cfs; thus, no samples were collected during the 2014-2015 monitoring year.

### 2.7.5 Summary of Monitoring Data – Canyon Lake Spillway

The Railroad Canyon Dam Spillway elevation at Canyon Lake is 1,381.76 feet (ft) (http://www.evmwd.com/depts/admin/public_affairs/lake_levels/default.asp.) During the 2014-15 monitoring year, water may have overflowed the dam at Canyon Lake for brief periods (ranging from 15 minutes to three hours) on nine separate days between December 14, 2014 and January 16, 2015 based on comparison of the lake levels to the spillway elevation (Figure 2-14 and Appendix B). During these brief episodes, the lake elevation ranged from 1,381.77 ft to 1,382.26 ft (i.e. 0.01 ft to 0.5 ft above the spillway elevation of 1,381.76 ft). The storm events between December 14, 2014 and January 16, 2015 did not meet the project mobilization criteria; therefore, no samples were collected at the Canyon Lake Spillway (Station ID 841) site during the 2014-2015 monitoring year.

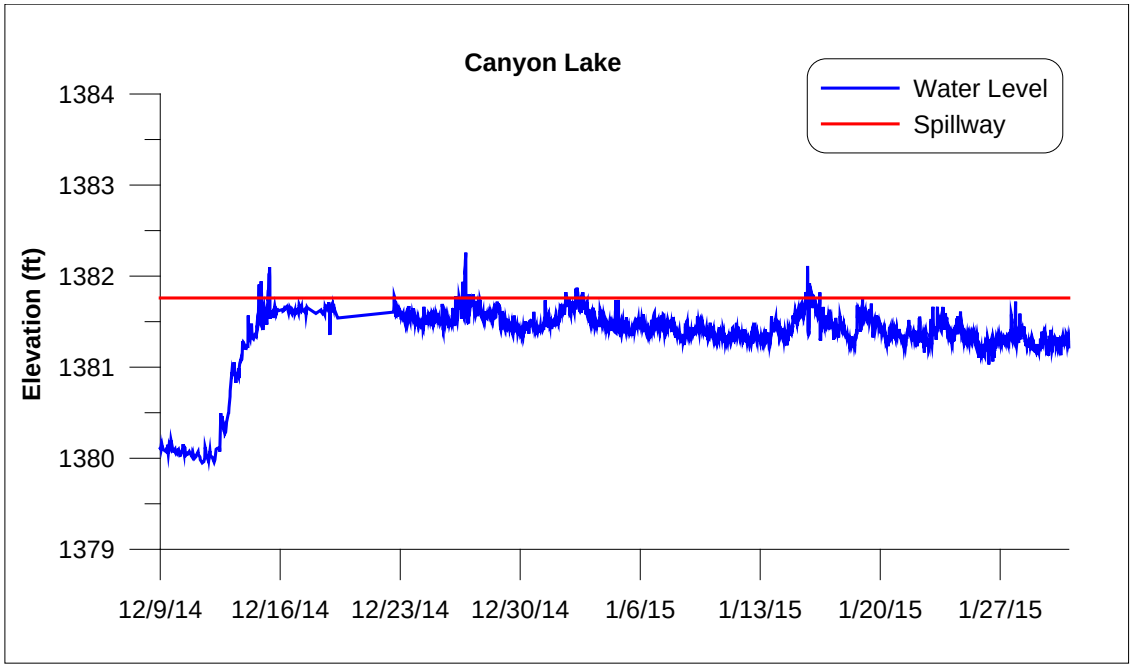


**Figure 2-14. Canyon Lake Water Level Elevation and Spillway Elevation (December 9 – January 27, 2014)**

## 2.8 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 2-8.

**Table 2-8. 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, 2014, through June 30, 2015, are summarized in Table 2-9. The complete set of rainfall gauge data is included as Appendix A.

**Table 2-9. Summary Rainfall Data (July 2014 to June 2015)**

| Monthly Rainfall (inches) | Perris | Winchester | Elsinore | San Jacinto | Pigeon Pass |
|---|---|---|---|---|---|
| Jul | 0 | 0.06 | 0 | 0 | 0 |
| Aug | 0.68 | 0.54 | 0.67 | 0.35 | 1.53 |
| Sep | 0 | 0.02 | 0.42 | 0.03 | 0.04 |
| Oct | 0 | 0 | 0.01 | 0 | 0 |
| Nov | 0.36 | 0.31 | 0.18 | 0.42 | 0.54 |
| Dec | 2.79 | 4.26 | 3.47 | 5.23 | 4.23 |
| Jan | 0.5 | 0.63 | 0.49 | 0.34 | 0.54 |
| Feb | 0.31 | 0.37 | 0.31 | 0.52 | 1.04 |
| Mar | 0.31 | 0.57 | 0.41 | 0.69 | 0.31 |
| Apr | 0.09 | 0.12 | 0.1 | 0.24 | 0.54 |
| May | 0.72 | 1.05 | 0.9 | 0.94 | 0.79 |
| Jun | 0 | 0 | 0 | 0 | 0 |
| **Annual Rainfall (Inches)** | 5.76 | 7.93 | 6.95 | 8.76 | 9.55 |

# 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 performed in coordination with EVMWD's NPDES compliance program (Order No. R8-2013-0017 for NPDES No. CA8000027 for the Regional Water Reclamation Plant, Lake Elsinore, Riverside County approved October 1, 2013).

EVMWD's NPDES compliance monitoring program for Lake Elsinore was initiated in April 2006. On October 26, 2012 the Regional Board issued a resolution (Resolution No. R8-2012-0052) granting the Task Force a temporary suspension of TMDL in-lake Canyon Lake and Lake Elsinore monitoring programs to achieve cost savings that will be applied to implementing on-the-ground projects aimed at reducing nutrient impacts in Canyon Lake and Lake Elsinore. Therefore, the Lake Elsinore TMDL compliance monitoring was not conducted for the July 2014 to June 2015 period. However, in situ water quality monitoring in Lake Elsinore by EVMWD related to the lake aeration/mixing system was performed during this monitoring period. Data collected from these efforts will be used to supplement TMDL-specific compliance monitoring that will be re-initiated in fiscal year 2015-2016. The Task Force intends to resume in-lake monitoring in fiscal year 2015-2016 per the Lake Elsinore & Canyon Lake Nutrient TMDL Compliance Monitoring Work Plan submitted to the Regional board in April 2015.

# 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. On October 26, 2012 the Regional Board issued a resolution (Resolution No. R8-2012-0052) granting the Task Force a temporary suspension of TMDL compliance monitoring in Canyon Lake and Lake Elsinore to achieve cost savings that will be applied to implementing on-the-ground projects aimed at reducing nutrient impacts in Canyon Lake and Lake Elsinore. Therefore, the Canyon Lake monitoring was not conducted for the July 2014 to June 2015 period. However, monitoring to support the alum effectiveness treatments in Canyon Lake and water quality monitoring of Canyon Lake by EVMWD near the intake of the water treatment plant was conducted during this period. Data collected from these efforts will be used to supplement TMDL-specific compliance monitoring that will be re-initiated in fiscal year 2015-2016. The Task Force intends to resume in-lake monitoring in fiscal year 2015-2016 per the Lake Elsinore & Canyon Lake Nutrient TMDL Compliance Monitoring Work Plan submitted to the Regional board in April 2015.

# 5.0 DATA MANAGEMENT

LESJWA, on behalf of the Task Force, oversees the management and storage of water quality samples and field analysis 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 (QAPP; http://www.sawpa.org/tmdl-monitoring-plan-and-qapp/

## 5.1 Management of TMDL Data

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 the Surface Water Ambient Monitoring Program (SWAMP) (http://www.waterboards.ca.gov/swamp/qapp.html).

LESJWA maintains 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. Weston has reviewed all field and laboratory data from the San Jacinto River Watershed Monitoring in 2014-2015 using a thorough QA/QC process. Field forms, chain of custody forms, and laboratory EDDs are provided to LESJWA.

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 are used to 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.

## 5.2 California Environmental Data Exchange Network

Weston has uploaded the 2014-2015 field and laboratory water quality data collected under the San Jacinto River Watershed Nutrient TMDL Monitoring Program to the Regional Data Center (RDC) of the California Environmental Data Exchange Network (CEDEN). The water quality data was formatted into CEDEN templates and then submitted through online data submission/checker programs to the RDC. The submission/checker programs ensure data integrity and comparability with other data sets. SAWPA has a direct link to the CEDEN database whereby the TMDL data uploaded by Weston is pushed out on a daily basis to a SQL Server database residing at SAWPA. The data can therefore be quickly accessed by SAWPA and stakeholders.

CEDEN is a central location to find and share information about California's water bodies, including streams, lakes, rivers, and the coastal ocean. Many groups in California monitor water quality, aquatic habitat, and wildlife health to ensure good stewardship of our ecological resources. CEDEN aggregates this data and makes it accessible to environmental managers and the public. To find out more about CEDEN or to download the water quality data collected under the San Jacinto River Watershed Nutrient TMDL Monitoring Program, go to www.ceden.org.

# APPENDIX A

# July 1, 2014 – June 30, 2015 Data

1. Rainfall Gauge Data
2. Stream Gauge Data
3. Laboratory Water Quality Data
4. Field Water Quality Data

# APPENDIX B

# Canyon Lake Levels