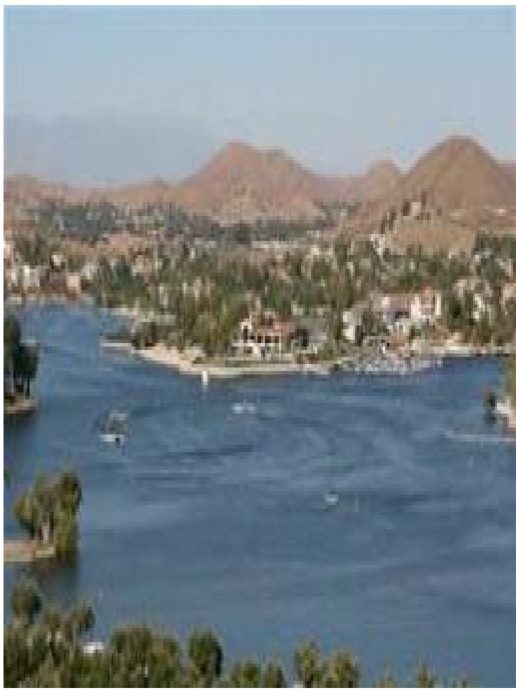
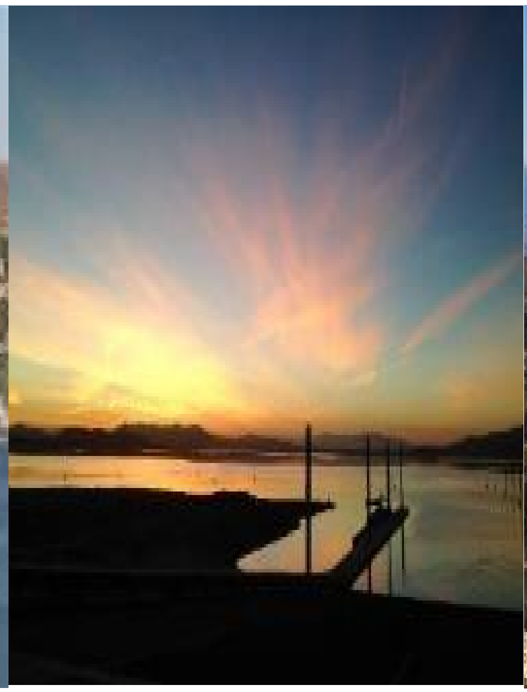
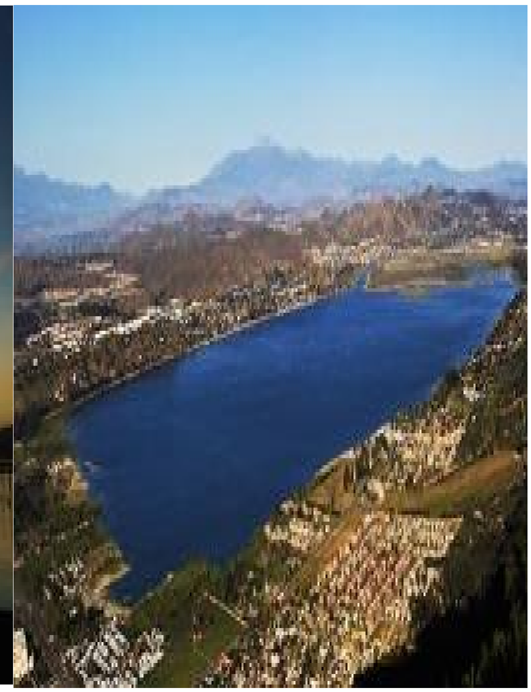
Lake Elsinore & Canyon Lake Nutrient Total Maximum Daily Loads (TMDLs)

Quality Assurance Project Plan

FINAL

Prepared for:
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9210 Sky Park Court
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September 27, 2016

Lake Elsinore & San Jacinto Watersheds Authority

amec foster wheeler

A. Project Management

A.1 TITLE AND APPROVAL SHEET

QUALITY ASSURANCE PROJECT PLAN

FOR

LAKE ELSINORE, CANYON LAKE AND SAN JACINTO RIVER WATERSHED TMDL MONITORING PROGRAM

September 27, 2016

APPROVAL SIGNATURES

10/19/16

Mark Norton
Task Force Chair
Lake Elsinore & Canyon Lake Nutrient TMDL Task Force

Date

10.11.2016

Renee Spears
QA Officer-State DMR-QA Coordinator
California State Water Resources Control Board

Date

10/17/16

Mark Smythe
TMDL Program Manager
Santa Ana Regional Water Quality Control Board

Date

10/17/2016

Ken Theisen
Water Resource Control Engineer
Santa Ana Regional Water Quality Control Board

Date

10/21/16

Sudhir C. Mohleji
Senior Civil Engineer
Elsinore Valley Municipal Water District

Date

Stuart E McKibbin

Date 10-11-16

Name: STUART E. McKIBBIN

Riverside County Flood Control & Water Conservation District

Nicole Dailey

Date 10/20/2016

Name: Nicole Dailey, Senior Management Analyst

City of Lake Elsinore

Aaron D Palmer

Date 11-2-16

Name: Aaron D Palmer

City of Canyon Lake

A.2 TABLE OF CONTENTS

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Acronyms and Abbreviations

AGR	agricultural supply
Amec FW	Amec Foster Wheeler, Environment & Infrastructure, Inc.
Basin Plan	Water Quality Control Plan for the Santa Ana River
BMP	Best Management Practice
CL	Canyon Lake
CWAD	Conditional Waiver for Agricultural Discharges
DO	dissolved oxygen
DOC	dissolved organic carbon
ELAP	Environmental Laboratory Accreditation Program
EPA	Environmental Protection Agency
EVMWD	Elsinore Valley Municipal Water District
GWR	groundwater recharge
LE	Lake Elsinore
LESJWA	Lake Elsinore & San Jacinto Watersheds Authority
m	meter
MS	matrix spike
MSD	matrix spike duplicate
MS4	Municipal Separate Storm Sewer System
MUN	municipal and domestic water supply
NPDES	National Pollutant Discharge Elimination System
PM	Project Manager
QA/QC	Quality Assurance/Quality Control
QAO	Quality Assurance Officer
QAPP	Quality Assurance Project Plan
RCFCWCD	Riverside County Flood Control & Water Conservation District
REC1	water contact recreation beneficial use designation
REC2	non-water contact recreation beneficial use designation
RPD	relative percent difference
RPE	relative percent error

Acronyms and Abbreviations (Cont.)

SARWCBD	Santa Ana Regional Water Quality Control Board
SC	specific conductance
SRM	standard reference material
SRP/Ortho-P	soluble reactive phosphorus
SAW DMS	Santa Ana Watershed Database Management System
SAWPA	Santa Ana Watershed Project Authority
SJW	San Jacinto Watershed
SOP	standard operating procedures
SWAMP	Surface Water Ambient Water Monitoring Program
TDS	total dissolved solids
TOC	total organic carbon
TKN	Total Kjeldahl Nitrogen
TMDL	Total Maximum Daily Load
USGS	United States Geological Survey
WARM	warm freshwater habitat
WILD	wildlife habitat
WLA	waste load allocation

A.3 DISTRIBUTION LIST

Table A-1 identifies those individuals who will each receive one controlled copy of the approved Quality Assurance Project Plan (QAPP). Additional un-controlled copies will also be provided to all key project team members mentioned in Table A-2.

Table A-1. Quality Assurance Project Plan Distribution List

Name	Title:	Name (Affiliation):	Tel. No.:	No. of copies:
Mark Norton	Task Force Chair	Lake Elsinore & San Jacinto Watersheds Authority	(951) 354-4221	1
Mark Smythe	TMDL Program Manager	Santa Ana Regional Water Quality Control Board	(951) 782-4998	1
Rick Whetsel	Task Force Monitoring	Program Manager Lake Elsinore & San Jacinto Watersheds Authority	(951) 354-4222	1
Jason Uhley	San Jacinto Watershed Quality Assurance Manager	Riverside County Flood Control & Water Conservation District	(951) 955-1346	1

A.4 PROJECT/TASK ORGANIZATION

A.4.1 Involved Parties and Project Roles

A list of responsible parties, their roles, and contact information is presented in Table A-2 and Figure A-1. Mr. Mark Norton serves as the Lake Elsinore and Canyon Lake Nutrient TMDL Task Force (Task Force) Chair. Mr. Mark Smythe and Mr. Ken Theisen, the TMDL Program Manager and Quality Assurance Program Manager respectively, will serve as the Santa Ana Regional Water Quality Control Board (SARWQCB) representatives. Ms. Renee Spears of the State Water Resources Control Board, serves as the State Water Board QA Officer. Amec Foster Wheeler Environment & Infrastructure, Inc. (Amec FW) will serve as the lead for the San Jacinto Watershed (SJW) Nutrient TMDL Monitoring Program on behalf of the Task Force, with Mr. Chris Stransky, of Amec FW serving as its Quality Assurance Manager.

Mr. John Rudolph of Amec FW will serve as the lead for the in-lake Lake Elsinore (LE) and Canyon Lake (CL) nutrient monitoring programs, including organization and training of field staff; scheduling of sampling days; data management and quality control; and interactions with contract laboratories, and coordination with lake patrol staff on Canyon Lake.

Mr. Garth Engelhorn of Alta Environmental, will be responsible for all aspects of the SJW stormwater nutrient monitoring program, including organization and training of field staff, scheduling of sampling days, data management and quality control, and interactions with contract laboratories associated with the SJW nutrient monitoring program.

Analytical chemistry will be performed by an ELAP or NELAP certified analytical laboratory. All samples will be under the authority of the certified laboratory QAPP once samples have been received by the laboratory. Standard operating procedures of the laboratory utilized for the analytes mentioned herein (see Tables B-7 and B-8) are noted in a stand-alone document, Attachment A.

Satellite imagery analysis will be performed by a sub-contractor with demonstrated experience analyzing for chlorophyll-a and turbidity. Prior to analysis, calibration exercises with historical in-lake analytical data will be performed to demonstrate that the sub-contractor has the capability to consistently and accurately predict in-lake concentrations of chlorophyll-a and turbidity from satellite imagery.

Table A-2. Responsible Personnel

Name	Organizational Affiliation	Title	Contact Information (Phone & Email)
Mark Norton	Lake Elsinore & San Jacinto Watersheds Authority	Task Force Chair	(951) 354-4221 mnorton@sawpa.org
Rick Whetsel	Lake Elsinore & San Jacinto Watersheds Authority	Monitoring Program Manager	(951) 354-4222 rwhetsel@sawpa.org
Chris Stransky	Amec FW	San Jacinto Watershed Nutrient TMDL Monitoring Project Quality Assurance Manager	(858) 300-4530 chris.stransky@amecfw.com
John Rudolph	Amec FW	In-Lake Monitoring Program Manager	(858) 514-6465 john.rudolph@amecfw.com
Garth Engelhorn	Alta Environmental	Watershed Monitoring Program Manager	(562) 495-5777 garth.engelhorn@altaenviron.com
Robert Taylor	U.S. Forest Service	Cranston Guard Station Monitoring Site Manager	(909) 382-2660 rgtaylor@fs.fed.us
Mark Smythe	Santa Ana Regional Water Resources Control Board	TMDL Program Manager	(951) 782-4998 mark.smythe@waterboards.ca.gov
Ken Theisen	Santa Ana Regional Water Resources Control Board	Quality Assurance Program Manager	(951) 320-2028 ken.theisen@waterboards.ca.gov
Renee Spears	State Water Resources Control Board	State Water Board QA Officer	(916) 341-5583 renee.spears@waterboards.ca.gov

A.4.2 Program Quality Assurance

The State Water Resources Control Board (SWRCB) QA Officer is responsible for reviewing the Quality Assurance Project Plan and recommending changes as necessary in order to provide the project proponent with a useful project plan that provides the necessary environmental data to answer questions and adheres to EPA and Water Board Guidance. If the project is multi-year, the project proponent is to re-evaluate the efficacy of the project plan and make necessary changes with the approval of the State Board QA Officer.

After approval of the project plan the Project QA manager will oversee data quality produced during this project as well review and assess procedures described within the project plan.

A.4.3 Laboratory QA/QC Managers

Each subcontracted laboratory will assign to this project a laboratory QA/QC manager who is knowledgeable in the quality system standard defined under the California Environmental Laboratory

Accreditation Program (ELAP) for chemistry. The laboratory QA/QC managers will report QA-related issues to the QAO.

A.4.4 Data Reporting QA/QC Roles

Once the data have passed QA/QC at the laboratory level and has been submitted to the Task Force and its consultants, data packages will undergo an additional round of QA review prior to subsequent analysis and reporting. This program includes QA Managers for both watershed monitoring and in-lake monitoring given the distinct activities required by each. These QA Managers will be responsible for the QA review and final deliverables associated with the respective monitoring program they oversee.

A.4.5 Persons Responsible for QAPP Revisions

Changes and updates to this QAPP may be made after a review of the evidence for change by the PM and with the concurrence of the TMDL Task Force.

The Task Force's consultant PM will be responsible for revising the QAPP, submitting drafts of the revisions for review, preparing a final version, and submitting the final version for signature.

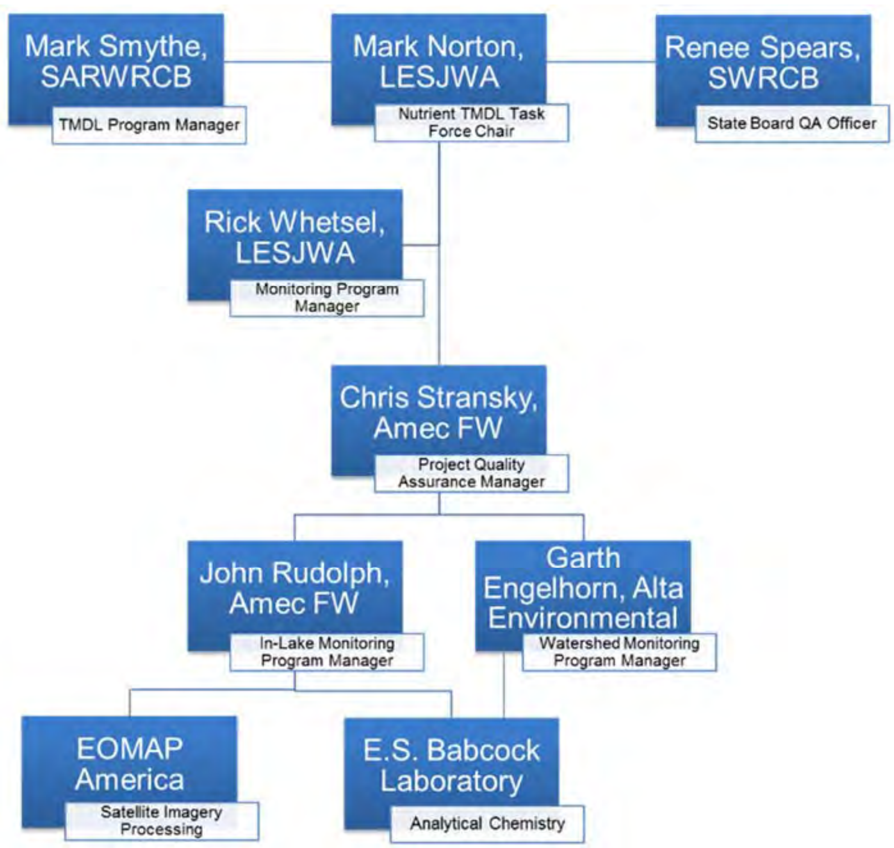

Figure A-1.
Organizational Chart

A.5 PROBLEM DEFINITION/BACKGROUND

A.5.1 Problem Statement

Lake Elsinore is a natural freshwater lake in Southern California, providing a variety of natural habitats for terrestrial and aquatic species. The beneficial uses of the lake include water contact recreation (REC1), non-water contact recreation (REC2), warm freshwater habitat (WARM) and wildlife habitat (WILD). Canyon Lake was constructed in 1928 as the Railroad Canyon Reservoir. It is located about 2 miles upstream of LE and water spilled from CL is a main source of water for LE. The beneficial uses of CL include municipal and domestic water supply (MUN), agricultural supply (AGR), groundwater recharge (GWR), body contact recreation (REC1), non-body contact recreation (REC2), warm freshwater aquatic habitat (WARM), and wildlife habitat (WILD).

Both Lake Elsinore and Canyon Lake have a history of elevated nutrient levels and algal blooms resulting in reduced water clarity, as well as occasional fish kills most likely attributable to transient low dissolved oxygen (DO) conditions. Since 2000, local stakeholders, in cooperation with the SARWQCB, have been working to identify the sources of nutrients impairing each lake, and to 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 along the San Jacinto River and Salt Creek, as well as, water quality monitoring of LE and CL 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 December 2004, the (SARWQCB) adopted amendments to the Water Quality Control Plan for the Santa Ana River Basin (Basin Plan) to incorporate TMDLs for nutrients in CL and LE. The Basin Plan Amendment specifies, among other things, monitoring recommendations to track compliance with TMDLs and associated load allocations, as well as measuring compliance to in-lake numeric water quality targets. Numeric targets have been established and incorporated in the TMDL for nutrients (total nitrogen, phosphorous, and ammonia), dissolved oxygen, and chlorophyll-a. To comply with beneficial use criteria defined for each lake, the primary goal is to reduce enhanced eutrophication which can negatively affect biological communities, result in fish kills, and impact recreational use. Recommendations outlined for the lakes in Resolution No. R8-2004-0037 required stakeholders to develop management plans and to conduct long-term monitoring and implementation programs targeted at reducing nutrient discharges to LE and CL.

A.5.2 Program Goals

To comply with Resolution No. R8-2004-0037, a phased monitoring approach was developed in 2006. Through this phased approach, the TMDL Task Force stakeholders were able to develop a priority schedule for addressing data gaps. Focus was oriented on the most prominent data gaps and limitations to the nutrient TMDL calculation, while an agreed upon level of monitoring to remain consistent with the Basin Plan requirements to track compliance with TMDLs and associated Waste Load Allocations (WLAs) was performed. The LE and CL Nutrient TMDL Monitoring Plan was approved by the Regional Board in March

2006, and was subsequently implemented by the TMDL Task Force. The Phase 1 approach was conducted from April 2006 to June 2015. The approach included: 1) an intensive study of in-lake processes; 2) an intensive watershed study; and 3) compliance monitoring. In agreement with the Regional Water Board, the in-lake monitoring efforts were discontinued temporarily in 2012 to redirect funding towards nutrient reduction actions. Nutrient reduction actions include lake stabilization efforts, fish management strategies to reduce re-suspension of sediments from carp and grazing of zooplankton by shad, as well as the addition of alum to bind nutrients in CL.

The following objectives (in order from highest to lowest priority) are being considered for the development of the Nutrient TMDL Compliance Monitoring Program:

1. Evaluate the current status and historic trends leading towards achievement of nutrient TMDL targets in both LE and CL;
2. Determine how to quantify the degree of influence natural background sources have conditions on LE and CL; and
3. Distinguish and quantify external pollutant loading from upstream watersheds including agricultural, urban, and open space sources

The monitoring program is also designed to support the stormwater compliance activities underway by other entities in the watershed, including the reissuance of the Riverside County Municipal Stormwater National Pollutant Discharge Elimination Systems (NPDES) Permit [Order R8-2010-0033; Municipal Separate Storm Sewer System (MS4) Permit], and land use monitoring requirements related to the Conditional Waiver of Agricultural Discharges (CWAD).

A.6 PROJECT/TASK DESCRIPTION

A.6.1 Project - San Jacinto Watershed (SJW) Nutrient TMDL Monitoring Program

A.6.1.1 Work Statement and Project Products

The study design for the SJW-wide monitoring will continue to evaluate nutrient loading into CL and LE from upstream watershed sources and add to the historical monitoring data set for identification of long-term trends. Consequently, stormwater runoff will continue to be sampled during three storm events per year during the wet season at all stations if flow is present. To date, watershed-wide monitoring has been conducted only during wet season rain events. However, in order to develop a better understanding of the potential influences of dry-weather runoff on LE and CL water quality, it may be necessary in the future to verify the existence and extent of dry-weather inputs from surrounding communities and major tributaries into the lakes. Based on past monitoring, the stormwater samples will be analyzed for various constituents as identified in Table A-3. These are the same constituents that have historically been monitored for in the watershed-wide monitoring.

In-lake monitoring was suspended temporarily in 2012 to redirect additional resources toward the implementation of in-lake best management practices (BMPs) (LESJWA, 2012). However, in-lake sampling is required to estimate progress towards attaining nutrient TMDL targets and for calculating annual and 10-year running averages. In-lake monitoring for LE will be resumed using the same three stations outlined in the initial approved LE and CL Nutrient TMDL Monitoring Plan (LESJWA, 2006). In-situ water quality measurements will be collected monthly during the summer period (June – September) and bi-monthly (i.e., every-other month) during the remainder of the year (October – May) for all three stations (LE01, LE02, and LE03), while analytical samples for those analytes outlined in Table A-4 will be collected at LE02 only. In-lake monitoring will be resumed for CL at four stations outlined in the approved LE and CL Nutrient TMDL Monitoring Plan (LESJWA, 2006). The stations include two in the main body of the lake (CL07 near the dam and CL08 in the northern arm) and two in the East Bay (CL09 and CL10) for bi-monthly (i.e., every-other month) monitoring. Analytical samples for those analytes outlined in Table A-4 will be collected at three of the four monitoring locations (CL07, CL08, and CL10), in-situ water quality monitoring will be performed at all stations, and surface chlorophyll-a samples will be collected at Station CL09 (see section B.1.2.2.

In Fiscal Year 2015-2016, the Task Force contracted with EOMap Americas to conduct remote sensing using Landsat satellite imagery to estimate chlorophyll-a concentrations in Lake Elsinore and Canyon Lake. Using a resolution of 5 pixels per acre, this effort produced maps of the lake showing graphical, color-coded images of chlorophyll-a and turbidity concentrations at up to approximately 1000 unique data points across Canyon Lake and approximately 11,000 unique data points across Lake Elsinore. This tool provides snapshots of conditions throughout the entire lake at a given point in time, as opposed to the single data points provided at water quality collection locations; however, the satellite imagery only represents approximately the upper 4 feet of the water column and therefore cannot completely replace manual sampling.

As part of the compliance monitoring, satellite imagery depicting lake-wide chlorophyll-a concentrations in Lake Elsinore and Canyon Lake will be generated for each in-lake monitoring event. In addition to examining lake-wide chlorophyll concentrations, these data can be used to measure chlorophyll-a as a means of collecting data for calculating the annual average concentration and conducting trends analysis. In the future, satellite imagery mapping could also be conducted prior to and following in-lake treatments (such as alum applications) to gauge effectiveness on a lake-wide scale.

Table A-3. Analytical Constituents and Methods for the San Jacinto Watershed Monitoring

Parameter	Analysis Method	Sample Type/ Frequency
Turbidity	Field Probe	Composite Samples Collected During 3 Storm Events Annually
Water Temperature	Field Probe	
pH	Field Probe	
Total Organic Nitrogen (Org-N)	Calculated [b]	
Nitrite Nitrogen (NO_2-N)	SM4500-NO_2 B	
Nitrate Nitrogen (NO_3-N)	EPA 300.0	
Ammonia Nitrogen (NH_4-N)	SM4500-NH_3 H	
Total Kjeldahl Nitrogen (TKN)	EPA 351.2	
Total Phosphorus (TP)	SM4500-P BE	
Soluble Reactive Phosphorus (SRP /	SM4500-P E	
Total Suspended Solids (TSS)	SM2540D	
Chemical Oxygen Demand (COD)[a]	SM5220D	
Biochemical Oxygen Demand (BOD)[a]	SM5210B	
Total Dissolved Solids (TDS)	EPA 2540C	
Total Hardness	SM2340B	

Notes:
[a] Analyses to be performed on the first discrete sample only.
[b] Sum of TKN and Nitrite + Nitrate

Table A-4. Analytical Constituents and Methods for In-Lake Monitoring

Parameter	Analysis Method	Sampling Method
Water Clarity	In-situ Field	Secchi disk
Water Temperature	In-situ Field	Field Meter
pH	In-situ Field	Field Meter
Dissolved Oxygen	In-situ Field	Field Meter
Nitrite Nitrogen (NO_2-N)	SM 4500-NO_2 B	Depth Integrated[a]
Nitrate Nitrogen (NO_3-N)	EPA 300.0	Depth Integrated[a]
Total Kjeldahl Nitrogen (TKN)	EPA 351.2	Depth Integrated[a]
Ammonia Nitrogen (NH_4-N)	SM 4500-NH_3 H	Depth Integrated[a]
Total Phosphorus (TP)	SM 4500-P BE	Depth Integrated[a]
Soluble Reactive Phosphorus (SRP /	SM 4500-P E	Depth Integrated[a]
Chlorophyll-a	SM 10200H	Surface & Depth Integrated[b]
Total Dissolved Solids (TDS)	SM 2540 C	Depth Integrated[a]

Notes:
[a] Depth integrated samples as described in Sections B.1.2.1 and B.1.2.2.
[b] Two samples collected for chlorophyll-a: 1) a surface to bottom depth integrated sample; and 2) a 0-2 meter depth integrated surface sample.
SM - Standard Methods

A.6.1.2 Project Deliverables

Deliverables for this program will contain the following information:

1. Electronic databases and summaries
2. QA/QC information
   - Raw data sheets,
   - Spike and recovery information, and
   - Internal QC audits
3. Draft and final comprehensive reports
   - Executive summary
   - Introduction and background information
   - Materials and methods
   - Summarized results of water quality, water chemistry, and remote sensing imagery
   - Discussion results related to the key study questions
   - Discussion of any special studies performed
   - Potential suggestions for future studies
   - Conclusions
   - List of references

A.6.1.3 Project Schedule

Table A-5 details the project schedule, including the start and end dates of major tasks, the required deliverables, and deliverable due dates.

Table A-5. Project Schedule

Task	Activity	Start Date (First Year)	Finish Date
Task 1	Project Management, Administration	07/01/2015	Ongoing
Task 2	Meeting Attendance, Monitoring Updates, Update QAPP and WP	07/01/2015	Monthly
Task 3	Monitoring Site Preparation, Meeting with RCFC & WCD	09/01/2015	Monthly/ as needed
Task 4	Lake Monitoring	7/20/2015	Ongoing monthly/ bi-monthly– see SAP
	Wet Event Watershed Monitoring	10/01/2015	Ongoing in wet season– see SAP
Task 5	Data QA/QC, CEDEN Formatting and Uploads	04/30/2016	Immediate after data receipt – monthly or as dictated by sampling frequency
Task 6	Draft Report	05/01/2016	Annually by July 15 to stakeholders
	Final Report	07/30/2016	August 15th to the RWQCB

Notes: QAPP = Quality Assurance Progress Plan; WP = Work Plan; RCFC & WCD = Riverside County Flood Control & Water Conservation District; QA/QC = quality assurance/quality control; CEDEN = California Environmental Data Exchange Network; RWQCB = Regional Water Quality Control Board, Santa Ana Region

A.6.1.4 Geographical Setting

Lake Elsinore is located approximately 60 miles southeast of Los Angeles and 22 miles southwest of the City of Riverside. The Lake is located within the City of Lake Elsinore in Riverside County, and is a natural low point of the San Jacinto River drainage basin. The total drainage basin of the San Jacinto River Watershed is approximately 782 square miles. Over 90 percent of the watershed (735 square miles) drains first into Railroad Canyon Reservoir (also known as CL), which in turn flows into LE, the terminus of the SJW. The local tributary area to LE, consisting of drainage from the Santa Ana Mountains to the west and the City of Lake Elsinore, is approximately 47 square miles.

A.6.1.5 Constraints

Wet event watershed sampling will be conducted only during the rainy season (October through April).

A.7 QUALITY OBJECTIVES AND CRITERIA

A.7.1 Measurement Quality Objectives (MQOs)

To determine the overall quality of data, the results of quality control sample analyses will be evaluated based on precision, accuracy, recovery and completeness of the data quality objectives established for this program. Results falling outside of recommended control limits will trigger corrective actions such as recalibration and reanalysis of the samples in question. A summary of overall MQOs for the specific field and analytical measurements required is provided in Table A-6.

Precision:

Precision is the reproducibility of measurements under a given set of conditions. For large data sets, precision is expressed as the variability of a group of measurements compared to their average value (i.e., standard deviation). For duplicate or replicate measurements, precision is expressed as the relative percent difference (RPD) of a data pair.

Field Precision:

Field precision will be assessed through the collection and analysis of field duplicate samples. Duplicates will be collected at a frequency of no less than one per 20 samples (5%). A control limit of less than 25 percent will be used for relative difference.

Laboratory Precision:

Analytical laboratory precision will be evaluated by analysis of replicate samples. Duplicates will be analyzed at a frequency of no less than one per 20 samples (5%). The RPD between the duplicates will be calculated as follows:

RPD = (C1-C2)/((C1+C2)/2)*100

Where C1 and C2 are concentrations of analyte in replicate samples 1 and 2, a control limit of <25 percent will be used for relative difference.

Bias and Accuracy:

Bias refers to the systematic or persistent distortion of a measurement process that causes errors in one direction (above or below the true value or mean). The bias of a measurement system is affected by the sample matrix or by errors introduced during sample collection, preservation, handling, preparation, and analysis. Accuracy is the degree of agreement of a measurement with an accepted reference or "true" value. Accuracy includes a combination of random error and systematic error (bias) components that result from sampling and analytical operations.

Field Bias:

Although bias of the field program cannot be assessed quantitatively, a qualitative bias assessment for the study will be conducted by reviewing the sample collection, preservation, and handling procedures.

Laboratory Bias:

Accuracy of analytical data will be evaluated by analyzing reference materials and spiked samples. Reference materials will be run with each batch of samples during laboratory analyses. Confidence intervals supplied with reference samples will be used as control limits at the 95 percent confidence level. The relative percent error (RPE) of standards will be calculated as follows:

RPE = (C1-C0)/C0*100

Where C1 is the concentration analyzed in the sample and C0 is the true concentration.

Spiked samples, one per 20 samples or one per batch (whichever is more frequent), will be used to assess the recovery of various analytes. Spikes will contain analytes at the level present in the sample, or at the concentration of the mid-range calibration standard, whichever is higher. Spike recovery will be calculated as follows:

% Recovery = (As-A0)/S*100

Whereas is the concentration of analyte in the spiked sample, A0 is the concentration of analyte in a non-spiked sample, and S is the amount of spike added. Control limits of 80 to 120 percent will be used for percent recovery.

Matrix spike replicates, one duplicate per 20 samples or one per batch (whichever is more frequent) will be used to assess method precision. A control limit of less than 25 percent will be used for relative difference.

Completeness:

Completeness is the measure of the amount of valid data obtained from a measurement system relative to the amount of data scheduled for collection under correct, normal conditions. Completeness measures the effectiveness of the overall investigation in collecting the required samples, completion of the required analyses, and producing valid results. Completeness will be calculated using the following equation:

Completeness = (number of valid data points / total number of measurements) * 100

Field Data:

Field completeness is a quantitative measure of the actual number of samples collected compared to those samples scheduled for collection. The field data goal for collection under this program is 90 percent.

Laboratory Data:

Laboratory data completeness is a quantitative measure of the percentage of valid data for all analytical data as determined by the precision, accuracy, and holding time criteria evaluation. The laboratory completeness goal for data collected under this program is 90 percent.

It may not always be possible to meet the target for completeness. One situation when this may occur is during a severely dry year when rain fall quantity is low and no samples are collected. In these situations, the TMDL Program Manager or QA Program Manager will be consulted for guidance and a description of efforts made to meet the completeness target will be provided in the Annual Report.

Representativeness:

Representativeness is a qualitative expression of the degree to which sample data accurately and precisely represents a characteristic of a population, a sampling point, or an environmental condition. Representativeness is maximized by ensuring that, for a given task, the number and location of sampling points and the sample collection and analysis techniques are appropriate for the specific investigation, and that the sampling and analysis program provides information that reflects "true" site conditions.

Field Data:

Representativeness of field data is dependent upon the proper design of the data collection procedures. Representativeness of the field data will be evaluated by assessing whether the sampling procedures defined in the SOPs were followed during sample collection. The analytical results from replicate samples will also be used to evaluate the representativeness of the field sampling procedures.

Laboratory Data:

Laboratory data will be evaluated for representativeness by assessing whether the laboratory followed the specific analytical criteria defined in the method SOPs, assessing compliance with holding time criteria, and the results of method and instrument blank samples and field replicate samples. The criteria for laboratory and field blanks will be less than the method detection limit for the target analyte.

A.7.2 Data Quality Objectives (DQO)

DQOs are the qualitative and quantitative statements derived from the QA process that (a) clarify the study's technical and quality objectives, (b) define the appropriate type of data, and (c) specify the tolerable levels of potential decision errors that will be used to establish the quality and quantity of data needed to support decisions.

A summary of DQOs for specific analytes and indicators compiled for the LE/CL TMDL monitoring program is provided in Tables A-7 and A-8 for field and laboratory measurements, respectively.

Table A-6. Summary of Measurement Quality Objectives

Measurement of Analysis Type	Applicable Measurement Quality Objectives
Water Samples	
Field Testing: pH Specific Conductance Salinity Dissolved Oxygen (DO) Temperature Transmissivity	Accuracy Precision Completeness Representativeness
Chemical Laboratory Analyses: Ammonia-N Nitrate-N Nitrate-N Total Kjeldahl Nitrogen – TKN Total Phosphorous Soluble Reactive Phosphorous - Orthophosphate Chemical Oxygen Demand (COD) Biochemical Oxygen Demand (BOD) Total Suspended Solids Total Dissolved Solids (TDS) Total Hardness Chlorophyll-a	Accuracy Precision Completeness Representativeness

Table A-7. Data Quality Objectives for Field Measurements

Group	Parameter	Accuracy	Precision	Recovery	Target Reporting Limits	Completeness
Field Testing	pH	± 0.1 units	No SWAMP requirement	NA	NA	No SWAMP requirement; will use 90%
	Specific Conductance	± 5% of appropriate standard for seawater (50,000 µs/cm)	No SWAMP requirement	NA	NA	No SWAMP requirement; will use 90%
	Salinity	± 0.1 ppt	No SWAMP requirement	NA	NA	No SWAMP requirement; will use 90%
	Dissolved Oxygen (DO)	± 2% of saturation	No SWAMP requirement	NA	NA	No SWAMP requirement; will use 90%
	Temperature	± 0.1°C	No SWAMP requirement	NA	NA	No SWAMP requirement; will use 90%
	Water Clarity (visual)	± 0.1 m between two field staff	No SWAMP requirement	NA	NA	No SWAMP requirement; will use 90%

Notes:

NA - not applicable; % - percent; °C - degrees Celsius; ppt - parts per thousand; SWAMP - Surface Water Ambient Monitoring Program

Table A-8. Data Quality Objectives for Analytical Laboratory Measurements

Group	Parameter	Accuracy	Precision	Completeness
Laboratory Analyses - Water	Ammonia-N	LCS within 90% to 110% of true values. Matrix spike 80% to 120% or control limits at ± 3 SD based on actual lab data.	Field duplicate / laboratory duplicate or MS/MSD will be collected / performed for 5% of total project sample count. < 25% RPD laboratory duplicate minimum	No SWAMP requirement; will use 90%
	Nitrate-N and Nitrite-N	LCS within 90% to 110% of true values. Matrix spike 80% to 120% or control limits at ± 3 SD based on actual lab data.	Field duplicate / laboratory duplicate or MS/MSD will be collected / performed for 5% of total project sample count.< 25% RPD laboratory duplicate minimum	No SWAMP requirement; will use 90%
	Total Kjeldahl Nitrogen – TKN	LCS within 90% to 110% of true values. Matrix spike 80% to 120% or control limits at ± 3 SD based on actual lab data.	Field duplicate / laboratory duplicate or MS/MSD will be collected / performed for 5% of total project sample count. < 25% RPD laboratory duplicate minimum	No SWAMP requirement; will use 90%
	Total Phosphorous	LCS within 90% to 110% of true values. Matrix spike 80% to 120% or control limits at ± 3 SD based on actual lab data.	Field duplicate / laboratory duplicate or MS/MSD will be collected / performed for 5% of total project sample count. < 25% RPD laboratory duplicate minimum	No SWAMP requirement; will use 90%
	Total Orthophosphate-P	LCS within 90% to 110% of true values. Matrix spike 80% to 120% or control limits at ± 3 SD based on actual lab data.	Field duplicate / laboratory duplicate or MS/MSD will be collected / performed for 5% of total project sample count. < 25% RPD laboratory duplicate minimum	No SWAMP requirement; will use 90%

Table A-8. Data Quality Objectives for Analytical Laboratory Measurements (Continued)

Group	Parameter	Accuracy	Precision	Completeness
Laboratory Analyses - Water	COD and BOD	LCS within 90% to 110% of true values. Matrix spike 80% to 120% or control limits at ± 3 SD based on actual lab data.	Field duplicate / laboratory duplicate or MS/MSD will be collected / performed for 5% of total project sample count. < 25% RPD laboratory duplicate minimum	No SWAMP requirement; will use 90%
	TSS and TDS	LCS within 90% to 110% of true values	Field duplicate / laboratory duplicate or MS/MSD will be collected / performed for 5% of total project sample count. < 25% RPD laboratory duplicate minimum	No SWAMP requirement; will use 90%
	Total Hardness	LCS within 90% to 110% of true values	Field duplicate / laboratory duplicate or MS/MSD will be collected / performed for 5% of total project sample count. < 25% RPD laboratory duplicate minimum	No SWAMP requirement; will use 90%
	Chlorophyll-a	LCS within 90% to 110% of true values	Field duplicate / laboratory duplicate or MS/MSD will be collected / performed for 5% of total project sample count. < 25% RPD laboratory duplicate minimum	No SWAMP requirement; will use 90%

Notes:
CI - Confidence Interval; CRM - Certified Reference Material; MS - Matrix spike; MSD - Matrix spike duplicate; RPD - Relative Percent Difference; SRM - Standard Reference Material; SWAMP - Surface Water Ambient Monitoring Program.

A.8 SPECIAL TRAINING AND CERTIFICATION

A.8.1 Specialized Training or Certifications

A.8.1.1 Field Sampling

Training for all persons involved in the field sampling activities will be conducted prior to any field sampling. All individuals that participate in sampling activities are required to have attended a Site Safety Training course provided by an appropriately qualified trainer. The training will cover the general health and safety issues associated with fieldwork, including sampling. The monitoring manager will also provide daily "tailgate" project specific training, pertinent to the details of a particular sampling program. This training will include, but not be limited to, proper use of field equipment, health and safety protocols, sample handling protocols, and chain of custody protocols.

Field staff training is to be documented and filed at LESJWA's headquarters at the Santa Ana Watershed Project Authority (SAWPA). Documentation consists of a record of the training date, instructor, whether initial or refresher, and whether the course was completed satisfactorily.

A.8.1.2 Analytical Laboratory

All contracting laboratories will maintain their own records of its training. Those records can be obtained, if needed, from the contract laboratory through their QA Officer.

A.8.2 Training and Certification Documentation

All personnel are responsible for complying with all QA/QC requirements that pertain to their organizational and technical function. Each technical staff member must have a combination of experience and education to adequately demonstrate a specific knowledge of their particular function and a general knowledge of laboratory operations, test methods, QA/QC procedures, and records management.

A.8.2.1 Field Sampling

Field personnel will be trained in proper sampling techniques, sample handling, sample preservation and storage, sample transport, and chain-of-custody procedures by the PMs and/or any designated trained lead field scientists.

A.8.2.2 Analytical Chemistry and Toxicity Laboratory

Training of individuals working in the analytical chemistry laboratories begins with reviewing the standard operating procedure (SOP) for a new task. The laboratory manager or a senior laboratory technician demonstrates the procedure to the trainee, shows the appropriate steps in the SOP, and explains the significance of each step. The trainee later performs the procedure under the supervision of the laboratory manager or senior laboratory technician. At this time, questions are answered and parts of the procedure may be demonstrated again to the trainee. The trainee continues to work under direct supervision until he/she can demonstrate the procedure with competence and full understanding. This process may be short or long depending on the procedure and the experience of the trainee. Once the trainee has demonstrated competence, the laboratory manager completes a training form, and at this time, the employee may work without supervision. This documentation is kept in files organized by individual with a separate form for each task. The analyst is re-qualified annually, and this requalification is documented on the training form as well.

A.9 DOCUMENTS AND RECORDS

A.9.1 Documentation, Tracking, and Storage of Records

The TMDL Task Force will maintain a record of all field analyses and samples collected for their respective projects. The LE/CL Task Force will maintain field analyses and sample records.

All samples delivered to contract laboratories for analysis will include a chain-of-custody form.

The contracting laboratory will generate records for sample receipt and storage, analyses, and reporting.

LESJWA has an existing database of laboratory and field measurement data from previous studies. This database, along with all future data, will be maintained by LESJWA on behalf of the Task Force.

All laboratory and field measurement data submitted to LESJWA for inclusion in the Santa Ana Watershed Database Management System (SAW DMS) will follow the guidelines and formats established by SWAMP (http://www.waterboards.ca.gov/swamp/qapp.html).

All chemical monitoring records generated by these programs will be stored at SAWPA. The contract laboratory's records pertinent to the program will be maintained at the contract laboratory's main office. Copies of all records held by the contract laboratory will be provided to the Task Force and stored in the LE/CL Task Force archives.

Copies of Draft and Final Reports will be prepared by the PMs for the watershed and in-lake monitoring programs. These will be integrated into single reports, as appropriate, and provided to key Project Personnel and the Task Force. These reports will describe activities undertaken, milestones, analytical results, and a discussion of the findings. The reports will be submitted to the Santa Ana RWQCB annually.

A.9.2 Distribution, Updates, and Retention of QAPP

Copies of this QAPP will be distributed to all parties involved with the project, including field sampling personnel and the Task Force. Copies will be sent to each contract laboratory QA Manager for distribution to appropriate laboratory staff. Any future amended QAPPs will be held and distributed in the same fashion. All originals of this and subsequent amended QAPPs will be held at SAWPA on behalf of LESWA. Copies of versions, other than the most current, will be discarded so as not to create confusion.

B. DATA GENERATION AND ACQUISITION

B.1 SAMPLING PROCESS DESIGN

B.1.1 San Jacinto Watershed Monitoring

B.1.1.1 Sampling Period

As has been done historically, stormwater runoff will be sampled at all stations during three wet season storm events per year if flow is present. To date, watershed-wide monitoring has been conducted only during wet season rain events. However, in order to develop a better understanding of the potential influences of dry-weather runoff on LE and CL water quality, it may be necessary in the future to verify the existence and extent of dry-weather inputs from surrounding communities and major tributaries into the lakes.

B.1.1.2 Sampling Locations for Watershed-Wide Monitoring

There are four historical sampling stations located throughout the SJW, LE and CL area (Table B-1, Figure B-1). The sampling locations were carefully selected to reflect various types of land use, and have been monitored since 2006. Three of the four sites were selected because they are indicative of inputs to CL originating from the main stem of the San Jacinto River, Salt Creek, and the watershed above Mystic Lake. The fourth site, located below the Canyon Lake Dam, is indicative of loads entering LE from CL and the upstream watershed (when the dam is spilling). Many of the sampling stations are located in close proximity to stream gauge stations installed by the US Geological Survey (USGS) or the RCFC & WCD. The USGS gauges provide a general estimate of the total flow in the channel at a location close to the autosampler; however, in the future it may be necessary to install a flow meter at each of the autosamplers in order to collect accurate flow weighted composite samples.

Table B-1. San Jacinto Watershed Monitoring Stations

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

The sampling location along the San Jacinto River at Ramona Expressway is located downgradient of Mystic Lake, an area of land that is subsiding. Flow has not been observed at this location since a strong El Nino event in the mid-1990s. Because of the active subsidence, this monitoring station is not expected to flow except under extremely high rainfall conditions.

In addition to the historical stations, sampling may be conducted at one additional rotating site which may change from year to year. This rotating site will be utilized to collect data from a new area or to help answer a technical question. Some examples of sites that may be sampled could include a background station, or sites downstream from areas of interest (e.g., downstream of Ortega or Hemet Channel, Salt Creek at State Street or Kitching Street Channel at Iris Avenue).

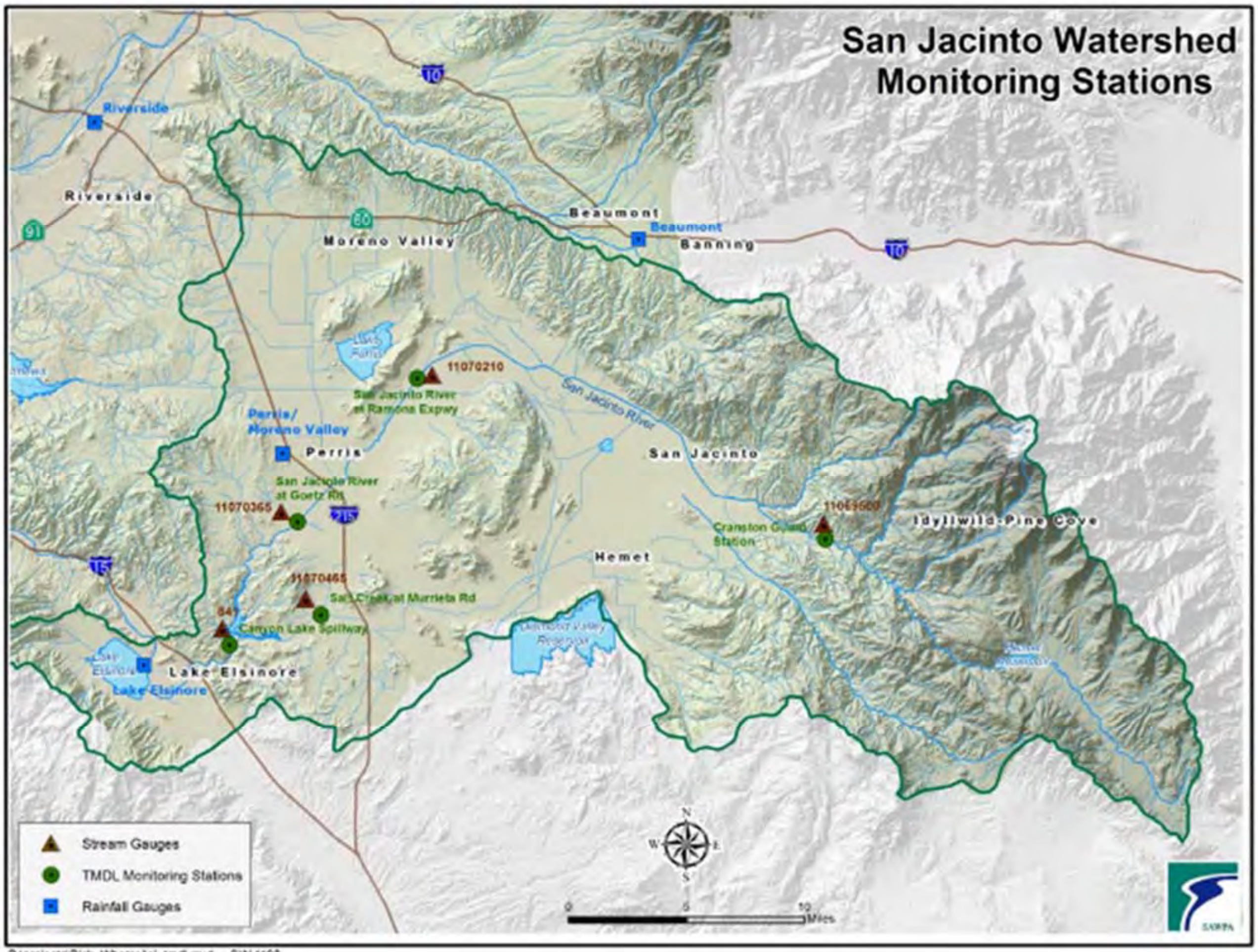

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Figure B-1.
San Jacinto Watershed Monitoring Locations

B.1.2 In Lake Monitoring

A summary of In-lake monitoring activities for both LE and CL is provided in Table B-2. Given their unique characteristics details related to each lake are presented individually below.

B.1.2.1 Lake Elsinore

In order to maintain consistency and facilitate the assessment of trends and compliance goal achievement, the in-lake monitoring design halted in 2012 (LESJWA, 2012) will be resumed using the three former stations outlined in the approved Lake Elsinore and Canyon Lake Nutrient TMDL Monitoring Plan (LESJWA, 2006, Figure B-2). One station (Site LE02) will have analytical samples collected and in-situ water quality readings, while the remaining two stations (LE01 and LE03) will only have in-situ water quality readings performed. Monitoring will occur monthly during the summer period (June – September) and bi-monthly (i.e., every-other month) during the remainder of the year (October – May).

Figure B-2. Lake Elsinore Sampling Locations

Table B-2. Summary In-Lake Collection Activities

Lake	Frequency	Location	Coordinates	Analytical Samples Collected (Y/N)[a]	Chlorophyll-a[b]	Field Water Quality Measurements (Y/N)[d]
Lake Elsinore	Monthly & Bi-monthly	Station LE01	33.66898° -117.36419°	N	N	Y
		Station LE02	33.66334° -117.35421°	Y	Y	Y
		Station LE03	33.65494° -117.34165°	N	N	Y
	Continuous	EVMWD Sondes (Buoys 1 and 2)	--	N	N	Y[e]
Canyon Lake	Bi-monthly	Station CL07	33.67803° -117.27514°	Y	Y	Y
		Station CL08	33.68821° -117.26894°	Y	Y	Y
		Station CL09	33.68110° -117.25889°	N	Y[c]	Y
		Station CL10	33.67950° -117.25067°	Y	Y	Y

Notes:

Note: Bi-monthly is sampling every other month (i.e. six times per year). Monthly sampling to occur over summer months only (June-September). Bi-monthly sampling to occur on Lake Elsinore outside of summer period.

[a] Includes depth integrated samples for nitrate, nitrite, ammonia, TKN, total phosphorous, soluble reactive phosphorus (SRP / Ortho-P), and TDS.

[b] Chlorophyll a: Two samples: 1) a surface-to-bottom depth integrated sample; and 2) a 0-2-m depth integrated surface sample.

[c] A 0-2-m depth integrated surface sample only will be collected for chlorophyll-a at Site CL09 for direct comparison to satellite imagery results at this location.

[d] Includes depth profile field measurements for pH, DO, temperature, and conductivity. Water clarity will be measured using a Secchi disk.

[e] Two stations located near the center of Lake Elsinore are monitored by EVMWD for DO, conductivity, pH, and temperature using permanently installed in-situ YSI data sondes.

The sampling will be coordinated so as to occur on the same day as satellite imagery. Depth integrated samples will be prepared by either combining discreet grab samples collected using a Van Dorn bottle at the surface and each 1-meter (m) depth interval throughout the water column, or using a peristaltic pump and lowering/raising the inlet tube through the water column at a uniform speed. Two discrete samples will be collected and analyzed for chlorophyll-a: 1) a surface-to-bottom depth integrated sample; and 2) a 0-2 m depth integrated surface sample. Note that while no waste load allocations for total ammonia are currently in place for LE, ammonia can be an important driver of toxicity, potentially causing fish kills and decreasing zooplankton survival/reproduction, particularly given the historically high ambient pH values observed in the lake which enhances the more toxic un-ionized fraction of ammonia.

In addition, during each sampling event, in-situ monitoring using pre-calibrated hand-held YSI field meters or equivalent will be performed at all three stations (LE01, LE02, and LE03) for field measurements of pH, DO, temperature, and conductivity. A complete depth profile at each station will be recorded for each of these parameters at 1-m intervals. These data will be used to assess spatial variability and in comparison to data obtained from the two currently installed data sondes operated by EVMWD near the center of the lake. Water clarity will also be assessed at all three stations using a Secchi disk. An attempt will be made to collect all water samples and perform all field measurements prior to noon during each sampling event to avoid collecting sediments re-suspended from the lake bottom by afternoon winds, and enhance comparisons with existing data. End-of-the-day field measurements (i.e. after ~2:30pm) will also be recorded for pH, DO, temperature, and conductivity at all three stations to assess any potential temporal variability in these parameters throughout the day. As an alternative to afternoon readings, in situ data sondes may be considered at compliance monitoring sites for future monitoring efforts to supplement morning field measurements, thus providing a more accurate measure of variability over time.

Data collected by the two currently installed in-situ data sondes maintained by EVMWD and used for monitoring the water pump/aeration system in LE will also be analyzed to evaluate daily cycles and trends across each monitoring period. These data could be compared to any other concurrent measurements during their use, as well as historic water quality records in relation to TMDL targets. Such an evaluation can provide valuable insight into: 1) whether the data sondes may provide a more cost effective solution to monitor water quality in the lake; and 2) whether the pump/aeration system is able to provide substantial measurable benefit related to the TMDL targets.

B.1.2.2 Canyon Lake

Similar to LE, monitoring efforts and locations in CL were selected to be consistent with monitoring conducted between 2006 and 2012. To ensure accurate comparisons with historical data, the in-lake monitoring design halted in 2012 will be resumed using the same four stations outlined in the approved LE and CL Nutrient TMDL Monitoring Plan (LESJWA, 2006, Figure B-3). Two stations are located in the main body of the lake (CL07 near the dam and CL08 in the northern arm) and two stations are located in the East Bay (CL09 and CL10). Bi-monthly monitoring (i.e., every-other month) will occur at each station.

Sampling will be coordinated so as to occur on the same day as satellite imagery. Consistent with monitoring of LE, surface-to-bottom depth integrated samples will be collected for nitrate, nitrite, ammonia, TKN, total phosphorous, soluble reactive phosphorus (SRP / Ortho-P), and TDS. Analytical samples will be collected at only three of the four monitoring locations (CL07, CL08, and CL10). Station CL10 was selected as the primary monitoring location in the east arm of CL for TMDL compliance monitoring in 2011-2012 following the approved reduction from four to three locations. This site is more centrally located within the eastern arm and results collected during previous studies indicate similar water quality between the two east bay sites overall. The width of the lake at Station CL10 is narrower than that at Station CL09, potentially resulting in an edge interference at this location for satellite imagery used to quantify chlorophyll-a over a larger area. As a result, a surface water sample (0-2m depth integrated) will be collected at Station CL09 for chlorophyll-a analysis only, to enable a more direct comparison to satellite imagery in the eastern arm.

Depth integrated samples at sites CL07, CL08, and CL10 will be prepared by either combining discreet grab samples collected using a Van Dorn bottle at the surface and each 1-m depth interval throughout the water column, or using a peristaltic pump and lowering/raising the inlet tube through the water column at a uniform speed. Two discrete samples will be collected and analyzed for chlorophyll-a at Stations CL07, CL08, and CL10: 1) a surface-to-bottom depth integrated sample; and 2) a 0-2-m depth integrated surface sample. One 0-2-m depth integrated surface sample will be collected for chlorophyll-a at Station CL09.

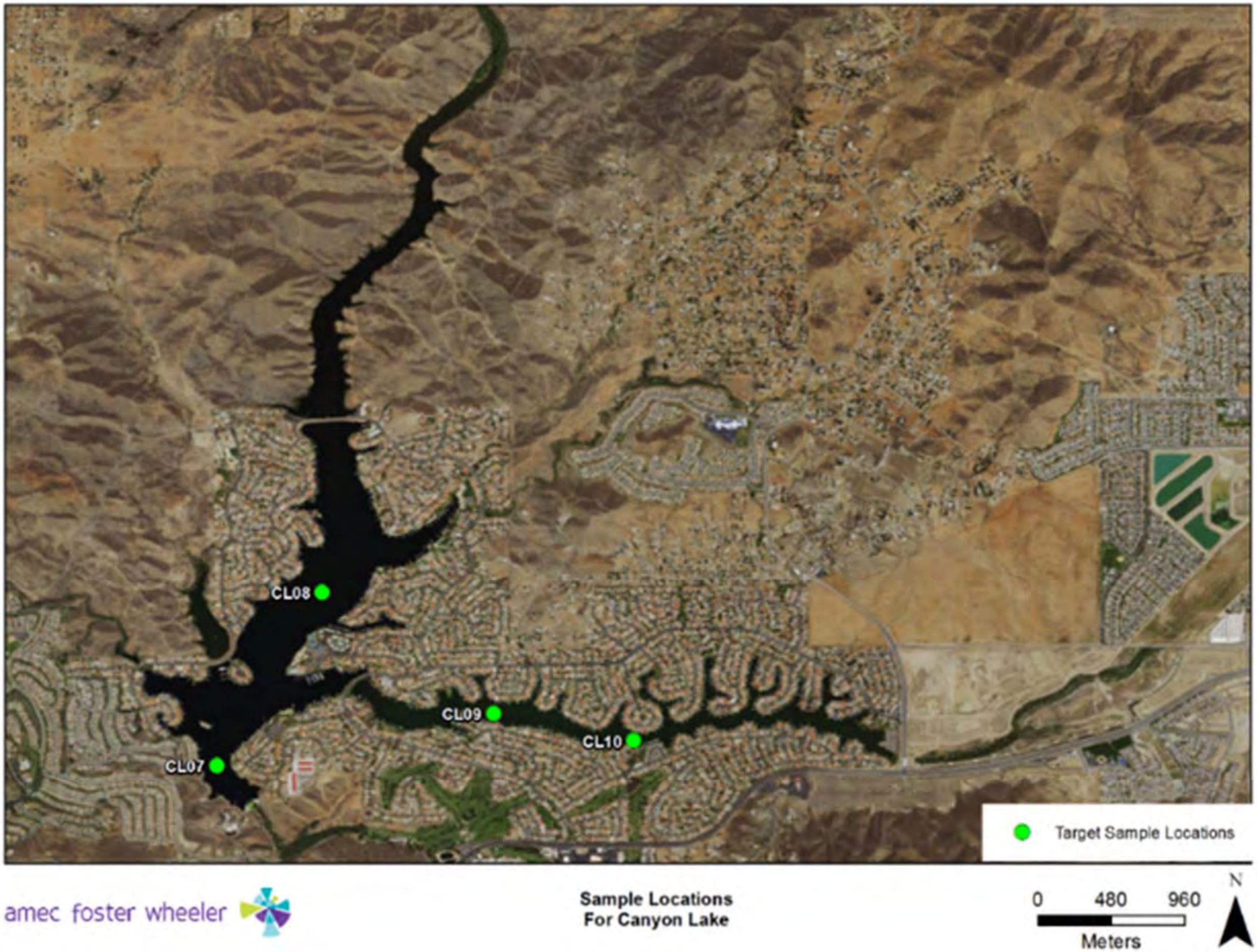

Figure B-3. Canyon Lake Sampling Locations

In addition, during each of the sampling events, in-situ monitoring using pre-calibrated hand-held YSI meters or equivalent will performed at all four stations (Stations CL07, CL08, CL09, and CL10). Field measurements will include pH, DO, temperature, and conductivity. A complete depth profile will be created for each of these parameters at 1-m intervals for all stations. Water clarity will also be assessed at each sampling location using a Secchi disk. An attempt will be made to collect all water samples and perform field measurements prior to noon during each sampling event to avoid collecting sediments re-suspended from the lake bottom by frequent afternoon winds, and enhance comparisons with existing data. End-of-the-day field measurements (i.e., after ~2:30pm) will also be recorded for pH, DO, temperature, and conductivity at all four stations to assess any potential temporal variability in these parameters throughout the day. As an alternative to afternoon readings, in situ data sondes may be considered at compliance monitoring sites for future monitoring efforts to supplement morning field measurements, thus providing a more accurate measure of variability over time.

B.1.3 Satellite Imagery Measurements for Chlorophyll-a

In Fiscal Year 2015-2016, the Task Force contracted with EOMAP Americas to conduct remote sensing using Landsat satellite imagery (Figure B-4) to estimate chlorophyll-a concentrations in Lake Elsinore and Canyon Lake. Using a resolution of 5 pixels per acre, this effort produced maps of the lake showing graphical, color-coded images of chlorophyll-a and turbidity concentrations at up to approximately 1000 unique data points across Canyon Lake and approximately 11,000 unique data points across Lake Elsinore. This tool provides snapshots of conditions throughout the entire lake at a given point in time, as opposed to the single data points provided at water quality collection locations; however, the satellite imagery only represents approximately the upper 4 feet of the water column and therefore cannot completely replace manual sampling.

As part of the compliance monitoring, satellite imagery depicting lake-wide chlorophyll-a concentrations in Lake Elsinore and Canyon Lake will be generated for each in-lake monitoring event. In addition to examining lake-wide chlorophyll concentrations, these data can be used to measure chlorophyll-a as a means of collecting data for calculating the annual average concentration and conducting trends analysis. In the future, satellite imagery mapping could also be conducted prior to and following in-lake treatments (such as alum applications) to gauge effectiveness on a lake-wide scale.

Additional details related to the sampling analysis design are located in the companion Work Plan for the LE/CL Nutrient TMDL Compliance Monitoring provided in Appendix C.

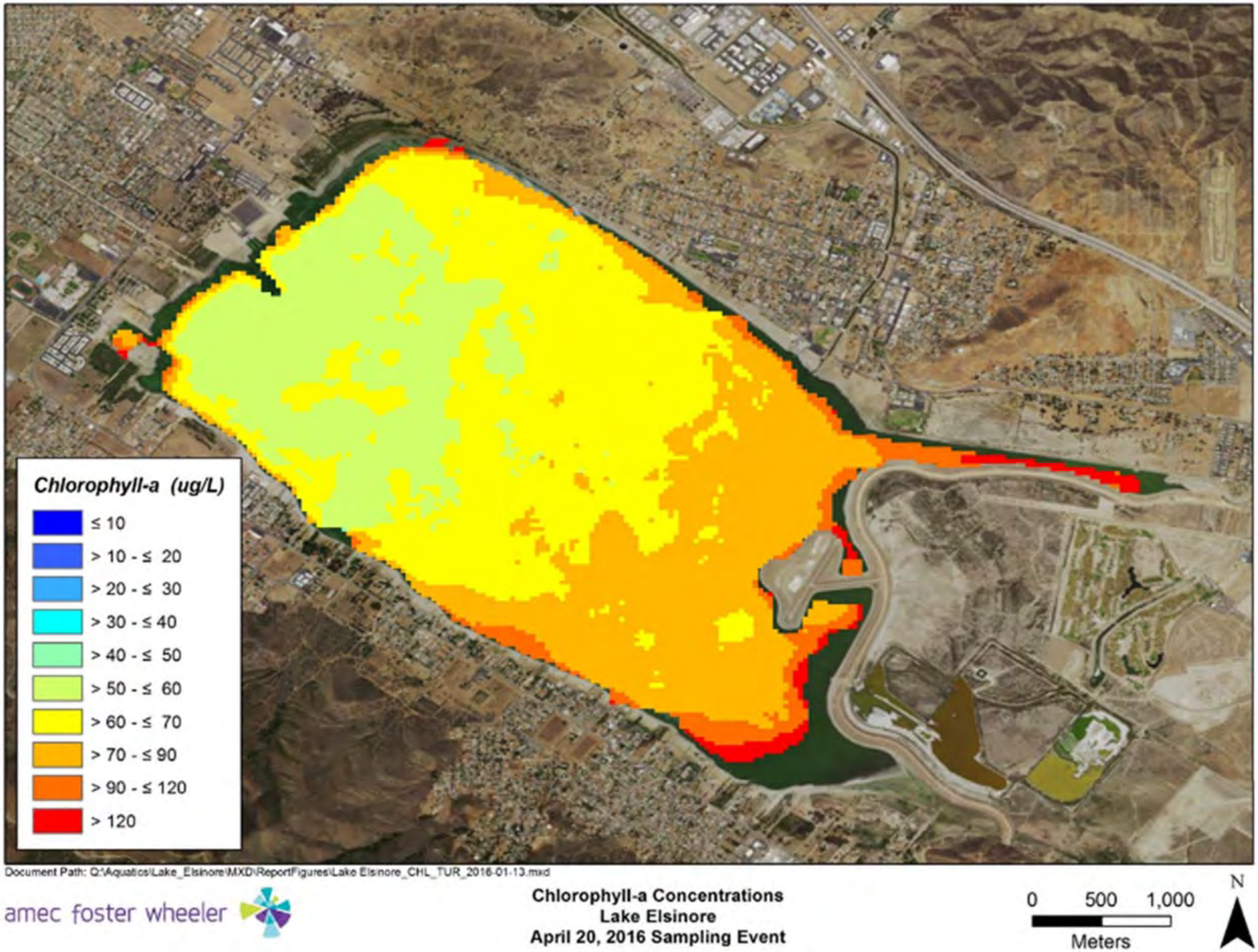

Figure B-4. Example Satellite Imagery depicting Chlorophyll-a Concentrations

B.2 SAMPLING METHODS

B.2.1 San Jacinto Watershed Monitoring

The following sample collection protocols are intended to collect flow-weighted composite samples at the monitoring sites listed in Table B-1 once flow is established in the channel. Samples may be collected either manually by compositing discrete grab samples, or automatically by using automatic sampling equipment (e.g., ISCO autosamplers equipped with flow meters). Samples will be collected on both the rising limb (increasing flow) and the falling limb (decreasing flow) of the hydrograph. Eight to twelve discrete samples will be collected for compositing if collected manually (consistent with previous direction from the RWQCB). Flow will be estimated based on data from USGS stream gauges collocated on the same streams near the sampling stations.

In the event of unusual or irregular storm or flow conditions, the sampling crews will consult with SAWPA to determine if a revised sampling schedule should be followed.

The samples will be collected by trained field staff and labeled for delivery to the designated laboratory(s). Containers types and preservatives for watershed stormwater samples are summarized in Table B-3. Duplicate samples for estimates of field precision will be collected at no less than one per 20 samples (5%).

Field measurements (pH, temperature, and turbidity) will be recorded in the field using portable calibrated Horiba or YSI meters, or equivalent.

B.2.2 In Lake Monitoring

In situ water column properties (temperature, DO, electrical conductivity, pH, and turbidity) will be measured at 1-m intervals using portable calibrated Horiba or YSI meters, or equivalent, while water transparency will be determined using a Secchi disk. Lake depth and time of sampling at each of the sites will also be noted (sampling is expected to be completed before noon under typical conditions). Field data will be recorded at the time of sampling in field logs that will later be transcribed into an Excel spreadsheet.

Depth-integrated surface (0-2m) and whole water column (0m-within 1m of bottom) will be collected at each sampling site as summarized in Table B-2. Depth integrated samples will be prepared by either combining discreet grab samples collected using a Van Dorn bottle at the surface and each 1-m depth interval throughout the water column, or using a peristaltic pump and lowering/raising the inlet tube through the water column at a uniform speed. For peristaltic pump sampling, the inlet tube will be lowered to within 1m of the bottom, the pump activated, and then the inlet tube will be raised through the water column stopping at each 1m increment for a consistent span of time. A stop watch will be utilized to ensure consistency in time elapsed at each increment. Duplicate samples for estimates of field precision will be collected at no less than one per 20 samples (5%).

Water samples will be stored in certified clean opaque polypropylene bottles on ice and returned to the laboratory. Containers types and preservatives for in-lake samples are summarized in Table B-4.

Table B-3. Watershed Sample Volume, Container and Preservation

Parameter	Analysis	Typical Sample Volume	Recommended Containers	Initial Field Preservation
Turbidity	Field	N/A	N/A, Measure on site	Unpreserved
Water Temperature	Field	N/A	N/A, Measure on site	Unpreserved
pH	Field	N/A	N/A, Measure on site	Unpreserved
Total Organic Nitrogen (Org-N)	Calculated	N/A	N/A	N/A
Nitrite Nitrogen (NO_2-N)	SM 4500-NO2 B	1L	Poly	<4°C
Nitrate Nitrogen (NO_3-N)	EPA 300.0	1L	Poly	<4°C
Ammonia Nitrogen (NH_4-N)	SM 4500-NH3 H	500 mL	Poly	<4°C, H_2SO_4
Total Kjeldahl Nitrogen (TKN)	EPA 351.2	500 mL	Poly	<4°C, H_2SO_4
Total Phosphorus (TP)	SM 4500P B E	500 mL	Poly	<4°C, H_2SO_4
Soluble Reactive Phosphorus[a] (SRP / ortho-P)	SM 4500P E	Minimum 1L field filtered	Poly	<4°C
Total Suspended Solids (TSS)	SM 2540D	1 L	Poly	<4°C
Chemical Oxygen Demand (COD)*	SM 5220D	500 mL	Poly	<4°C, H_2SO_4
Biochemical Oxygen Demand (BOD)*	SM 5210B	1L	Poly	<4°C
Total Dissolved Solids (TDS)	SM 2540C	1 L	Poly	<4°C
Total Hardness	SM 2340B	500 mL	Poly	<4°C, HNO_3

Note:
[a] Samples will be filtered (0.45um) and kept in the dark on wet ice in the field.
*Analysis to be performed on the first discrete sample only.
mL – milliliter

Table B-4. In-Lake Sample Volume, Container and Preservation

Parameter	Analysis	Sampling Method	Typical Sample Volume	Recommended Containers	Initial Field Preservation
Water Clarity	In-situ Field	Secchi disk	N/A	N/A, Measure on site	N/A, Measure on site
Water Temperature	In-situ Field	Field Meter	N/A	N/A, Measure on site	N/A, Measure on site
pH	In-situ Field	Field Meter	N/A	N/A, Measure on site	N/A, Measure on site
Dissolved Oxygen	In-situ Field	Field Meter	N/A	N/A, Measure on site	N/A, Measure on site
Nitrite Nitrogen (NO_2-N)	SM 4500-NO2 B	Depth Integrated[a]	1L	Poly	<4°C, H_2SO_4
Nitrate Nitrogen (NO_3-N)	EPA 300.0	Depth Integrated[a]	1L	Poly	<4°C, H_2SO_4
Total Kjeldahl Nitrogen (TKN)	EPA 351.2	Depth Integrated[a]	600 mL	Poly	<4°C, H_2SO_4
Ammonia Nitrogen (NH_4-N)	SM 4500-NH_3 H	Depth Integrated[a]	500 mL	Poly	<4°C, H_2SO_4
Total Phosphorus (TP)	SM 4500P B E	Depth Integrated[a]	500 mL	Poly	<4°C, H_2SO_4
Soluble Reactive Phosphorus (SRP / Ortho-P)[c]	SM 4500P E	Depth Integrated[a]	Minimum 1L field filtered	Poly	<4°C
Chlorophyll-a[d]	SM 10200H	Surface & Depth Integrated[b]	Minimum 250ml field filtered[e]	Glass-fiber filter wrapped in Foil	<4°C,
Total Dissolved Solids (TDS)	SM 2540 C	Depth Integrated[a]	1L	Poly	<4°C

Note:
[a] Depth integrated samples of the entire water column as described in Section B.2.2.
[b] Two samples collected for chlorophyll-a: 1) a surface to bottom depth integrated sample; and 2) a 0-2m depth integrated surface sample.
[c] Samples will be filtered (0.45um) and kept in the dark on wet ice in the field.
[d] Samples will be filtered (0.7um) and kept in the dark on ice in the field and then frozen within 8 hours.
[e] If less than 250ml can be filtered as a result of turbid water rapidly clogging the filter, the volume actually filtered will be recorded.
mL – milliliter

B.3 SAMPLE HANDLING AND CUSTODY

B.3.1 Water Quality Samples

Once sample containers are filled, they are assigned a unique identification label number. Individual sample labels consist of a site number, depth, and the sampling date. The samples are stored on ice until transported to the laboratory for analysis.

All samples prepared for laboratory analysis will be labeled and recorded in a project-specific field data form at the time of collection. Entries will include the date, names of sampling personnel, weather conditions, site number, time of sampling, depth, and whether the sample is a field split/duplicate. An example data form for field observations and analytical samples of watershed stormwater monitoring is included in Appendix A. This same form will be used for any in situ measurements of temperature, pH, DO, conductivity during watershed sampling events.

In situ measurements of in-lake water quality will be recorded in a daily field log specific to these measures. Entries will include the date, names of sampling personnel, weather conditions, site number, time of sampling, depth, temperature, DO concentration, pH, conductivity, and water clarity using a Secchi disk. An example field log form specific to in-lake measurements is included in Appendix B.

Field documentation will be completed using indelible ink, with any corrections made by drawing a single line through the error and entering the correct value. Samples will be delivered to the laboratory at the end of the sampling event to initiate processing within 24 hours.

Sample holding times for those analytical constituents required for the watershed and in-lake monitoring efforts are provided in Tables B-5 and B-6, respectively.

B.3.2 Chain of Custody Procedures

Chain-of-custody (COC) forms will also be prepared for all samples submitted for laboratory analysis. The COC will identify the sample number, sampling location description, date, time, sample type, number of containers, tests required, and relinquishing signatures. An example COC form is included in Appendix D.

Table B-5. Holding Times for Watershed Monitoring Analyses

Parameter	Maximum Holding Time
Turbidity	N/A
Water Temperature	N/A
pH	N/A
Total Organic Nitrogen (Org-N)	N/A
Nitrite Nitrogen (NO_2-N)	48 hours
Nitrate Nitrogen (NO_3-N)	48 hours
Ammonia Nitrogen (NH_4-N)	28 days
Total Kjeldahl Nitrogen (TKN)	28 days
Total Phosphorus (TP)	28 days
Soluble Reactive Phosphorus (SRP / ortho-P)	48 hours
Total Suspended Solids (TSS)	7 days
Chemical Oxygen Demand (COD)	28 days
Biochemical Oxygen Demand (BOD)	48 hours
Total Dissolved Solids (TDS)	7 days
Total Hardness	6 months

Table B-6. Holding Times for In-Lake Monitoring Analyses

Parameter	Maximum Holding Time
Water Clarity	N/A
Water Temperature	N/A
pH	N/A
Dissolved Oxygen	N/A
Nitrite Nitrogen (NO_2-N)	48 hours
Nitrate Nitrogen (NO_3-N)	48 hours
Total Kjeldahl Nitrogen (TKN)	28 days
Ammonia Nitrogen (NH4-N)	28 days
Total Phosphorus (TP)	28 days
Soluble Reactive Phosphorus (SRP / Ortho-P)	48 hours
Chlorophyll-a[a]	28 days
Total Dissolved Solids (TDS)	7 Days

[a] Samples will be field-filtered and then frozen within 8 hours of collection. Filtered samples will be stored on ice in the dark until frozen. Once frozen, samples can be held for 28 days.

B.4 ANALYTICAL METHODS

B.4.1 Analytical Methods for Watershed and In-Lake Monitoring Programs

Analytical methods used for the LE and CL Nutrient TMDL Monitoring program will follow the State of California and the U.S. Environmental Protection Agency (EPA) approved standard laboratory methods for all applicable water quality analyses as presented in Tables B-7 and B-8 for watershed and in-lake monitoring, respectively.

All submitted samples will be analyzed for nutrients, including total nitrogen (N) and total phosphorous (P), soluble reactive P (SRP), NO3-N+NO2-N, NH4-N, and Total Kjeldahl Nitrogen (TKN), and other supporting constituents specific to watershed and in-lake monitoring efforts. Organic N and total inorganic N (TIN) concentrations will be calculated from the measured N forms as presented in Tables B-7 and B-8. Unfiltered water samples will be digested for total N and total P using persulfate methods 4500-N and 4500-P (APHA, 1998). SRP, NO3-N+NO2-N and NH4-N concentrations will be determined on samples filtered through 0.45-µm polycarbonate syringe filters and acidified with H2SO4. All nutrient samples will be analyzed colorimetrically on an Alpkem Autoanalyzer, or equivalent, following standard methods (APHA 1998). Specifically, dissolved and total P will be determined using the ascorbic acid reduction method (4500-P G), total N and NO3-N+NO2-N will be measured using the cadmium reduction flow injection method (4500-NO3- F), and NH4-N levels will be quantified using an automated phenate method (4500-NH3 H) (APHA, 1998). TDS and TSS concentrations will be determined using standard methods 2540 C and 2540 D (APHA 1998).

B.4.2 Sample Disposal Procedures

No sample disposal will occur related to monitoring efforts in the field. Analytical sample disposal will follow standard analytical laboratory protocols.

B.4.3 Laboratory Turnaround Times

Typical laboratory turnaround time is two weeks from the time of sample receipt.

Table B-7. Analytical Methods for the Watershed Monitoring Program

Parameter	Analysis	Reporting Limit	Method Detection Limit	Operating Range	Calibration Method
Turbidity	Calibrated portable Horiba, YSI, or equivalent meter	NA	0.13 NTU	0.2-4000 NTU	4 point curve
Water Temperature		NA	0.1°C	4-35°C	N/A
pH		NA	1 pH units	1-14 units	2 point curve
Total Organic Nitrogen (Org-N)	Calculated	N/A	N/A	N/A	N/A
Nitrite Nitrogen (NO_2-N)	SM4500-NO_2 B	0.1 µg/L	0.046 µg/L	0.01-1.0 mg/L	6 point curve
Nitrate Nitrogen (NO_3-N)	EPA 300.0	0.2 mg/L	0.107 mg/L	0.1-5.0 mg/L	8 point curve
Ammonia Nitrogen (NH_4-N)	SM4500-NH_3 H	0.1 mg/L	0.0591 mg/L	0.1-2.0 mg/L	8 point curve
Total Kjeldahl Nitrogen (TKN)	EPA 351.2	0.1 mg/L	0.063 mg/L	0.1-1400 mg/L	7 point curve
Total Phosphorus (TP)	SM4500-P B E	0.05 mg/L	0.0191 mg/L	0.05-1.0 mg/L	7 point curve
Soluble Reactive Phosphorus (SRP / ortho-P)	SM4500-P E	0.05 mg/L	0.0028 mg/L	0.05-1.0 mg/L	7 point curve
Total Suspended Solids (TSS)	SM2540D	5 mg/L	3.7058 mg/L	5-2000 mg/L	Standard
Chemical Oxygen Demand (COD)	SM5220D	10 mg/L	7.79 mg/L	10/500 mg/L	9 point curve
Biochemical Oxygen Demand (BOD)	SM5210B	2 mg/L	0.3995 mg/L	Depends on dilution	Standards
Total Dissolved Solids (TDS)	SM 2540 C	10 mg/L	5.8343 mg/L	10-20,000 mg/L	Standards
Total Hardness	SM 2340B	3 mg/L	0.35 mg/L	5-2,000 mg/L	Standards

NA – not applicable

Table B-8. In-situ and Laboratory Analytical Methods for In-Lake Water Samples

Parameter	Analytical Method	Reporting Limit	Method Detection Limit	Operating Range	Calibration Method
Field Analyses					
Dissolved Oxygen (DO)	Calibrated portable Horiba, YSI, or equivalent meter	NA	0.1 mg/L	0.1-20 mg/L	Air saturated water
Water Temperature		NA	0.1 °C	4-35 °C	N/A
pH		NA	0.01	2-12	2 point curve
Turbidity		NA	0.1 NTU	0.1 – 100 NTU	4 point curve
Water Clarity	Secchi Disk	NA	0.1 m	0.1 – 30 m	N/A
Laboratory Analyses					
Ammonia Nitrogen (NH_4-N)	SM 4500-NH_3 H	0.1 mg/L	0.0591 mg/L	0.01-2 mg/L	8 point curve
Nitrite Nitrogen (NO_2-N)	SM 4500-NO_2 B	0.1 µg/L	0.046 µg/L	0.01-1 mg/L	6 point curve
Nitrate Nitrogen (NO_3-N)	EPA 300.0	0.2 mg/L	0.107 mg/L	0.10-5.0 mg/L	8 point curve
Total Kjeldahl Nitrogen (TKN)	EPA 351.3	0.1 mg/L	0.063 mg/L	0.10-1400 mg/L	7 point curve
Soluble Reactive Phosphorus (SRP)	SM 4500-P E	0.05 mg/L	0.0028 mg/L	0.01-1 mg/L	7 point curve
Chlorophyll-a	SM 10200H	1.0 mg/cubic meter	1.0 mg/cubic meter	0.1-1000 µg/L	Standards
Total Phosphorus (TP)	SM 4500-P B E	0.05 mg/L	0.0191 mg/L	0.2-2 mg/L	7 point curve
Total Dissolved Solids (TDS)	SM 2540 C	10 mg/L	5.83 mg/L	10–20,000 mg/L	Standards

NA – not applicable

B.5 QUALITY CONTROL

B.5.1 Field Measurements

All field instruments will be inspected and calibrated daily prior to visiting the field. All equipment used to provide numerical data will be calibrated to the accuracy requirements for its use prior to and at the end of sample analysis. In the event that a failure in the sampling or field measurement system occurs, the PM will be responsible for the corrective action. The corrective actions may include: rescheduling the sampling event, obtaining different sampling equipment from other entities, or taking discrete samples and completing analysis in the laboratory.

B.5.2 Field Collections

Water quality samples collected under programs described within this QAPP will take care to ensure the collection of representative water samples. QA/QC for the sampling processes will begin with proper collection of the samples in order to minimize the possibility of contamination. All water samples will be collected in laboratory-supplied, laboratory-certified, contaminant-free sample containers.

B.5.3 Analytical Chemistry Laboratory

All laboratories contracted by the LE/CL Task Force will follow QA/QC programs in accordance with guidelines established by the State of California and the U.S. EPA. Laboratories are required to submit a copy of their SOPs for laboratory quality control to the LE/CL Task Force QA Manager for review and approval.

B.5.4 Data Analysis

All laboratory data will be entered into the Task Force database, and filed in the archives along with related materials such as field forms, chain-of-custody forms, photographs, correspondence, etc.

The Task Force QA Manager will review all laboratory data as submitted for the SJW Nutrient Monitoring Program and will request additional re-analysis as warranted.

The In-lake QA Manager will review all laboratory data as submitted for the Nutrient TMDL Monitoring Program and will request additional re-analysis as warranted.

The appropriate QC Officer for each component of the QAPP will review laboratory data to determine compliance with the quality control limits established for precision, bias, completeness, and representativeness. If criteria are not met, the QC Officer will request that samples be re-analyzed (if holding times allow). In coordination with the Laboratory Manager, if results from the re-testing are within QC limits, these results will be used. Otherwise, data will be rejected and flagged accordingly.

B.5.5 Reporting

Prior to draft reports being submitted to the Agencies for review, all text will be cross-checked with data in tables and figures to ensure accurate transcription of data. In addition, draft reports will be submitted to third-party reviewers for review and comment prior to release. Any deviations from those methods included in the QAPP will be clearly noted with justification and/or qualification.

B.6 INSTRUMENT/EQUIPMENT TESTING, INSPECTION AND MAINTENANCE

B.6.1 Field Sampling

All field instruments will be inspected and calibrated prior to visiting the field. Maintenance schedules shall be followed according to manufacturer recommendations which will vary depending on the specific equipment type and model.

B.6.2 Analytical Laboratory

As with field equipment, maintenance schedules shall be followed for all laboratory analytical equipment according to manufacturer recommendations which will vary depending on the specific equipment type and model.

B.7 INSTRUMENT/EQUIPMENT CALIBRATION AND FREQUENCY

All equipment and instruments used for the Nutrient TMDL Monitoring Program will be operated and calibrated according to the manufacturer's recommendations. Operation and calibration will be performed by personnel properly trained in these procedures. Documentation of all routine and special calibration information will be recorded in appropriate log books and reference files. If a critical measurement is found to be out-of-compliance during analysis, the results of that analysis will not be reported, corrective action will be taken and documented (see Section C.1), and the analysis will be repeated.

B.8 INSPECTION/ACCEPTANCE OF SUPPLIES AND CONSUMABLE

Contract Laboratories will supply all the sample containers and other consumable supplies necessary for the Nutrient TMDL Monitoring Program.

B.9 NON-DIRECT MEASUREMENTS

The only indirect measurements used within the Nutrient TMDL monitoring program are from databases maintained by the Task Force or from prior studies. The database is maintained in accordance with Task Force policy as stated earlier. The data will be reviewed against the data quality objectives stated in Section A.7.2, and only that data meeting all of the criteria will be used in this project.

Other items within the non-direct measurement component are not applicable to the TMDL.

B.10 DATA MANAGEMENT

The Task Force will maintain an inventory of data and its forms, and will periodically check the inventory against the records in their possession. Data will be collected according to the procedures outlined in Section B.1 Sampling Process Design. Field measurements will be recorded on standard Field Log forms included in Appendices A and B. Analytical samples will be transferred to the laboratory under required chain-of-custody procedures using a standard COC form included as Appendix D.

All laboratory and field measurement data submitted to SAWPA for inclusion in the SAW DMS will follow guidelines and formats established by SWAMP (http://www.waterboards.ca.gov/swamp/qapp.html). Data will be transmitted and uploaded to SAWPA in the standard SWAMP electronic format. All contract laboratories will 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 will 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 will be 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 will be uploaded to the database. A unique batch number, date loaded, originating laboratory, and the person who loaded the data will be recorded in the database, so that data can be identified and removed in the future if necessary.

The database is backed up using built-in software backup procedures. In addition, all data files will be recorded to a tape on a weekly basis as part of SAWPA's SOP for disaster recovery. Back-up 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.

The database will be operated with a transaction log recording all changes with ability to roll back if necessary. Full database backups will occur on a weekly basis and immediately before batch uploads. It is expected TMDL data will be loaded quarterly to twice per year.

Data will be exported from SAW DMS into the SWAMP format using a pre-made query that will map data fields from SAW DMS to the SWAMP template. The exported data will then be sent to the SWRCB IM Coordinator for processing into the SWAMP database. The data will be retrieved for analysis and report writing by exporting from SAW DMS using pre-made queries.

C. ASSESSMENT AND OVERSIGHT

C.1 ASSESSMENTS AND RESPONSE ACTIONS

Sampling procedures will be reviewed on an annual basis. All reviews will be conducted by the Task Force and its consultants, and may include the RWQCB. Reviews will compare observed practices against those described in this QAPP. The Task Force and its consultants will audit all contract laboratories annually. The review will be observed method practices against contract laboratory's SOPs and an audit of data from the contract laboratory's QA/QC program.

If an audit discovers any discrepancy, the consultant PM will discuss the observed discrepancy with the appropriate person responsible for the activity. The discussion will begin with whether the information collected is accurate, what were the cause(s) leading to the deviation, how the deviation might impact data quality, and what corrective actions might be considered.

C.2 REPORTS TO MANAGEMENT

Interim and final reports for Task Force projects will be issued by the Task Force in accordance with the LE and CL Nutrient TMDLs, SARWQCB Resolution No. RB8-2004-0037. This calls for the submission of an annual water quality report by August 15th of each year.

D. DATA VALIDATION AND USABILITY

D.1 DATA REVIEW, VERIFICATION, AND VALIDATION

Data generated by each project's activities will be reviewed against the data quality objectives cited in Section A.7.2 and the QA/QC practices cited in Section B.5. Data will be separated into three categories:

1. Data meeting all data quality objectives,
2. Data meeting failing precision or recovery criteria, and
3. Data failing to meet accuracy criteria.

Data meeting all data quality objectives, but with failures of QA/QC practices will be set aside until the impact of the failure on data quality is determined. Once determined, the data will be moved into either the first or last category.

Data falling in the first category are considered usable by the project. Data falling in the last category are considered not usable. Data falling in the second category will have all aspects assessed. If sufficient evidence is found supporting data quality for use in this project, the data will be moved to the first category, but will be flagged with a "J" as per EPA specifications.

D.2 VERIFICATION AND VALIDATION METHODS

All data records will be checked visually and recorded as checked by initials and dates. The Task Force and its consultants will perform a check of 10 percent of the reports. The contract laboratory's QA Officers will perform checks of all of its records and the contract's Laboratory Director will recheck 10 percent. All checks by the contract laboratory will be reviewed by appropriate Task Force personnel.

Issues will be noted. Reconciliation and correction will be performed, and the contract laboratory's QA Officer and Laboratory Director will be notified. Any corrections require a unanimous agreement that the correction is appropriate.

D.3 RECONCILIATION WITH USER REQUIREMENTS

The project needs a sufficient number of data points, as represented by the completeness data quality objective in order to perform trend analyses for the LE/CL Nutrient TMDLs. However, natural variability and seasonal trends in water quality will be reflected in measured parameters along with variability from lake and watershed management actions, such as recycled water addition and aeration system operation in LE. Thus, careful consideration of natural variability will be necessary.

Additionally, if data are not sufficiently complete, the variability in the data may result in a large TMDL Margin of Safety when reporting loads for compliance.

The data will be used within the context of the SWAMP umbrella and the SWAMP database to determine whether LE and/or CL should be delisted.

E. REFERENCES

1. American Public Health Association (APHA) 1998. Standard methods for the examination of water and wastewater. Washington, D.C. APHA-AWWA-WEF, 1998.

2. California Regional Water Quality Control Board, Santa Ana Region, "Resolution No. R8-2004-0037, Resolution Amending the Water Quality Control Plan for the Santa Ana River Basin to Incorporate Nutrient Total Maximum Daily Loads (TMDLS) for Lake Elsinore and Canyon Lake," 2007.

3. Lake Elsinore and San Jacinto Watersheds Authority (LESJWA). 2006. Lake Elsinore and Canyon Lake Nutrient TMDL Monitoring Plan. CA Regional Water Quality Control Board, Santa Ana Region. February.

4. Lake Elsinore and San Jacinto Watersheds Authority (LESJWA). 2012. Lake Elsinore and Canyon Lake Nutrient TMDL Annual Water Quality Report. Santa Ana Regional Water Quality Control Board. August.

5. Lake Elsinore/ Canyon Lake TMDL Task Force, 2007. In-Lake Sediment Nutrient Reduction Plan for Lake Elsinore. Prepared for the California Regional Water Quality Control Board – Santa Ana region. October 31, 2007.

6. Santa Ana Watershed Protection Authority (SAWPA) online data portal. www.sawpa.net.

7. Santa Ana Regional Water Quality Control Board (2007), Resolution R8-2007-0083. Resolution Approving Plans and Schedules Submitted by the Canyon Lake/Lake Elsinore TMDL Task Force and Individual Discharger Groups Pursuant to the Lake Elsinore and Canyon Lake Nutrient Total Maximum Daily Loads Specified in the Water Quality Control Plan for the Santa Ana River Basin.

APPENDIX A

Example Field Data Sheet for Watershed Stormwater Monitoring

Lake Elsinore & Canyon Lake Nutrient TMDL
Watershed-Wide Sampling Form

Station ID No.: _________________ Station Name: ____

SAMPLE ________ Time (24-hr clock): ___________ Date: ___/___/___ Number of containers: ___

Staff Gauge Depth:_______ Meter Depth: ___________ Lab No.: _________________

Water Temp:________ pH: ____________ Cond: ____________________

Observations:

____

____

Station ID No.: _________________ Station Name:____

SAMPLE ________ Time (24-hr clock): ___________ Date: ___/___/___ Number of containers: ___

Staff Gauge Depth:_______ Meter Depth: ___________ Lab No.: _________________

Water Temp:________ pH: ___________ Cond: ____________________

Observations:

____

____

Station ID No.: _________________ Station Name:____

SAMPLE ________ Time (24-hr clock): ___________ Date: ___/___/___ Number of containers: ___

Staff Gauge Depth:_______ Meter Depth: ___________ Lab No.: _________________

Water Temp:________ pH: ___________ Cond: ____________________

Observations:

____

____

Station ID No.: _________________ Station Name:____

SAMPLE ________ Time (24-hr clock): ___________ Date: ___/___/___ Number of containers: ___

Staff Gauge Depth:_______ Meter Depth: ___________ Lab No.: _________________

Water Temp:________ pH: ___________ Cond: ____________________

Observations:

____

____

Lake Elsinore & Canyon Lake Nutrient TMDL
Watershed-Wide Sampling Form

Station Location: ___________________ Date:________________ Name of Sampler:__________________

Field Observation Suggestions (circle appropriate description):

Odor:	None, Musty, Sewage, Rotten egg, Sour milk, Fishy, Other
Color:	None, Yellow, Brown, Grey, Green, Red, Other
Clarity:	Clear, Cloudy, Opaque, Suspended solids, Other
Floatable:	None, Oil sheen, Foam, Animal waste, Green waste, Food, Paper, Plastic, Grease, Hydrophytes, Trash, Other
Settable:	None, Salt, Clay, Oil, Rust, Microbes, Other
Weeds:	None, Normal, Excessive, Note* _____________________
Biology:	Unobserved, Algae bloom, Larvae, Crawfish, Frogs, Fish, Water fowl, Hydrophytes, Blue-green algae, Other
Structural:	Normal, Cracking, Spauling, Note* _____________________
Sky:	Stormy, Overcast, Partial clouds, Haze, Fog, Clear
Wind:	Calm, Light breeze, Strong breeze, Windy, Gusts
Flow:	Storm/Flood, Rapid, Tranquil, Laminar, Standing, Dry Measurement:_________________

**Note: Any condition that seems noteworthy, place on this line. Also use the back of the field sheet for additional information.*

APPENDIX B

Example Field Data Sheet for In-Lake Monitoring

FIELD DATASHEET

Date:______________ Location (Circle): Lake Elsinore/Canyon Lake Station:____________

Time on Station:_______________ Time off Station:_______________

Weather Conditions:_________________________ Wind (mph & direction):__________________

Lat:___________________________________ Long:__________________________________

Water Depth (m):_____________ Secchi Depth (m):_______________________

Water Chemistry Sample?: Y / N Chl-a Sample?: Y / N Plankton Sample?: Y / N

Surface volume filtered (ml):___________

Depth-Integrated volume filtered (ml):___________

Comments:

Depth (m)	Temp (°C)	Cond (mS/cm)	pH	DO (mg/L)	Depth (m)	Temp (°C)	Cond (mS/cm)	pH	DO (mg/L)
0					**15**				
1					**16**				
2					**17**				
3					**18**				
4					**19**				
5					**20**				
6					**21**				
7					**22**				
8					**23**				
9					**24**				
10					**25**				
11					**26**				
12					**27**				
13					**28**				
14					**29**				

FIELD SAMPLING CHECKLIST

Date: ______________________________

Lake Elsinore

<u>LE1</u>

- ☐ Morning: In-situ water quality (pH, DO, Temperature, Conductivity)
- ☐ End of Day (after 2 pm): In-situ water quality (pH, DO, Temperature, Conductivity)

<u>LE2</u>

- ☐ Morning: In-situ water quality (pH, DO, Temperature, Conductivity)
- ☐ Depth integrated sample for chemistry
  - Quart Bottle Unpreserved (Nitrite/Nitrate, TDS)
  - Pint Bottle Preserved with H_2SO_4 (TKN, Ammonia, Total Phosphorus)
  - Pint Bottle Preserved with Zinc Acetate & NaOH (Total Sulfide)
  - Half Pint Bottle Unpreserved (Soluble Reactive Phosphorus [Ortho-P])
    - Filtered in field using 1.2 µm and 0.45 µm filters prior to filling bottle
- ☐ Depth integrated samples for Chlorophyll-a
  - Surface-to-Bottom
  - 0-2 m
- ☐ Plankton Sample (Surface-to-Bottom)
- ☐ End of Day (after 2 pm): In-situ water quality (pH, DO, Temperature, Conductivity)

<u>LE3</u>

- ☐ Morning: In-situ water quality (pH, DO, Temperature, Conductivity)
- ☐ End of Day (after 2 pm): In-situ water quality (pH, DO, Temperature, Conductivity)

<u>Lakeshore Sonde</u>

- ☐ Morning: In-situ water quality (pH, DO, Temperature, Conductivity)
- ☐ End of Day (after 2 pm): In-situ water quality (pH, DO, Temperature, Conductivity)

<u>Grand Avenue Sonde</u>

- ☐ Morning: In-situ water quality (pH, DO, Temperature, Conductivity)
- ☐ End of Day (after 2 pm): In-situ water quality (pH, DO, Temperature, Conductivity)

Canyon Lake

<u>CL07</u>

- ☐ Morning: In-situ water quality (pH, DO, Temperature, Conductivity)
- ☐ Depth integrated sample for chemistry
  - Quart Bottle Unpreserved (Nitrite/Nitrate, TDS)
  - Pint Bottle Preserved with H_2SO_4 (TKN, Ammonia, Total Phosphorus)
  - Pint Bottle Preserved with Zinc Acetate & NaOH (Total Sulfide)
  - Half Pint Bottle Unpreserved (Soluble Reactive Phosphorus [Ortho-P])
    - Filtered in field using 1.2 µm and 0.45 µm filters prior to filling bottle

FIELD SAMPLING CHECKLIST

- ☐ Depth integrated samples for Chlorophyll-a
  - Surface-to-Bottom
  - 0-2 m
- ☐ Plankton Sample (Surface-to-Bottom)
- ☐ End of Day (after 2 pm): In-situ water quality (pH, DO, Temperature, Conductivity)

<u>CL08</u>

- ☐ Morning: In-situ water quality (pH, DO, Temperature, Conductivity)
- ☐ Depth integrated sample for chemistry
  - Quart Bottle Unpreserved (Nitrite/Nitrate, TDS)
  - Pint Bottle Preserved with H_2SO_4 (TKN, Ammonia, Total Phosphorus)
  - Pint Bottle Preserved with Zinc Acetate & NaOH (Total Sulfide)
  - Half Pint Bottle Unpreserved (Soluble Reactive Phosphorus [Ortho-P])
    - Filtered in field using 1.2 µm and 0.45 µm filters prior to filling bottle
- ☐ Depth integrated samples for Chlorophyll-a
  - Surface-to-Bottom
  - 0-2 m
- ☐ Plankton Sample (Surface-to-Bottom)
- ☐ End of Day (after 2 pm): In-situ water quality (pH, DO, Temperature, Conductivity)

<u>CL09</u>

- ☐ Morning: In-situ water quality (pH, DO, Temperature, Conductivity)
- ☐ Surface (0-2m) sample for Chlorophyll-a Plankton Sample (Surface-to-Bottom)
- ☐ Plankton Sample (Surface-to-Bottom)
- ☐ End of Day (after 2 pm): In-situ water quality (pH, DO, Temperature, Conductivity)

<u>CL10</u>

- ☐ Morning: In-situ water quality (pH, DO, Temperature, Conductivity)
- ☐ Depth integrated sample for chemistry
  - Quart Bottle Unpreserved (Nitrite/Nitrate, TDS)
  - Pint Bottle Preserved with H_2SO_4 (TKN, Ammonia, Total Phosphorus)
  - Pint Bottle Preserved with Zinc Acetate & NaOH (Total Sulfide)
  - Half Pint Bottle Unpreserved (Soluble Reactive Phosphorus [Ortho-P])
    - Filtered in field using 1.2 µm and 0.45 µm filters prior to filling bottle
- ☐ Depth integrated samples for Chlorophyll-a
  - Surface-to-Bottom
  - 0-2 m
- ☐ Plankton Sample (Surface-to-Bottom)
- ☐ End of Day (after 2 pm): In-situ water quality (pH, DO, Temperature, Conductivity)

APPENDIX C

Final Lake Elsinore & Canyon Lake Nutrient TMDL Compliance Monitoring Work Plan

Haley & Aldrich, Inc.
5333 Mission Center Road
Suite 300
San Diego, CA 92108
619.280.9210

27 July 2016

Lake Elsinore & San Jacinto Watershed Authority
11615 Sterling Avenue
Riverside, California 92503

Attention: Mr. Rick Whetsel

Subject: Lake Elsinore & Canyon Lake Nutrient TMDL
Compliance Monitoring Work Plan
Revised July 2016
Lake Elsinore & San Jacinto Watershed Authority
Riverside, California

Ladies and Gentlemen:

Attached please find the Revised Final Lake Elsinore & Canyon Lake Nutrient TMDL Compliance Monitoring Work Plan. Please contact me directly at 619.285.7132 or by e-mail at ngardiner@haleyaldrich.com if you have any questions.

Sincerely yours,
HALEY & ALDRICH, INC.

Nancy E. Gardiner

Nancy Gardiner
Vice President/Senior Client Leader

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1. BACKGROUND AND INTRODUCTION

The following document presents the Comprehensive Monitoring Plan for compliance with the Lake Elsinore & Canyon Lake Nutrient Total Maximum Daily Loads (TMDLs) and demonstrates progress toward attaining compliance with respective waste load allocations (WLAs) and/or TMDL response targets. This document is intended to describe the overall approach for compliance monitoring in the near term (2014 through 2019). Details regarding sample collection, handling, and analysis protocols are discussed in the Quality Assurance Project Plan for this monitoring program.

Lake Elsinore is a natural freshwater lake in Southern California that provides a variety of natural habitats for terrestrial and aquatic species. The beneficial uses of the lake include water contact recreation (REC1), non-water contact recreation (REC2), warm freshwater habitat (WARM), and wildlife habitat (WILD). Canyon Lake was constructed in 1928 as the Railroad Canyon Reservoir. It is located about 2 miles upstream of Lake Elsinore and water spilled from Canyon Lake is a main source of water for Lake Elsinore. The beneficial uses of Canyon Lake include municipal and domestic water supply (MUN), agricultural supply (AGR), groundwater recharge (GWR), body contact recreation (REC1), non-body contact recreation (REC2), warm freshwater aquatic habitat (WARM), and wildlife habitat (WILD).

Local stakeholders and the Santa Ana Regional Water Quality Control Board (SARWQCB) have been working together since 2000 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 along the San Jacinto River and Salt Creek and monitor Lake Elsinore and Canyon Lake water quality with the support of the Elsinore Valley Municipal Water District (EVMWD) and the San Jacinto River Watershed Council. Available grant funding helped stakeholders to develop models of the lakes to better understand their characteristics and a San Jacinto River Watershed model to simulate wash off and nutrient transport to the lakes. The Lake Elsinore & San Jacinto Watersheds Authority (LESJWA) also performed numerous studies of each lake and started to implement projects expected to improve in-lake water quality.

In December 2004, the RWQCB adopted amendments to the Water Quality Control Plan for the Santa Ana River Basin (Basin Plan) to incorporate TMDLs for nutrients in Canyon Lake and Lake Elsinore. The Basin Plan Amendment specifies, among other things, monitoring recommendations to track compliance with TMDLs and associated WLAs and measuring compliance to in-lake numeric water quality targets. Numeric targets have been established and incorporated in the TMDLs for nutrients (total nitrogen, phosphorous, and ammonia), pH, dissolved oxygen, chlorophyll a, and total dissolved solids (TDS); however the ultimate compliance goal for beneficial uses in both lakes is to reduce enhanced eutrophication, which can negatively affect biological communities, result in fish kills, and impact recreational use. The recommendations outlined in SARWQCB Resolution No. R8-2004-0037 (SARWQCB, 2004) required stakeholders to develop management plans and conduct long-term monitoring and implementation programs aimed at reducing nutrient discharges to Lake Elsinore and Canyon Lake.

Beginning in December 2004, the Lake Elsinore and Canyon Lake TMDL Task Force (Task Force) was convened to provide a forum for stakeholder interaction related to the TMDL process. The Task Force consists of representatives from local cities, Riverside County, agriculture and dairy, environmental groups, and the regulatory community. At the request of the RWQCB, The Santa Ana Watershed Project

Authority serves as a neutral facilitator for the TMDL development process for Lake Elsinore and Canyon Lake.

Throughout this time, the Task Force stakeholders were able to develop a priority schedule for addressing data gaps. This enabled them 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 WLAs. The Lake Elsinore and Canyon Lake Nutrient TMDL Monitoring Plan was approved by the RWQCB in March 2006 and subsequently implemented by the Task Force in April 2006 through June 2012. This monitoring approach included an intensive study of in-lake processes, an intensive watershed study, and compliance monitoring. The in-lake monitoring efforts were subsequently discontinued temporarily in agreement with the RWQCB to redirect funding towards nutrient reduction actions including lake stabilization efforts, fish management strategies to reduce resuspension of sediments from carp and zooplankton grazing by shad, and adding alum to bind nutrients in Canyon Lake. As stipulated in the agreement with the RWQCB, the Task Force drafted this Compliance Monitoring Work Plan to reassess current conditions and establish a monitoring framework to assess trends towards meeting TMDL targets.

2. OBJECTIVES OF THE NUTRIENT TMDL COMPLIANCE MONITORING WORK PLAN

The following objectives (in order from highest to lowest priority) are being considered in developing the Nutrient TMDL Compliance Monitoring Work Plan:

1. Evaluate the status and trends toward achieving response targets in both lakes;
2. Determine how to quantify the amount of influence natural background has on the status and trend; and
3. Distinguish and quantify the external pollutant loading originating in the upstream watershed above the lakes.

Additional objectives of the monitoring are to support the stormwater compliance activities underway by other entities in the watershed, including the reissuance of the Riverside County Municipal Stormwater National Pollutant Discharge Elimination Systems Permit [Order R8-2010-0033; Municipal Separate Storm Sewer System (MS4) Permit], and land use monitoring requirements related to the Conditional Waiver for Agricultural Discharges.

3. WATERSHED-WIDE MONITORING

The study design for the watershed-wide monitoring is to continue to determine nutrient loading into Canyon Lake and Lake Elsinore from upstream watershed sources and to add to the historical monitoring data set for identifying long-term trends.

3.1 SAMPLING PERIOD

Stormwater runoff will continue to be sampled during three storm events per year during the wet season at all stations when flow is present. Samples will not be collected during dry weather. However, total annual flows measured at the collocated US Geological Survey (USGS) stream gauges will be used to calculate total watershed loading (based on the average event mean concentrations measured during the storm events).

3.2 SAMPLING LOCATIONS FOR WATERSHED-WIDE MONITORING

There are four historical sampling stations located throughout the San Jacinto River watershed, Lake Elsinore, and Canyon Lake area (Table I and Figure 1). The sampling locations were carefully selected to reflect various types of land use and have been monitored since 2006. Three of the four sites were selected because they are indicative of inputs to Canyon Lake originating from the main stem of the San Jacinto River, Salt Creek, and the watershed above Mystic Lake. The fourth site, located below the Canyon Lake Dam, is indicative of loads entering Lake Elsinore from Canyon Lake and the upstream watershed (when the dam is spilling). Many of the sampling stations are located in close proximity to stream gauge stations installed by the USGS or the Riverside County Flood Control & Water Conservation District. The stream gauges provide a general estimate of the total flow in the channel at a location close to each autosampler.

Table I. Watershed-Wide Monitoring Stations

Location Number and Description	Historical Database Station Number
Salt Creek at Murrieta Rd	745
San Jacinto River at Goetz Rd	759
San Jacinto River at Ramona Expressway	741
Canyon Lake Spillway	841

The sampling location along the San Jacinto River at Ramona Expressway is located downgradient of Mystic Lake, an area of land subsidence. Flow has not been observed at this location since a strong El Nino event in the mid-1990s. Because of the active subsidence, this monitoring station is not expected to flow except under extremely high rainfall conditions.

In addition to the historical stations, sampling may be conducted at one additional site that may rotate from year to year as needed to collect data from a new area or to help answer a technical question. Some examples of sites that may be sampled could include a background station, or sites downstream from areas of interest (e.g., downstream of Ortega or Hemet Channel, Salt Creek at State Street, or Kitching Street Channel at Iris Avenue).

3.3 SAMPLING APPROACH

The following sample collection protocols are intended to collect flow-weighted composite samples at the monitoring sites listed in Table I. Samples may be collected either manually by compositing discrete grab samples, or automatically using automatic sampling equipment (e.g., ISCO autosamplers equipped with flow meters). Samples will be collected on both the rising limb (increasing flow) and the falling limb (decreasing flow) of the hydrograph. Eight to twelve discrete samples will be collected for compositing if collected manually (consistent with previous direction from the RWQCB). More detail regarding the sampling approach (e.g., compositing, sample naming conventions) are described in the Quality Assurance Project Plan (QAPP) for this monitoring program. Flow will be estimated based on data from USGS stream gauges collocated on the same streams near the sampling stations.

3.4 FIELD SAMPLING AND MEASUREMENTS

Field measurements (pH, temperature, and turbidity) will be conducted using a portable meter. Analytes and their associated laboratory methods are summarized in Table II.

3.5 SAMPLE BOTTLES AND LABELS

The analytical laboratory will supply bottles to the sampling team prior to the anticipated storm event. The field staff will complete the sample labels and affix them to the sample bottles. Once the samples are collected, the following information will be identified on each sample label prior to delivery to the analytical laboratory:

- Analyses to be performed on the samples;
- Date and time sample collected;
- Sample number identifying the sample location, date, and aliquot type; and
- Initials of the individual who collected the sample.

3.6 FIELD DATA SHEETS

Field data sheets (Appendix A) will be completed in the field and submitted to LESJWA on behalf of the Task Force and placed in the TMDL file.

3.7 CHAIN OF CUSTODY FORMS

The analytical laboratory will supply the chain of custody forms; a sample chain of custody form is included in Appendix A. The field sampling team will complete these forms with the following information:

- Contact person and telephone numbers;
- Name of study;
- Analyses to be performed on the samples;

- Type of sample collected; and
- Number of bottles per sample and preservatives used.

Each sampling team will complete the following information on their chain of custody form:

- Sample number;
- Date and time sample collected; and
- Name of sampling staff and signature.

3.8 ANALYTICAL CONSTITUENTS

Stormwater samples will be analyzed for the same constituents historically monitored for in the watershed-wide monitoring and as noted in Table II below.

Table II. Analytical Constituents and Methods

Parameter	Analysis	Typical Sample Volume	Recommended Containers	Initial Field Preservation	Maximum Holding Time
Turbidity	Field	N/A	N/A, Measure on site	Unpreserved	N/A
Water Temperature	Field	N/A	N/A, Measure on site	Unpreserved	N/A
pH	Field	N/A	N/A, Measure on site	Unpreserved	N/A
Total Organic Nitrogen (Org-N)	CALC	N/A	N/A	N/A	N/A
Nitrite Nitrogen (NO2-N)	SM4500-NO2 B	150 m/L	Poly	Unpreserved	48 hours
Nitrate Nitrogen (NO3-N)	EPA 300.0	300 m/L	Poly	Unpreserved	48 hours
Ammonia Nitrogen (NH4-N)	SM4500-NH3 H	500 m/L	Poly	H2SO4	28 days
Total Kjeldahl Nitrogen (TKN)	EPA 351.3	600 m/L	Poly	H2SO4	28 days
Total Phosphorus (TP)	SM4500-P E	300 m/L	Poly	H2SO4	28 days
Soluble Reactive Phosphorus (SRP / ortho-P)	SM4500-P E	1 L	Poly	Unpreserved	48 hours
Total Suspended Solids (TSS)	SM2540C	1 L	Poly	Unpreserved	7 days

Parameter	Analysis	Typical Sample Volume	Recommended Containers	Initial Field Preservation	Maximum Holding Time
Chemical Oxygen Demand (COD)*	SM5220D	1 L	Poly	H2SO4	28 days
Biochemical Oxygen Demand (BOD)*	SM5210B	4 L	Poly	Unpreserved	48 hours
Total Dissolved Solids (TDS)	EPA 160.1	1 L	Poly	Unpreserved	7 days
Total Hardness	SM 2340C	300 m/L	Poly	HNO2	6 months

* Analyses to be performed on the first discrete sample only.

3.9 SAMPLE TRANSPORTATION

Samples will be transported to the analytical laboratory within holding times for the intended analyses.

4. IN-LAKE MONITORING

4.1 BACKGROUND

Routine in-lake monitoring was initiated in 2006 by local stakeholders in cooperation with the RWQCB at three open water locations in Lake Elsinore and four locations in Canyon Lake. Monitoring was conducted monthly between October and May and twice per month between June and September, with grab samples collected at the surface, within the water column, and/or as depth-integrated samples (depending on the lake and the analyte). In 2011-2012, sampling locations in Lake Elsinore and Canyon Lake were reduced to one and three stations, respectively, following a review of available data that indicated consistent similar nutrient concentrations and physical water quality parameters among the three sampling sites in Lake Elsinore and two sites in east Canyon Lake. This saving also shifted resources towards a number of implementation strategies aimed at reducing nutrient impacts in both lakes as described in RWQCB Resolution No. R8-2011-0023. In-lake monitoring was then suspended temporarily in 2012-2013 to further redirect additional resources toward implementing in-lake best management practices. However, ongoing in-lake sampling will be required to estimate progress toward attaining nutrient TMDL targets and calculating annual and 10-year running averages.

4.2 MANAGEMENT QUESTIONS

Specific questions to be addressed through the Compliance Monitoring Work Plan proposed herein:

1. What is the status and trend of each lake towards achieving TMDL response targets seasonally and over time?
2. How do single point in time in-situ water quality profiles of dissolved oxygen (DO), pH, conductivity, and temperature in Lake Elsinore compare to data derived from real time data sondes currently installed and managed by the EVMWD for TMDL compliance purposes?
3. How do estimated chlorophyll-a concentrations from satellite imagery compare to individual grab samples in each lake? Can the satellite imagery provide a more accurate cost effective means of assessing chlorophyll-a concentrations for compliance purposes?

4.3 LAKE ELSINORE MONITORING

In order to maintain consistency and facilitate the assessment of trends toward meeting compliance goals, the in-lake monitoring design halted in 2012 (LESJWA, 2012) will be resumed using the three former stations outlined in the approved Lake Elsinore and Canyon Lake Nutrient TMDL Monitoring Plan (LESJWA, 2006; Figure 2). One station (Site 2 on Figure 2) will have analytical samples collected and in-situ water quality readings, while the remaining two stations will only have in-situ water quality readings performed. Monitoring in the central portion of the lake at Site 2 will consist of collecting surface-to-bottom depth integrated samples for nitrate, nitrite, ammonia, TKN, total phosphorous, soluble reactive phosphorus (SRP/Ortho-P), and TDS monthly during the summer period (June through September) and every-other month (bi-monthly) during the remainder of the annual cycle (October through May). The enhanced monitoring during the summer months in Lake Elsinore is justified given the current TMDL criteria for chlorophyll-a, which is based on a summer average for this water body as opposed to an annual average for other constituents. This sampling regime will continue to help assess seasonal changes and statistical trends over time using an annual average calculation with each date treated as a replicate data point. This sampling will be coordinated to occur on the same day as satellite imagery discussed in Section 4.5. Depth-integrated samples will be prepared by either combining discreet grab samples collected using a Van Dorn bottle at each 1-meter (m) depth interval throughout the water column, including the surface, or using a peristaltic pump and lowering/raising the inlet tube through the water column at a uniform speed. Two discrete samples will also be collected and analyzed at Site 2 for chlorophyll-a: 1) a surface-to-bottom depth integrated sample; and 2) a 0-2-m depth integrated surface sample. Both chlorophyll-a sample types will be collected in the same manner as analytical chemistry samples. Note that while no WLAs for total ammonia are currently in place for Lake Elsinore, ammonia can be an important driver of toxicity, potentially causing fish kills and decreasing zooplankton survival/reproduction, particularly given the historically high ambient pH values observed in the lake that enhance the more toxic un-ionized fraction of ammonia.

In-situ monitoring using pre-calibrated hand-held YSI field meters or equivalent will also be performed during each sampling event at all three stations (Sites 1, 2, and 3) for pH, DO, temperature, and conductivity field measurements. A complete depth profile at each station will be recorded for each parameter at 1-m intervals. These data will be used to assess spatial variability and compared to data obtained from the currently installed data sondes operated by EVMWD near the center of the lake. Water clarity will also be assessed at all three stations using a Secchi disk. An attempt will be made for a better comparison to existing data by collecting all water samples and field measurements prior to noon during each sampling event to avoid collecting suspended sediments potentially stirred up from the bottom of the lake by frequent afternoon winds. End-of-the-day field measurements (i.e. after ~2:30pm) will also be recorded for pH, DO, temperature, and conductivity at all three stations to assess any potential temporal variability in these parameters throughout the day.

A summary of collection activities for Lake Elsinore and Canyon Lake is outlined in Table III. A summary of analytical parameters and methodologies for routine TMDL compliance monitoring is provided in Table IV.

Data collected by the two currently installed in-situ data sondes used for monitoring the water pump/aeration system in Lake Elsinore will be analyzed to look at daily cycles and trends across each two-month monitoring period. These data could be compared to any other concurrent measurements that might have been performed during their use, as well as historic water quality records in relation to TMDL targets. Such an evaluation could provide valuable insight into: 1) whether the data sondes may provide a more cost effective solution to monitor water quality in the lake; and 2) whether the pump/aeration system is able to provide substantial measurable benefit related to the TMDL targets.

4.4 CANYON LAKE MONITORING

Similar to Lake Elsinore, monitoring efforts and locations in Canyon Lake were selected based on the monitoring conducted between 2006 and 2012 to provide consistency in assessing trends toward meeting compliance goals. The in-lake monitoring design halted in 2012 will therefore be resumed using four stations outlined in the approved Lake Elsinore and Canyon Lake Nutrient TMDL Monitoring Plan (LESJWA, 2006; Figure 3). These include two in the main body of the lake (CL07 near the dam and CL08 in the northern arm) and two in the East Bay (CL09 and CL10). This sampling will be conducted every-other month (bi-monthly) and coordinated to occur on the same day as satellite imagery as described in Section 4.5. Consistent with Lake Elsinore monitoring, surface-to-bottom depth integrated samples will be collected for nitrate, nitrite, ammonia, TKN, total phosphorous, soluble reactive phosphorus (SRP / Ortho-P), and TDS. These analytical samples will be collected at only three of the four monitoring locations (CL07, CL08, and CL10). Station CL10 was selected as the primary monitoring location in the east arm of Canyon Lake for TMDL compliance monitoring in 2011-2012 following the approved reduction from four to three locations as described in Section 4.1. This site is more centrally located within the east arm and past results indicated similar water quality between the two east bay sites overall. The width of the lake at Station CL10 is narrower than that at Station CL09, potentially resulting in an edge interference at this location for the satellite imagery used to quantify chlorophyll-a over a larger area. As a result, a surface water sample will also be collected from this location for chlorophyll-a analysis only to enable a more direct comparison to satellite imagery at Station CL09.

Depth integrated samples at sites CL07, CL08, and CL10 will be prepared by either combining discreet grab samples collected using a Van Dorn bottle at each 1-m depth interval throughout the water column, including the surface, or using a peristaltic pump and lowering/raising the inlet tube through the water column at a uniform speed. Two discrete samples will be collected and analyzed for chlorophyll-a at Stations CL07, CL08, and CL10: 1) a surface-to-bottom depth integrated sample; and 2) a 0-2-m depth integrated surface sample. Both chlorophyll-a sample types will be collected in the same manner as analytical chemistry samples. One 0-2-m depth integrated surface sample will be collected for chlorophyll-a at Station CL09.

In-situ monitoring using pre-calibrated hand-held YSI meters or equivalent will also be performed during each sampling event at all four stations (Sites CL07, CL08, CL09, and CL10) for pH, DO, temperature, and conductivity field measurements. A complete depth profile at each station will be collected for each of these parameters at 1-m intervals. Water clarity will also be assessed at each sampling location using a Secchi disk. An attempt will be made for a better comparison to existing data by collecting all water samples and field measurements prior to noon during each sampling event to avoid collecting suspended sediments potentially stirred up from the bottom of the lake by frequent afternoon winds. End-of-the-day field measurements (i.e., after ~2:30pm) will also be recorded for pH, DO, temperature, and conductivity at all four stations to assess any potential temporal variability in these parameters throughout the day.

Table III. Summary of In-Lake Collection Activities

Lake	Frequency	Location	Analytical Samples Collected (Y/N)[a]	Chlorophyll-a[b]	Field Water Quality Measurements (Y/N)[d]
Lake Elsinore	Monthly & Bi-monthly	Station 1	N	N	Y
		Station 2	Y	Y	Y
		Station 3	N	N	Y
	Continuous	EVMWD Sites (Buoys 1 and 2)	N	N	Y[e]
Canyon Lake	Bi-monthly	Station 7	Y	Y	Y
		Station 8	Y	Y	Y
		Station 9	N	Y[c]	Y
		Station 10	Y	Y	Y

Note: Bi-monthly is sampling every other month (i.e. six times per year). Monthly sampling to occur over summer months only (June-September). Bi-monthly sampling to occur on Lake Elsinore outside of summer period.

[a] Includes depth integrated samples for nitrate, nitrite, ammonia, TKN, total phosphorous, soluble reactive phosphorus (SRP / Ortho-P), and TDS.

[b] Chlorophyll-a: Two samples: 1) a surface-to-bottom depth integrated sample; and 2) a 0-2-m depth integrated surface sample.

[c] A 0-2-m depth integrated surface sample only will be collected for chlorophyll-a at Site CL09 for direct comparison to satellite imagery results at this location.

[d] Includes depth profile field measurements for pH, DO, temperature, and conductivity. Water clarity will be measured using a Secchi disk.

[e] Two stations located near the center of Lake Elsinore are monitored by EVMWD for DO, conductivity, pH, and temperature using permanently installed in-situ YSI data sondes. The primary purpose of these sondes is to monitor vertical DO profiles daily to efficiently determine when aeration pumps should be operated to minimize DO stratification in the lake.

Table IV. In-lake Analytical Constituents and Methods

Parameter	Analysis SOP #	Sampling Method[a,b]	Typical Sample Volume	Recommended Containers	Initial Field Preservation	Maximum Holding Time
Water Clarity	In-situ Field	Secchi disk	N/A	N/A, Measure on site	N/A, Measure on site	N/A
Water Temperature	In-situ Field	Field Meter	N/A	N/A, Measure on site	N/A, Measure on site	N/A
pH	In-situ Field	Field Meter	N/A	N/A, Measure on site	N/A, Measure on site	N/A
Dissolved Oxygen	In-situ Field	Field Meter	N/A	N/A, Measure on site	N/A, Measure on site	N/A
Nitrite Nitrogen (NO_2-N)	SM4500-NO2 B	Depth Integrated	150 mL	Poly	<4°C, H_2SO_4	48 hours
Nitrate Nitrogen (NO_3-N)	EPA 300.0	Depth Integrated	300 mL	Poly	<4°C, H_2SO_4	48 hours
Total Kjeldahl Nitrogen (TKN)	EPA 351.3	Depth Integrated	600 mL	Poly	<4°C, H_2SO_4	28 days
Ammonia Nitrogen (NH4-N)	SM4500-NH_3 H	Depth Integrated	500 mL	Poly	<4°C, H_2SO_4	28 days
Total Phosphorus (TP)	SM4500-P E	Depth Integrated	300 mL	Amber Poly	<4°C, H_2SO_4	28 days
Soluble Reactive Phosphorus (SRP / Ortho-P)	SM4500-P E	Depth Integrated	1 L	Amber Poly	<4°C	48 hours
Chlorophyll-a	SM 10200H	Surface & Depth Integrated	1000 mL	Amber Poly	<4°C	48 hours
Total Dissolved Solids (TDS)	SM 2540 C	Depth Integrated	1000 mL	Poly	<4°C	7 Days

[a] Depth integrated samples of the entire water column as described in Sections 4.3 and 4.4.

[b] Two samples collected for chlorophyll-a: 1) a surface to bottom depth integrated sample; and 2) a 0-2m depth integrated surface sample.

mL – milliliter

L - liter

4.5 SATELLITE IMAGERY

In Fiscal Year 2015-2016, the Task Force contracted with EOMap Americas to conduct remote sensing using Landsat satellite imagery (Figure 4) to estimate chlorophyll-a concentrations in Lake Elsinore and Canyon Lake. Using a resolution of 5 pixels per acre, this effort produced maps of the lake showing graphical, color-coded images of chlorophyll-a and turbidity concentrations at up to approximately 1000 unique data points across Canyon Lake and approximately 11,000 unique data points across Lake Elsinore. This tool provides snapshots of conditions throughout the entire lake at a given point in time, as opposed to the single data points provided at water quality collection locations; however, the satellite imagery only represents approximately the upper 4 feet of the water column and therefore cannot completely replace manual sampling.

As part of the compliance monitoring, satellite imagery depicting lake-wide chlorophyll-a concentrations in Lake Elsinore and Canyon Lake will be generated for each in-lake monitoring event. In addition to examining lake-wide chlorophyll concentrations, these data can be used to measure chlorophyll-a as a means of collecting data for calculating the annual average concentration and conducting trends analysis. In the future, satellite imagery mapping could also be conducted prior to and following in-lake treatments (such as alum applications) to gauge effectiveness on a lake-wide scale.

5. REPORTING

Assessing current conditions and an integrative analysis of temporal and spatial trends in water quality related to TMDL targets are important components of the overall nutrient TMDL compliance program. All data collected will be summarized in tables and displayed graphically using methods similar to that provided in prior the Annual TMDL Water Quality Reports to evaluate trends in water quality among both watershed monitoring locations and within Lake Elsinore and Canyon Lake. This will become increasingly important as various watershed and in-lake best management practices are implemented to evaluate their effectiveness at achieving TMDL goals. Tables will provide numerical comparisons relative to Basin Plan Objectives and TMDL targets for in-lake monitoring. Supporting in-lake monitoring information will include vertical profile plots with in-situ measurements of pH, DO, conductivity, temperature, and turbidity and a summary of any field observations of note during sampling efforts. Vertical profile plots of DO will also be compared to the continuous in-situ measurements from the existing data sondes in Lake Elsinore to assess their comparability and applicability to support TMDL compliance. Supporting data from the watershed monitoring will include stream hydrographs, rainfall plots, a summary of analytical results, and an estimate of both dry and wet weather loading of nutrients and total suspended solids to Lake Elsinore and Canyon Lake.

6. REFERENCES

1. Santa Ana Regional Water Quality Control Board (2004), Resolution R8-2004-0037. Resolution Amending the Water Quality Control Plan for the Santa Ana River Basin to Incorporate Nutrient Total Maximum Daily Loads (TMDLs) for Lake Elsinore and Canyon Lake.

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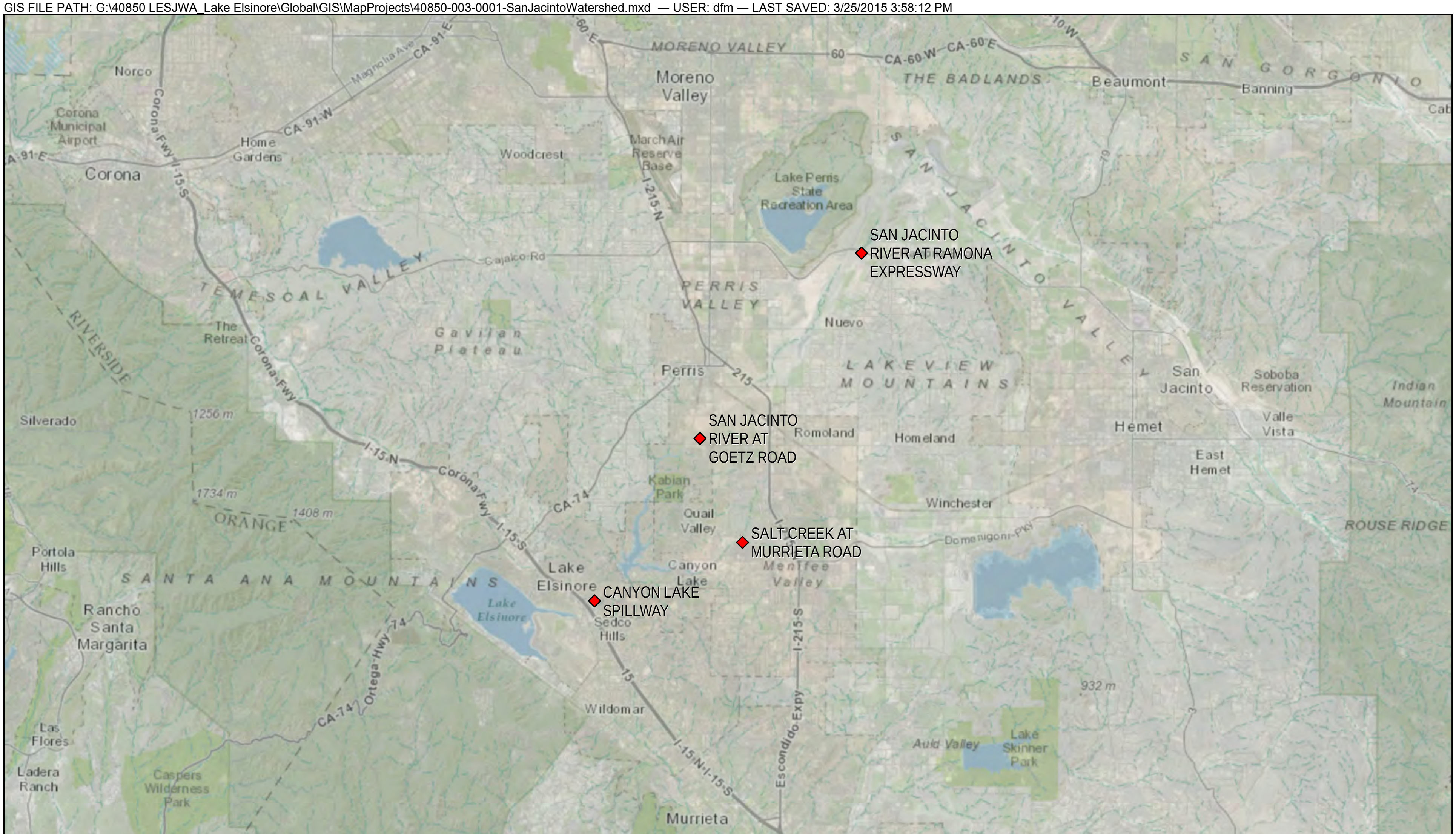

LEGEND

◆ SAN JACINTO WATERSHED-WIDE MONITORING LOCATION

NOTES

1. ALL LOCATIONS AND DIMENSIONS ARE APPROXIMATE
2. SOURCE: LAKE ELSINORE AND CANYON LAKE NUTRIENT TMDL ANNUAL WATER QUALITY REPORT; LAKE ELSINORE AND SAN JACINTO WATERSHEDS AUTHORITY; AUGUST 2014

0 2.5 5
MILES

HALEY ALDRICH

LAKE ELSINORE AND SAN JACINTO WATERSHEDS AUTHORITY
COUNTY OF RIVERSIDE, CALIFORNIA

SAN JACINTO WATERSHED-WIDE MONITORING STATIONS

APRIL 2015

FIGURE 1

GIS FILE PATH: G:\40850 LESJWA_Lake Elsinore\Global\GIS\MapProjects\40850-003-0002-LakeElsinorSamples.mxd — USER: dfm — LAST SAVED: 3/25/2015 2:26:11 PM

LEGEND

◆ LAKE ELSINORE SAMPLING LOCATION

NOTES

1. ALL LOCATIONS AND DIMENSIONS ARE APPROXIMATE
2. SOURCE: APRIL 2007 - MARCH 2008 LAKE ELSINORE WATER QUALITY MONITORING PLAN; MWH ; APRIL 2007; FIGURE 1

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SCALE IN FEET

HALEY ALDRICH

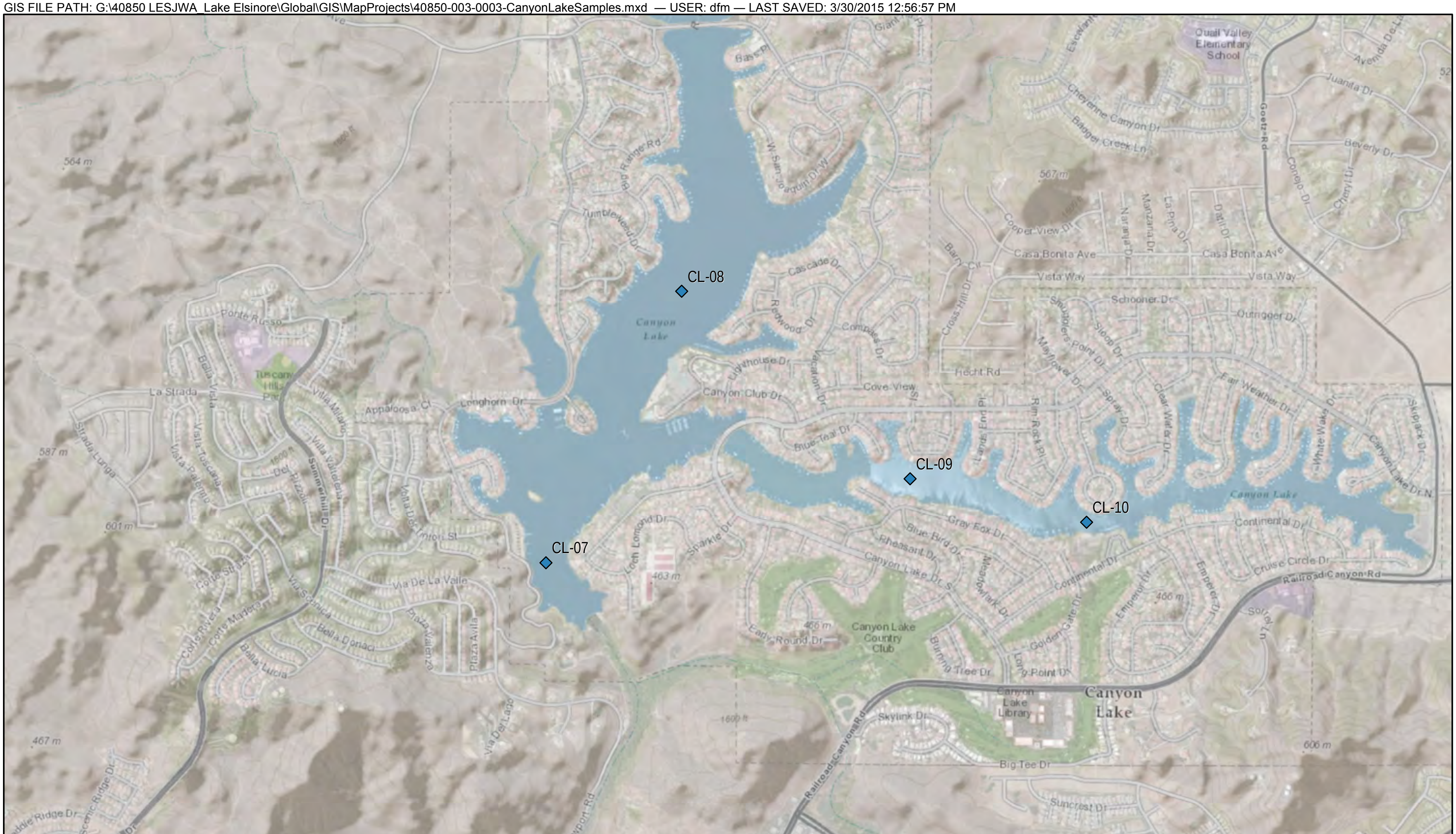
LAKE ELSINORE AND SAN JACINTO WATERSHEDS AUTHORITY
COUNTY OF RIVERSIDE, CALIFORNIA

LAKE ELSINORE IN-LAKE SAMPLING LOCATIONS

APRIL 2015

FIGURE 2

GIS FILE PATH: G:\40850 LESJWA_Lake Elsinore\Global\GIS\MapProjects\40850-003-0003-CanyonLakeSamples.mxd — USER: dfm — LAST SAVED: 3/30/2015 12:56:57 PM



LEGEND

◆ CANYON LAKE SAMPLING LOCATION

NOTES

1. ALL LOCATIONS AND DIMENSIONS ARE APPROXIMATE
2. SOURCE:WATER QUALITY MONITORING PLAN FOR THE CANYON LAKE ALUM APPLICATION PROGRAM; MWH ; AUGUST 2013

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HALEY ALDRICH

LAKE ELSINORE AND SAN JACINTO WATERSHEDS AUTHORITY
COUNTY OF RIVERSIDE, CALIFORNIA

CANYON LAKE SAMPLING LOCATIONS

APRIL 2015

FIGURE 3

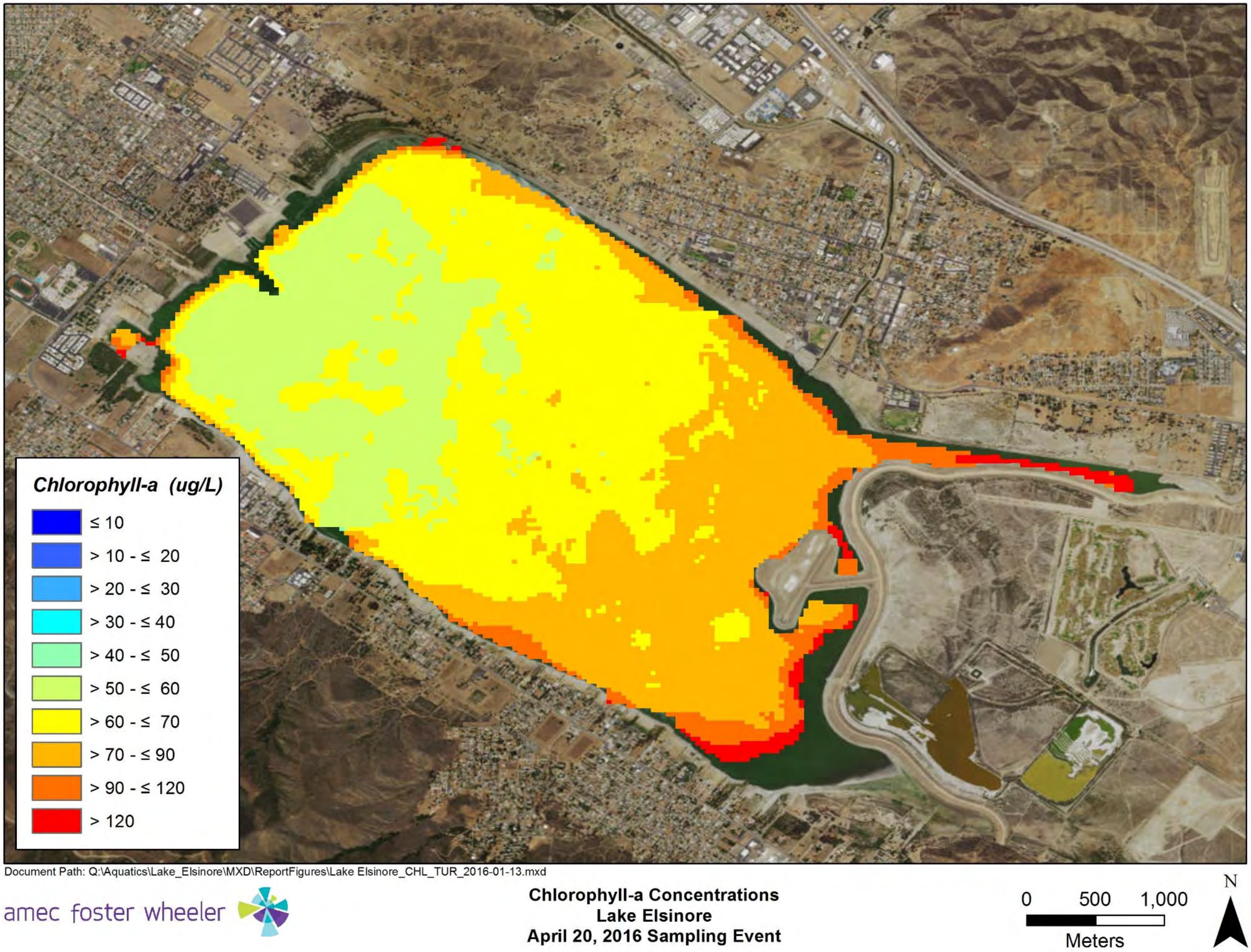

Figure 4. Example Satellite Imagery depicting Chlorophyll-a Concentrations

APPENDIX A

Sampling Forms and Example Chain of Custody

FIELD SAMPLING CHECKLIST

Date:

Lake Elsinore

LE1

- ☐ Morning: In-situ water quality (pH, DO, Temperature, Conductivity)
- ☐ End of Day (after 2 pm): In-situ water quality (pH, DO, Temperature, Conductivity)

LE2

- ☐ Morning: In-situ water quality (pH, DO, Temperature, Conductivity)
- ☐ Depth integrated sample for chemistry
    - Quart Bottle Unpreserved (Nitrite/Nitrate, TDS)
    - Pint Bottle Preserved with H_2SO_4 (TKN, Ammonia, Total Phosphorus)
    - Pint Bottle Preserved with Zinc Acetate & NaOH (Total Sulfide)
    - Half Pint Bottle Unpreserved (Soluble Reactive Phosphorus [Ortho-P])
        - Filtered in field using 1.2 µm and 0.45 µm filters prior to filling bottle
- ☐ Depth integrated samples for Chlorophyll-a
    - Surface-to-Bottom
    - 0-2 m
- ☐ Plankton Sample (Surface-to-Bottom)
- ☐ End of Day (after 2 pm): In-situ water quality (pH, DO, Temperature, Conductivity)

LE3

- ☐ Morning: In-situ water quality (pH, DO, Temperature, Conductivity)
- ☐ End of Day (after 2 pm): In-situ water quality (pH, DO, Temperature, Conductivity)

Lakeshore Sonde

- ☐ Morning: In-situ water quality (pH, DO, Temperature, Conductivity)
- ☐ End of Day (after 2 pm): In-situ water quality (pH, DO, Temperature, Conductivity)

Grand Avenue Sonde

- ☐ Morning: In-situ water quality (pH, DO, Temperature, Conductivity)
- ☐ End of Day (after 2 pm): In-situ water quality (pH, DO, Temperature, Conductivity)

Canyon Lake

CL07

- ☐ Morning: In-situ water quality (pH, DO, Temperature, Conductivity)
- ☐ Depth integrated sample for chemistry
    - Quart Bottle Unpreserved (Nitrite/Nitrate, TDS)
    - Pint Bottle Preserved with H_2SO_4 (TKN, Ammonia, Total Phosphorus)
    - Pint Bottle Preserved with Zinc Acetate & NaOH (Total Sulfide)
    - Half Pint Bottle Unpreserved (Soluble Reactive Phosphorus [Ortho-P])
        - Filtered in field using 1.2 µm and 0.45 µm filters prior to filling bottle

FIELD SAMPLING CHECKLIST

- ☐ Depth integrated samples for Chlorophyll-a
    - Surface-to-Bottom
    - 0-2 m
- ☐ Plankton Sample (Surface-to-Bottom)
- ☐ End of Day (after 2 pm): In-situ water quality (pH, DO, Temperature, Conductivity)

<u>CL08</u>

- ☐ Morning: In-situ water quality (pH, DO, Temperature, Conductivity)
- ☐ Depth integrated sample for chemistry
    - Quart Bottle Unpreserved (Nitrite/Nitrate, TDS)
    - Pint Bottle Preserved with H_2SO_4 (TKN, Ammonia, Total Phosphorus)
    - Pint Bottle Preserved with Zinc Acetate & NaOH (Total Sulfide)
    - Half Pint Bottle Unpreserved (Soluble Reactive Phosphorus [Ortho-P])
        - Filtered in field using 1.2 µm and 0.45 µm filters prior to filling bottle
- ☐ Depth integrated samples for Chlorophyll-a
    - Surface-to-Bottom
    - 0-2 m
- ☐ Plankton Sample (Surface-to-Bottom)
- ☐ End of Day (after 2 pm): In-situ water quality (pH, DO, Temperature, Conductivity)

<u>CL09</u>

- ☐ Morning: In-situ water quality (pH, DO, Temperature, Conductivity)
- ☐ Surface (0-2m) sample for Chlorophyll-a Plankton Sample (Surface-to-Bottom)
- ☐ Plankton Sample (Surface-to-Bottom)
- ☐ End of Day (after 2 pm): In-situ water quality (pH, DO, Temperature, Conductivity)

<u>CL10</u>

- ☐ Morning: In-situ water quality (pH, DO, Temperature, Conductivity)
- ☐ Depth integrated sample for chemistry
    - Quart Bottle Unpreserved (Nitrite/Nitrate, TDS)
    - Pint Bottle Preserved with H_2SO_4 (TKN, Ammonia, Total Phosphorus)
    - Pint Bottle Preserved with Zinc Acetate & NaOH (Total Sulfide)
    - Half Pint Bottle Unpreserved (Soluble Reactive Phosphorus [Ortho-P])
        - Filtered in field using 1.2 µm and 0.45 µm filters prior to filling bottle
- ☐ Depth integrated samples for Chlorophyll-a
    - Surface-to-Bottom
    - 0-2 m
- ☐ Plankton Sample (Surface-to-Bottom)
- ☐ End of Day (after 2 pm): In-situ water quality (pH, DO, Temperature, Conductivity)

FIELD DATASHEET

Date:______________ Location (Circle): Lake Elsinore/Canyon Lake Station:____________

Time on Station:_______________ Time off Station:_______________

Weather Conditions:_________________________ Wind (mph & direction):__________________

Lat:____________________________________ Long:___________________________________

Water Depth (m):_____________ Secchi Depth (m):_______________________

Water Chemistry Sample?: Y / N Chl-a Sample?: Y / N Plankton Sample?: Y / N

Surface volume filtered (ml):___________

Depth-Integrated volume filtered (ml):___________

Comments:

Depth (m)	Temp (°C)	Cond (mS/cm)	pH	DO (mg/L)	Depth (m)	Temp (°C)	Cond (mS/cm)	pH	DO (mg/L)
0					**15**				
1					**16**				
2					**17**				
3					**18**				
4					**19**				
5					**20**				
6					**21**				
7					**22**				
8					**23**				
9					**24**				
10					**25**				
11					**26**				
12					**27**				
13					**28**				
14					**29**				

E.S. Babcock & Sons, Inc. Environmental Laboratories

(951) 653-3351 FAX (951) 653-1662

www.babcocklabs.com

Chain of Custody & Sample Information Record

Client: Amec Foster Wheeler **Contact:** **Phone No.**

FAX No. **Email:**

Project Name: ______________________

Project Location:

Turn Around Time: Routine | *3-5 Day Rush | *48 Hour Rush | *24 Hour Rush

***Lab TAT Approval:** By: *Additional Charges May Apply

Additional Reporting Requests

Include QC Data Package: ☐ Yes ☐ No

FAX Results: ☐ Yes ☐ No

Email Results: ☐ Yes ☐ No

State EDT: ☐ Yes ☐ No

(Include Source Number in Notes)

Sampler Information

Name: ______________________

Employer: Amec Foster Wheeler

Signature: ______________________

Matrix

DW = Drinking Water

WW = Wastewater

GW = Groundwater

S = Soil

SG = Sludge

L = Liquid

M = Miscellaneous

Sample ID	Date	Time	# of Containers & Preservatives: Unpreserved	H2SO4	HCl	HNO3	Na2S2O3	NaOH	NaOH/ZnAcetate	NH4Cl	MCAA	Frozen		Total # of Containers	Sample Type: *Routine*	*Resample*	*Special*	Analysis Requested: Total Sulfide	Nitrate - Nitrite	TDS	TKN	Ammonia	Total Phosphorus	SRP/Ortho-P	Chlorophyll-a		Matrix	Notes

Relinquished By (sign)	Print Name / Company	Date / Time	Received By (Sign)	Print Name / Company

(For Lab Use Only) Sample Integrity Upon Receipt					Lab Notes
Sample(s) Submitted on Ice?	Yes	No		Temperature	
Custody Seal(s) Intact?	Yes	No	N/A	°C	
Sample(s) Intact?	Yes	No		☐ Cooler Blank	

Lab No. ______________________

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APPENDIX D

Example Chain of Custody Form

E.S. Babcock & Sons, Inc. Environmental Laboratories
(951) 653-3351 FAX (951) 653-1662
www.babcocklabs.com

Chain of Custody & Sample Information Record

Client: Amec Foster Wheeler **Contact:** **Phone No.**

FAX No. **Email:**

Additional Reporting Requests
Include QC Data Package: ☐ Yes ☐ No
FAX Results: ☐ Yes ☐ No
Email Results: ☐ Yes ☐ No
State EDT: ☐ Yes ☐ No
(Include Source Number in Notes)

Project Name: ______

Project Location:

Turn Around Time: Routine *3-5 Day Rush *48 Hour Rush *24 Hour Rush

***Lab TAT Approval:** By: *Additional Charges May Apply

Sampler Information

Name: ______

Employer: Amec Foster Wheeler

Signature: ______

Matrix
DW = Drinking Water
WW = Wastewater
GW = Groundwater
S = Soil
SG = Sludge
L = Liquid
M = Miscellaneous

Sample ID	Date	Time	# of Containers & Preservatives: Unpreserved	H2SO4	HCl	HNO3	Na2S2O3	NaOH	NaOH/ZnAcetate	NH4Cl	MCAA	Frozen		Total # of Containers	Sample Type: *Routine*	*Resample*	*Special*	Analysis Requested: Total Sulfide	Nitrate - Nitrite	TDS	TKN	Ammonia	Total Phosphorus	SRP/Ortho-P	Chlorophyll-a		Matrix	Notes

Relinquished By (sign)	Print Name / Company	Date / Time	Received By (Sign)	Print Name / Company

(For Lab Use Only) Sample Integrity Upon Receipt					Lab Notes
Sample(s) Submitted on Ice?	Yes	No		Temperature	
Custody Seal(s) Intact?	Yes	No	N/A	°C	
Sample(s) Intact?	Yes	No		☐ Cooler Blank	

Lab No. ______

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ATTACHMENT A

Analytical Laboratory Standard Operating Procedures and QAPP

(submitted as a stand-alone document)