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6 July 2014
File No. 40850-001

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

Attention: Mr. Rick Whetsel

Subject: Lake Elsinore & Canyon Lake TMDL Comprehensive Phase 2
Compliance Monitoring Program Framework
Lake Elsinore & San Jacinto Watersheds Authority
Riverside, California

Ladies and Gentlemen:

Attached please find a Draft Lake Elsinore & Canyon Lake TMDL Comprehensive Phase 2 Compliance Monitoring Framework document. Please review this draft and provide any changes you require. Haley & Aldrich will then finalize the document. If you have any questions, please contact me directly at (619) 285-7132 or by e-mail at ngardiner@haleyaldrich.com.

Sincerely yours,
HALEY & ALDRICH, INC.

Nancy Gardiner
Vice President/Senior Client Leader

Enclosures

Draft Report

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REPORT ON

LAKE ELSINORE & CANYON LAKE TMDL
COMPREHENSIVE PHASE 2
COMPLIANCE MONITORING PROGRAM FRAMEWORK
LAKE ELSINORE & SAN JACINTO
WATERSHEDS AUTHORITY
RIVERSIDE, CALIFORNIA

BY

Haley & Aldrich, Inc.
San Diego, California

FOR

Lake Elsinore & San Jacinto Watersheds Authority
Riverside, California

File No. 12345-678
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1. BACKGROUND AND INTRODUCTION

The following document presents a Framework for developing and implementing a comprehensive monitoring program for compliance with the Lake Elsinore & Canyon Lake Nutrient Total Maximum Daily Loads (TMDLs) and to demonstrate progress toward attaining respective waste load allocations (WLAs). This document is intended to provide a high-level vision for compliance monitoring in the near term (2014 – 2019).

Since the adoption of the TMDLs in 2005, a Task Force consisting of stakeholders was convened and began working on planning and implementation efforts to address nutrient TMDLs in the two lakes. The Lake Elsinore Sediment Nutrient Reduction Plan and Comprehensive Nutrient Reduction Plan were developed and approved in 2007 and 2013, respectively. Important projects were also initiated, notably the Aeration Project in Lake Elsinore (beginning in 2008), and alum applications in Canyon Lake (Fall 2013). The TMDL includes interim response targets for Chlorophyll-a and dissolved oxygen in both lakes by December 2015. Thus, the most immediate concern for the monitoring program is to defensibly measure progress toward achieving those response targets. Additionally, the TMDL includes causal targets for Phosphorous and Nitrogen (calculated as annual and 10-year running averages). Monitoring was performed in both lakes beginning in approximately 2000, and in the watershed beginning in 2006 (Phase 1 Monitoring Program). The Phase 1 program focused on collecting data to better understand in-lake processes and the linkage between external pollutant loading and in-lake response and associated nutrient concentrations, compared to numeric water quality targets. As the TMDL program has matured and faces interim compliance targets in 2015, there is a need to revisit the monitoring program to ensure that the appropriate data are being collected to demonstrate progress. This Framework discusses proposed changes to the existing monitoring programs (Phase 2 Compliance Monitoring Program), and provides recommendations for special studies to measure the effectiveness of the compliance strategy for the two lakes and help guide best management practice (BMP) selection and implementation. It also touches on a proposed regulatory strategy using performance-based BMP monitoring as an alternative to numeric effluent limits. The details of the revised monitoring program will be described in a Comprehensive Phase 2 Compliance Monitoring Program Plan. Specific sampling protocols and quality assurance/quality control (QA/QC) will be provided in a Phase 2 Monitoring Plan and Quality Assurance Project Plan (QAPP), which will be finalized by December 2014.

2. OBJECTIVES OF THE PHASE 2 COMPLIANCE MONITORING PROGRAM

With respect to the TMDLs, the following objectives (in order from highest to lowest priority) are being considered in developing the Phase 2 Compliance Monitoring Program:

1. Evaluate the status and trends towards achieving response targets in both lakes and determine how to separate the trend from the natural state (highest priority and easiest to achieve)
2. Quantify the external pollutant loading originating in the upstream watershed above the lakes
3. Distinguish between and quantify categorical loadings from agricultural, urban, and natural sources
4. Begin to distinguish between and quantify dischargers' contributions within each of the categories (lowest priority and most difficult to achieve)

Additional objectives of the Phase 2 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 (NPDES) Permit (Order R8-2010-0033; Municipal Separate Storm Sewer System (MS4) Permit), and land use monitoring requirements related to the Conditional Waiver to be issued to agricultural operators.

3. STUDY QUESTIONS TO BE ADDRESSED

The following section presents study questions to be answered in the course of developing the next phase of in-lake and watershed-wide monitoring, consistent with the objectives laid out in the TMDL, Regional Board-adopted Comprehensive Nutrient Reduction Plan, and the MS4 Permit. In some instances, these questions must be answered in order to demonstrate how compliance is being measured and for assessing progress toward attaining the targets.

- How do you define the "summer" compliance period (for purposes of demonstrating compliance with response targets)?
- What is the appropriate averaging method and time period to calculate annual average concentrations (e.g., of Chlorophyll-a)?
- What is the appropriate number and location of compliance monitoring stations?
- What are the appropriate depth increments for calculating depth-integrated averages?
- Can a volume-weighted average be used?
- What does it mean to be "compliant" with the TMDL and its response targets?
- Since algae can be mobilized by wind, what does it mean to be "compliant" when some parts of the lake have no algae, while other parts have a lot due to prevailing wind conditions?
- How do you resolve the difference between 10-year rolling averages and seasonal response targets?
- Can remote sensing (e.g., satellite imagery) be used as a defensible monitoring technology for demonstrating compliance with Chlorophyll-a and Phosphorous targets?
- What is the appropriate level of frequency and resolution for satellite imagery?

4. WATERSHED-WIDE MONITORING

4.1 Historical Watershed-Wide Monitoring

Currently, watershed monitoring is conducted according to the Phase 1 Monitoring Plan that was developed in 2006 and modified in 2010/11. This consists of flow-weighted composite stormwater quality monitoring during three storm events per year at three sites: the San Jacinto River at Goetz Road, Salt Creek at Murrieta Road, and the San Jacinto River below the Railroad Canyon Dam (Canyon Lake) Spillway. The first two sites provide a way to estimate the total nutrient load entering Canyon Lake from the lake's two main tributary inputs, and the third site is used to calculate loading from Canyon Lake (and thus the entire upstream watershed) into Lake Elsinore, when the dam is spilling. A fourth monitoring site selected for the Phase 1 program (the San Jacinto River at Ramona Expressway) has not flowed for several years and is unlikely to flow except during unusually large storm events due to subsidence of the land (and accompanying stormwater impoundment) upstream at Mystic Lake.

4.2 Proposed Modifications to the Watershed-Wide Monitoring

Earlier notions of a Phase 2 watershed-wide monitoring program included 13 monitoring locations around the watershed. Based on water quality data collected to date, it does not appear that as many sites are necessary. Since the existing three stations have been monitored for 7 years, it makes sense to continue to monitor at these locations to create a long-term record and correct for variability in water quality data to establish trends. However, a few additional carefully-selected sites may help refine our understanding of the sources of nutrients in the watershed. To the extent possible, these additional sites could be coordinated with monitoring sites of interest to other stakeholders, such as the municipal stormwater permittees and agricultural dischargers. Key regulatory changes are underway in the region, including the reissuance of the MS4 Permit (2015) and issuance of a Conditional Waiver to agricultural operators (likely in 2014-15). Specifically, the Riverside County Flood Control and Water Conservation District (District) has suggested including a background or reference station (such as at Cranston Guard Station, a site formerly monitored by the US Forest Service), or another site that would enable calculation of loading from natural background drainage areas. Also, the Western Riverside County Agriculture Coalition (WRCAC) has suggested adding a monitoring site immediately downstream of the Hemet Channel's confluence with Salt Creek to better characterize nutrient loading from the watershed upstream of this location.

To date, watershed-wide monitoring has been conducted only during wet weather events. While streams generally dry up during the summer months, it would be possible to sample some dry weather events (monthly, when flow is present) at the three existing stormwater monitoring locations in order to improve the calculation of average annual nutrient loading from external inputs.

5. IN-LAKE MONITORING

5.1 Historical In-Lake Monitoring

In-lake monitoring was initiated in approximately 2000 at three open water locations in Lake Elsinore and four locations in Canyon Lake. Monitoring was conducted monthly between October and May and bi-weekly 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 2011-12, the number of sampling locations in Lake Elsinore and Canyon Lake were reduced to one and three stations, respectively. In-lake monitoring was suspended in 2012-13 to redirect resources toward the implementation of in-lake BMPs. However, ongoing in-lake sampling will be required in order to estimate progress in attaining TMDL targets and for calculating annual and 10-year running averages.

5.2 Proposed Monitoring in Lake Elsinore

In Lake Elsinore, 2 mid-lake monitoring sites (marked by buoys) are recommended for monthly collection of samples of Chlorophyll-a, and Total Phosphorous (TP) and Total Nitrogen (TN). Sampling results for TP and TN should be depth-integrated and averaged to create data for computing the 10-year running average for comparison to causal targets. Automated sondes may be attached to the sampling buoys for cost-effective collection of data to compute daily average dissolved oxygen (DO) and weekly average conductivity; no monitoring for ammonia is recommended in the near term (2014-2019)

5.3 Proposed Monitoring in Canyon Lake

In Canyon Lake, two sampling locations are also suggested: one in the main body of the lake and the second in the East Bay. The two portions of the lake function very differently, since the main body of the lake is deep and has good circulation, whereas the East Bay (Salt Creek tributary) is shallow with less circulation. It is recommended that monthly, depth-integrated samples be analyzed for Chlorophyll-a at both locations; monthly, depth-integrated volume-weighted samples be analyzed for DO in the main body only; and monthly, depth-integrated samples be collected in the photic zone only and analyzed for total and dissolved phosphorous (both locations). No near-term monitoring is proposed for ammonia or TN at this time.

6. CANDIDATE SPECIAL STUDIES

6.1 Special Water Quality Studies in Lake Elsinore

6.1.1 Annual Zooplankton Study

Zooplankton are heterotrophic organisms consisting of a wide range of unicellular and multicellular animals. They play an important role in a lake's ecosystem and food chain by eating algae that may otherwise grow to excess. Zooplankton are sensitive to salinity, and high salinity levels may hinder reproduction. Because Lake Elsinore is a terminal water body with no outlet, evaporation during the warm months results in increased salinity levels as high as 2,000 mg/L that may impact the zooplankton population. Additionally, shad present in the lake are known to eat zooplankton, further driving down their population and contributing to excess algal growth. By conducting an annual survey of zooplankton in the lake (e.g., in mid-summer from 2014 to 2019), we can begin to understand the relationship between zooplankton population and salinity concentrations.

6.1.2 Zooplankton Salinity Tolerance Study

As a complement to the zooplankton field study described above, the zooplankton salinity tolerance test is a laboratory study designed to develop a mathematical relationship between salinity concentration and zooplankton reproduction rate. The study design would be similar to water quality toxicity tests, whereby organisms would be exposed to prepared waters of progressively higher salinity concentrations. The hypothesis is that the naturally-occurring high salinity levels in Lake Elsinore observed in the summer months are high enough to impede zooplankton reproduction, leading to a reduction in the zooplankton population. This information may be input to a future, more sophisticated lake model that incorporates the biological factors influencing lake water quality.

6.1.3 Characterize TP Flux from Lake Bottom Sediments

TP sequestered in lake bottom sediments has been shown to mobilize into the water column, contributing to elevated TP concentrations in lake waters. An aeration system was installed in the lake in 2008 as a BMP for controlling the flux of TP from the sediment. Prior to installation of this system, sediment cores were collected and tested in the laboratory to determine the baseline TP flux prior to aeration treatment. The objective of this special study is to evaluate the effectiveness of the aeration treatment by obtaining new sediment cores and testing them in the laboratory to compare post-treatment TP flux with the baseline, with the goal of demonstrating the effectiveness of the aeration BMP in reducing TP loading from the lake bottom sediments.

6.1.4 Seasonal Satellite Monitoring for Chlorophyll-a

In recent years, the Task Force has contracted with Blue Water Satellite to conduct remote sensing using Landsat satellite imagery to estimate the concentration of Chlorophyll-a in Lake Elsinore. Using a resolution of 5 pixels per acre, this effort produced maps of the lake showing graphical, color-coded images of Chlorophyll-a concentrations at 15,000 unique data points across the lake. 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 represents only the upper 4 feet of water and thus cannot completely replace manual sampling. Monthly satellite mapping (during the summer months only in Lake Elsinore) could be used to provide trend data at relatively low cost.

6.2 Special Water Quality Studies in Canyon Lake

6.2.1 Monthly Satellite Monitoring for Chlorophyll-a in Canyon Lake

As in Lake Elsinore, monthly satellite imagery can be used to measure Chlorophyll-a as a means of collecting data for calculating the annual average concentration and for conducting trends analysis. Additionally, satellite imagery mapping could be conducted prior to and following treatment (such as alum applications) to gauge effectiveness.

6.2.2 Monitor TP from Lake Bottom Sediments in Canyon Lake

This special study would be conducted using a similar approach to the study described above for Lake Elsinore. In Canyon Lake, TP flux from lake bottom sediment is being controlled through the application of alum rather than aeration. As in Lake Elsinore, sediment cores were collected and tested prior to alum application (Fall 2013). In this study, new sediment cores will be collected and tested in the laboratory to compare post-treatment TP flux with the baseline, with the goal of demonstrating the effectiveness of the alum application in reducing TP loading from the lake bottom sediments.

6.3 Other Special Studies

6.3.1 Evaluate Wildfires as a Source of Nutrients

With the recent years of drought, southern California has become increasingly prone to wildfires, particularly in the forested lands on surrounding mountains in the headwaters of the watershed. The Riverside County Flood Control and Water Conservation District performed a study on Ortega Creek shortly after a wildfire, and found elevated concentrations of nutrients. The District has expressed interest in conducting a more rigorous study of post-fire nutrient contributions in the event such a wildfire occurs in an area of interest for this program. Samples could be collected in tributaries immediately downstream of the burn area as well as at key discharge points into the San Jacinto River or Salt Creek to estimate increases in nutrient loading resulting from the fires (by comparing these data with historic water quality data collected at the monitoring sites at the San Jacinto River at Goetz Road or Salt Creek at Murrieta Road).

6.3.2 Evaluate Use of Satellite Imagery for Phosphorous and Other Constituents

Blue Water is in the process of optimizing its technology to map Phosphorous concentrations using the same Landsat satellite imagery used to estimate Chlorophyll-a concentrations. A pilot study using this new technology could be implemented as part of the Phase 2 Compliance Monitoring Program. As the satellite imagery technology improves, it may be possible to use it to remotely measure the concentrations of additional constituents.

7. PERFORMANCE-BASED MONITORING

Performance-based BMP monitoring and reporting is a potential alternative to compliance with numeric effluent limitations. Numerous BMPs are currently being implemented (or are under consideration) in both lakes and the upstream watershed, including the following:

- Alum application
- Aerator operation
- Axial mixers
- Carp removal
- Stormwater diversion
- Onsite retention
- Future agricultural BMPs

Many of the tasks and proposed special studies described above are intended to support the validity of performance-based BMP monitoring as a means of demonstrating reasonable progress toward the attainment of TMDL targets, and as a tool for evaluating trends. Through the Phase 2 Compliance Monitoring Program, the Task Force will test this approach and formulate a recommendation to the Santa Ana RWQCB to consider accepting this alternative regulatory strategy.

REFERENCES

1. 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.

2. Risk Sciences, “Lake Elsinore/Canyon Lake TDML Task Force Monitoring Priorities,” 14 January 2014.

3. Timothy Moore, Terrance McNabb, Mark Norton, and Rick Whetsel, “Using Satellite Imagery to Develop TMDLs and Assess Compliance,” Technical paper presented at WEFTEC Conference, 2011.