

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
SAN FRANCISCO BAY REGION

PROPOSED CLEANUP AND ABATEMENT ORDER NO. R2-2011-0042

MARIN MUNICIPAL WATER DISTRICT

FOR THE PROPERTY LOCATED AT:
SOULAJULE RESERVOIR
MARIN COUNTY, CALIFORNIA

This Order is issued to Marin Municipal Water District (Discharger) based on provisions of California Water Code (CWC) sections 13223, 13304, and 13267, which authorize the California Regional Water Quality Control Board, San Francisco Bay Region (Regional Water Board), or its Executive Officer as its delegate, to issue a Cleanup and Abatement Order (Order). This Order requires the Discharger to abate anticipated discharges of reservoir water with unreasonably low dissolved oxygen concentrations, and unreasonably high concentrations of dissolved sulfide and un-ionized ammonia into waters of the state and United States that have caused and threaten to cause a condition of pollution. In addition, this Order requires the submittal of technical and monitoring reports.

The Regional Water Board hereby finds that:

- 1) **Purpose of Order:** This Order requires the Discharger to abate anticipated intermittent waste discharges from Soulajule Reservoir (the Reservoir) to Arroyo Sausal (a creek). The Discharger has seasonally released reservoir water containing low dissolved oxygen and high dissolved sulfide and un-ionized ammonia concentrations. These discharges have resulted in exceedances of respective water quality objectives in the San Francisco Bay Basin Water Quality Control Plan (Basin Plan). The Discharger's current reservoir management and discharge practices have created a situation where future discharges are likely to impact receiving waters. These discharges alter the quality of the waters of the state by adding waste to a degree that unreasonably affects the waters for beneficial uses.
- 2) **Discharger:** The Marin Municipal Water District is the named responsible party because it is the owner and operator of the Reservoir. As the owner and operator, the Discharger has the authority and ability to release water from the Reservoir into Arroyo Sausal. The Discharger is a public agency that provides drinking water to approximately 195,000 people in south and central Marin County. The Reservoir was constructed to provide a source of drinking water.
- 3) **Site Location and Description:** The Reservoir is located approximately one mile south of the intersection of Arroyo Sausal Road and Marshall-Petaluma Road in the western portion of Marin County, California (Figure 1). The Reservoir is situated in a rural

agricultural area that provides grazing land for cattle in the immediate vicinity of the Reservoir. The Reservoir was completed in 1981 and has a capacity of 10,572 acre feet. The Reservoir and Arroyo Sausal are in the Walker Creek Watershed of the Marin Coastal Basin.¹ The Discharger releases water from the Reservoir into a creek named Arroyo Sausal, which then drains to Walker Creek and ultimately to the Pacific Ocean. These water bodies are waters of the state and the United States.

- 4) **Site History and Regulatory Status:** The Discharger's water releases from the Reservoir are currently not subject to any permits, orders, or waste discharge requirements through the Regional Water Board. The following apply to the Discharger's water releases from the Reservoir.
- a) The State Water Resources Control Board (State Water Board) issued the Discharger Water Rights License 12807, dated November 12, 1991, and Water Rights Permit 16892, dated June 17, 1977. The License and Permit are both subject to the Regional Water Board's ongoing water quality jurisdiction, as well as a Cooperative Agreement between California Department of Fish and Game (CDFG) and the Discharger (entered on August 24, 1976, and amended on July 1, 1985) to regulate the Reservoir to enhance salmon and steelhead resources in Walker Creek and the Pacific Ocean. The Cooperative Agreement allows the Discharger to release water to Arroyo Sausal throughout the year to improve fish habitat. The Cooperative Agreement contains flow criteria, but not water quality criteria for the discharged water.
 - b) The Basin Plan specifies the following beneficial uses for Walker Creek: cold freshwater habitat, fish migration, preservation of rare and endangered species, fish spawning, warm freshwater habitat, and wildlife habitat. Additionally, water contact recreation and noncontact water recreation are listed as potential beneficial uses.² These beneficial uses also apply to Arroyo Sausal as well as the following objectives that are intended to protect these uses.
 - (1) The Basin Plan's water quality objective for dissolved oxygen is 7 mg/L.
 - (2) The Basin Plan's narrative water quality objective for dissolved sulfide requires all water to be free from dissolved sulfide concentrations above natural background levels.
 - (3) The Basin Plan's water quality objective for un-ionized ammonia is an annual median of 0.025 mg/L.

¹ Basin Plan, p. 7-52, fig. 2-3

² Basin Plan, Table 2-1

- 6) **Basis for 13304 Order:** Historic and recent monitoring information indicates that the Discharger has discharged, and continues to threaten to discharge, low levels of dissolved oxygen and high levels of dissolved sulfide and un-ionized ammonia into the waters of the state and United States that violate the Basin Plan and cause, and threaten to cause, a condition of pollution.
- a) The water released from the Reservoir flows into an inlet tower and associated piping that allows the Discharger to release water taken from specific depths in the reservoir to the reservoir outlet structure. The reservoir outlet structure discharges to an armored channel, and then to Arroyo Sausal, which flows into Walker Creek about a mile downstream (see Figures 1a, 1b, and 2).
 - b) Temperature profiles and dissolved oxygen monitoring data collected from the Reservoir from 2007 to 2009 indicate that the reservoir thermally stratifies during the late summer and early fall, as reported in the Discharger's November 5, 2010, document, *Soulajule Reservoir Stream Release Water Quality Testing Results – Soulajule Reservoir profile data spanning several years*.
 - c) The Discharger monitored and reported to the Regional Water Board temperature, turbidity, and dissolved oxygen concentrations in its discharges from the Reservoir to Arroyo Sausal from two to twelve times a year between 1995 and 2009. During that period, the results show dissolved oxygen concentrations below the Basin Plan water quality objective of 7 mg/L during 11 out of 15 years, for a total of 28 occurrences out of 127 monitoring dates (i.e., on 22% of the days monitored). The low dissolved oxygen concentrations consistently occurred during the late summer and early fall. Because the Discharger has continually reported seasonal discharges below the water quality objective for dissolved oxygen, it is reasonable to conclude that the seasonal discharges will continue, and that the dissolved oxygen concentration will continue below the water quality objective of 7 mg/L.
 - d) It is likely that the discharge from the inlet towers to Arroyo Sausal seasonally contains dissolved sulfide and un-ionized ammonia because of seasonally anoxic conditions. When the Reservoir water is thermally stratified, as the dissolved oxygen is consumed in the layers below the hypolimnion, organic materials break down in a manner that creates dissolved sulfide and un-ionized ammonia. Because the Discharger has reported low dissolved oxygen concentrations in the Reservoir's late summer and fall discharges since 1995, the anoxic conditions support the conclusion that the discharges also contained high concentrations of dissolved sulfide and un-ionized ammonia, and that the seasonal discharges will continue.
 - e) Low levels of dissolved oxygen and high levels of dissolved sulfide and un-ionized ammonia are detrimental to fish because they put aquatic life under stress.³ The low

³ Horne, Alexander J., and C. R. Goldman, 1994, *Limnology – Second Edition*, pp. 51, 53, 181, 510, and 511

- levels of dissolved oxygen and high levels of dissolved sulfide and un-ionized ammonia in the anticipated discharges are wastes that alter the water quality in Arroyo Sausal to a degree that unreasonably affects the waters for beneficial uses. Therefore, the low concentration of dissolved oxygen and the elevated concentrations of dissolved sulfide and un-ionized ammonia are causing and threatening to cause a condition of pollution in Arroyo Sausal and Walker Creek.
- f) On October 20, 2010, Regional Water Board staff measured dissolved oxygen at the reservoir outlet structure and two downstream locations within Arroyo Sausal. Concentrations ranged from 2.87 to 4.44 mg/L, well below the 7 mg/L objective.
 - g) On November 8, 2010, the dissolved oxygen concentration measured by Regional Water Board staff at the reservoir outlet structure was 5.05 mg/L.
 - h) During June, July, August, September, and October 2011, the Discharger implemented the monitoring program outlined in its May 2011 plan *Existing Conditions, Reservoir Operations, and Monitoring Program*. From the afternoon of June 24 through October 27, 2011, the dissolved oxygen concentration monitored at the outlet structure never exceeded 4.60 mg/L, failing to meet the Basin Plan water quality objective of 7 mg/L for dissolved oxygen each day for 98 days.
 - i) On October 27, 2011, Regional Water Board staff inspected the Reservoir outlet structure and creek and noted a strong to moderate sulfurous odor.
- 7) **Federal Clean Water Act:** The Federal Water Pollution Control Act (Clean Water Act) requires any person who discharges any pollutant into a water of the United States to have a National Pollutant Discharge Elimination System (NPDES) permit. The purpose of the Clean Water Act is to restore and maintain the chemical, physical, and biological integrity of the nation's waters (33 U.S.C. §§ 1251 et seq.). The Discharger is violating the Clean Water Act section 301 in that it has discharged, and likely will discharge again, a low concentration of dissolved oxygen into the waters of the state and United States without complying with the NPDES program.
- 8) **Technical Reports:** This Order requires the Discharger to submit technical reports to the Regional Water Board pursuant to CWC § 13267. The reports are required because they will assist the Discharger and the Regional Water Board in determining what actions will best improve the water quality in Walker Creek and protect beneficial uses. The burden on the Discharger to provide these technical reports is substantially outweighed by the benefit to water quality for fish migration, preservation of rare and endangered species, fish spawning, and wildlife habitat.
- 9) **CEQA:** This action is an order to enforce the laws and regulations administered by the Regional Water Board. As such, this action is categorically exempt from the provisions of the California Environmental Quality Act (CEQA) pursuant to section 15321 of the

Resources Agency Guidelines in Article 19, Division 3, Title 14 of the California Code of Regulations.

IT IS HEREBY ORDERED, pursuant to section 13304 of the California Water Code, that the Discharger, or their agents, successors, or assigns, shall abate the effects described in the above findings as follows:

A. PROHIBITIONS

- 1) The discharge of pollutants, wastes, and hazardous substances in a manner that will degrade water quality or adversely affect beneficial uses of waters of the state and United States is prohibited.
- 2) Any storage, handling, treatment, or disposal of polluted surface water, groundwater, or soil shall that creates a condition of pollution as defined in California Water Code section 13050(1)(1) is prohibited.
- 3) Any discharge of water from the Reservoir to Arroyo Sausal not conforming to the following discharge standards is prohibited.

Table 1. Reservoir Discharge Standards

Constituent	Discharge Standard
Dissolved Oxygen	≥ 7 mg/L
Temperature (May 1 – October 31)	$\leq 58^{\circ}\text{F}$
Temperature (November 1 – April 30)	$\leq 56^{\circ}\text{F}$
Dissolved Sulfide	≤ 0.004 mg/L
Un-ionized Ammonia	≤ 0.025 mg/L

Table Notes:

mg/L = milligrams per liter

F = temperature in degrees Fahrenheit

B. CLEANUP AND ABATEMENT TASKS

1) IMPLEMENT MAY 26, 2011, SOULAJULE RESERVOIR MONITORING PROGRAM

COMPLIANCE DATE: DATE OF THE ADOPTION OF THIS ORDER AND ONGOING

The Discharger prepared and submitted a monitoring program plan that was acceptable to Regional Water Board staff on May 26, 2011, as part of their *Soulajule Reservoir and Arroyo Sausal – Existing Conditions, Reservoir Operations, and Monitoring Program* (Program). The Program contains a satisfactory monitoring plan, but does not contain a plan to abate the low dissolved oxygen, high dissolved sulfide and un-ionized ammonia, reservoir water discharge. The Discharger began implementing the Program voluntarily on June 27, 2011. The Discharger is required by this Order to continue implementing the Program contained in its May 26, 2011 report.

2) SUBMIT AND IMPLEMENT A PRELIMINARY RESERVOIR DISCHARGE WATER QUALITY MITIGATION CONTINGENCY PLAN

COMPLIANCE DATE: December 14, 2011

- a) The Discharger shall submit a Preliminary Reservoir Discharge Water Quality Mitigation Contingency Plan (Preliminary Plan), acceptable to the Executive Officer, that describes the measures the Discharger will take to mitigate existing and future discharges from Soulajule Reservoir to Arroyo Sausal to meet the Reservoir Discharge Standards in Table 1. The Preliminary Plan shall address how the Discharger will consistently meet all discharge standards throughout each year. The Preliminary Plan shall be drafted and implemented as a companion plan to the Discharger's May 26, 2011 Program. Combined with the Program, the Preliminary Plan shall be used to garner the information necessary to prepare and submit a final Reservoir Discharge Water Quality Management Plan, as discussed below in Cleanup and Abatement Task No. 3.
- b) The Preliminary Plan shall contain a schedule that requires the Discharger to complete all engineering design, construction, and installation of remedial measures sufficient to meet Table 1 Reservoir Discharge Standards.

3) SUBMIT AND IMPLEMENT A FINAL RESERVOIR DISCHARGE WATER QUALITY MANAGEMENT PLAN

COMPLIANCE DATE: June 11, 2012

The Discharger shall submit a Final Reservoir Discharge Water Quality Management Plan (Final Plan), acceptable to the Executive Officer, for continued management of the Reservoir discharge water quality. The final plan shall summarize and utilize the information collected during the Preliminary Reservoir Discharge Water Quality Management Plan's implementation. The Final Plan shall propose remedial measures sufficient to ensure that the water discharged from the Reservoir to Arroyo Sausal consistently meets the Table 1 Reservoir Discharge Standards.

Specifically, the Final Reservoir Discharge Water Quality Management Plan shall include:

- a) A monitoring plan equivalent to, or more comprehensive than, the monitoring plan contained in the May 26, 2011 *Soulajule Reservoir and Arroyo Sausal – Existing Conditions, Reservoir Operations, and Monitoring Program* referenced in Task 1. The monitoring plan shall include sampling and analysis for constituents/information including, but not limited to: dissolved oxygen, dissolved sulfide, un-ionized ammonia, temperature, pH, and reservoir discharge flow rates and volumes.
- b) Detailed descriptions and drawings of all practices and engineered structures that the Discharger will use to achieve compliance with the Discharge Standards in Table 1.
- c) A detailed contingency plan that describes how the Discharger will augment their water quality management system should monitoring data indicate violation of any of the Table 1 Reservoir Discharge Standards. The contingency plan shall include, at a minimum: 1) reporting to the Regional Water Board of any Table 1 Reservoir Discharge Standards exceedances within 24 hours of the exceedance; 2) preparing a mitigation plan and submittal to the Regional Water Board for review and comment within 7 days of the exceedance; and 3) an expedited schedule to design and implement the augmented practice or engineered remediation system proposed in the draft mitigation plan. The mitigation plan and design and implementation schedule shall be acceptable to the Executive Officer.

4) SEMI-ANNUAL RESERVOIR DISCHARGE MONITORING REPORTS

COMPLIANCE DATES: March 1st and September 1st of each year

The Discharger shall submit, acceptable to the Executive Officer, semi-annual monitoring reports documenting compliance with the Reservoir Discharge Standards. The semi-annual monitoring reports shall address the following:

- a) Each report shall include all observed Reservoir Discharge Standard (Table 1) exceedances that occurred during the reporting period.
- b) Each report shall describe proposed and approved amendments to the Final Plan, should the Final Plan require changes or augmentation to prevent future Discharge Standard exceedances. Proposed changes shall not become effective until accepted in writing by the Executive Officer.
- c) Each report shall include in a tabular format all analytical laboratory results for dissolved sulfide and un-ionized ammonia, and reservoir discharge flow rates and volumes, and include all data collected as part of this Order. All data for dissolved oxygen, temperature and pH shall be summarized in the report and made available in a spreadsheet upon request by the Regional Water Board staff. Water quality monitoring data collected using a permanent installed water quality monitoring meter (e.g., a Sonde meter) will have a large number of data points during each reporting period and need not be reported in its entirety unless requested by Regional Water Board staff. The reporting summary data of maxima, minima and means will suffice, unless additional data is requested by Regional Water Board staff.
- d) Any proposed changes to the monitoring reports shall be made in writing and will not become effective unless accepted in writing by the Executive Officer.

C. PROVISIONS

- 1) **Cost Recovery:** The Discharger shall be liable, pursuant to California Water Code section 13304, to the Regional Water Board for all reasonable costs actually incurred by the Regional Water Board and associated agencies including the CDFG to investigate unauthorized discharges of waste and to oversee cleanup of such waste, abatement of the effects thereof, or other remedial action, required by this Order. Such costs include, but are not limited to, staff time for investigation of the discharges, preparation of this Order, review of reports and correspondence submitted pursuant to this Order, work to complete the directives specified in this Order, and communications between Regional Water Board staff and parties associated with the cleanup and abatement of the discharged waste, including the Dischargers, interested members of the public, and other regulatory agencies.

- 2) **Contractor/Consultant Qualifications:** All technical documents shall be signed by and stamped with the seal of a California licensed geologist, a California certified engineering geologist, or a California registered civil engineer (CA Bus. and Prof. Code §§ 6735, 7835, and 7835.).
- 3) **Lab Qualifications:** All samples shall be analyzed by State of California-certified laboratories or laboratories accepted by the Regional Water Board using approved EPA methods for the type of analysis to be performed. All laboratories shall maintain quality assurance/quality control (QA/QC) records for Regional Water Board review. This provision does not apply to analyses that can only reasonably be performed on-site (e.g., temperature and dissolved oxygen).
- 4) **Reporting of Changed Owner or Operator:** The Discharger shall file a written report on any changes in operator or ownership associated with the Reservoir described in this Order. The Discharger presently owns and operates the Reservoir. This report shall be filed with the Regional Water Board within 30 days following a change in operator or ownership.
- 5) **State Water Board Petition:** Any person aggrieved by this action may petition the State Water Board to review the action in accordance with California Water Code section 13320 and Title 23, California Code of Regulations, section 2050 et al. The State Water Board, Office of Chief Counsel, must receive the petition by 5:00 p.m. 30 days after the date this Order becomes final (if the thirtieth day falls on a weekend or state holiday, the petition must be received by the next business day).⁴ This Order is effective upon the date of signature.
- 6) **Periodic Cleanup and Abatement Order Review:** The Regional Water Board will review this Order periodically and may revise it when necessary.

Bruce H. Wolfe
Executive Officer

Date

Attachments

- Attachment A: Staff Technical Analysis Memo
- Figure 1a: Site Location Map
- Figure 1b: Marin Coastal Basin and Walker Creek Watershed
- Figure 2: Reservoir Structures

⁴ Instructions for petitioning will be provided upon request or you may view them at:
www.waterboards.ca.gov/public_notices/petitions/water_quality/index.shtml

ATTACHMENT A

TECHNICAL ANALYSIS PROPOSED CLEANUP AND ABATEMENT ORDER NO. R2-2011-0042 MARIN MUNICIPAL WATER DISTRICT SOULAJULE RESERVOIR, MARIN COUNTY, CALIFORNIA

Prepared by: David Elias, CEG, CHG
Engineering Geologist
San Francisco Bay Regional Water Quality Control Board

Introduction

Cleanup and Abatement Order No. R2-2011-0042 (CAO) directs the Marin Municipal Water District (Discharger), a public agency that provides drinking water to approximately 195,000 people in south and central Marin County, to cleanup and abate polluted water discharged from Soulajule Reservoir (Reservoir). The discharged water contains low dissolved oxygen, and potentially contains high dissolved sulfide and un-ionized ammonia concentrations. This water is released from the Reservoir into Arroyo Sausal, which is a tributary to Walker Creek and a water of the state and United States.

This analysis summarizes the technical grounds in support that such discharges exist and threaten to continue, and that the discharges have caused, and threaten to cause, detrimental impacts to the receiving waters.

Physical Setting and Reservoir Characteristics

The Reservoir and Arroyo Sausal are located within the Walker Creek watershed, which is part of the Marin Coastal Basin. The watershed is comprised of 76 square miles of low rolling hills and steep canyons which drain into the northern end of Tomales Bay. Walker Creek, the Bay's second-largest tributary, has an annual rainfall of 24–32 inches and supplies about 25 percent of the annual runoff into Tomales Bay.⁵ Typically, there is little or no precipitation from May to October. During the November to March rainy season, rainfall and runoff are often intense over relatively short periods.

⁵ Fischer, D.T., S.V. Smith, and R.R. Churchill. 1996. "Simulation of a century of runoff across the Tomales watershed, Marin County, California." *Journal of Hydrology* 186:187

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The 10,572 acre-foot Reservoir is about 2.5 miles wide from east to west and averages about one quarter mile wide from bank to bank from north to south. The Reservoir is situated in a rural agricultural area that provides grazing land for cattle in the immediate vicinity of the Reservoir, including on lands upstream of the Reservoir that discharge into it, and likely provide nutrients to the Reservoir. Wildlife habitat in this watershed consists of a mosaic of grassland, valley foothill riparian forest, coastal scrub, and oak bay woodland.

Arroyo Sausal and Walker Creek provide critical habitat for two salmonid species listed as threatened under the federal Endangered Species Act: the coho salmon and steelhead trout. California Department of Fish and Game (CDFG), the San Francisco Bay Regional Water Quality Control Board (Regional Water Board), and the Discharger have conducted studies and participated in efforts to support and restore the Walker Creek fishery, including fish stocking.

The Walker Creek watershed is impacted by elemental mercury and methyl-mercury from the now-closed Gambonini mercury mine, located north of the Reservoir, and two mercury mines that were operated in the area inundated when the Reservoir was created.⁶ Due to this legacy contamination, Walker Creek is a Clean Water Act Section 303(d)-listed water body. The Regional Water Board adopted the Walker Creek Total Maximum Daily Load (TMDL) in 2007 to address this legacy contamination. The United States Environmental Protection Agency (USEPA) approved an amendment in 2008 incorporating a Walker Creek mercury TMDL into the San Francisco Bay Basin Water Quality Control Plan (Basin Plan).

The Reservoir includes a dam, a spillway with a plunge pool, a discharge structure with an inlet tower, and a pump station that is used on occasion to transfer water from SoulaJule Reservoir to Nicasio Reservoir (Figure 2). The Reservoir's inlet tower and associated piping allows the Discharger to release water from the Reservoir from various depths (about 5 foot, 20 foot, 35 foot, and 50 foot depths). The Discharger has stated that water is typically discharged to Arroyo Sausal simultaneously from both the 35 foot and 50 foot depths.⁷ The Discharger's data shows that both inlet tower depths are below the hypolimnion during the late fall and would be expected to discharge ammonia, dissolved sulfide, and low dissolved oxygen to Arroyo Sausal when those constituents are present in the Reservoir water. The discharges flow from Arroyo Sausal into Walker Creek about a mile downstream.

⁶ The watershed is underlain by the Late Jurassic to Cretaceous Franciscan Complex, which consists of sandstone, interbedded shales, mudstone, chert, greywacke, and minor conglomerate. High grade, localized, and small deposits containing cinnabar (a mercury sulfide ore) are found along Miocene Age faults that dissect the area. Mercury concentrations in soils and water are likely to be naturally enriched in this watershed (Source: U.S. Geological Survey, 2000. Geologic map and map database of parts of Marin, San Francisco, Alameda, Contra Costa, and Sonoma Counties, California. Pamphlet to accompany miscellaneous field studies MF-2337, Online Version 1.0, pp. 12-14).

⁷ MMWD, *SoulaJule Reservoir and Arroyo Sausal – Existing Conditions, Reservoir Operations, and Monitoring Program*, May 26, 2010, pp. 4-5.

Site Regulatory History and Current Status

The Reservoir was constructed in 1981 to provide an additional drinking water supply for the Discharger. The State Water Resources Control Board (State Water Board) has issued the Discharger two water rights governing diversions at the Reservoir: Water Rights License 12807 (dated November 12, 1991) and Water Rights Permit 16892 (Application 24928)(dated June 17, 1977). The License allows diversion of up to 901 acre-feet per year for Municipal, Domestic, Irrigation, Recreational and Fish and Wildlife Enhancement uses; the Permit allows diversion of up to 10,560 acre-feet per year for Municipal, Domestic, Irrigation, Incidental Power, Recreation and Fish and Wildlife Protection and Enhancement. The total diversion to storage under the License and Permit combined cannot exceed 10,500 acre-feet per year. The License and the Permit do not establish specific water quality criteria, although both remain subject to State and Regional Water Board water quality jurisdiction.⁸

The Discharger's Water Right License and Permit are both subject to the terms of a Cooperative Agreement (dated August 24, 1976, and amended July 1, 1985) executed between CDFG and the Discharger to regulate the new Reservoir. The Cooperative Agreement provides that the Discharger will release water into Arroyo Sausal in order to provide and enhance flows in Arroyo Sausal for the enhancement of salmon and steelhead populations in Walker Creek. The Cooperative Agreement establishes specific flow criteria for the releases to Arroyo Sausal, varying according to season, natural flows, and the amount of storage in the Reservoir. The Cooperative Agreement does not establish specific water quality criteria, but does allow for changes in operational procedures when necessary to support the goal of enhancing salmon and steelhead populations.

Technical Rationale for the Cleanup and Abatement Order

The Discharger has seasonally released reservoir water containing low dissolved oxygen concentrations at levels below the 7 mg/L receiving water objective in the Basin Plan. Discharges of water with dissolved oxygen below the objective are harmful to the beneficial uses of the receiving waters. The Discharger threatens to discharge reservoir water containing dissolved sulfide and un-ionized ammonia at levels above the related receiving water objectives of background and 0.025 milligrams per liter (mg/L), respectively. Discharge of these pollutants would also harm the beneficial uses of the receiving waters.

These polluted discharges are caused by conditions following from seasonal temperature stratification in the Reservoir. Temperature profiles and dissolved oxygen monitoring data collected from the Reservoir from 2007 to 2009 indicate that the reservoir thermally stratifies during the late summer and early fall, as reported in the Discharger's November 5, 2010,

⁸ Permit 16892 also contains language specifically requiring the Discharger to file a Report of Waste Discharge prior to construction of the dam or use of the water (Permit 16892, Terms 20 and 21).

document, *Soulajule Reservoir Stream Release Water Quality Testing Results – Soulajule Reservoir profile data spanning several years.*

When the Reservoir stratifies, water at depths below the hypolimnion⁹ no longer mixes, or mixes very little, with the water above it and closer to the Reservoir's dissolved oxygen-rich surface. The Reservoir contains a significant amount of organic matter, which readily degrades, consuming the oxygen in the volume of water below the hypolimnion. Because this water is not mixing with the water above, new oxygen is not introduced to replenish that consumed. The longer the Reservoir is stratified, the greater the oxygen deficit becomes, and portions of the Reservoir may become anoxic. Over time, thermally stratified lake water below the hypolimnion is likely to contain ammonia and dissolved sulfide, which are byproducts of the breakdown of organic matter in the absence of oxygen. Reservoir inlet valves supplying water to Arroyo Sausal are located at elevations below the hypolimnion, and those same valves are used to discharge Reservoir water to the Arroyo. As a result, Reservoir discharge during the late summer and fall has been observed to contain low dissolved oxygen, dissolved sulfide, and un-ionized ammonia. In addition, the strong possibility exists that it will at times contain ammonia and dissolved sulfide at levels of concern for aquatic species in the receiving waters.

The Discharger and Regional Water Board staff have both observed actual discharges of Reservoir water with dissolved oxygen levels well below Basin Plan receiving water objectives for the downstream creeks.

Recent Inspections and Sampling History

On October 19, 2010, the Regional Water Board received a report from National Oceanographic and Atmospheric Administration (NOAA) staff of a discharge from the Reservoir that appeared to contain dissolved sulfide and low dissolved oxygen.

Subsequent to that report, on October 20, 2010, Regional Water Board staff inspected the reservoir and reach of Arroyo Sausal downstream of the Reservoir, met on several occasions and had numerous telephone and email communications with the Discharger's staff. These discussions also included coordination with CDFG and State Water Board Water Rights Division staff because of the CDFG Cooperative Agreement and the State Water Board License for the Reservoir discharge. The discussions identified the significant potential for seasonal reservoir discharges to contain low dissolved oxygen and dissolved sulfide at levels of concern for aquatic life downstream.

These communications culminated in a March 17, 2011, meeting. During that meeting, we indicated our intent to draft a CAO requiring the preparation of both a monitoring plan and a

⁹ The hypolimnion is the layer of water below the thermocline in a thermally-stratified lake.

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contingency plan to address reservoir discharges to Arroyo Sausal that did not comply with State water quality requirements. The Discharger requested the opportunity to prepare both plans voluntarily, in lieu of being regulated by a CAO. We agreed to delay the CAO based on the understanding the Discharger would prepare both plans, and that the plans would propose appropriate monitoring and, as a contingency, measures to ensure that discharges of water from the reservoir would meet state water quality standards.

The Discharger submitted its *Soulajule Reservoir and Arroyo Sausal – Existing Conditions, Reservoir Operations, and Monitoring Program* (Program) report on May 26, 2011. We concurred with the monitoring program included in the Program, which the Discharger implemented this summer. However, the Program did not propose contingency measures to prevent the discharge of low quality water from the Reservoir into Arroyo Sausal as requested at the March 17, 2011 meeting. These discharges generally occur each year during late summer and fall. The requirement to have a plan to ensure clean discharges from the Reservoir was communicated to the Discharger during the March 17, 2011, meeting and again during a May 16, 2011, meeting. Additionally, we informed Discharger staff that such discharges are a discharge of waste that requires submittal of a report of waste discharge to the Board pursuant to California Water Code section 13260 and receipt of appropriate approvals prior to discharge. However, the Discharger has yet to submit a report of waste discharge for its Reservoir discharges.

Existing Water Quality Data

Following the October 19, 2010, NOAA staff observation, dissolved oxygen concentrations ranging from 3 to 4 ppm were monitored by Regional Water Board staff in the upper reaches of Arroyo Sausal on October 20, 2010. In addition, the Discharger has monitored the Reservoir discharge for temperature, turbidity, and dissolved oxygen concentrations from two to twelve times a year between 1995 and 2009. During that time period, the results showed dissolved oxygen concentrations below the Basin Plan water quality objective of 7 mg/L during eleven out of fifteen years for a total of 28 occurrences out of 127 monitoring dates (22% of the time). The low dissolved oxygen concentrations consistently occurred during the late summer and early fall seasons. The discharge was not monitored for dissolved sulfide or ammonia during this time period.

There is anecdotal evidence that the reservoir discharge smells strongly of hydrogen sulfide annually during a period of time in late summer and fall. However, sufficient monitoring data do not yet exist to accurately estimate the likely concentrations or duration of these pollutants in the Reservoir discharge.

Additional monitoring and sample collection at the Reservoir discharge location was completed by Regional Water Board staff and the Discharger in late 2010:

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- On October 20, 2010, Regional Water Board staff monitored dissolved oxygen concentrations ranging from 2.87 to 4.44 mg/L, below the Basin Plan water quality objective of 7 mg/L
- On October 27, the Discharger collected a sample of the Reservoir discharge to be analyzed for un-ionized ammonia and dissolved sulfide at an analytic laboratory. The sample contained 0.0026 mg/L un-ionized ammonia. The Basin Water Quality Objective for un-ionized ammonia is an annual median of 0.025 mg/L. No dissolved sulfide was detected above the 0.05 mg/L detection limit.
- On November 8, 2010, the Reservoir discharge's dissolved oxygen concentration was measured at 5.05 mg/L by Regional Water Board staff. Staff also collected and submitted water samples to be analyzed for un-ionized ammonia and dissolved sulfide at an analytic laboratory. Un-ionized ammonia was detected at concentrations ranging from 0.0026 to 0.0020 mg/L. No dissolved sulfide was detected above the detection limit of 0.1 mg/L.
- During June and July 2011, the Discharger implemented the monitoring program outlined in its May 2011 plan *Existing Conditions, Reservoir Operations, and Monitoring Program*. From the afternoon of June 24, when monitoring commenced, through July 31, 2011, the dissolved oxygen concentration monitored at the outlet structure never exceeded 4.60 mg/L. From June 24-30, dissolved oxygen was measured every 15 minutes, and ranged from 2.80 – 4.60 mg/L. In July, dissolved oxygen was measured hourly, and ranged from 1.76 – 4.53 mg/L. Thus, every measurement taken from the afternoon of June 24 until the end of July found the Reservoir discharges exceeded the Basin Plan water quality objective of 7 mg/L for dissolved oxygen.

In June and July 2011, the Discharger did not detect dissolved sulfide or un-ionized ammonia above the detection limits of 0.004 mg/L or 0.1 mg/L, respectively.

- In August 2011, the Discharger continued to implement its monitoring program. Dissolved oxygen was measured hourly, and ranged from 1.40 – 3.93 mg/L during the month. During August, the depressed dissolved oxygen concentrations extended to both the downstream monitoring locations. At 270 feet downstream, the measured dissolved oxygen concentration averaged 4.2 mg/L and at 1,750 feet downstream the measured concentration averaged 6.2 mg/L. Thus, every measurement taken during the month of August found the Reservoir discharges failed to meet the Basin Plan water quality objective of 7 mg/L for dissolved oxygen.

Dissolved sulfide was detected in the Reservoir itself at valve 4 (~ 50 foot depth) at 0.06 mg/L. This detection supports the allegation that the Reservoir threatens to discharge dissolved sulfide above the associated Basin Plan water quality objective. The Discharger also reported that on August 29, 2011, the sample team observed a mild sulfurous odor in proximity to SR1, the monitoring location at the Reservoir outfall structure. A sulfur odor

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indicates the presence of dissolved sulfide, potentially at concentrations above the Basin Plan water quality objective.

- In September 2011, the Discharger continued to implement its monitoring program. Dissolved oxygen was measured hourly, and ranged from 0.8 – 2.9 mg/L during the month. During September, the depressed dissolved oxygen concentrations extended to both the downstream monitoring locations. At 270 feet downstream, the measured dissolved oxygen concentration averaged 3.8 mg/L and at 1,750 feet downstream the measured concentration averaged 5.5 mg/L. Thus, every measurement taken during the month of September found the Reservoir discharges failed to meet the Basin Plan water quality objective of 7 mg/L for dissolved oxygen.

The Discharger detected dissolved sulfide concentrations of 0.14 and 0.20 mg/L in water samples it collected at the Reservoir outlet structure on September 23 and 30, 2011, respectively. In addition, dissolved sulfide concentrations of 0.05 and 0.07 mg/L, were detected at sampling location SR2, which is located about 270 feet downstream of the outlet structure, also on September 23 and 27, respectively. These dissolved sulfide concentrations exceed the Basin Plan narrative Water Quality Objective for dissolved sulfide, which requires all water to be free from dissolved sulfide concentrations above natural background levels. The background concentration of dissolved sulfide for Arroyo Sausal is 0 mg/L.

- On September 23, 2011, Regional Water Board staff joined the Discharger's staff at the reservoir to observe the sampling program. A moderate sulfurous odor was noted by both staffs at the discharge outlet structure.
- From October 1 – 27, 2011, the Discharger continued to implement its monitoring program. Dissolved oxygen was measured hourly, and ranged from 0.0 – 1.6 mg/L during the month. During October, the depressed dissolved oxygen concentrations extended to both the downstream monitoring locations. At 270 feet downstream, the measured dissolved oxygen concentration averaged 3.1 mg/L and at 1,750 feet downstream the measured concentration averaged 5.5 mg/L. Thus, for every measurement taken from October 1 – 27 the Reservoir discharges failed to meet the Basin Plan water quality objective of 7 mg/L for dissolved oxygen.

The Discharger detected dissolved sulfide concentrations of 0.28, 0.27, and 0.26 mg/L in water samples it collected at the Reservoir outlet structure on October 7, 14, and 27, respectively. In addition, dissolved sulfide concentrations of 0.10, 0.11, and 0.11 mg/L were detected at sampling location SR2, which is located about 270 feet downstream of the outlet structure, also on October 7, 14, and 27, respectively. These dissolved sulfide concentrations exceed the Basin Plan narrative Water Quality Objective for dissolved sulfide, which requires all water to be free from dissolved sulfide concentrations above natural background levels. As noted above, the background concentration of dissolved sulfide for Arroyo Sausal is 0 mg/L.

- On October 27, 2011, Regional Water Board staff noted a moderate to strong sulfurous odor at the discharge outlet structure and directly downstream.

Reservoir Discharge Standards

Based on the rationale presented above, and the Water Quality Objectives in the Basin Plan, the CAO prohibits the discharge of water from Soulajule Reservoir to Arroyo Sausal that does not conform to the following discharge standards:

Reservoir Discharge Standards

Constituent	Discharge Standard	Basis
Dissolved Oxygen	≥ 7 mg/L	Basin Plan Water Quality Objective
Temperature (May 1 – October 31)	≤ 58°F	See below ^{1,2}
Temperature (November 1 – April 30)	≤ 56°F	See below ^{1,2}
Dissolved Sulfide	≤ 0.004 mg/L	Basin Plan Water Quality Objective ³
Un-ionized Ammonia	≤ 0.025 mg/L	Basin Plan Water Quality Objective

Table Notes:

mg/L = milligrams per liter

F = temperature in degrees Fahrenheit

(1) State Water Board, Order No. WR 95-17, Lagunitas Creek, 1995, p. 86.

(2) Sullivan K, Martin DJ, Cardwell RD, Toll JE, Duke S., An analysis of the effects of temperature on Salmonids of the Pacific Northwest with implications for selecting temperature criteria, Portland, Oregon, Sustainable Ecosystems Institute, 2000, p. 6-2.

(3) This is a technology-based limit. Regional Water Board staff’s communication of September 12, 2011, with Hamilton, E., McCampbell Analytical, Pittsburg, California, Laboratory Director: “The correct laboratory analytic method to detect dissolved sulfide concentrations is American Public Health Association (APHA) Method No. 4500-S2-D

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and B. If soluble sulfides are detected, a hydrogen sulfide concentration can then be calculated using field temperature and pH using APHA Method No. 4500-S2-H.”