CALIFORNIA
Water Boards

EDMUND G. BROWN JR.
GOVERNOR

MATTHEW RODRIQUEZ
SECRETARY FOR
ENVIRONMENTAL PROTECTION

State Water Resources Control Board

October 29, 2012

CERTIFIED MAIL & EMAIL

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Mr. Bill Jennings, Executive Director
California Sportfishing Protection Alliance
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Dear Messrs. Simmons and Jennings and Mses. Dunham and Aw-Yang:

PETITIONS OF SACRAMENTO REGIONAL COUNTY SANITATION DISTRICT AND CALIFORNIA SPORTFISHING PROTECTION ALLIANCE (WASTE DISCHARGE REQUIREMENTS ORDER NO. R5-2010-0114 [NPDES NO. CA0077682] FOR THE SACRAMENTO REGIONAL COUNTY SANITATION DISTRICT, SACRAMENTO REGIONAL WASTEWATER TREATMENT PLANT, SACRAMENTO COUNTY), CENTRAL VALLEY WATER BOARD: BOARD MEETING NOTIFICATION
SWRCB/OCC FILES A-2144(a) and A-2144(b)

Enclosed is a copy of the proposed order of the State Water Resources Control Board (State Water Board) relating to the above-entitled matter. A prior draft order was discussed at the State Water Board workshop on July 18, 2012. Changes from the prior order are shown in strikeout/underline format. A clean copy of the proposed order is also enclosed. Adoption of the proposed order will be considered by the State Water Board at its business meeting on *Tuesday, December 4, 2012*, commencing at *9:00 a.m.* The meeting will be held in the Coastal Hearing Room, Second Floor of the Cal/EPA Building, 1001 I Street, Sacramento, California.

Evidence relating to this matter will not be heard and written submittals will be accepted only if they are limited to the revisions in the draft order. Written comments and any other materials to be presented at the board meeting, including power point and other visual displays, must be received by **12:00 noon, Tuesday, November 13, 2012**. Please indicate in the subject line, comments to A-2144—December 4 Board Meeting. Those comments must be addressed to:

Ms. Jeanine Townsend
Clerk to the Board
State Water Resources Control Board
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P.O. Box 100
Sacramento, CA 95812-0100
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(email) commentletters@waterboards.ca.gov

The petitioners, Sacramento Regional County Sanitation District and California Sportfishing Protection Alliance, and the Central Valley Regional Water Quality Control Board will each be allowed twenty (20) minutes for oral comment, with additional time for questions by the State Water Board members. The Water Agencies, collectively,[1] will be allowed ten (10) minutes for oral comment, with additional time for questions by the State Water Board members. Other interested persons will be allotted a lesser amount of time to address the State Water Board. Comments may address only the changes made in the proposed order from that was discussed at the prior meeting. As a result of the meeting, the order may be adopted as proposed or may be further modified.

If there are any questions or comments, please contact James Herink, Staff Counsel, in the Office of Chief Counsel, at (916) 341-5150 or email jherink@waterboards.ca.gov.

Sincerely,

FOR Michael A.M. Lauffer
Chief Counsel

Enclosures

[1] The Water Agencies are a collection of entities that have jointly filed a response to the consolidated petition and are considered "an interested person" pursuant to State Water Board regulations. (See Cal. Code Regs., tit. 23, § 2050.5, subd.(a).) The Water Agencies are: Alameda County Water District; Alameda County Flood Control and Water Conservation District, Zone 7; Kern County Water Agency; Metropolitan Water District; Santa Clara Valley Water District; Contra Costa Water District; State Water Contractors; Westlands Water District; and, San Luis & Delta-Mendota Water Authority. These entities will collectively be allowed ten (10) minutes for oral comment.

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(Continued next page)

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Interested Persons List

Lyris List

DRAFT

STATE OF CALIFORNIA

STATE WATER RESOURCES CONTROL BOARD

ORDER WQ 2012-

In the Matter of Own Motion Review of

Waste Discharge Requirements Order No. R5-2010-0114
[NPDES No. CA0077682]
for

SACRAMENTO REGIONAL WASTEWATER TREATMENT PLANT

Issued by the
California Regional Water Quality Control Board,
Central Valley Region

SWRCB/OCC FILES A-2144(a) and A-2144(b)

BY THE BOARD:

In this Order, the State Water Resources Control Board (State Water Board or Board) reviews on its own motion National Pollutant Discharge Elimination System (NPDES) permit and Waste Discharge Requirements Order No. R5-2010-0114 (Permit) issued by the Central Valley Regional Water Quality Control Board (Central Valley Water Board) to the Sacramento Regional County Sanitation District (District). The Permit authorizes effluent discharges from the District's Sacramento Regional Wastewater Treatment Plant (Facility) to the Sacramento River within the boundaries of the Sacramento-San Joaquin Delta (Delta). For the reasons discussed herein, the State Water Board upholds most of the Permit ~~and remands other portions of the Permit to~~but amends the final effluent limitations for ammonia. Additionally, while the Order concludes that the Central Valley Water Board ~~for reconsideration and revision consistent with this Order~~'s stated reasons for denying dilution credits and a mixing zone were improper, this Order upholds the Permit's final effluent limitation for nitrate for other reasons stated herein.

BACKGROUND

The District owns and operates the Facility. The Facility was constructed in 1982 and provides "secondary" level treatment.[1] The District provides sewerage service to the Cities of Sacramento, Folsom, West Sacramento, and the Sacramento Area Sewer District service area. The Sacramento Area Sewer District includes the Cities of Elk Grove, Rancho Cordova, Citrus Heights, Courtland, and Walnut Grove, as well as portions of the unincorporated areas of Sacramento County. The population served is approximately 1.3 million people. The District owns and operates the main trunk lines and interceptors feeding the Facility, while the smaller diameter collection systems are owned and operated by the various contributing agencies.

The Facility is a regional wastewater plant and has an average dry weather flow design capacity of 181 million gallons per day (mgd). Currently, the Facility's average dry weather flow is 141 mgd. The Facility's current permitted discharge flow of 181 mgd represents nearly 60 percent of the total volume of all publicly owned treatment works' permitted ~~discharge~~discharges within the Delta[2] that are within the Central Valley Water Board's jurisdiction. The Facility is one of the three remaining wastewater treatment plants under the Central Valley Water Board's jurisdiction that discharge within the Delta and only provide secondary treatment to its effluent.[3] The Facility's treatment system consists of mechanical bar screens, aerated grit removal, primary sedimentation, pure oxygen activated sludge aeration, secondary clarification, chlorine disinfection with dechlorination, and a diffuser for discharges to the Sacramento River. Solids handling consists of dissolved air flotation thickeners, gravity belt thickeners, anaerobic digesters, and sludge stabilization basins with disposal on-site through land application or a biosolids recycling facility.[4]

The Facility discharges to the Sacramento River from an outfall diffuser downstream of the Freeport Bridge. The outfall discharges within the legal boundaries of the Delta. The existing beneficial uses of the Delta, as listed in the *Water Quality Control Plan for the Sacramento River and San Joaquin River Basins* (Basin Plan), include: municipal and domestic supply (MUN); agricultural supply (AGR); water contact recreation (REC-1);

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[1] Compliance with secondary treatment standards represents the *minimum* standard for all publicly owned treatment works nationwide. (See 33 U.S.C. § 1311(b).)

[2] Wat. Code, § 12220.

[3] The other two facilities are the Discovery Bay Wastewater Treatment Plant (see Order No. R5-2008-0179) and the City of Rio Vista's Beach Wastewater Treatment Facility (see Order No. R5-2008-0108-1). These facilities are authorized to discharge up to 2.1 mgd and 0.65 mgd respectively.

[4] The Permit regulates only the Facility. The biosolids, solids storage, and disposal facilities are regulated pursuant to Waste Discharge Requirements Order No. R5-2003-0076.

non-contact water recreation (REC-2); warm freshwater habitat (WARM); and cold freshwater habitat (COLD). The outfall diffuser is approximately 300 feet long with 74 ten-inch diameter ports and is placed perpendicular to the river flow. At the point of discharge, the Sacramento River is approximately 600 feet wide at the surface with a bottom width of approximately 400 feet and depth of 25 to 30 feet.[5]

During low river flows, tidal activity can cause the river in the vicinity of the outfall to flow northward, in the reverse direction, towards the City of Sacramento. The Discharger diverts its discharge to emergency storage basins whenever these conditions exist.

The Central Valley Water Board issued the Permit on December 9, 2010. The Permit is a renewal of the District's prior permit that was issued in 2000 and had been administratively extended since 2005. Contrary to the District's claim that the Permit renewal was "characterized by haste, particularly related to the major issues that are subject to this appeal[,]"[6] the administrative record contains evidence of a decade-long effort on the part of the Central Valley Water Board to study and understand the Delta and the Facility's effect on it and water quality in general. The record reveals the effort made by the Central Valley Water Board staff to understand the extremely complex scientific issues involved with this Permit's development. As a result of this effort, the Permit contains several new or more stringent effluent limitations and requirements. Recognizing these changes, the Permit will require substantial changes to the character of the District's discharge and upgrades to the Facility to meet the Permit's requirements. The Permit grants the District up to ten years before some of the final effluent limitations take effect.

In response to the Permit's adoption, the District and the California Sportfishing Protection Alliance (CSPA) both filed timely petitions for review with the State Water Board. After deeming the petitions complete, consolidating them for review, receiving the response and administrative record from the Central Valley Water Board, and responses from interested persons, we adopted Order WQ 2011-0013 on September 19, 2011, taking this matter up on our own motion. We granted own motion review in order to have sufficient time to adequately review the voluminous submissions and allow a detailed legal and technical review of the submissions. During our review of the petitions and the administrative record, the District and interested persons submitted numerous requests to file supplemental pleadings and augment

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[5] Waste Discharge Requirements Order No. R5-2010-0114, p. F-82.

[6] District's Petition for Review of Waste Discharge Requirements Order No. R5-2010-0114 (SWRCB/OCC File A-2144(a)), p. 15.

the administrative record. These requests were granted in part and denied in part on November 22, 2011. Subsequently, the District filed a petition for writ of mandate with the Sacramento Superior Court.[7] Unless the District withdraws its petition with the Superior Court or an extension is granted, that judicial proceeding is stayed until ~~July 1,~~December 10, 2012.

ISSUES AND FINDINGS

Between the two petitions, a total of over 80 contentions were raised claiming fault with nearly every aspect of the Permit. This Order addresses only a few topics – primarily pathogens, ammonia, and nitrate. To the extent petitioners raised issues that are not discussed in this Order, either in whole or in part, such issues are dismissed as not raising substantial issues appropriate for our review.[8]

Pathogens and Filtration

The Permit contains a final effluent limitation for total coliform organisms of 2.2 most probable number (MPN) per 100 milliliters.[9] The Permit also requires the District's effluent discharged to the Sacramento River to be oxidized, coagulated, filtered, and adequately disinfected pursuant to the California Department of Public Health (CDPH) reclamation criteria, California Code of Regulations, title 22, division 4, chapter 3 (commencing with section 60301), or equivalent.[10] The District contends that the new filtration requirements are not justified, and that the Central Valley Water Board mischaracterizes the site-specific risk assessment provided by the District. Based on our technical review of the evidence in the record and in light of CDPH's site-specific recommendation, we find that the Central Valley Water Board correctly concluded that the Permit's requirement to provide equivalent to "disinfected tertiary recycled water"[11] level of treatment is appropriate and necessary to protect beneficial uses at and around the point of discharge.

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[7] *Sacramento Regional County Sanitation Dist. v. Cal. Regional Water Quality Control Bd., Central Valley Region* (Super. Ct. Sac. County, Case No. 34-2011-80001028). The effective date of the final effluent limitations that are the subject of the petition for writ of mandate are extended for a period equal to the duration of the court-imposed, stipulated stay.

[8] *People v. Barry* (1987) 194 Cal.App.3d 158, 175-177; *Johnson v. State Water Resources Control Bd.* (2004) 123 Cal.App.4th 1107, 1114; Cal. Code Regs., tit. 23, § 2052, subd. (a)(1).

[9] "Most probable number" is a measure of the number of colony forming units of bacteria in a culture grown with a water sample on specific media for the bacteria of interest.

[10] Waste Discharge Requirements Order No. R5-2010-0114, p. 33.

[11] "Disinfected tertiary recycled water" is defined as an oxidized (i.e., secondary treated or equivalent) wastewater that has been coagulated, filtered, and disinfected using chlorine, meeting a chlorine concentration and contact time standard, or an equivalent process, meeting a virus inactivation standard, including that the median total coliform *(Continued)*

The Central Valley Water Board found that the Sacramento River is currently being used for AGR and REC-1 purposes at or near the outfall. Dilution in this vicinity is less than 20 to 1[12] and the potential for "double dosing"[~~12~~13] occurs during some low river flow conditions coinciding with tidal influences. While the Central Valley Water Board's determination to impose its requirements may be criticized as being conservative, we have previously recognized that it is within a regional water quality control board's (regional water board's) discretion to be conservative in its approach when faced with decisions involving public health protection.[~~13~~14]

The treatment level of wastewater affects how effectively and efficiently it can be disinfected. A cleaner effluent can be more effectively disinfected, because constituents in the effluent may affect how thoroughly the disinfectant inactivates pathogens in the effluent and the degree to which harmful disinfection byproducts are formed from the reaction between residual contaminants in the treated wastewater and the applied disinfectants.[~~14~~15] The disinfection level required for wastewater is largely determined by the degree of public exposure and an acceptable level of risk for acquiring infection or illness as a result of exposure to the treated wastewater.

In California, CDPH determines ~~the~~this level of risk and the State Water Board ~~and~~or a regional water board may establish waste discharge requirements that mitigate the risk to the level identified by CDPH. CDPH has adopted general guidelines and, when requested will provide site-specific recommendations for the disinfection requirements necessary for municipal wastewater dischargers to comport with state public health policy and acceptable risk

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bacteria concentration does not exceed an MPN of 2.2 per 100 milliliters as a 7-day average, the number of total coliform bacteria does not exceed an MPN of 23 per 100 milliliters in more than one sample in any 30-day period, and no sample exceeds an MPN of 240 total coliform bacteria per 100 milliliters. (Cal. Code Regs., tit. 22, § 60301.230.)

[12] Unless specified otherwise, all ratios are expressed as receiving water to effluent.

[~~12~~13] "Double Dosing" refers to a doubling of the concentration of pathogens due to flow reversals occurring during high tide and low flow conditions. While conditions in the Permit limit double dosing occurrences, they are not eliminated due in part to the varying strength of the tidal influence. (See Waste Discharge Requirements Order No. R5-2010-0114, p. F-32, fn. 1.)

[~~13~~14] See State Water Board Order WQ 95-4 (*City and County of San Francisco*), p. 21.

[~~14~~15] Residual particulate matter in treated wastewater can shield pathogens from contact with disinfectant, and residual chemical constituents in the treated wastewater can form disinfection byproducts that can be toxic to humans, animals, and aquatic life when discharged to water bodies. (See Emerick, Robert W. et al., *Factors Influencing Ultraviolet Disinfection Performance Part II: Association of Coliform Bacteria with Wastewater Particles*, (Sept./Oct. 1999) Water Environment Research, p. 1178; Waste Discharge Requirements Order No. R5-2010-0114, pp. F-~~62 and F-~~75.)

levels.[15~~16~~] The *Uniform Guidelines for Sewage Disinfection* (*CDPH Guidelines*)[17] recommend specific treatment and disinfection levels based on available dilution in the receiving waters. According to the *CDPH Guidelines*, the amount of dilution available is based on "low flow over an average period of time and not the instantaneous minimum low flow of the year."[18] As noted by the District, following the *CDPH Guidelines*, the District would not be required to meet a "2.2 MPN" level of treatment based on the average dilution provided by receiving waters at the point of discharge. Following the *CDPH Guidelines*, a "23 MPN" level of treatment, as currently provided by the District, would be required.

However, since the District's discharge and the circumstances surrounding the District's discharge are unique, the Central Valley Water Board and CDPH staffs determined that a site-specific evaluation of the discharge should be conducted to establish disinfection requirements. Conducting site-specific evaluations when setting disinfection requirements is "best practice" and consistent with guidance from CDPH and the United States Environmental Protection Agency (U.S. EPA).[19] The reasons that the Central Valley Water Board and CDPH considered the District's discharge unique include:

1. Double Dosing: Unique to the Sacramento River at the point of discharge are the tidal flows that slow the river flow, and at times cause flow reversals. After the high tides which occur in varying magnitudes twice daily, the areas downstream of the District's outfall can be

[15~~16~~] State Department of Health Services, *Uniform Guidelines for Sewage Disinfection* (Nov. 1980). The State Department of Health Services is the predecessor to the current California Department of Public Health.

[17] Prior to the State Water Board workshop held on July 18, 2012 (July 18 Workshop), the District requested that the State Water Board take official notice of two CDPH documents: *Wastewater Disinfection for Health Protection*, Sanitary Engineering Branch, California Department of Health Services (Feb. 1987); and Memorandum to Office of Drinking Water Management Staff, from Office of Drinking Water, Peter A. Rogers, Chief (Aug. 18, 1992) re: Uniform Guidelines for Disinfection of Wastewater, including attached Uniform Guidelines for the Disinfection of Wastewater (1992 CDPH Memo). Neither the Water Agencies, nor the Central Valley Water Board objected to taking official notice of these two items. The State Water Board takes official notice of these two items. However, since the 1980 *CDPH Guidelines* was included in the administrative record and the Permit relies on and refers to it, this Order continues to refer to the *CDPH Guidelines* and references the 1980 version. Taking official notice of the 1987 document and 1992 CDPH Memo does not alter the conclusions of this Order.

[18] State Department of Health Services, *Uniform Guidelines for Sewage Disinfection* (Nov. 1980), p. 5.

[19] On July 26, 1976, U.S. EPA removed the fecal coliform bacteria limitations from the definition of secondary treatment in the Code of Federal Regulations, title 40, part 133 (41 Fed. Reg. 30786 (Jul. 26, 1976)). This change resulted in bacteria effluent limitations in NPDES permits being established as water quality-based effluent limitations instead of as technology-based effluent limitations. On this same date, U.S. EPA published the Quality Criteria for Water (The Red Book, EPA 440/9-76-023, Jul. 1976), which are U.S. EPA recommendations for water quality criteria intended to be used by states as guidelines for development of receiving water specific water quality standards including development of bacteria water quality criteria and corresponding disinfection requirements. The current version of these criteria was published in 1986 (The Gold Book, EPA 440/5-86-001, May 1986). The purpose of this change was to encourage states to develop site-specific disinfection requirements that consider both public health hazards (i.e., the site specific-need to protect the public from disease as a result of consumption or contact with the receiving water) and potential adverse impacts on aquatic life in the receiving water resulting from disinfection byproducts. The 1992 CDPH Memo notes that, "[a]ll discharges of wastewater or reclaimed water which may affect domestic water supplies should be considered on a case by case basis taking all factors into account."

"double dosed" with effluent when the high tide recedes. The doubling of effluent concentrations similarly doubles the concentration of pathogens.[20] While conditions in the Permit limit double dosing occurrences, they are not eliminated;

2. Low Flow Conditions: Dilution of the effluent normally exceeds 20 to 1 after complete mixing of the effluent in the river which occurs one to two miles downstream of the point of discharge. Dilution within the mixing zone downstream of the point of discharge can be significantly lower than 20 to 1. This can occur under a variety of regularly occurring river flow and tidal conditions, including when river flows are at the minimum level allowable for the District's discharge (i.e., a dilution of 14 to 1 or less) and even when overall average dilution is greater than 20 to 1. The occurrence of river flows at the minimum level allowable for the District to discharge is not uncommon in dry years. Between January 2007 and June 2008, the District was required to cease discharging and to divert effluent to its storage basins on 137 occasions in order to meet the minimum dilution/flow conditions;[21]
3. Public Contact and Diversions within the Mixing Zone: The area around the point of discharge is a popular sport fishing area. Located within the mixing zone is Cliff's Marina. In addition, there are approximately 30 agricultural diversions within one mile upstream and two miles downstream (i.e., within the mixing zone) of the point of discharge that can potentially draw in varying mixtures of river water and effluent at dilution ratios less than 20 to 1;
4. Chlorine Contact Time: The Facility does not have a conventional chlorine contact chamber in its treatment train. Chlorine contact time for effluent disinfection is provided in the District's outfall pipe.[22] As a result, chlorine contact time varies with effluent flow rate and may be insufficient to provide adequate disinfection at times. Without a chlorine contact chamber, chlorine contact time can only be adjusted by adjusting the effluent flow rate. This limits the ability of the plant operators to adjust chlorine contact in order to achieve consistent contact time and, hence, consistent effluent disinfection; and,
5. Pathogen Removal Efficiency: Studies conducted on the District's effluent indicate that up to 20 percent of coliforms may be shielded from detection by solids in the effluent.[23] This is an indication that pathogens shielded by solids in the effluent may not be adequately inactivated by chlorination.

The *CDPH Guidelines* require a median MPN of 2.2 when a stream's low flow provides dilution of less than 100 to 1~~[16]~~ to protect MUN use, and to protect AGR or REC-1 beneficial uses, a median MPN of 2.2 is required when a stream's low flow provides dilution of less than 20 to 1.~~[17]~~[24] The *CDPH Guidelines* state that "[f]or these discharge situations it is

[20] See Waste Discharge Requirements Order No. R5-2010-0114, p. F-32.

[21] Central Valley Water Board, *NPDES Permit Renewal Issues Drinking Water Supply and Public Health* (Dec. 14, 2009), p. 16.

[22] Letter from Assistant Executive Officer Ken Landau, Central Valley Water Board to Chief Carl Lischeske, California Department of Public Health (May 11, 2009), p. 2.

[23] Waste Discharge Requirements Order No. R5-2010-0114, p. F-75.

~~[16] Unless specified otherwise, all ratios are expressed as receiving water to effluent.~~

~~[17]~~[24] *CDPH Guidelines*, p. 5.

particularly important to fully consider the individual circumstances so that adequate health protection is provided through the application of reasonable disinfection requirements. For example, it may be appropriate to reflect seasonal changes in recreational use, dilution at the use area, etc."[~~18~~25] Additionally, the U.S. ~~Environmental Protection Agency (U.S. EPA)~~EPA publishes guidelines and recommendations for public health protection from recreational contact with pathogens in waters subject to wastewater discharges.[~~19~~] The U.S. EPA guidelines and recommendations are "not rules and they do not have regulatory impact."[~~20~~26]

Data submitted by the District to the Central Valley Water Board indicated the presence of *Giardia* cysts and *Cryptosporidium* oocysts in the Facility's discharge, prompting the Central Valley Water Board to request a site-specific health risk assessment.[~~21~~27] CDPH met with the District and concluded that a formal risk assessment was appropriate. The District engaged third party professional services to conduct the risk assessment. The District's final risk report indicated that the combined average risk of infection from *Giardia* and *Cryptosporidium* for one swimming exposure is reported as 2.4 in 10,000 upstream of the District's outfall and 3.6 in 10,000 downstream of the District's outfall. Further, the District's final report indicated that the combined average risk of infection for ten swimming exposures is reported as 30.2 in 10,000 upstream of the District's outfall and 43.8 in 10,000 downstream of the District's outfall.[~~22~~28] Upon presentation of the results, CDPH recommended that the District

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[~~18~~25] ~~*Id*~~*Ibid.*~~, p. 5.~~

[~~19~~] ~~On July 26, 1976, U.S. EPA removed the fecal coliform bacteria limitations from the definition of secondary treatment in the Code of Federal Regulations, title 40, part 133 (41 Fed. Reg. 30786 (Jul. 26, 1976)). This change resulted in bacteria effluent limitations in NPDES permits being established as water quality based effluent limitations instead of as technology based effluent limitations. On this same date, U.S. EPA published the Quality Criteria for Water (The Red Book, EPA 440/9-76-023, Jul. 1976), which are U.S. EPA recommendations for water quality criteria intended to be used by states as guidelines for development of receiving water specific water quality standards including development of bacteria water quality criteria and corresponding disinfection requirements. The current version of these criteria was published in 1986 (The Gold Book, EPA 440/5-86-001, May 1986). The purpose of this change was to encourage states to develop site specific disinfection requirements that consider both public health hazards (i.e., the site specific need to protect the public from disease as a result of consumption or contact with the receiving water) and potential adverse impacts on aquatic life in the receiving water resulting from disinfection byproducts.~~

[~~20~~26] See The Gold Book, EPA 440/5-86-001 (May 1986), p. 2.

[~~21~~27] Letter from Assistant Executive Officer Kenneth D. Landau, Central Valley Water Board to Chief Carl Lischeske, California Department of Public Health (May 11, 2009), p. 2.

[~~22~~28] See Gerba, Charles, P., *Estimated Risk of Illness from Swimming in the Sacramento River* (Feb. 23, 2010). Dr. Gerba's draft risk assessment report notes that for ten swimming exposures, the risk of infection from *Giardia* and *Cryptosporidium* are 4.4×10^{-4} and 3.0×10^{-4}, respectively, upstream of the District's outfall and 9.0×10^{-4} and 5.8×10^{-4}, respectively, downstream of the District's outfall. Based on these results~~,~~ the risk of infection downstream of the District's outfall compared to upstream more than doubles due to *Giardia* in the District's effluent and nearly doubles due to *Cryptosporidium* in the District's effluent. (See Gerba, Charles, P., *Estimated Risk of Illness from Swimming in the Sacramento River* (Sep. 24, 2009).) State Water Board staff reproduced the risk calculations presented in both *(Continued)*

"provide additional treatment sufficient to reduce the *additional* risk of infection posed by exposure to its discharge to as close to 1 in 10,000 as can be achieved by a cost-combination using filtration and/or a disinfection process that effectively inactivates *Giardia* cysts and *Cryptosporidium* oocysts."[~~23~~29] CDPH noted that according to the District's final risk assessment, the District's discharge "appears to be contributing at least 30 percent of the pathogens detected in the receiving waters," that "the average risk of infection from a single swimming exposure to the effluent is approximately one order of magnitude higher than this [additional risk of infection of 1 in 10,000] threshold," and that "[t]he estimated risk of infection from ten such exposures is two orders of magnitude higher."[~~24~~30]

At the July 18 Workshop, the District asserted that the risk of infection is significantly lower than 1 in 10,000 downstream of the discharge since all *Giardia* are inactivated by chlorination of the effluent before discharge. CDPH staff correctly responded that this conclusion utilized tables for required chlorine concentration and contact time to inactivate *Giardia* that were prepared for "clean," low solids water which is inconsistent with the quality of the District's effluent.[31] In addition, the District's assessment of *Giardia* inactivation does not consider that up to 20 percent of pathogens may be shielded by solids in the effluent.

The chlorine contact time requirement for "disinfected tertiary recycled water" is "not less than 450 milligram-minutes per liter at all times with a modal contact time of at least 90 minutes, based on peak dry weather design flow."[32] This requirement is based on a filtered effluent which contains low particulate matter (i.e., turbidity in range of 1-2 Nephelometric Turbidity Units [NTU]) as a result of filtration. The District's effluent is not filtered and the effluent turbidity (i.e., an indirect measure of particulate in the effluent) recorded on 32 occasions between April 3, 2002 through April 6, 2006 ranges from 4.3 to 11.0 NTU.[33] As

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the District's draft September 2009 risk assessment report and in the final February 2010 report. State Water Board staff used the model and parameters presented and protozoa concentrations reported in the District's report and in the administrative record. State Water Board staff was able to reproduce the District's draft risk assessment results exactly, but could not reproduce the final risk model results. These estimates do not consider double dosing effects that result from the twice daily tidal influence at the point of discharge.

[~~23~~29] Letter from Chief Gary H. Yamamoto, California Department of Public Health to Assistant Executive Officer Kenneth D. Landau, Central Valley Water Board (Jun. 15, 2010), p. 3 (first emphasis added).

[~~24~~30] *Id.*, p. 2.

[31] Video recording of the July 18 Workshop, 2:12:45-2:14:00.

[32] Cal. Code Regs., tit. 22, § 60301.230, subd. (a).

[33] Gerba, Charles, P., *Estimated Risk of Illness from Swimming in the Sacramento River* (Feb. 23, 2010), p. 34.

indicated by the District's data, chlorine contact times are generally, but not always, above 450 milligram-minutes per liter, but contact times rarely exceed 70 minutes.[34]

The District asserts that the U.S. EPA's Recreational Water Quality Criteria (U.S. EPA Rec Criteria) risk threshold is the appropriate risk standard to apply to its discharge. The reasons CDPH considers the additional 1 infection in 10,000 exposures risk threshold to be appropriate and the U.S. EPA Rec Criteria's risk threshold of 8 illnesses to 1,000 (i.e., 80 in 10,000) exposures inappropriate include:

1. The U.S. EPA Rec Criteria are based on risks posed by ambient recreational waters, where the pathogens present are from both human and animal sources. In the District's case, the discharge appears to be contributing at least 30 percent of the pathogens detected in the receiving water. The human origin of these pathogens renders them more hazardous to human swimmers;
2. The District's discharge is a controllable source, and the risk it poses is more readily abated by additional treatment. This is not true of waters impacted by non-point sources;
3. The U.S. EPA Rec Criteria represent a trade-off between the public's desire to swim in natural waters, and the minimum level of risk that could reasonably be achieved in 1986. CDPH questions whether this represents a level of risk that is currently 'acceptable' to the public; and,
4. CDPH considers an additional 1 in 10,000 risk of infection to be an acceptable risk from exposure to treated effluents, and used this as a basis for its Recycled Water Regulations. Dr. Gerba estimates that the average risk of infection from a single swimming exposure to the effluent is approximately one order of magnitude higher than this threshold. The estimated risk of infection from ten such exposures is two orders of magnitude higher.

CDPH staff reiterated its recommendation at the July 18 Workshop.

Effluent and instream monitoring data support CDPH's conclusion regarding the pathogenic load added by the District's discharge. The number of detections of potentially viable *Giardia* cysts and *Cryptosporidium* oocysts in water quality samples is significantly higher downstream of the discharge and in the effluent compared to upstream of the discharge.[35] In addition, instream monitoring results indicate that the average concentrations for both *Giardia* cysts and *Cryptosporidium* oocysts double from 100 feet upstream to 3,300 feet downstream of the discharge.

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[34] See Chlorine Free Elemental/Chlorine Contact Time Worksheet (2006-2009).

[35] For the period of June 1999 through April 2006, *Giardia* cysts and *Cryptosporidium* oocysts have been detected in 33 percent and 3 percent, respectively, of samples collected upstream of the discharge, and in 55 percent and 14 percent, respectively, of samples collected downstream of the discharge. During this same time period, *Giardia* cysts and *Cryptosporidium* oocysts have been detected in 95 percent and 89 percent, respectively, of effluent samples collected. (Gerba, Charles, P., *Estimated Risk of Illness from Swimming in the Sacramento River* (Feb. 23, 2010), p. 26.) These data indicate there are a significantly higher percentage of samples collected with potentially viable pathogenic protozoa in the District's effluent and in the receiving water downstream of the outfall compared to the ambient receiving water conditions upstream of the outfall.

The size of the District's discharge is significant. The District's discharge represents 60 percent of all publicly owned treatment works' permitted discharge within the Delta[36] and approximately 85 percent of all wastewater discharged to the Sacramento River downstream of Shasta Dam.[37] The Basin Plan contains a water quality objective of a maximum geometric mean of 200 fecal coliform per 100 ml (i.e., approximately 8 in 1,000 risk of illness) for protection of REC-1 use.[38] Ambient water quality monitoring at Freeport, 100 feet upstream of the District's outfall, indicates that the long-term average fecal coliform concentration from 1992 to 2008-09 is 226 MPN/100ml and from 1992 to 2009-10 is 228 MPN/100ml.[39] Based on these data, the risk of illness from REC-1 use may currently exceed 8 in 1,000 upstream of the District's outfall. Thus, the Basin Plan water quality objective for REC-1 use just upstream of the District's outfall may not currently be met and, as a result, there may be no assimilative capacity for fecal coliform (i.e., pathogens) in the Sacramento River at, around, and downstream of the District's point of discharge.

The Central Valley Water Board found that the District's wastewater needed to be disinfected adequately to prevent disease. The Sacramento River near the outfall is a popular sport fishing area with a marina located within the mixing zone (REC-1 use) and there are at least 20 agricultural diversions within one mile upstream and two miles downstream of the outfall (AGR use).[2540] Additionally, the Sacramento River is currently designated as a source of drinking water (MUN use).[2641] Within a 2010 Progress Report on the Bay Delta Conservation Plan, there are five drinking water intakes proposed between Freeport and Courtland, near the outfall.[2742]

While the Central Valley Water Board could have set effluent limits equivalent to "disinfected secondary-2.2 recycled water"[2843] to minimally comport with CDPH's

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[36] See Letter from Assistant Executive Officer Kenneth D. Landau, Central Valley Water Board to Chief Carl Lischeske, California Department of Public Health (May 11, 2009), p. 2.

[37] Waste Discharge Requirements Order No. R5-2010-0114, p. F-74.

[38] Basin Plan, p. III-3.00.

[39] See Sacramento Coordinated Monitoring Program, Appx. B, Summary Statistics (Dec. 1992-June 2010).

[2540] Waste Discharge Requirements Order No. R5-2010-0114, p. F-73.

[2641] State Water Board Resolution No. 88-63.

[2742] See Progress Report on the Bay Delta Conservation Plan (Nov. 18, 2010), pp. 3-306, 4-15, and figure 3-52. We take official notice of this document (Cal. Code Reg., tit. 23, § 648.2) as it was publicly available and in existence at the time of the Permit's adoption by the Central Valley Water Board.

[2843] "Disinfected secondary–2.2 recycled water" is defined as oxidized wastewater that has been disinfected such that the median concentration of total coliform bacteria does not exceed an MPN of 2.2 per 100 milliliters as a 7-day

(Continued)

recommendation, this would not address issues with particle-associated pathogen indicators in the District's effluent. We have previously concluded that tertiary treatment may be a reasonable requirement where the treatment is necessary to achieve compliance with water quality standards and to protect water quality.[2944] The Central Valley Water Board concluded that given the very high level of public contact with the receiving water, the use of the receiving water for irrigation, and the extensive use of Delta waters as private and public water supplies, any increased risk of illness and infection from exposure to the District's wastewater does not protect beneficial uses.[3045] We agree. As we have previously concluded, effluent limitations must protect beneficial uses considering reasonable, worst-case conditions.[46]

In summary, a "2.2 MPN" level of treatment was deemed appropriate by the Central Valley Water Board for the following reasons:

1. The tidal influence and reverse flows at the point of discharge can lead to double dosing of the areas around and downstream of the discharge with effluent;
2. The potential for REC-1 and AGR user contact with the discharge at dilution ratios less than 20 to 1 around the point of discharge and within the mixing zone;
3. The relatively high number of solids associated coliform, the lack of a conventional chlorine contact chamber in the District's wastewater treatment plant, and associated issues with pathogen shielding by solids in the effluent may result in inconsistent and inadequate effluent disinfection;
4. The pathogenic load and resulting estimated risks of infection to users exposed to the effluent indicate that the discharge contributes significant numbers of viable pathogens to the receiving waters. The incremental risks of infection resulting from the discharge exceed 1 in 10,000 and, under worst case scenarios, exceed 8 in 1,000;
5. Under double dosing conditions, the approximate combined risk of infection from exposure to *Giardia* and *Cryptosporidium* in the effluent at a hypothetical 20 to 1 dilution ratio may be as high as 2 in 1,000 for 1 swimming exposure and 20 in 1,000 for 10 swimming exposures based on the District's final risk assessment results. The 10 swim exposures estimate, under double dosing conditions, exceeds by approximately 2.5 fold the 8 in 1,000 risk of illness criteria that U.S. EPA utilizes and the risk of illness criteria represented by the Basin Plan water quality objective for fecal coliform;

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average, and the number of total coliform bacteria does not exceed an MPN of 23 per 100 milliliters in more than one sample in any 30-day period. (Cal. Code Regs., tit. 22, § 60301.220.)

[2944] State Water Board Order WQ 2009-0012 (*City of Stockton*) and Order WQO 2004-0010 (*City of Woodland*). As we discussed in the *City of Woodland* order, "[t]ertiary treatment typically involves adding coagulation and filtration to a secondary treatment process. Other processes may also be used to achieve tertiary quality."

[30] ~~Waste Discharge Requirements Order No. R5-2010-0114, p. F-77.~~

[45] Waste Discharge Requirements Order No. R5-2010-0114, p. F-77. U.S. EPA also commented that Title 22 tertiary filtration requirements were necessary for the protection of beneficial uses, specifically municipal and domestic supply. (Letter from Director Alexis Strauss, U.S. EPA, Region IX to Pamela Creedon, Executive Officer, Central Valley Water Board (Oct. 7, 2010), p. 5.)

[46] State Water Board Order WQ 2008-0008 (*City of Davis*), pp. 12-13.

6. Per the Basin Plan water quality objective, the receiving waters must be maintained at such quality that the risk of illness does not exceed approximately 8 in 1,000. The District's discharge cannot be allowed to cause the receiving waters to exceed this objective nor utilize all of the available assimilative capacity. Under worst case scenarios, the discharge appears to both exceed the 8 in 1,000 threshold and, in light of the upstream monitoring results for fecal coliform noted above, may be utilizing all remaining available assimilative capacity in the receiving waters; and,
7. The proximity and potential impacts to existing and future drinking water intakes that can affect available dilution at the District's outfall and location and operation of drinking water diversions.[47]

Given these concerns, the Permit requires an essentially pathogen-free wastewater discharge. Most technologies necessary to achieve this standard involve filtration to produce a very low-solids effluent. The Central Valley Water Board further found that filtration would have the added benefits of (1) reduction of total organic carbon, (2) substantial reductions in concentrations for copper, mercury, total suspended solids, and biochemical oxygen demand, and (3) potential reduction of other constituents. We conclude that the Central Valley Water Board appropriately adopted effluent limitations for total coliform organisms and filtration requirements at a level necessary to protect existing beneficial uses at and near the outfall as well as existing downstream beneficial uses for the Delta.

~~Consideration of Costs~~Water Code Section 13241 Factors

The federal Clean Water Act permits states to establish their own effluent limitations as long as they are not "less stringent" than those set forth in the Clean Water Act.[~~34~~48]

[47] An additional issue with the District's discharge is its effect on existing and future drinking water diversions. The discharge has the potential to affect the existing upstream drinking water intake at Freeport during reverse flow events. Operational agreements between the District and the Freeport Water Authority require the District to stop discharging when 0.1 percent effluent is present at the drinking water intakes. This intake and operational agreement has only been in place for approximately two years. (See Central Valley Water Board, *NPDES Permit Renewal Issues Drinking Water Supply and Public Health* (Dec. 14, 2009).) With the proposed "disinfected tertiary recycled water" level of treatment for the District's discharge, this potential impact to the Freeport drinking water intake would not be present and the operational agreement in place to prevent it may not be necessary.

Future water diversions upstream of the discharge may affect available dilution for the discharge. The draft Bay-Delta Conservation Plan-associated North Delta Tunnel proposal could result in the diversion of significant volumes of water near the District's outfall. (See Progress Report on the Bay Delta Conservation Plan (Nov. 18, 2010), pp. 3-307 through 3-324.) If this were to occur upstream of the District's discharge, daily average dilution at the District's outfall would be significantly reduced. This may necessitate stricter discharge requirements, consistent with the CDPH Guidelines, at the "disinfected tertiary recycled water" level of treatment to ensure protection of beneficial uses. Additional operational agreements may be required with current and future diverters to ensure they do not intake river water with high concentrations of the District's effluent. Future diversions downstream of the discharge may need to be placed outside of the District's mixing zone to avoid intake of river water with high concentrations of the District's effluent. With the Permit's "disinfected tertiary recycled water" level of treatment, these potential impacts would not be present and additional flexibility in locating intakes would be available.

[~~34~~48] 33 U.S.C. § 1370.

The Porter-Cologne Water Quality Control Act (Porter-Cologne Act) requires regional water boards to implement the Clean Water Act in California and requires them to consider~~, among other things, "economic considerations"[32]~~ a list of factors when establishing water quality objectives (13241 Factors).[49] When establishing waste discharge requirements pursuant to Water Code, section 13263, the Porter-Cologne Act cross-references ~~these economic considerations.[33]~~this list of factors.[50] The California Supreme Court has concluded that because both laws require regional water boards to comply with federal standards, and because the supremacy clause of the U.S. Constitution requires state law to yield to federal law, a regional water board is only required to consider ~~economic factors~~ the 13241 Factors(e.g., a discharger's cost of compliance) when an effluent limitation is more stringent than federal law requires.[34][51]

~~The District contends that the Central Valley Water Board failed to comply with Water Code, section 13241 by failing to adequately analyze and support the "costs of compliance" in its imposition of effluent limitation for total coliform organisms. To the contrary, the record shows that the Central Valley Water Board went above and beyond what is required.~~

~~As explained in greater detail below, the Central Valley Water Board considered a wide range of economic information when establishing the Permit's requirements for total coliform organisms. There are sound policy reasons for the regional water boards to consider the economic information and data presented to them or in certain circumstances to develop the information on their own. In this case though, the Clean Water Act imposed a lesser legal obligation on the Central Valley Water Board than the economic consideration it undertook.~~

~~The Central Valley Water Board calculated a numeric effluent limitation to implement existing narrative water quality objectives set forth in the Basin Plan. In these circumstances, the Central Valley Water Board could not use economic considerations, such as "compliance costs to justify pollutant restrictions that do not comply with federal clean water standards."[35]~~Under Federal law, a regional water board has an obligation to protect beneficial uses, even if there is no appropriate water quality objective for the affected receiving water or the existing water quality objectives are not protective enough.[52] When a regional water board adopts a permit under either of these scenarios, then the regional water board must consider

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~~[32] Wat. Code, § 13241.~~

[49] Wat. Code, § 13241.

[33][50] See Wat. Code, § 13263, subd. (a) (referring to Wat. Code, § 13241).

[34][51] *City of Burbank v. State Water Resources Control Bd.* (2005) 35 Cal.4th 613, 618.

[52] State Water Board Order WQ 2008-0008 (*City of Davis*), pp. 12-13.

the 13241 Factors. Conversely, when a regional water board adopts a permit that merely implements an existing water quality objective that serves as a federal water quality standard, there is no requirement to consider any of the 13241 Factors.[53] ~~Under state law, the water boards establish beneficial uses and water quality objectives in their basin plans. Together with an anti-degradation policy, these beneficial uses and water quality objectives serve as water quality standards under the Clean Water Act. In Clean Water Act parlance, state beneficial uses are called "designated uses" and state water quality objectives are called "criteria."[36]~~ In this case, the Central Valley Water Board established effluent limitations necessary, in part, to protect the REC-1 beneficial use. The limits in the Permit are more stringent than the Basin Plan's existing numeric objective for REC-1 beneficial use.[54] Therefore, the Central Valley Water Board was under an obligation to consider the 13241 Factors.

~~The Basin Plan's narrative water quality objectives for the Delta are water quality standards pursuant to Clean Water Act, section 303(c).[37] Clean Water Act, section 301(b)(1)(C) generally requires that NPDES permits include effluent limits for all pollutants, such as total coliform organisms, that can be discharged at levels that can cause or contribute to a violation of water quality standards.[38] As the California Supreme Court recently explained, the Clean Water Act requires that "publicly operated wastewater treatment plants . . . must comply with the act's clean water standards, regardless of cost."[39] Because the total coliform limits established by the Central Valley Water Board are implementing existing water quality objectives that serve as water quality standards, there is no requirement to consider economics.~~

~~Despite the absence of any legal requirement to consider economics,~~While the District makes a number of specific contentions about the Central Valley Water Board's findings for each of the 13241 Factors, these contentions can be summarized as "the findings are superficial, incorrect, unsupported by evidence, and not consistent with the requirements of the

~~35~~53 *City of Burbank v. State Water Resources Control Bd.* ~~(2005)~~, *supra*, 35 Cal.4th ~~613~~,at p. 626.

~~36 Compare 40 C.F.R. § 131.3(b) & (f) with Wat. Code, § 13050, subds. (f) and (h). The terms are interchangeable, and below we use the relevant term depending on the statutory scheme.~~

54 Basin Plan, p. III-3.00.

~~37 33 U.S.C. § 1313(c). See also 40 C.F.R. § 131.3(b).~~

~~38 33 U.S.C. § 1311(b)(1)(C).~~

~~39 *City of Burbank v. State Water Resources Control Bd.*, *supra*, 35 Cal.4th 613 at p. 626 (citing, in part, 33 U.S.C. § 1311(b)(1)(C)).~~

Water Code."[55] Section 13241 itself, does not specify how a water board must go about considering the factors, nor does it require that a water board make specific findings on each of the specified factors.[56] Instead, courts have required some evidence that a water board has considered the 13241 Factors. In this case, there is ample evidence that the Central Valley Water Board ~~did consider economic factors through the submission of the District's anti-degradation analysis and three economic~~has considered the 13241 Factors.

Beyond the brief findings added to the Permit's Fact Sheet in response to the District's comment on a prior draft of the Permit, the related discussion within the Permit's fact sheet,[57] the various documents and studies in the Central Valley Water Board's administrative record,[58] and the comments received in response to the draft Permit, provide the necessary evidence that the Central Valley Water Board considered the 13241 Factors.[40] Additionally, the various presentation materials and the board meeting transcript demonstrate that some of the 13241 Factors, specifically economic considerations, were presented, commented upon, and discussed at some length by Central Valley Water Board staff, the District, the public, and board members during the Permit's adoption meeting. ~~While having no legal obligation to do so, the~~The Central Valley Water Board ~~carefully considered economics, including the economic ramifications of its decision to adopt the Permit~~complied with its requirements under Water Code section 13241 as demonstrated by the Permit's Fact Sheet and the administrative record.

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[55] District's Petition for Review of Waste Discharge Requirements Order No. R5-2010-0114 (SWRCB/OCC File A-2144(a)), p. 45.

[56] *City of Arcadia v. State Water Resources Control Bd.* (2010) 191 Cal.App.4th 156, 177; see also *Cal. Assn. of Sanitation Agencies v. State Water Resources Control Bd.* (2012) 208 Cal.App.4th 1438.

[57] See Waste Discharge Requirements Order No. R5-2010-0114, pp. F-19, F-30-31, F-73-80, and F-96.

[58] There are numerous studies and memoranda in the administrative record that address one or more of the 13241 Factors. Some examples include: Entrix, Inc., *Economic Analysis of the Advanced Treatment Trains in the Tentative NPDES Permit* (Oct. 8, 2010); Economic & Planning Systems, Inc., *Sacramento Regional County Sanitation District Potential Fee Increase Feasibility Analysis* (Oct. 8, 2010); Michael, Jeffrey, et al., *A retrospective Estimate of the Economic Impacts of Reduced Water Supplies in the San Joaquin Valley in 2009* (Sept. 28, 2010); Garvey, Elisa, *Draft Project Memorandum SRWTP Advanced Treatment Cost Updates* (Aug. 25, 2010); Michael & Pogue, *Advanced Wastewater Treatment for Nutrient Reduction: Impact on Sacramento Income and Employment* (Aug. 23, 2010); PG Environmental, LLC, *Technical Review of Estimated Costs for Proposed Changes to the Sacramento Wastewater Treatment Plant* (Aug. 18, 2010); Trussell, R. Shane, et al., *Ammonia Removal Cost Alternatives for the Sacramento Regional Wastewater Treatment Plant* (May 31, 2010); Larry Walker Associates, *Technical Memorandum: Analysis of Costs and Benefits of Advanced Treatment Alternatives for the Sacramento Regional Wastewater Treatment Plant* (May 2010); Gomez, M., et al., *A Comparative Study of Tertiary Wastewater Treatment by Physico-Chemical-UV Process and Macrofiltration-Ultrafiltration Technologies* (Dec. 23, 2005).

[40] ~~Economic & Planning Systems, Inc., *Sacramento Regional County Sanitation District Potential Fee Increase Feasibility Analysis* (Oct. 8, 2010); Trussell, R. Shane, et al., *Ammonia Removal Cost Alternatives for the Sacramento Regional Wastewater Treatment Plant* (May 31, 2010); Michael & Pogue, *Advanced Wastewater Treatment for Nutrient Reduction: Impact on Sacramento Income and Employment* (Aug. 23, 2010).~~

Denial of Mixing Zone for Ammonia

The Permit contains final average monthly and maximum daily effluent limitations for total ammonia nitrogen of 1.8 milligrams per liter (mg/L) as nitrogen and 2.2 mg/L as nitrogen, respectively. The Central Valley Water Board set its limits based on the current U.S. EPA *Update of Ambient Water Quality Criteria for Ammonia*[4159] (1999 Criteria) and decided to not allow a mixing zone. ~~Absent a mixing zone, a discharger must meet effluent limitations at the point of discharge.~~ Because the Central Valley Water Board denied the use of a mixing zone, it calculated the effluent limitations with no allowance for dilution within the receiving water. The Central Valley Water Board based its decision, in part, on confirmed aquatic life impacts and the need to protect downstream beneficial uses. Generally, the District asserts that its request for a mixing zone and dilution credits was inappropriately denied. It claims that the Central Valley Water Board lacks sufficient evidence and what evidence it does have in the record is unreliable.

The Central Valley Water Board has been examining the effects of ammonia on the Delta for many years and notified dischargers that permits may be modified in the future as information becomes more definitive.[4260] However, absolute scientific certainty is not required in order for the Central Valley Water Board to exercise its judgment.[4361] Absolute consensus of the experts almost never occurs in science, including consensus as to the demarcation between acceptable versus toxic amounts of ammonia in a system as complex as the Delta. Ammonia's ecological effects are the subject of ongoing study, not just by the Central Valley Water Board, but by a multitude of public agencies, including U.S. EPA. Mindful of this backdrop, we inquire whether the Central Valley Water Board, relying on the federal NPDES regulations, relied upon sound science informed by an appropriate exercise of discretion to supplement the 1999 Criteria.

The Permit defines mixing zones as "a limited volume of receiving water that is allocated for mixing with a wastewater discharge where water quality criteria can be exceeded without causing adverse effects to the overall water body."[4462] Mixing zones are allowable because "[i]t is not always necessary to meet all water quality criteria within the discharge pipe

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[4159] 1999 Update of Ambient Water Quality Criteria for Ammonia (U.S. EPA, Dec. 1999) (EPA-822-R-99-014).

[4260] See State Water Board Order WQ 2009-0012 (*City of Stockton*), pp. 8-9.

[4361] *In re: City of Attleboro, MA Wastewater Treatment Plant*, 14 E.A.D. ___, 2009 WL 2985479 (U.S. EPA Environmental Appeals Board, Sep. 15, 2009).

[4462] Waste Discharge Requirements Order No. R5-2010-0114, p. A-4.

to protect the integrity of the ~~water body~~waterbody as a whole. Sometimes it is appropriate to allow for ambient concentrations above the criteria in small areas near outfalls."[4563] The effects of allowing a mixing zone are less stringent effluent limitations and, depending on the constituent involved, additional mass loading of the constituent downstream of the discharge.

For priority pollutants,[4664] the state and regional water boards may grant mixing zones and dilution credits to NPDES-permitted discharges in accordance with the provisions in the *Policy for Implementation of Toxics Standards for Inland Surface Waters, Enclosed Bays, and Estuaries of California* (SIP). For non-priority pollutants, such as ammonia and nitrate, the State Water Board has previously held that regional water boards may use the SIP and U.S. EPA's *Technical Support Document for Water Quality-Based Toxics Control* (TSD) as guidance for determining whether and to what extent to allow dilution credits and a mixing zone.[4765] When applying SIP and TSD methodologies, a regional water board may not grant a mixing zone if it would "compromise the integrity of the entire water body" or "adversely impact biologically sensitive or critical habitats."[4866] A regional water board's authorization of dilution credits or a mixing zone is discretionary and the burden to prove that the approval of either does not violate the SIP or the applicable basin plan falls on the discharger.[4967] When reaching a conclusion using SIP methodologies, a regional water board "shall use all available, valid, relevant, representative data and information, *as determined by the* [*regional water board*].[5068]

Applying SIP methodologies, the Central Valley Water Board first used the 1999 Criteria to translate its narrative toxicity objective to determine whether the discharge has reasonable potential to cause or contribute to a violation of that objective. The Basin Plan's toxicity objective states:

[4563] Water Quality Standards Handbook (U.S. EPA, 2d ed., 1994), § 5.1.1, p. 5-5.

[4664] Priority pollutants are the 126 toxic pollutants for which U.S. EPA has established test methods and required or established criteria to protect designated uses in the California Toxics Rule. (See 40 C.F.R. § 131.38.)

[4765] State Water Board Order WQO 2004-0013 (*Yuba City*), p. 6; see also State Water Board Order WQ 2001-16 (*Napa Sanitation Dist.*), p. 24. The TSD provides technical guidance for assessing and regulating the discharge of toxic pollutants to surface waters. The TSD is intended to be guidance only and does not establish or affect any legal rights or obligations.

[4866] SIP, p. 17. We emphasize that when granting a mixing zone pursuant to the SIP, the conditions that "shall not" occur are listed in the disjunctive. A regional water board need only find that a single condition potentially exists to deny a mixing zone pursuant to the SIP.

[4967] State Water Board Order WQ 2009-0012 (*City of Stockton*), p. 9; State Water Board Order WQO 2002-0012 (*East Bay Municipal Utility Dist.*), p. 13.

[5068] SIP, p. 5 (emphasis added).

> All waters shall be maintained free of toxic substances in concentrations that produce detrimental physiological responses in human, plant, animal, or aquatic life. This objective applies regardless of whether the toxicity is caused by a single substance or the interactive effect of multiple substances. Compliance with this objective will be determined by analyses of indicator organisms, species diversity, population density, growth anomalies, and biotoxicity tests of appropriate duration or other methods as specified by the Regional Water Board.
>
> The Regional Water Board will also consider all material and relevant information submitted by the discharger and other interested parties and numerical criteria and guidelines for toxic substances developed by the State Water Board, the California Office of Environmental Health Hazard Assessment, the California Department of Health Services, the U.S. Food and Drug Administration, the National Academy of Sciences, the U.S. Environmental Protection Agency, and other appropriate organizations to evaluate compliance with this objective.

Having determined that the District's discharge had a reasonable potential to violate this objective, the Central Valley Water Board then considered whether a mixing zone and dilution were appropriate based on relevant information. It concluded that the allowance of a mixing zone for ammonia would: "compromise the integrity of the entire water body" and "adversely impact biologically sensitive or critical habitats."[5169]

The District contends that the Central Valley Water Board must use a proposed state criterion, or an explicit state policy or regulation interpreting its narrative toxicity objective supplemented with other relevant information to establish effluent limitations.[5270] The District is incorrect. Pursuant to the relevant federal regulation, when a state has not established a water quality criterion for a specific chemical pollutant, the permitting agency may use one or more of three listed options to establish a water quality-based effluent limitation that implements a narrative criterion.[5371] The District claims that the Central Valley Water Board must choose the first option. The Central Valley Water Board instead chose the second option by "[e]stablishing effluent limits on a case-by-case basis, using [U.S.] EPA's water quality criteria, published under section 304(a) of the CWA, supplemented where necessary by other relevant information." It used the 1999 Criteria to establish the numerical water quality-based effluent limitation that interprets its narrative toxicity objective, and supplemented that determination with other

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[5169] These reasons from the SIP have their origin in the TSD and ~~are~~ more aptly address the sizing of an approved mixing zone rather than the initial approval or denial of a mixing zone.

[5270] District's Petition for Review of Waste Discharge Requirements Order No. R5-2010-0114 (SWRCB/OCC File A-2144(a)), p. 61.

[5371] 40 C.F.R. § 122.44(d)(1)(vi).

relevant information that allowing a mixing zone would not adequately protect beneficial uses or implement the narrative criteria.

The Central Valley Water Board derived effluent limitations, in part, based on other relevant information that granting a mixing zone for the 1999 Criteria are not protective of beneficial uses in the receiving water. A significant portion of the District's petition concerns the "other relevant information" used by the Central Valley Water Board and its interpretation of that information. The District's contention that aquatic life beneficial uses are protected when the 1999 Criteria are met at the edge of the mixing zones is predicated on the assumption that the criteria are adequate to protect beneficial uses. The Central Valley Water Board was mindful that the fully mixed discharge implements the 1999 Criteria. The Permit acknowledges that, "[t]he discharge, when the approved mixing zones are considered, is in compliance with current [1999] USEPA acute and chronic ammonia criteria."[5472]

In this case, though, the Central Valley Water Board had before it ample evidence showing that the 1999 Criteria are not sufficiently protective. The record indicates that existing levels of ammonia in the receiving water are not protective of aquatic life beneficial uses downstream of the discharge even though the receiving water does not exceed the 1999 Criteria.[5573] The TSD provides guidance that, as in this case, where adverse effects have been observed far downstream, rather than confined to a mixing zone, mixing zones may be denied where such denial is used as a device to compensate for uncertainties in the protectiveness of water quality criteria.[5674] In this respect, the Central Valley Water Board appropriately supplemented the available water quality criteria with other relevant information.

Draft 2009 Ammonia Criteria

The Central Valley Water Board examined U.S. EPA's *Draft 2009 Update Aquatic Life Ambient Water Quality Criteria for Ammonia – Freshwater* (Draft 2009 Criteria) in considering whether to grant a mixing zone. The District contends that this is inappropriate because it is a draft, not peer reviewed, and not available for use in a regulatory setting. The

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[5472] Waste Discharge Requirements Order No. R5-2010-0114, p. J-1.

[5573] Werner, I., et al., *The Effects of Wastewater Treatment Effluent- Associated Contaminants on Delta Smelt*, (Sept. 26, 2008); Werner, I., et al., *Acute toxicity of Ammonia/um and Wastewater Treatment Effluent-Associated Contaminant on Delta Smelt*, (2009); Foe, Chris, *Nutrient Concentrations and Biological Effects in the Sacramento-San Joaquin Delta*, (May 2010); Teh, S. et al., *Full Life-Cycle Bioassay Approach to Assess Chronic Exposure of Pseudodiaptomus forbesi to Ammonia/Ammonium.* The technical and scientific bases for these conclusions are discussed more fully below in the discussion of the Draft 2009 Criteria and ammonia's impact on copepods.

[5674] TSD, p. 34.

District would be correct if the Central Valley Water Board had used the Draft 2009 Criteria to interpret its narrative toxicity objective, but that is not the case. Instead the Central Valley Water Board used the scientific literature that is the basis for the Draft 2009 Criteria as "other relevant information" to deny a mixing zone.

Once finalized, the Draft 2009 Criteria will update the existing water quality criteria for ammonia and include more stringent chronic toxicity values for ammonia based on studies of ammonia as a toxicant to freshwater mussel species of the family Unionidae (Unionid mussels). The choice of freshwater mussels as a chronic toxicity endpoint in the Draft 2009 Criteria is mainly due to U.S. EPA's current reconsideration of relatively recent, peer-reviewed, scientific literature regarding ammonia toxicity to Unionid mussels.[~~57~~75] Unionid mussels are indigenous to many freshwater habitats in North America, including the Central Valley. The Permit notes that the freshwater Unionid mussel *Anadonata* sp. is present in the Sacramento watershed upstream of the City of Sacramento and in the Delta.[~~58~~76] *Anadonata* disperses during a larval stage in which it attaches to passing fish. It is present upstream of the Facility's discharge point and downstream in the Delta. Therefore, *Anadonata* is likely present in the Sacramento River within the vicinity of the outfall. The peer-reviewed scientific literature forming the basis of the Draft 2009 Criteria leads to the conclusion that Unionid mussels, such as *Anadonata,* would exhibit toxic effects from ammonia levels ~~higher~~lower than the 1999 Criteria. The peer-reviewed scientific literature provides "other relevant information" that the Central Valley Water Board could rely upon to deny a mixing zone in order to protect local, freshwater mussels.

We conclude that the Central Valley Water Board correctly used the peer-reviewed scientific literature that forms the basis of the Draft 2009 Criteria in determining the appropriateness of a mixing zone for ammonia. The Central Valley Water Board appropriately applied its narrative objective for toxicity by considering relevant information supplied by other agencies, researchers, and other sources of credible scientific/technical information as required by its toxicity objective and Code of Federal Regulations, title 40, section 122.44(d)(1)(vi). It also established that Unionid mussels are present in the Sacramento

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[~~57~~75] See Draft 2009 Criteria, Appx. A and C. The Draft 2009 Criteria rely on several peer-reviewed studies, including: Goudreau, S.E., et al., *Effects of Wastewater Treatment Plant Effluents on Freshwater Mollusks in the Upper Clinch River, Virginia, USA*, (1993); Mummert, A.K., et al., *Sensitivity of Juvenile Freshwater Mussels (Lampsilis fasciola, Villosa iris) to Total and Un-ionized Ammonia*, (2003); Newton, T.J. and Bartsch, M.R., *Lethal and Sublethal Effects of Ammonia to Juvinile lampsilis Mussels (Unionidae) in Sediment and Water-Only Exposures*, (2007); Wang, N., et al., *Contaminant Sensitivity of Freshwater Mussels: Chronic Toxicity of Copper and Ammonia to Juvenile Freshwater Mussels (Unionidae)*, (2007).

[~~58~~76] Waste Discharge Requirements Order No. R5-2010-0114, p. J-3.

River and are likely present in the immediate vicinity of the outfall. Further, water quality data submitted to the Central Valley Water Board establishes ammonia toxicity that appears to be attributable to the District's outfall. Specifically, the outfall is approximately 4,200 feet upstream of the Cliff's Marina sample station, which has regularly sampled elevated ammonia levels.[5977] As noted by the Central Valley Water Board, up to 41 percent of samples obtained annually during 2007-2009 from this location exceeded the Draft 2009 Criteria for Unionid mussels.[6078] The Central Valley Water Board appropriately denied the request for a mixing zone, because ammonia toxicity to Unionid mussels is one of the contributing factors compromising the integrity of the ~~water body~~waterbody.

Ammonia Toxicity to Copepods Compromises the Integrity of the Entire ~~Water Body~~Waterbody

Evidence of ammonia's toxicity to copepods is another reason that the Central Valley Water Board denied the District's request for a mixing zone. The District contends that the Permit's findings regarding acute and chronic toxicity to Delta copepods (*Eurytemora affinis* and *Pseudodiaptomus forbesi*) are based on preliminary and questionable study results. Specifically, the District contends, in part, that the study's laboratory work was not peer reviewed and it uses novel organisms that have no established protocols or comparable results. We find neither of these arguments persuasive.

The Central Valley Water Board considered Dr. Swee Teh's 31-day full life-cycle bioassay results with *P. forbesi*. It used the results as one reason to deny a mixing zone and support the need for downstream ammonia reduction. The full life-cycle test results were presented at a July 2010 meeting of the Interagency Ecological Program (IEP) Contaminant Work Team.[6179] The results demonstrated that ammonia concentrations as low as 0.36 ~~milligrams of~~mg/L as nitrogen ~~per liter~~ negatively affected *P. forbesi* reproduction, nauplii (a juvenile life stage for copepods) survival, or both. Ammonia concentrations greater than 0.36 mg/L ~~of~~as nitrogen are routinely measured for up to 30 miles downstream of the District's outfall, while concentrations upstream are an order of magnitude lower.[6280] Central Valley Water Board

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[5977] In addition to the other upstream regulated point sources, the State Water Board is aware of other undocumented sources of ammonia.

[6078] *Id.*, p. J-4.

[6179] Dr. Swee Teh, University of California, Davis, Full Life-Cycle Bioassay Approach to Assess Chronic Exposure of *Pseudodiaptomus forbesi* to Ammonia/Ammonium, (July 2010), slides 15-17.

[6280] Foe, C., Ballard, A., and S. Fong, Central Valley Water Board, *Nutrient Concentrations and Biological Effects in the Sacramento-San Joaquin Delta*, (May 2010).

staff asked Dr. Teh to repeat the reproduction/nauplii survival part of the bioassay procedure because the previous results showed aquatic toxicity at ammonia concentrations much lower than the 1999 Criteria to protect freshwater aquatic organisms. Dr. Teh did so and his additional studies confirmed earlier preliminary findings that ammonia concentrations as low as 0.36 mg/L ~~of~~as nitrogen impaired *P. forbesi*'s reproduction and juvenile life-stage survival.

The District correctly notes that none of the laboratory work for Dr. Teh's studies was peer reviewed. While peer review can elevate the weight given to scientific work, the lack of peer review is not a reason to exclude scientific data. There is no requirement that laboratory work be peer reviewed. The study was commissioned after comments were received at the fall 2009 Ammonia Summit that the 1999 Criteria might not be protective of freshwater copepods. These comments theorized that part of the reason for the collapse of native fish in the Delta might be because their young were having trouble finding food. *P. forbesi* is an important prey item for both larval Delta smelt and Longfin smelt. The study plan was reviewed by the ammonia subcommittee of the IEP Contaminant Work Team and followed U.S. EPA standard toxicity testing procedures (EPA-821-R-02-012; EPA-821-R-02-013) as much as possible. The results of the full life-cycle test were reviewed by the IEP Contaminant Work Team at a July 2010 meeting.[81] Under these circumstances, the Central Valley Water Board could consider Dr. Teh's laboratory work as relevant evidence to support its decision to deny an ammonia mixing zone. The available scientific evidence indicates that ammonia toxicity to copepods is one of the contributing factors compromising the integrity of the entire ~~water body~~waterbody.

Ammonia Toxicity is Adversely Impacting Biologically Sensitive or Critical Habitats

As would be expected, ammonia's toxic effect on copepods also affects those species that feed on copepods. The District contends that the Permit fails to include supported findings to show that its discharge is adversely impacting biologically sensitive or critical habitats, either inside or outside the acute and chronic aquatic life mixing zones. Again, we disagree and find that the record supports the Central Valley Water Board's determination that the District's discharge of ammonia affects designated critical habitat for species listed as endangered under the federal Endangered Species Act.[82]

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[81] The IEP Contaminant Work Team is composed of a number of scientists from various local, state, and federal agencies and regularly works with additional scientists from universities both within and outside of California. While review by the IEP Contaminant Work Team is not a peer review process that complies with Health and Safety Code section 57004, Dr. Teh's work was reviewed by a number of his peers with significant expertise in both this general area of study and the specific issues associated with the Delta.

[82] 16 U.S.C. § 1531 et seq.

The Sacramento River at Freeport is within the designated critical habitat for several federally listed fish species including winter- and spring-run Chinook salmon (*Oncorhynchus tshawytscha*), Steelhead (*Oncorhynchus mykiss*), Delta smelt (*Hypomesus transpacificus*) and Green sturgeon (*Acipenser medirostris*). In addition, the U.S. Fish and Wildlife Service recently identified the San Francisco Bay-Delta population of the Longfin smelt (*Spirinchus thaleichthys*) as a candidate species for protection under the federal Endangered Species Act.[6383] The Central Valley Water Board concluded that:

> ammonia concentrations inhibited diatom primary production rates and caused *P. forbesi* toxicity outside the mixing zone. Inhibition of diatom growth by elevated ammonia concentrations has been documented between Rio Vista and Suisun Bay. This is a primary spawning and nursery area for Delta smelt and Longfin smelt and an important rearing area for striped bass. Ambient ammonia concentrations are also sufficiently high to cause toxicity to the copepod *P. forbesi* as far downstream as Isleton (28 miles downstream of the discharge). The Sacramento River between the discharge and Isleton is a rearing area for striped bass. Phytoplankton, such as diatoms, are a primary food resource for many zooplankton species including *P. forbesi*[6484] and these in turn are a major item in the diet of all three of the above fish species. Therefore, the discharge is adversely affecting critical fish habitat by reducing, both directly and indirectly, the amount of available food for the young of these three important fish species. The conclusion that the collapse of these fish populations might be caused by the quantity and quality of available food is not new. The hypothesis was first presented in the peer reviewed literature in 2007 and has been termed the "bottom-up" hypothesis.[6585] What is new is the emerging information about the effect of ammonia on diatom production and *P. forbesi* reproduction and survival.[6686]

The National Marine Fisheries Service echoed these comments.[6787] We concur with the Central Valley Water Board's conclusion that ammonia toxicity to copepods is likely a factor adversely affecting candidate, threatened, or endangered species populations (sometimes referred to as

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[6383] 77 Fed. Reg 19756 (Apr. 2, 2012). The U.S. Fish and Wildlife Service found that the available scientific information warranted listing the Bay Delta distinct population segment of Longfin smelt as threatened or endangered, but because of other priorities, the Service would only place the Longfin smelt on the candidate list. We take official notice of the listing (Cal. Code Reg., tit. 23, § 648.2) as it occurred after briefing was complete. The listing is only cumulative of other evidence, though, of vulnerable ~~specifies~~species and habitat in the lower Sacramento River.

[6484] In its response, the Central Valley Water Board clarified that this was not a basis for the ammonia effluent limitations. (See Response to Petitions for Review of Waste Discharge Requirements Order No. R5-2010-0114 (SWRCB/OCC File A-2144(a) and A-2144(b)), p. 53.)

[6585] Sommer, Ted, et al., *The Collapse of Pelagic Fishes in the Upper San Francisco Estuary*, (June 2007).

[6686] Central Valley Water Board's Response to Petitions for Review of Waste Discharge Requirements Order No. R5-2010-0114 (SWRCB/OCC File A-2144(a) and A-2144(b)), p. 41.

[6787] Letter from Maria R. Rea, Central Valley Office Supervisor, National Marine Fisheries Service to James D. Marshall, Senior Water Resources Control Engineer, Central Valley Water Board (Oct. 13, 2010).

pelagic organism decline) in the Delta and that the Permit's findings are supported by the administrative record.

Final Ammonia Effluent Limitation Calculation

As previously mentioned, the Permit contains final average monthly and maximum daily effluent limitations for total ammonia nitrogen of 1.8 mg/L as nitrogen and 2.2 mg/L as nitrogen, respectively. The Central Valley ~~Regional~~ Water Board made changes to the final adopted version of the Permit in the Fact Sheet discussion of ammonia criteria that are not reflected within effluent limitation calculations shown in Attachment H of the Permit. Originally, the Permit calculated the water quality-based effluent limitation using the 1999 Criteria's acute criterion for ammonia based on a pH of 8.5. This resulted in an ~~effluent limitation~~acute criterion for ammonia of 2.14 mg/L as nitrogen. Because the District indicated that it can consistently comply with a maximum performance based limitation for pH of 8.0, the Central Valley Water Board changed the maximum effluent ~~maximum~~ limitation for pH to 8.0 and then used a pH of 8.0 and temperature of 22.5°C in determining the applicable ammonia criteria.

Based on a pH of 8.0 and a temperature of 22.5°C cited by the Fact Sheet,[~~68~~88] when salmonids and early life stages are present, the 1999 Criteria recommend acute and chronic criteria for ammonia nitrogen ~~are~~of 5.62 mg/L as nitrogen and 1.45 mg/L as nitrogen, respectively. ~~It would appear that the~~The effluent limitations calculated by the Central Valley Water Board in Attachment H are incorrectly based on acute and chronic criteria for ammonia nitrogen of 2.14 mg/L as nitrogen and 1.68 mg/L as nitrogen, respectively. The 2.14 mg/L no longer applies since a pH of 8.5 is no longer applicable. Additionally, the 1.68 mg/L chronic criterion does not appear to coincide with a pH of 8.0 and temperature of 22.5°C. Therefore, in this case where mixing zones and dilution credits are denied, the correct lower chronic criterion of 1.45 mg/L should govern over the correct acute criterion of 5.62 mg/L for the development of ammonia effluent limitations when using the SIP methodology. ~~On remand, the Central Valley Water Board should review the ammonia criteria that are applicable to the District's discharge and make corrections to the final ammonia~~Using the SIP methodology, considering daily monitoring, and applying the corrected criteria as shown in the Ammonia Effluent Calculation Table below, the final effluent limitation~~ calculations and limitations, as appropriate.~~s are

[~~68~~88] Waste Discharge Requirements Order No. R5-2010-0114, p. F-55.

calculated to be 1.5 mg/L as the average monthly effluent limitation and 2.0 mg/L as the maximum daily effluent limitation.

These limitations are protective for all of the District's discharges year-round. However, it is appropriate to consider seasonal effluent limitations because ammonia criteria depend on temperature. More appropriate, yet equally protective effluent limitations can apply during the colder months when the receiving water is sustained at lower temperatures; the colder months being November 1 through March 31. Based on downstream receiving water seasonal data from 2000 through 2010 at monitoring station R3, 4,200 feet downstream of the discharge (i.e., Cliff's Marina),[89] the worst case receiving water temperature (warmest temperature) of 14.4°C can apply. For the cold season, the acute criterion is 5.62 mg/L and the chronic criterion is 2.43 mg/L. Under these circumstances the average monthly effluent limitation is 2.4 mg/L and the maximum daily effluent limitation is 3.3 mg/L.

The effluent limitations for ammonia in Table 6, section IV. A. 1.a. of the Permit under Effluent Limitations and Discharge Specifications, are corrected to read as follows:

Table 6. Effluent Limitations

Parameter	Units	Effluent Limitations				
		Average Monthly	Average Weekly	Maximum Daily	Instantaneous Minimum	Instantaneous Maximum
Ammonia Nitrogen, Total (as N) (Apr-Oct)	mg/L	1.5		2.0		
Ammonia Nitrogen, Total (as N) (Nov-Mar)	mg/L	2.4		3.3		

In addition, the Fact Sheet of the Permit is corrected to include the following Tables showing the calculation of seasonal ammonia effluent limitations applying the SIP procedures, considering daily monitoring in the calculations of statistical multipliers, and using data from June 2005 through July 2008.

Ammonia Effluent Limitations Calculation (Apr-Oct)

Description	Ammonia
Effluent Concentrations	
Sample Dates - Begin	Jun-1-2005
Sample Dates - End	Jul-31-2008
At least 80% of data ND?	No

[89] See Sacramento Regional Wastewater Treatment Plant Monthly Discharge Reports (July 2000 - Aug. 2010).

Sample Count	334	
MEC (mg/l)	45.0	
Mean (mg/l)	24.0	
Std. Deviation (mg/l)	3.70	
Coefficient of Variation (CV) (mg/l)	0.1542	
Background Concentrations		
Max Background (mg/l)	1.3	
Are Salmonids Present?	Yes	
Are Early Life Stages Present?	Yes	
Criteria	acute	chronic
Hardness (mg/l as $CaCO_3$)	N/A	N/A
BP Objective (mg/l) (USEPA Ambient)	5.62	1.45
Translator	N/A	N/A
Design pH	8.0	8.0
Temperature, max 30day Avg (^{0}C)	22.5	22.5
Criteria (total recoverable)	5.62	1.455
Effluent Limit Calculations		
Dilution Credit	0	0
ECA (mg/l)	5.62	1.455
σ^2	0.02	0.023
σ_{30}^2	0.0008	0.0008
ECA Multiplier	0.708	N/A
Long-Term Average	3.98	1.455
AMEL Multiplier	**N/A**	1.047
AMEL	**N/A**	**1.5**
MDEL Multiplier	**N/A**	1.41
MDEL	**N/A**	**2.0**

Ammonia Effluent Limitations Calculation (Nov-Mar)

Description	**Ammonia**
Effluent Concentrations	
Sample Dates - Begin	Jun-1-2005
Sample Dates - End	Jul-31-2008
At least 80% of data ND?	No
Sample Count	334
MEC (mg/l)	45.0
Mean (mg/l)	24.0
Std. Deviation (mg/l)	3.70
Coefficient of Variation (CV) (mg/l)	0.1542
Background Concentrations	
Max Background (mg/l)	1.3

Are Salmonids Present?	Yes	
Are Early Life Stages Present?	Yes	
Criteria	acute	chronic
Hardness (mg/l as $CaCO_3$)	N/A	N/A
BP Objective (mg/l) (USEPA Ambient)	5.62	2.43
Translator	N/A	N/A
Design pH	8.0	8.0
Temperature, max 30day Avg (^0C)	14.4	14.4
Criteria (total recoverable)	5.62	2.43
Effluent Limit Calculations		
Dilution Credit	0	0
ECA (mg/l)	5.62	2.43
σ^2	0.02	0.023
σ_{30}^2	0.0008	0.0008
ECA Multiplier	0.708	N/A
Long-Term Average	3.98	2.43
AMEL Multiplier	**N/A**	1.047
AMEL	**N/A**	**2.4**
MDEL Multiplier	**N/A**	1.41
MDEL	**N/A**	**3.3**

Nitrate (Nutrients)

For the same reasons discussed concerning ammonia, the Central Valley Water Board has the discretion to grant or deny a mixing zone for nitrate using the SIP and TSD methodologies as guidance. The Basin Plan allows the Central Valley Water Board to:

> designate mixing zones . . . for different types of objectives, including, but not limited to, acute aquatic life objectives, chronic aquatic life objectives, [and] human health objectives . . . depending in part on the averaging period *over which the objectives apply*. In determining the size of such mixing zones, the Regional [Water] Board will consider the applicable procedures and guidelines in the [U.S.] EPA's Water Quality Standards Handbook and the [TSD].[6990]

In the Permit, the Central Valley Water Board set the final effluent limitation equal to U.S. EPA's primary maximum contaminant level (Primary MCL) for drinking water for nitrate as nitrogen of 10 mg/L without allowance for a mixing zone and dilution credit.[7091]

[6990] Basin Plan, p. IV-16.00, col. 2 (emphasis added).

[7091] Throughout this discussion, when referring to the nitrate limitation and Primary MCL level of 10 mg/L, we mean the result to be expressed as nitrate as nitrogen, as opposed to the equivalent result of 45 mg/L expressed as NO_3 (nitrate). The reason for the 4.5 factor difference is because the ratio of atomic weights between NO_3 (62.5 mg) and N (14 mg) is approximately 4.5.

Currently, the Facility discharges very low concentrations of nitrate, because the nitrogen discharge is predominantly in the form of ammonia. The Permit, however, now requires the Facility to ~~fully~~ nitrify[71] in order to meet its ammonia effluent limitations. The Central Valley Water Board concluded that, f~~F~~ollowing full nitrification, the discharge will have reasonable potential to exceed the Primary MCL for nitrate and may necessitate denitrification. Nitrate generates two relevant concerns. First, excessive nitrates in drinking water pose a human health concern, particularly for human fetuses and infants. Second, excessive nitrogen in the form of nitrates can contribute to excessive algal growth and change the ecology of a waterbody. The Central Valley Water Board denied a mixing zone stating that it did so to protect beneficial uses, specifically municipal and domestic supply (MUN), and because a human health mixing zone for nitrate does not comport with the SIP's requirements.

The District contends that an effluent limitation equal to the Primary MCL is unnecessary to protect the MUN beneficial use. We agree with the District to the extent that ~~as~~ it relates to protecting ~~the MUN beneficial use~~ human health from nitrate. The Central Valley Water Board states that there is sufficient dilution available in the Sacramento River that, after mixing, the river will not exceed the nitrate drinking water standard.[72][92] Therefore, it appears that solely for the protection of human health~~the MUN beneficial use solely~~ from nitrate, an effluent limitation equal to the Primary MCL was not necessary since the standard of 10 mg/L would have been met at the boundaries of an appropriately sized mixing zone.

The District further contends that the denial of a mixing zone for nitrate is improper, in part, because "the denial [of a human health mixing zone] has nothing to do with the merits of a human health mixing zone."[73][93] Again, we agree with the District. In this case, the water quality objective for which a mixing zone was denied is based on human health. However, the reasons for denying the mixing zone were related to aquatic and ecological impacts. This does not comport with what the Basin Plan and TSD specify in allowing or denying mixing zones.[74][94]

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[71] ~~Full nitrification refers to the conversion of ammonia all the way to nitrate, while partial nitrification would only convert the ammonia to nitrite. Discharge of nitrite may cause a demand for oxygen in the receiving water, which would create its own adverse water quality impacts. Thus the Central Valley Water Board required full nitrification as the appropriate type of treatment.~~

[72][92] Central Valley Water Board's Response to Petitions for Review of Waste Discharge Requirements Order No. R5-2010-0114 (SWRCB/OCC File A-2144(a) and A-2144(b)), p. 62.

[73][93] District's Petition for Review of Waste Discharge Requirements Order No. R5-2010-0114 (SWRCB/OCC File A-2144(a)), p. 125.

[74][94] TSD, p. 33 states: "In the general case, where a State has both acute and chronic aquatic life criteria, as well as human health criteria, independently established mixing zone specifications may apply to each of the three types of

(Continued)

A mixing zone can be denied if it is determined that the receiving water already exceeds the water quality objective that was used to establish the effluent limitation or "to compensate for uncertainties in the protectiveness of the water quality criteria."[~~75~~95] With respect to nitrate, however, the receiving water provides assimilative capacity and dilution to meet the water quality objective that protects human health requirements. The Permit's Findings do not support a conclusion that there are uncertainties in the protectiveness of the water quality objective from a human health perspective. As a result, the denial of a mixing zone relying on the Primary MCL for ~~nitrate of 10 mg/L~~the protection of human health is inappropriate.

The foregoing conclusion with respect to the nitrate mixing zone contrasts with our previous discussion of ammonia because of the manner in which water quality objectives and criteria protect specific uses. Water quality objectives protect specific beneficial uses. The water quality objectives that protect aquatic life are different from those that protect human health, and will create different permit limitations. Similarly, a permit writer must be mindful of the nexus between objectives and uses in each analytical step when deriving a water quality-based effluent limitation to implement a water quality objective. The decision to grant or deny a mixing zone for a pollutant should, in each analytical step, consider the use that is being protected by the applicable water quality objective. With respect to ammonia, the uses were aquatic life, the criteria were designed to protect aquatic life, and the mixing zone was denied based on other relevant information that the recommended 1999 Criteria were not protective of aquatic life. Each step was tied to the aquatic life use. In contrast, with respect to nitrate, the use was MUN beneficial use, the water quality objective was to protect human health, but the mixing zone was denied based on information that nitrate discharges have biostimulatory effects unrelated to drinking water protection through implementation of the Primary MCL. The last analytical step for nitrates uncoupled the use to be protected from the objective providing the protection. ~~There does not appear to be evidence that any further restrictions are necessary to protect human health with respect to the nitrate discharges. As a result, the Central Valley~~

criteria. The acute mixing zone may be sized to prevent lethality to passing organisms, the chronic mixing zone sized to protect the ecology of the waterbody as a whole, and the health criteria mixing zone sized to prevent significant human risks. For any particular pollutant from any particular discharge, the magnitude, duration, frequency, and mixing zone associated with each of the three types of criteria will determine which one most limits the allowable discharge."

[~~75~~95] TSD, p. 34.

~~Water Board improperly denied a human health mixing zone derived from the Primary MCL for nitrate.[76]~~

Although we have concluded that the Central Valley Water Board's denial of dilution credits and a mixing zone for nitrate in order to comply with the Primary MCL was not appropriate, that does not conclude our review. Further limitations on nutrient discharges are ~~likely~~ necessary based on the evidence in the record showing ecological and aquatic impacts from nutrients in the waterbodies downstream of the discharge. Both the Central Valley Water Board's and the San Francisco Bay Regional Water Quality Control Board's (San Francisco Bay Water Board) Basin Plans contain a narrative objective for biostimulatory substances that states "[w]ater shall not contain biostimulatory substances which promote aquatic growths in concentrations that cause nuisance or adversely affect beneficial uses."~~[77]~~[96] The San Francisco Bay Water Board's narrative objective further states "[c]hanges in chlorophyll a and associated phytoplankton communities follow complex dynamics that are sometimes associated with a discharge of biostimulatory substances. Irregular and extreme levels of chlorophyll a or phytoplankton blooms may indicate exceedance of this objective and require investigation." Therefore, ~~the Central Valley Water Board could determine the~~we conclude that there is a need to set ~~a limitation for nitrogen based on reasonable potential to exceed~~effluent limitations for nitrate based, in part, that the District's discharge is contributing to an exceedance of the downstream biostimulatory ~~substances~~ water quality objectives.

Cultural Eutrophication

Nitrogen, phosphorus, and other elements are vital for a functional aquatic ecosystem. In particular, nitrogen and phosphorus are essential for fueling primary productivity. Inorganic nitrogen sources (e.g., nitrate, nitrite, and ammonia) and organic nitrogen (e.g., urea) are all nutrients for algal growth. Primary producer organisms (organisms that perform photosynthesis, such as algae and plants) can directly use all of these forms of nitrogen to varying degrees to form proteins and other organic compounds necessary for life. Organic nitrogen, in the form of detritus (e.g., decomposing vegetation and animal fecal matter) is broken down by bacteria into inorganic nitrogen. One form of inorganic nitrogen, ammonia, can

~~[76] The Central Valley Water Board should reconsider the allowance of dilution credits and a mixing zone, but must do so based on an approach consistent with this Order's discussion of the grounds on which a mixing zone may be denied. In addition, the Permit also established a reasonable potential for the discharge to exceed the nitrite MCL of 1 mg/L. Since there is also reasonable potential for nitrite to exceed the MCL of 1 mg/L, it seems appropriate that the effluent limitation be expressed as the sum of nitrate and nitrite.~~

~~[77]~~[96] Basin Plan, p. III-3.00; San Francisco Bay Basin Water Quality Control Plan, p. 3-3.

eventually be oxidized by bacteria into nitrite and then nitrate. Typically, in healthy aquatic ecosystems, nitrate is the most abundant form of nitrogen.

However, excessive nutrient inputs to a waterbody can become too much of a good thing. Cultural eutrophication is a process fueled by unnaturally high concentrations of nitrogen and phosphorus due to human-related activities. When excessive levels of these nutrients are introduced into a water system, algae populations rapidly multiply to nuisance levels. As algal populations "bloom" and die-off in quick succession, dead algae accumulate and decompose. Their nutrient-laden remains further enrich the immediate environment, thereby perpetuating the eutrophication cycle. Increased rates of respiration and decomposition deplete the available dissolved oxygen in the water, threatening other plant and animal life in the system. When dissolved oxygen concentrations drop below what is needed by fish and invertebrates to respire, the waters become host to fish kills and other events which can pose threats to both the aquatic ecosystem and human health. The impacts can cascade through the trophic levels, changing the ecosystem structure and function, and causing a nuisance or adversely affecting beneficial uses of surface water, including recreational, wildlife, fishery, aquatic life, and drinking water uses.

Cultural eutrophication occurs despite the form of nitrogen being discharged into the ecosystem. The total amount, or load, of nitrogen needs to be reduced in the Delta in order to address the damaging effects of nutrient over-enrichment. Since ammonia and nitrate are the dominant forms of nitrogen from point source discharges, the loads of both forms of nitrogen to waterbodies experiencing excessive biostimulation needs to be reduced. Elevated levels of ammonia are toxic and thus the conversion to nitrate through nitrification is necessary to protect aquatic life beneficial uses. However, converting the dominant form from primarily ammonia to nitrate will still result in cultural eutrophication. Reductions of total nitrogen loads through both nitrification and denitrification is the goal to protect beneficial uses from cultural eutrophication from point source discharges.

The San Francisco Bay and the Delta together is the largest estuarine system in California. There is evidence in the record showing that the San Francisco Bay and Delta are nutrient-enriched, receiving external loads of total nitrogen and total phosphorus from point and non-point sources.[97] The San Francisco Bay and Delta ecosystem (Bay-Delta ecosystem) does

[97] Heidel, K., et al., *Conceptual Model for Nutrients in the Central Valley and Sacramento-San Joaquin Delta*, (Sept. 2006).

not follow the typical paradigm for excess nutrients and cultural eutrophication.[98] This is due to the complexity of the system, with fewer phytoplankton blooms and higher dissolved oxygen than expected when considering the elevated input of nutrients. Co-factors that influence the Bay-Delta ecosystem's response to nutrient loading include elevated turbidity, increased grazing pressures from invasive clams, and decreased freshwater flows.[99] However, the historical resilience of the Bay-Delta ecosystem to excess anthropogenic nutrient loading is weakening and may be nearing an irreversible tipping point.

~~Downstream~~Protection of beneficial uses ~~must be protected~~includes those beneficial uses that are downstream, and in this case those downstream uses are in the Delta and San Francisco Bay, as well as Suisun Bay.[100] U.S. EPA's current Section 303(d) list of impaired water bodies lists the Suisun Marsh Wetlands as impaired for nutrients.[~~78~~101] ~~There is enough evidence in the record of cyanobacteria in the Delta, and phytoplankton blooms in the San Francisco Bay (including blooms of *Heterosigma akashiwo*) to demonstrate that biostimulation is occurring, even if diatom populations in Suisun Bay are not experiencing bloom conditions.[79] The District's outfall~~The Suisun Bay ecosystem provides essential habitat for numerous birds, mammals, and fish, including threatened and endangered species such as winter- and spring-run Chinook salmon, Steelhead, Green sturgeon, Delta smelt, and Longfin smelt.[102] The consequences of excessive nutrients, including changes in phytoplankton and zooplankton communities, negatively impact the survival and success of these threatened and

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[98] Parker, A., et al., *Biogeochemical Processing of Anthropogenic Ammonium in the Sacramento River and the Northern San Francisco Estuary*, (Sept. 2010).

[99] Jassby, A.D. et al., *Annual Primary Production: Patterns and Mechanisms of Change in a Nutrient Rich Tidal Estuary*, (2002).

[100] Both the Central Valley Water Board and the San Francisco Bay Water Board should consider similar controls for significant controllable sources of nutrient loading to the Bay-Delta ecosystem.

[~~78~~101] While the Suisun Marsh is not within the legal boundaries of the Delta, it is hydrologically connected to Suisun Bay and is addressed within the Bay-Delta Conservation Plan. (See Progress Report on the Bay-Delta Conservation Plan (5th ed., Aug. 2, 2011), p. 56; compare Wat. Code, § 12220 with Pub. Resources Code, § 29101.)

~~[79] See Lehman, P.W., et al., *Initial Impacts of Microcystis aeruginosa Blooms on the Aquatic Food Web In the San Francisco Estuary* (Dec. 2009); Lehman, P.W., et al., *The Influence of Environmental Conditions on the Seasonal Variation of Microcystis Cell Density and Microcystins Concentration in the San Francisco Estuary* (2008); Dugdale, R.C., et al., *The Role of Ammonium and Nitrate in Spring Bloom Development in San Francisco Bay* (2007); Lehman, P.W., et al. *Phytoplankton Biomass, Cell Diameter, and Species Composition in the Low Salinity Zone of Northern San Francisco Bay Estuary* (2000).~~

[102] Note that the Longfin smelt is currently a candidate species.

endangered species.[103] The District's discharge contributes substantial nutrients, nitrogen (currently as ammonia) and phosphorus, directly to San Francisco Bay and the Delta.

Additionally, there is enough evidence in the record of cyanobacteria blooms in the Delta, and other phytoplankton blooms in the San Francisco Bay (including blooms of *Heterosigma akashiwo*) to demonstrate that excessive biostimulation is occurring, even if diatom populations in Suisun Bay are not experiencing bloom conditions.[104] Higher than natural primary productivity and algal blooms pose multiple detrimental effects to surface waters: ecosystem changes, depressed dissolved oxygen, cyanotoxin (e.g., microcystin) production, nuisance to recreational uses, and taste and odor issues for drinking water supplies. Evidence is present in the record for each of these indicators of cultural eutrophication in the Delta and San Francisco Bay with the current nutrient loads. The Northern San Francisco Bay, specifically Suisun Bay, has undergone significant changes in ecosystem structure. These changes are presently being attributed to ecosystem perturbations over the past several decades resulting from changes in nutrient ecosystem stoichiometry.[105]

Historically, Suisun Bay was a diatom-based food web. In 1982, the Facility began operations and began discharging secondarily treated effluent, discharging up to 14 tons of ammonium-nitrogen into the Sacramento River daily. This discharge of ammonium-nitrogen coincided with the Sacramento River and Suisun Marsh shifting from a nitrate-based diatom phytoplankton system, to an ammonium-based small phytoplankton system and shift into a small-sized zooplankton community (*Eurytemora* and *Pseudodiatomus*).[106] Additionally, in 1987 the invasive Asian clam (*Corbula amurensis*) was introduced and diatom-based blooms became

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[103] See Glibert, Patricia M., *Long-term Changes in Nutrient Loading and Stoichiometry and their Relationships with Changes in the Food Web and Dominant Pelagic Fish Species in San Francisco Estuary, Califomia*, (2010); Sommer, Ted, et al., *The Collapse of Pelagic Fishes in the Upper San Francisco Estuary*, (June 2007). Baxter, R. R., et al., *Pelagic Organism Decline Progress Report: 2007 Synthesis of Results*, (2008); Letter from Maria R. Rea, Central Valley Office Supervisor, National Marine Fisheries Service to James D. Marshall, Senior Water Resources Control Engineer, Central Valley Water Board (Oct. 13, 2010).

[104] See Lehman, P.W., et al., *Initial Impacts of Microcystis aeruginosa Blooms on the Aquatic Food Web In the San Francisco Estuary* (Dec. 2009); Lehman, P.W., et al., *The Influence of Environmental Conditions on the Seasonal Variation of Microcystis Cell Density and Microcystins Concentration in the San Francisco Estuary* (2008); Dugdale, R.C., et al., *The Role of Ammonium and Nitrate in Spring Bloom Development in San Francisco Bay* (2007); Lehman, P.W., et al. *Phytoplankton Biomass, Cell Diameter, and Species Composition in the Low Salinity Zone of Northern San Francisco Bay Estuary* (2000).

[105] Glibert, Patricia M., *Long-term Changes in Nutrient Loading and Stoichiometry and their Relationships with Changes in the Food Web and Dominant Pelagic Fish Species in San Francisco Estuary, Califomia*, (2010).

[106] *Ibid.*; Dugdale, Richard C., et al., *The Role of Ammonium and Nitrate in Spring Bloom Development in San Francisco Bay*, (Feb. 2007).

rare. Currently, Suisun Bay is an enriched ammonium, low phosphorous ecosystem, which is highly conducive to cyanobacterial blooms.[107]

Cyanobacteria blooms have been detected in the Delta and Suisun Bay since 1999. They can form surface scum, be a nuisance to recreational users, reduce aesthetics and oxygen, and produce microcystins (cyanotoxins).[108] Microcystins have been shown to obstruct zooplankton feeding abilities, growth and fecundity. Additionally, microcystins can be biomagnified through the food web. While a standard for total microcystin is not established in the United States, the World Health Organization (WHO) recommends 1 microgram per liter (µg/L) of total microcystin for drinking water.[109] Effects from microcystins can range from non-fatal neurological impairment to organ damage in humans. Within the Delta, microcystin levels exceeding the WHO guidelines have been detected in the San Joaquin River, while in the Sacramento River microcystins have been detected but not yet at toxic levels.[110]

In addition to ecosystem impacts and microcystin production, cultural eutrophication impacts the taste and odor of drinking water supplies. A portion of the discharge from the District becomes source water for drinking water supplies in the Central Valley, the San Francisco Bay Area, and Southern California. The water exported from the Delta helps supply drinking water for approximately 25 million Californians.[111] Excess primary productivity can clog drains and pumps for water treatment facilities. Elevated primary productivity adds to the levels of dissolved and total organic carbon in the water. High levels of organic carbon in source water for drinking water is a concern due to the formation of carcinogenic byproducts during disinfection at water treatment facilities. Some species of algae produce compounds such as geosmin and 2-methylisoborneol that produce objectionable odors and taste in drinking water.[112]

The Central Valley Water Board's Selection of the Nitrate Effluent Limitation

In a prior draft of the Permit, the effluent limitation for nitrate was not the Primary MCL (10.0 mg/L), but a much more stringent performance-based average monthly limit of 0.26

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[107] Lehman, P.W., et al., *The Influence of Environmental Conditions on the Seasonal Variation of Microcystis Cell Density and Microcystins Concentration in the San Francisco Estuary* (2008).

[108] *Ibid.*

[109] Mioni, C.E., *What Controls Microcystis Bloom & Toxicity in the San Francisco Estuary?* (Summer/Fall 2008 & 2009).

[110] *Ibid.*

[111] Central Valley Water Board staff presentation, (Dec. 9, 2010), slide 9.

[112] Heidel, K., et al., *Conceptual Model for Nutrients in the Central Valley and Sacramento-San Joaquin Delta*, (Sept. 2006).

mg/L.[113] The Central Valley Water Board's tentative permitting options stated that full denitrification was necessary in order to protect the aquatic life beneficial use of the Delta. It also concluded that if the "controlling beneficial use" is MUN, the Primary MCL with dilution credit, would result in no additional requirements for nitrate removal than is currently required (i.e., in the 2000 Permit).[114] The prior draft's fact sheet stated that the 0.26 mg/L effluent limitation was based on an analysis prepared for the District.[115]

The District's comments on the prior draft of the Permit state that this effluent limitation is unachievable. Further, the District claims that in the absence of being able to identify or support appropriate numeric criteria to interpret the narrative water quality objective, the Central Valley Water Board is precluded from adopting a final water quality-based effluent limitation for the protection of aquatic life.[116] In response, the Central Valley Water Board acknowledged the District's claim of the inability to achieve the 0.26 mg/L effluent limitation and adopted the current Primary MCL without any dilution. It has been noted that nitrogen-based cultural eutrophication becomes more difficult to address the longer it is left unchecked.[117] Nitrogen loadings accumulate and persist in water systems in a way that can exacerbate future water quality problems.[118] The Central Valley Water Board adopted the 10.0 mg/L effluent limit for nitrate to provide the District with a readily achievable effluent limitation that is commonly met within California by other publicly-owned treatment works, yet would require the District to at least partially denitrify its effluent in order to place a partial check on the existing cultural eutrophication problem occurring downstream of the discharge.[119]

The Permit's Existing Effluent Limitation for Nitrate is Reasonable

[113] Tentative Waste Discharge Requirements Order No. R5-2010-xxxx (Sept. 3, 2010), p. 13.

[114] Tentative NPDES Permitting Options (Sept. 3, 2010), p. 8.

[115] Tentative Waste Discharge Requirements Order No. R5-2010-xxxx (Sept. 3, 2010), pp. F-71-72. The analysis referred to is *Technical Memorandum: Analysis of Costs and Benefits of Advanced Treatment Alternatives for the Sacramento Regional Wastewater Treatment Plant*, prepared by Larry Walker Associates and dated May 2010.

[116] Letter from District Engineer Stan Dean, Sacramento Regional County Sanitation District, to Kathleen Harder (Oct. 11, 2010), pp. 55-56.

[117] *Upper Blackstone Water Pollution Abatement Dist. v. U.S. Environmental Protection Agency* (1st Cir. 2012) 690 F.3d 9, 23.

[118] *Ibid.*

[119] Central Valley Water Board Staff Response to Comments, p. 34.

As previously noted, the Permit has been administratively continued since 2005 and was five years late at the time it was adopted.[120] Neither the Clean Water Act, nor U.S. EPA's regulations allow indefinite delay until better science can be developed, or a statewide policy can be adopted. In almost every case, more data can be collected and the hope or anticipation that better science will materialize is always present in the context of science-based agency decision-making. Congress was aware of this when it nonetheless set a firm deadline for issuing new permits.[121] The U.S. Supreme Court has held that U.S. EPA cannot avoid its statutory obligation by noting the presence of uncertainty.[122] Various appellate courts have held that where a complex statute requires an agency to set a numerical standard or effluent limitation, it will not overturn the agency's choice of a precise figure where it falls within the "zone of reasonableness."[123]

Similarly, where a statute is precautionary in nature and where the evidence difficult to come by, uncertain, or even conflicting because it is on the frontiers of scientific knowledge, a rigorous step-by-step proof of cause and effect is not required.[124] Beneficial Uses must be protected, including downstream beneficial uses.[125] We have previously noted that regional water boards can, and should, take preventative action to regulate discharges that may affect the quality of the waters of the state from degradation.[126] Additionally, the Study Panel to the California State Water Resources Control Board which prepared a report (Study Panel Report) on recommended changes in water quality control for the Legislature in March 1969 stated that corrective actions must be initiated before a problem becomes acute and forces are set in motion which may well be irreversible except over very long periods of time.[127]

While the Primary MCL is intended to protect human health and there is adequate dilution available in the receiving water to protect that use, the allowance of dilution

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[120] 33 U.S.C. § 1342(a)(3); 40 C.F.R. § 122.46(a)-(b).

[121] *Upper Blackstone Water Pollution Abatement Dist. v. U.S. Environmental Protection Agency, supra*, 690 F.3d at p. 23.

[122] *Massachusetts v. U.S. Environmental Protection Agency* (2007) 549 U.S. 497, 534.

[123] *Upper Blackstone Water Pollution Abatement Dist. v. U.S. Environmental Protection Agency, supra*, 690 F.3d at p. 28; *National Maritime Safety Assn. v. Occupational Safety & Health Admin.* (D.C. Cir. 2011) 649 F.3d 743, 752; *Reynolds Metals Co. v. U.S. Environmental Protection Agency* (4th Cir. 1985) 760 F.2d 549, 559.

[124] *Miami-Dade County v. U.S. Environmental Protection Agency* (11th Cir. 2008) 529 F.3d 1049, 1064-65 (quoting *Ethyl Corp. v. Environmental Protection Agency* (D.C. Cir. 1976) 542 F.2d 1, 28).

[125] State Water Board Order WQ 2008-0008 (*City of Davis*), pp. 12-13.

[126] State Water Board Order No. WQ 82-2 (*Marina County Water Dist.*), p. 16.

[127] Final Report of the Study Panel to the California State Water Resources Control Board, *Recommended changes in Water Quality Control*, (March 1969), pp. 3 and 15.

credits and a mixing zone will not protect all of the beneficial uses of the receiving waters downstream of the discharge. Since the Delta, Suisun Bay, and the greater San Francisco Bay are presently exhibiting cultural eutrophication at the current nutrient loading levels, without a reduction in the current nutrient loading by the District, nitrification without denitrification will not be protective of downstream beneficial uses and will only exacerbate the ecological decline of the Bay-Delta ecosystem. Nutrient reduction in the Sacramento River is a critical step to restoring the Bay-Delta ecosystem's health and better protecting drinking water supplies. As such, the Central Valley Water Board was correct in requiring denitrification of the District's discharge.

An average monthly effluent limitation of 10.0 mg/L for nitrate as nitrogen is appropriate given the totality of the circumstances and is within the zone of reasonableness. The Central Valley Water Board correctly concluded that this limit is readily achievable using standard nitrate removal technologies.[128] Currently, of the 267 NPDES-permitted publicly-owned treatment works (POTWs) in California, 79 include effluent limitations for nitrate or nitrate plus nitrite. Of those 79 POTWs, 72 have effluent limitations between 5.0 and 10.0 mg/L. The Facility's use of standard nitrate removal technologies will be an important initial step in restoring Bay-Delta ecosystem health.[129]

This is not the first occasion that the State Water Board has upheld a similar effluent limitation for nitrogen in order to reduce nutrient loading and protect downstream receiving waters from exceeding a narrative biostimulatory objective. In *Los Coyotes*, the Los Angeles Regional Water Quality Control Board (Los Angeles Water Board) established a final effluent limitation for total inorganic nitrogen of 8.0 mg/L, based on the performance of a different wastewater plant operated by the same discharger.[130] At the time, the Los Angeles Water Board lacked conclusive evidence whether the algae impairment was being caused by excess nitrogen, but knew that the two facilities were major, controllable point sources of nitrogen. In our *Los Coyotes* order, we concluded that it was reasonable for the Los Angeles

[128] Central Valley Water Board Staff Response to Comments, p. 34.

[129] Both the Central Valley Water Board and the San Francisco Bay Water Board should recognize that the requirement to control the Facility's nitrogen discharge is simply an initial step. These Boards should consider future regulatory efforts across relevant portions of their regions to limit the total nutrient loading from major sources to the Bay-Delta ecosystem.

[130] State Water Board Order WQO 2003-0012 (*Los Coyotes*), p. 6. The *Los Coyotes* order concerned two NPDES-permits for the Los Coyotes Water Reclamation Plant and the Long Beach Water Reclamation Plant. The 8.0 mg/L effluent limitation was based on the performance of the Whittier Narrows Water Reclamation Plant. All three facilities are owned and operated by the County Sanitation District of Los Angeles.

Water Board to impose the performance-based effluent limitation rather than impose a more stringent water quality-based effluent limitation.[131]

As in *Los Coyotes*, the Facility is a major, controllable point source of nitrogen (currently as ammonium-nitrogen) which is contributing to the cultural eutrophication and exceedance of the downstream biostimulatory objectives. While the Suisun Marsh is currently on U.S. EPA's current Section 303(d) list as impaired for nutrients, neither the San Francisco Bay, nor the Delta are listed as impaired for nutrients. However, we have previously recognized that because a waterbody is not listed does not necessarily mean that the waterbody has assimilative capacity for a pollutant.[132] Additionally, as noted in *Marina County Water District* and the Study Panel Report, a regional water board should take preventative action to regulate discharges before a water quality problem becomes acute and may be irreversible except over very long periods of time. The Central Valley Water Board correctly took action to prevent additional detrimental impacts to the Bay-Delta ecosystem.

Upholding the Permit's average monthly effluent limitation of 10.0 mg/L for nitrate will require the District to include standard nitrate removal technologies at the same time that it upgrades the Facility to comply with the other requirements of the Permit. It may be more cost-effective to construct and operate a combined system (i.e., a system that nitrifies and denitrifies) rather than first constructing a nitrification treatment process and then later constructing a denitrification treatment process.[133] Additionally, an option for a combined system may allow a better use of the District's resources.

~~The Central Valley Water Board was certainly justified in being concerned about total nutrient loading from the District's discharge even after full nitrification. Among the reasons for concern are: (1) the impairment by nutrients to the Suisun Marsh Wetlands; (2) data showing that the nutrient concentrations downstream of the discharge are more than double the upstream concentrations; and (3) data showing that the levels of total nitrogen and total phosphorus in the discharge consistently exceed U.S. EPA's recommended Aggregate Ecoregion 1 nutrient levels.[80]~~An alternate avenue available to the Central Valley Water Board for regulating the District's discharge of total nitrogen was to use U.S. EPA's water quality criteria for nutrients to calculate a water-quality based numeric effluent limitation. U.S. EPA

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[131] *Id.* at p. 8.

[132] State Water Board Order WQ 2001-16 (*Napa Sanitation Dist.*), p. 22.

[133] Metcalf & Eddy, Inc., *Wastewater Treatment/Disposal/Reuse*, (3d ed., 1991), pp. 711-727. We take official notice of the reference guide (Cal. Code Reg., tit. 23, § 648.2).

section 304(a) criteria establishes recommended Aggregate Ecoregion I nutrient levels of 0.31 mg/L for total nitrogen.[134] ~~While these concerns are appropriate, they do not resolve the issue of the appropriate limitations on nutrient loading from the Facility's discharge.~~ Receiving water concentrations for total nitrogen upstream of the District's discharge range from 0.12 mg/L to 0.89 mg/L and averaging at 0.39 mg/L.[135] This average exceeds the Ecoregion I level of 0.31 mg/L. Because there is no assimilative capacity in the Sacramento River, an end-of-pipe effluent limitation for total nitrogen could be established at 0.31 mg/L as a monthly average. While this nitrogen level is expected to be fully protective of aquatic life beneficial uses, technological and economic considerations are not conducive to using this end-of-pipe effluent limitation. Additionally, an end-of-pipe limit of 0.31 mg/L may not be technologically feasible with standard treatment technologies.[136] A nitrate effluent limitation of 10.0 mg/L as nitrogen is not only protective for human health relative to the MUN beneficial use, but it also provides a technologically attainable performance-based level for protection of aquatic life and the reduction of a major source of nutrients to the Bay-Delta ecosystem. This reduction in nutrient loading will provide an initial step in compliance with the narrative objective for biostimulatory substances.

State and regional water board staffs, working collaboratively with U.S. EPA, have developed a draft science-based approach to translate narrative water quality objectives for biostimulatory substances to numeric target thresholds for inland surface waters. This approach, known as the Nutrient Numeric Endpoint (NNE) framework, establishes a suite of biologically -based numeric endpoints to address nutrient over-enrichment and cultural eutrophication. A draft NNE framework currently exists for streams and lakes. In order to be employed, the NNE framework requires a conceptual model specific to the ~~water body~~waterbody. The NNE framework for San Francisco Bay, the Delta, and smaller estuaries is currently under development. Staff will be presenting the NNE framework, in concert with a

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~~80~~134 Ambient Water Quality Criteria Recommendations, Rivers and Streams in Ecoregion I (U.S. EPA, Dec. 2001) (EPA 822-B-01-012). Ecoregion ~~1~~I includes the Central Valley and recommends a median concentration of ~~0.66~~0.31 mg/L of total nitrogen and ~~0.055~~0.047 mg/L of total phosphorus. U.S. EPA developed these nutrient criteria recommendations with the intent that they serve as a starting point for states and Tribes to develop more refined criteria to reflect local conditions. In its response to the petitions, the Central Valley Water Board referred to the incorrect limits for total nitrogen and total phosphorus in the U.S. EPA nutrient criteria and that mistake was repeated in the prior draft of this Order.

135 Central Valley Water Board, Nutrient Concentrations and Biological Effects in the Sacramento-San Joaquin Delta (July 2010).

136 As previously noted the District's response to the September 2010 tentative permit stated that a similar effluent limitation (0.26 mg/L) is "unachievable." (See Letter from District Engineer Stan Dean, Sacramento Regional County Sanitation District, to Kathleen Harder (Oct. 11, 2010), pp. 55-56.)

statewide policy for nutrient control for inland surface waters for future State Water Board consideration. However, it will still take considerable effort after State Water Board adoption of the NNE framework to develop the site-specific conceptual model(s) necessary to implement the framework and generate sufficiently protective water quality-based effluent limitations for the District's discharge. Use of the NNE framework will result in scientifically-based thresholds to fully implement the narrative biostimulatory objectives found in the basin plans.

~~Given these on-going policy developments and the need to protect downstream beneficial uses, we remand the Permit to the Central Valley Water Board to re-evaluate the need to control the District's discharge of nutrients (total nitrogen and phosphorus) on a basis other than human health.[84] If a statewide nutrient policy is in effect prior to the District's ten year compliance date for ammonia, the Central Valley Water Board shall use the policy's approved method to calculate the District's final numeric effluent limitations. If no statewide nutrient policy is in effect, the Central Valley Water Board may consider developing a site-specific conceptual model and utilize the NNE framework to calculate final nutrient numeric effluent limitations.~~

The Central Valley Water Board was certainly justified in being concerned about total nutrient loading from the District's discharge even after nitrification. Among the reasons for concern include:

1. The impairment by nutrients to the Suisun Marsh Wetlands;
2. Data showing that the nutrient concentrations downstream of the discharge are more than double the upstream concentrations;
3. Evidence that the San Francisco Bay and Delta are receiving excessive nutrients despite the existing biostimulatory substances objectives in the basin plans;
4. The Bay-Delta ecosystem has undergone a shift from a nitrate-based diatom phytoplankton system, to an ammonium-based phytoplankton and small-sized zooplankton community;
5. Cultural eutrophication has led to microcystins levels exceeding the World Health Organization's recommended drinking water standards in the Delta;
6. Data showing that excess nutrients are impacting the taste and odor of drinking water supplies; and,
7. Data showing that the levels of total nitrogen and total phosphorus in the discharge consistently exceed U.S. EPA's recommended Aggregate Ecoregion I nutrient levels.

~~[84] If denitrification is required for the control of nutrients, the Central Valley Water Board should consider whether year round denitrification is necessary since conditions necessary for biostimulation may not occur on a year-round basis.~~

These concerns are appropriate, and we find the Central Valley Water Board sufficiently justified the denial of dilution credits and a mixing zone for nitrate and that the use an end-of-pipe effluent limitation of 10.0 mg/L for nitrate to be within the zone of reasonableness.

Public Notice Requirements

CSPA contends that the Central Valley Water Board violated U.S. EPA's regulations by making significant changes to the Permit after the closure of the public comment period without recirculating the revised permit for comment. We find that this contention lacks merit.

Federal regulations require that draft NPDES permits shall be released to the public for at least a thirty-day public comment period.[82137] Courts have noted that a final permit issued by an agency need not be identical to the draft permit, which would be antithetical to the whole concept of notice and comment.[83138] However, a final permit that departs from a proposed permit must be a logical outgrowth of the noticed proposal. If the interested parties reasonably could have anticipated the final version from the draft permit, then an additional notice and comment period is not required.[84139] The law does not require that every alteration in a proposed permit result in a new notice and comment period.[85140]

The Central Valley Water Board met its NDPES notice obligations when it noticed the draft permit on September 3, 2010. CSPA does not provide any evidence of how the draft permit was modified such that it was beyond the scope of the comments received. We have reviewed the changes made after the close of the comment period. The changes are within the scope of the noticed permit and responsive to comments and information received. Additionally, CSPA has not shown or even alleged that its rights were violated as a result of the modifications. The transcript of the adoption hearing shows that CSPA commented on the revisions.[86141] Finally, CSPA incorrectly contends that U.S. EPA's NPDES regulations obligated the Central Valley Water Board to recirculate the revised draft permit for another public

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[82137] 40 C.F.R. § 124.10(b).

[83138] *Natural Resources Defense Council v. U.S. Environmental Protection Agency* (9th Cir. 2002) 279 F.3d 1180, 1186.

[84139] *Ibid.*

[85140] *First Am. Discount Corp. v. Commodity Futures Trading Comm.* (D.C. Cir. 2000) 222 F.3d 1008, 1015.

[86141] Central Valley Water Board Hearing Transcript (Dec. 9, 2010), pp. 304-313.

comment period. CSPA's reliance on section 124.14 of title 40 of the Code of Federal Regulations is misplaced. That section does not apply to the states, only to U.S. EPA.[87142]

ORDER

IT IS HEREBY ORDERED that ~~this matter be remanded to the Central Valley Water Board. Except for the following matters, all other aspects of the Permit are upheld. The Central Valley Water Board shall make revisions to the Permit that are~~the final effluent limitations for Ammonia Nitrogen (Total as N) and the Ammonia Effluent Limitations Calculation Table in Waste Discharge Requirements Order No. R5-2010-0114 [NPDES No. CA0077682] be amended to be consistent with this Order.

~~1. The Central Valley Water Board shall review the calculation of its effluent limitations for ammonia and utilize the lower chronic criterion set forth in the Fact Sheet based on a pH of 8.0 and a temperature of 22.5°C.~~

~~2. The Central Valley Water Board shall re-evaluate control of the District's discharge of nutrients (total nitrogen and phosphorus) on a basis other than human health.~~

~~3. If the Central Valley Water Board determines that denitrification is necessary to comply with the biostimulatory substances narrative objective, it should either:~~

~~a. Calculate final numeric effluent limitations to control nutrients (total nitrogen and phosphorus) pursuant to the statewide nutrient policy if such a policy is in effect before the District's ammonia compliance date; or,~~

~~b. If no statewide nutrient policy is in effect, the Central Valley Water Board may consider developing a site-specific conceptual model and utilize the NNE framework to calculate final nutrient numeric effluent.~~

~~4. The Central Valley Water Board, in order to protect the MUN beneficial use, should reconsider the allowance of dilution credits and a mixing zone for nitrate. It should also consider whether the effluent limitation should be expressed as the sum of nitrate and nitrite.~~

CERTIFICATION

The undersigned, Clerk to the Board, does hereby certify that the foregoing is a full, true, and correct copy of an order duly and regularly adopted at a meeting of the State Water Resources Control Board held on _____.

[87142] See 40 C.F.R. § 123.25.

AYE:

NO:

ABSENT:

ABSTAIN:

DRAFT

Jeanine Townsend
Clerk to the Board

DRAFT

STATE OF CALIFORNIA

STATE WATER RESOURCES CONTROL BOARD

ORDER WQ 2012-

In the Matter of Own Motion Review of

Waste Discharge Requirements Order No. R5-2010-0114
[NPDES No. CA0077682]
for

SACRAMENTO REGIONAL WASTEWATER TREATMENT PLANT

Issued by the
California Regional Water Quality Control Board,
Central Valley Region

SWRCB/OCC FILES A-2144(a) and A-2144(b)

BY THE BOARD:

In this Order, the State Water Resources Control Board (State Water Board or Board) reviews on its own motion National Pollutant Discharge Elimination System (NPDES) permit and Waste Discharge Requirements Order No. R5-2010-0114 (Permit) issued by the Central Valley Regional Water Quality Control Board (Central Valley Water Board) to the Sacramento Regional County Sanitation District (District). The Permit authorizes effluent discharges from the District's Sacramento Regional Wastewater Treatment Plant (Facility) to the Sacramento River within the boundaries of the Sacramento-San Joaquin Delta (Delta). For the reasons discussed herein, the State Water Board upholds most of the Permit but amends the final effluent limitations for ammonia. Additionally, while the Order concludes that the Central Valley Water Board's stated reasons for denying dilution credits and a mixing zone were improper, this Order upholds the Permit's final effluent limitation for nitrate for other reasons stated herein.

BACKGROUND

The District owns and operates the Facility. The Facility was constructed in 1982 and provides "secondary" level treatment.[1] The District provides sewerage service to the

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[1] Compliance with secondary treatment standards represents the *minimum* standard for all publicly owned treatment works nationwide. (See 33 U.S.C. § 1311(b).)

Cities of Sacramento, Folsom, West Sacramento, and the Sacramento Area Sewer District service area. The Sacramento Area Sewer District includes the Cities of Elk Grove, Rancho Cordova, Citrus Heights, Courtland, and Walnut Grove, as well as portions of the unincorporated areas of Sacramento County. The population served is approximately 1.3 million people. The District owns and operates the main trunk lines and interceptors feeding the Facility, while the smaller diameter collection systems are owned and operated by the various contributing agencies.

The Facility is a regional wastewater plant and has an average dry weather flow design capacity of 181 million gallons per day (mgd). Currently, the Facility's average dry weather flow is 141 mgd. The Facility's current permitted discharge flow of 181 mgd represents nearly 60 percent of the total volume of all publicly owned treatment works' permitted discharges within the Delta[2] that are within the Central Valley Water Board's jurisdiction. The Facility is one of the three remaining wastewater treatment plants under the Central Valley Water Board's jurisdiction that discharge within the Delta and only provide secondary treatment to its effluent.[3] The Facility's treatment system consists of mechanical bar screens, aerated grit removal, primary sedimentation, pure oxygen activated sludge aeration, secondary clarification, chlorine disinfection with dechlorination, and a diffuser for discharges to the Sacramento River. Solids handling consists of dissolved air flotation thickeners, gravity belt thickeners, anaerobic digesters, and sludge stabilization basins with disposal on-site through land application or a biosolids recycling facility.[4]

The Facility discharges to the Sacramento River from an outfall diffuser downstream of the Freeport Bridge. The outfall discharges within the legal boundaries of the Delta. The existing beneficial uses of the Delta, as listed in the *Water Quality Control Plan for the Sacramento River and San Joaquin River Basins* (Basin Plan), include: municipal and domestic supply (MUN); agricultural supply (AGR); water contact recreation (REC-1); non-contact water recreation (REC-2); warm freshwater habitat (WARM); and cold freshwater habitat (COLD). The outfall diffuser is approximately 300 feet long with 74 ten-inch diameter ports and is placed perpendicular to the river flow. At the point of discharge, the Sacramento

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[2] Wat. Code, § 12220.

[3] The other two facilities are the Discovery Bay Wastewater Treatment Plant (see Order No. R5-2008-0179) and the City of Rio Vista's Beach Wastewater Treatment Facility (see Order No. R5-2008-0108-1). These facilities are authorized to discharge up to 2.1 mgd and 0.65 mgd respectively.

[4] The Permit regulates only the Facility. The biosolids, solids storage, and disposal facilities are regulated pursuant to Waste Discharge Requirements Order No. R5-2003-0076.

River is approximately 600 feet wide at the surface with a bottom width of approximately 400 feet and depth of 25 to 30 feet.[5]

During low river flows, tidal activity can cause the river in the vicinity of the outfall to flow northward, in the reverse direction, towards the City of Sacramento. The Discharger diverts its discharge to emergency storage basins whenever these conditions exist.

The Central Valley Water Board issued the Permit on December 9, 2010. The Permit is a renewal of the District's prior permit that was issued in 2000 and had been administratively extended since 2005. Contrary to the District's claim that the Permit renewal was "characterized by haste, particularly related to the major issues that are subject to this appeal[,]"[6] the administrative record contains evidence of a decade-long effort on the part of the Central Valley Water Board to study and understand the Delta and the Facility's effect on it and water quality in general. The record reveals the effort made by the Central Valley Water Board staff to understand the extremely complex scientific issues involved with this Permit's development. As a result of this effort, the Permit contains several new or more stringent effluent limitations and requirements. Recognizing these changes, the Permit will require substantial changes to the character of the District's discharge and upgrades to the Facility to meet the Permit's requirements. The Permit grants the District up to ten years before some of the final effluent limitations take effect.

In response to the Permit's adoption, the District and the California Sportfishing Protection Alliance (CSPA) both filed timely petitions for review with the State Water Board. After deeming the petitions complete, consolidating them for review, receiving the response and administrative record from the Central Valley Water Board, and responses from interested persons, we adopted Order WQ 2011-0013 on September 19, 2011, taking this matter up on our own motion. We granted own motion review in order to have sufficient time to adequately review the voluminous submissions and allow a detailed legal and technical review of the submissions. During our review of the petitions and the administrative record, the District and interested persons submitted numerous requests to file supplemental pleadings and augment the administrative record. These requests were granted in part and denied in part on November 22, 2011. Subsequently, the District filed a petition for writ of mandate with the

[5] Waste Discharge Requirements Order No. R5-2010-0114, p. F-82.

[6] District's Petition for Review of Waste Discharge Requirements Order No. R5-2010-0114 (SWRCB/OCC File A-2144(a)), p. 15.

Sacramento Superior Court.[7] Unless the District withdraws its petition with the Superior Court or an extension is granted, that judicial proceeding is stayed until December 10, 2012.

ISSUES AND FINDINGS

Between the two petitions, a total of over 80 contentions were raised claiming fault with nearly every aspect of the Permit. This Order addresses only a few topics – primarily pathogens, ammonia, and nitrate. To the extent petitioners raised issues that are not discussed in this Order, either in whole or in part, such issues are dismissed as not raising substantial issues appropriate for our review.[8]

Pathogens and Filtration

The Permit contains a final effluent limitation for total coliform organisms of 2.2 most probable number (MPN) per 100 milliliters.[9] The Permit also requires the District's effluent discharged to the Sacramento River to be oxidized, coagulated, filtered, and adequately disinfected pursuant to the California Department of Public Health (CDPH) reclamation criteria, California Code of Regulations, title 22, division 4, chapter 3 (commencing with section 60301), or equivalent.[10] The District contends that the new filtration requirements are not justified, and that the Central Valley Water Board mischaracterizes the site-specific risk assessment provided by the District. Based on our technical review of the evidence in the record and in light of CDPH's site-specific recommendation, we find that the Central Valley Water Board correctly concluded that the Permit's requirement to provide equivalent to "disinfected tertiary recycled water"[11] level of treatment is appropriate and necessary to protect beneficial uses at and around the point of discharge.

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[7] *Sacramento Regional County Sanitation Dist. v. Cal. Regional Water Quality Control Bd., Central Valley Region* (Super. Ct. Sac. County, Case No. 34-2011-80001028). The effective date of the final effluent limitations that are the subject of the petition for writ of mandate are extended for a period equal to the duration of the court-imposed, stipulated stay.

[8] *People v. Barry* (1987) 194 Cal.App.3d 158, 175-177; *Johnson v. State Water Resources Control Bd.* (2004) 123 Cal.App.4th 1107, 1114; Cal. Code Regs., tit. 23, § 2052, subd. (a)(1).

[9] "Most probable number" is a measure of the number of colony forming units of bacteria in a culture grown with a water sample on specific media for the bacteria of interest.

[10] Waste Discharge Requirements Order No. R5-2010-0114, p. 33.

[11] "Disinfected tertiary recycled water" is defined as an oxidized (i.e., secondary treated or equivalent) wastewater that has been coagulated, filtered, and disinfected using chlorine, meeting a chlorine concentration and contact time standard, or an equivalent process, meeting a virus inactivation standard, including that the median total coliform bacteria concentration does not exceed an MPN of 2.2 per 100 milliliters as a 7-day average, the number of total coliform bacteria does not exceed an MPN of 23 per 100 milliliters in more than one sample in any 30-day period, and no sample exceeds an MPN of 240 total coliform bacteria per 100 milliliters. (Cal. Code Regs., tit. 22, § 60301.230.)

The Central Valley Water Board found that the Sacramento River is currently being used for AGR and REC-1 purposes at or near the outfall. Dilution in this vicinity is less than 20 to 1[12] and the potential for "double dosing"[13] occurs during some low river flow conditions coinciding with tidal influences. While the Central Valley Water Board's determination to impose its requirements may be criticized as being conservative, we have previously recognized that it is within a regional water quality control board's (regional water board's) discretion to be conservative in its approach when faced with decisions involving public health protection.[14]

The treatment level of wastewater affects how effectively and efficiently it can be disinfected. A cleaner effluent can be more effectively disinfected, because constituents in the effluent may affect how thoroughly the disinfectant inactivates pathogens in the effluent and the degree to which harmful disinfection byproducts are formed from the reaction between residual contaminants in the treated wastewater and the applied disinfectants.[15] The disinfection level required for wastewater is largely determined by the degree of public exposure and an acceptable level of risk for acquiring infection or illness as a result of exposure to the treated wastewater.

In California, CDPH determines this level of risk and the State Water Board or a regional water board may establish waste discharge requirements that mitigate the risk to the level identified by CDPH. CDPH has adopted general guidelines and, when requested will provide site-specific recommendations for the disinfection requirements necessary for municipal wastewater dischargers to comport with state public health policy and acceptable risk levels.[16] The *Uniform Guidelines for Sewage Disinfection* (*CDPH Guidelines*)[17] recommend specific

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[12] Unless specified otherwise, all ratios are expressed as receiving water to effluent.

[13] "Double Dosing" refers to a doubling of the concentration of pathogens due to flow reversals occurring during high tide and low flow conditions. While conditions in the Permit limit double dosing occurrences, they are not eliminated due in part to the varying strength of the tidal influence. (See Waste Discharge Requirements Order No. R5-2010-0114, p. F-32, fn. 1.)

[14] See State Water Board Order WQ 95-4 (*City and County of San Francisco*), p. 21.

[15] Residual particulate matter in treated wastewater can shield pathogens from contact with disinfectant, and residual chemical constituents in the treated wastewater can form disinfection byproducts that can be toxic to humans, animals, and aquatic life when discharged to water bodies. (See Emerick, Robert W. et al., *Factors Influencing Ultraviolet Disinfection Performance Part II: Association of Coliform Bacteria with Wastewater Particles*, (Sept./Oct. 1999) Water Environment Research, p. 1178; Waste Discharge Requirements Order No. R5-2010-0114, p. F-75.)

[16] State Department of Health Services, *Uniform Guidelines for Sewage Disinfection* (Nov. 1980). The State Department of Health Services is the predecessor to the current California Department of Public Health.

[17] Prior to the State Water Board workshop held on July 18, 2012 (July 18 Workshop), the District requested that the State Water Board take official notice of two CDPH documents: *Wastewater Disinfection for Health Protection*, Sanitary Engineering Branch, California Department of Health Services (Feb. 1987); and Memorandum to Office of *(Continued)*

treatment and disinfection levels based on available dilution in the receiving waters. According to the *CDPH Guidelines*, the amount of dilution available is based on "low flow over an average period of time and not the instantaneous minimum low flow of the year."[18] As noted by the District, following the *CDPH Guidelines*, the District would not be required to meet a "2.2 MPN" level of treatment based on the average dilution provided by receiving waters at the point of discharge. Following the *CDPH Guidelines*, a "23 MPN" level of treatment, as currently provided by the District, would be required.

However, since the District's discharge and the circumstances surrounding the District's discharge are unique, the Central Valley Water Board and CDPH staffs determined that a site-specific evaluation of the discharge should be conducted to establish disinfection requirements. Conducting site-specific evaluations when setting disinfection requirements is "best practice" and consistent with guidance from CDPH and the United States Environmental Protection Agency (U.S. EPA).[19] The reasons that the Central Valley Water Board and CDPH considered the District's discharge unique include:

1. Double Dosing: Unique to the Sacramento River at the point of discharge are the tidal flows that slow the river flow, and at times cause flow reversals. After the high tides which occur in varying magnitudes twice daily, the areas downstream of the District's outfall can be "double dosed" with effluent when the high tide recedes. The doubling of effluent concentrations similarly doubles the concentration of pathogens.[20] While conditions in the Permit limit double dosing occurrences, they are not eliminated;

Drinking Water Management Staff, from Office of Drinking Water, Peter A. Rogers, Chief (Aug. 18, 1992) re: Uniform Guidelines for Disinfection of Wastewater, including attached Uniform Guidelines for the Disinfection of Wastewater (1992 CDPH Memo). Neither the Water Agencies, nor the Central Valley Water Board objected to taking official notice of these two items. The State Water Board takes official notice of these two items. However, since the 1980 *CDPH Guidelines* was included in the administrative record and the Permit relies on and refers to it, this Order continues to refer to the *CDPH Guidelines* and references the 1980 version. Taking official notice of the 1987 document and 1992 CDPH Memo does not alter the conclusions of this Order.

[18] State Department of Health Services, *Uniform Guidelines for Sewage Disinfection* (Nov. 1980), p. 5.

[19] On July 26, 1976, U.S. EPA removed the fecal coliform bacteria limitations from the definition of secondary treatment in the Code of Federal Regulations, title 40, part 133 (41 Fed. Reg. 30786 (Jul. 26, 1976)). This change resulted in bacteria effluent limitations in NPDES permits being established as water quality-based effluent limitations instead of as technology-based effluent limitations. On this same date, U.S. EPA published the Quality Criteria for Water (The Red Book, EPA 440/9-76-023, Jul. 1976), which are U.S. EPA recommendations for water quality criteria intended to be used by states as guidelines for development of receiving water specific water quality standards including development of bacteria water quality criteria and corresponding disinfection requirements. The current version of these criteria was published in 1986 (The Gold Book, EPA 440/5-86-001, May 1986). The purpose of this change was to encourage states to develop site-specific disinfection requirements that consider both public health hazards (i.e., the site specific-need to protect the public from disease as a result of consumption or contact with the receiving water) and potential adverse impacts on aquatic life in the receiving water resulting from disinfection byproducts. The 1992 CDPH Memo notes that, "[a]ll discharges of wastewater or reclaimed water which may affect domestic water supplies should be considered on a case by case basis taking all factors into account."

[20] See Waste Discharge Requirements Order No. R5-2010-0114, p. F-32.

2. Low Flow Conditions: Dilution of the effluent normally exceeds 20 to 1 after complete mixing of the effluent in the river which occurs one to two miles downstream of the point of discharge. Dilution within the mixing zone downstream of the point of discharge can be significantly lower than 20 to 1. This can occur under a variety of regularly occurring river flow and tidal conditions, including when river flows are at the minimum level allowable for the District's discharge (i.e., a dilution of 14 to 1 or less) and even when overall average dilution is greater than 20 to 1. The occurrence of river flows at the minimum level allowable for the District to discharge is not uncommon in dry years. Between January 2007 and June 2008, the District was required to cease discharging and to divert effluent to its storage basins on 137 occasions in order to meet the minimum dilution/flow conditions;[21]
3. Public Contact and Diversions within the Mixing Zone: The area around the point of discharge is a popular sport fishing area. Located within the mixing zone is Cliff's Marina. In addition, there are approximately 30 agricultural diversions within one mile upstream and two miles downstream (i.e., within the mixing zone) of the point of discharge that can potentially draw in varying mixtures of river water and effluent at dilution ratios less than 20 to 1;
4. Chlorine Contact Time: The Facility does not have a conventional chlorine contact chamber in its treatment train. Chlorine contact time for effluent disinfection is provided in the District's outfall pipe.[22] As a result, chlorine contact time varies with effluent flow rate and may be insufficient to provide adequate disinfection at times. Without a chlorine contact chamber, chlorine contact time can only be adjusted by adjusting the effluent flow rate. This limits the ability of the plant operators to adjust chlorine contact in order to achieve consistent contact time and, hence, consistent effluent disinfection; and,
5. Pathogen Removal Efficiency: Studies conducted on the District's effluent indicate that up to 20 percent of coliforms may be shielded from detection by solids in the effluent.[23] This is an indication that pathogens shielded by solids in the effluent may not be adequately inactivated by chlorination.

The *CDPH Guidelines* require a median MPN of 2.2 when a stream's low flow provides dilution of less than 100 to 1 to protect MUN use, and to protect AGR or REC-1 beneficial uses, a median MPN of 2.2 is required when a stream's low flow provides dilution of less than 20 to 1.[24] The *CDPH Guidelines* state that "[f]or these discharge situations it is particularly important to fully consider the individual circumstances so that adequate health protection is provided through the application of reasonable disinfection requirements. For example, it may be appropriate to reflect seasonal changes in recreational use, dilution at the use area, etc."[25] Additionally, the U.S. EPA publishes guidelines and recommendations for

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[21] Central Valley Water Board, *NPDES Permit Renewal Issues Drinking Water Supply and Public Health* (Dec. 14, 2009), p. 16.

[22] Letter from Assistant Executive Officer Ken Landau, Central Valley Water Board to Chief Carl Lischeske, California Department of Public Health (May 11, 2009), p. 2.

[23] Waste Discharge Requirements Order No. R5-2010-0114, p. F-75.

[24] *CDPH Guidelines*, p. 5.

[25] *Ibid.*

public health protection from recreational contact with pathogens in waters subject to wastewater discharges. The U.S. EPA guidelines and recommendations are "not rules and they do not have regulatory impact."[26]

Data submitted by the District to the Central Valley Water Board indicated the presence of *Giardia* cysts and *Cryptosporidium* oocysts in the Facility's discharge, prompting the Central Valley Water Board to request a site-specific health risk assessment.[27] CDPH met with the District and concluded that a formal risk assessment was appropriate. The District engaged third party professional services to conduct the risk assessment. The District's final risk report indicated that the combined average risk of infection from *Giardia* and *Cryptosporidium* for one swimming exposure is reported as 2.4 in 10,000 upstream of the District's outfall and 3.6 in 10,000 downstream of the District's outfall. Further, the District's final report indicated that the combined average risk of infection for ten swimming exposures is reported as 30.2 in 10,000 upstream of the District's outfall and 43.8 in 10,000 downstream of the District's outfall.[28] Upon presentation of the results, CDPH recommended that the District "provide additional treatment sufficient to reduce the *additional* risk of infection posed by exposure to its discharge to as close to 1 in 10,000 as can be achieved by a cost-combination using filtration and/or a disinfection process that effectively inactivates *Giardia* cysts and *Cryptosporidium* oocysts."[29] CDPH noted that according to the District's final risk assessment, the District's discharge "appears to be contributing at least 30 percent of the pathogens detected in the receiving waters," that "the average risk of infection from a single swimming exposure to the effluent is approximately one order of magnitude higher than this [additional risk

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[26] See The Gold Book, EPA 440/5-86-001 (May 1986), p. 2.

[27] Letter from Assistant Executive Officer Kenneth D. Landau, Central Valley Water Board to Chief Carl Lischeske, California Department of Public Health (May 11, 2009), p. 2.

[28] See Gerba, Charles, P., *Estimated Risk of Illness from Swimming in the Sacramento River* (Feb. 23, 2010). Dr. Gerba's draft risk assessment report notes that for ten swimming exposures, the risk of infection from *Giardia* and *Cryptosporidium* are 4.4×10^{-4} and 3.0×10^{-4}, respectively, upstream of the District's outfall and 9.0×10^{-4} and 5.8×10^{-4}, respectively, downstream of the District's outfall. Based on these results the risk of infection downstream of the District's outfall compared to upstream more than doubles due to *Giardia* in the District's effluent and nearly doubles due to *Cryptosporidium* in the District's effluent. (See Gerba, Charles, P., *Estimated Risk of Illness from Swimming in the Sacramento River* (Sep. 24, 2009).) State Water Board staff reproduced the risk calculations presented in both the District's draft September 2009 risk assessment report and in the final February 2010 report. State Water Board staff used the model and parameters presented and protozoa concentrations reported in the District's report and in the administrative record. State Water Board staff was able to reproduce the District's draft risk assessment results exactly, but could not reproduce the final risk model results. These estimates do not consider double dosing effects that result from the twice daily tidal influence at the point of discharge.

[29] Letter from Chief Gary H. Yamamoto, California Department of Public Health to Assistant Executive Officer Kenneth D. Landau, Central Valley Water Board (Jun. 15, 2010), p. 3 (first emphasis added).

of infection of 1 in 10,000] threshold," and that "[t]he estimated risk of infection from ten such exposures is two orders of magnitude higher."[30]

At the July 18 Workshop, the District asserted that the risk of infection is significantly lower than 1 in 10,000 downstream of the discharge since all *Giardia* are inactivated by chlorination of the effluent before discharge. CDPH staff correctly responded that this conclusion utilized tables for required chlorine concentration and contact time to inactivate *Giardia* that were prepared for "clean," low solids water which is inconsistent with the quality of the District's effluent.[31] In addition, the District's assessment of *Giardia* inactivation does not consider that up to 20 percent of pathogens may be shielded by solids in the effluent.

The chlorine contact time requirement for "disinfected tertiary recycled water" is "not less than 450 milligram-minutes per liter at all times with a modal contact time of at least 90 minutes, based on peak dry weather design flow."[32] This requirement is based on a filtered effluent which contains low particulate matter (i.e., turbidity in range of 1-2 Nephelometric Turbidity Units [NTU]) as a result of filtration. The District's effluent is not filtered and the effluent turbidity (i.e., an indirect measure of particulate in the effluent) recorded on 32 occasions between April 3, 2002 through April 6, 2006 ranges from 4.3 to 11.0 NTU.[33] As indicated by the District's data, chlorine contact times are generally, but not always, above 450 milligram-minutes per liter, but contact times rarely exceed 70 minutes.[34]

The District asserts that the U.S. EPA's Recreational Water Quality Criteria (U.S. EPA Rec Criteria) risk threshold is the appropriate risk standard to apply to its discharge. The reasons CDPH considers the additional 1 infection in 10,000 exposures risk threshold to be appropriate and the U.S. EPA Rec Criteria's risk threshold of 8 illnesses to 1,000 (i.e., 80 in 10,000) exposures inappropriate include:

1. The U.S. EPA Rec Criteria are based on risks posed by ambient recreational waters, where the pathogens present are from both human and animal sources. In the District's case, the discharge appears to be contributing at least 30 percent of the pathogens detected in the receiving water. The human origin of these pathogens renders them more hazardous to human swimmers;
2. The District's discharge is a controllable source, and the risk it poses is more readily abated by additional treatment. This is not true of waters impacted by non-point sources;

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[30] *Id.*, p. 2.

[31] Video recording of the July 18 Workshop, 2:12:45-2:14:00.

[32] Cal. Code Regs., tit. 22, § 60301.230, subd. (a).

[33] Gerba, Charles, P., *Estimated Risk of Illness from Swimming in the Sacramento River* (Feb. 23, 2010), p. 34.

[34] See Chlorine Free Elemental/Chlorine Contact Time Worksheet (2006-2009).

3. The U.S. EPA Rec Criteria represent a trade-off between the public's desire to swim in natural waters, and the minimum level of risk that could reasonably be achieved in 1986. CDPH questions whether this represents a level of risk that is currently 'acceptable' to the public; and,
4. CDPH considers an additional 1 in 10,000 risk of infection to be an acceptable risk from exposure to treated effluents, and used this as a basis for its Recycled Water Regulations. Dr. Gerba estimates that the average risk of infection from a single swimming exposure to the effluent is approximately one order of magnitude higher than this threshold. The estimated risk of infection from ten such exposures is two orders of magnitude higher.

CDPH staff reiterated its recommendation at the July 18 Workshop.

Effluent and instream monitoring data support CDPH's conclusion regarding the pathogenic load added by the District's discharge. The number of detections of potentially viable *Giardia* cysts and *Cryptosporidium* oocysts in water quality samples is significantly higher downstream of the discharge and in the effluent compared to upstream of the discharge.[35] In addition, instream monitoring results indicate that the average concentrations for both *Giardia* cysts and *Cryptosporidium* oocysts double from 100 feet upstream to 3,300 feet downstream of the discharge.

The size of the District's discharge is significant. The District's discharge represents 60 percent of all publicly owned treatment works' permitted discharge within the Delta[36] and approximately 85 percent of all wastewater discharged to the Sacramento River downstream of Shasta Dam.[37] The Basin Plan contains a water quality objective of a maximum geometric mean of 200 fecal coliform per 100 ml (i.e., approximately 8 in 1,000 risk of illness) for protection of REC-1 use.[38] Ambient water quality monitoring at Freeport, 100 feet upstream of the District's outfall, indicates that the long-term average fecal coliform concentration from 1992 to 2008-09 is 226 MPN/100ml and from 1992 to 2009-10 is 228 MPN/100ml.[39] Based on these data, the risk of illness from REC-1 use may currently exceed 8 in 1,000 upstream of the

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[35] For the period of June 1999 through April 2006, *Giardia* cysts and *Cryptosporidium* oocysts have been detected in 33 percent and 3 percent, respectively, of samples collected upstream of the discharge, and in 55 percent and 14 percent, respectively, of samples collected downstream of the discharge. During this same time period, *Giardia* cysts and *Cryptosporidium* oocysts have been detected in 95 percent and 89 percent, respectively, of effluent samples collected. (Gerba, Charles, P., *Estimated Risk of Illness from Swimming in the Sacramento River* (Feb. 23, 2010), p. 26.) These data indicate there are a significantly higher percentage of samples collected with potentially viable pathogenic protozoa in the District's effluent and in the receiving water downstream of the outfall compared to the ambient receiving water conditions upstream of the outfall.

[36] See Letter from Assistant Executive Officer Kenneth D. Landau, Central Valley Water Board to Chief Carl Lischeske, California Department of Public Health (May 11, 2009), p. 2.

[37] Waste Discharge Requirements Order No. R5-2010-0114, p. F-74.

[38] Basin Plan, p. III-3.00.

[39] See Sacramento Coordinated Monitoring Program, Appx. B, Summary Statistics (Dec. 1992-June 2010).

District's outfall. Thus, the Basin Plan water quality objective for REC-1 use just upstream of the District's outfall may not currently be met and, as a result, there may be no assimilative capacity for fecal coliform (i.e., pathogens) in the Sacramento River at, around, and downstream of the District's point of discharge.

The Central Valley Water Board found that the District's wastewater needed to be disinfected adequately to prevent disease. The Sacramento River near the outfall is a popular sport fishing area with a marina located within the mixing zone (REC-1 use) and there are at least 20 agricultural diversions within one mile upstream and two miles downstream of the outfall (AGR use).[40] Additionally, the Sacramento River is currently designated as a source of drinking water (MUN use).[41] Within a 2010 Progress Report on the Bay Delta Conservation Plan, there are five drinking water intakes proposed between Freeport and Courtland, near the outfall.[42]

While the Central Valley Water Board could have set effluent limits equivalent to "disinfected secondary-2.2 recycled water"[43] to minimally comport with CDPH's recommendation, this would not address issues with particle-associated pathogen indicators in the District's effluent. We have previously concluded that tertiary treatment may be a reasonable requirement where the treatment is necessary to achieve compliance with water quality standards and to protect water quality.[44] The Central Valley Water Board concluded that given the very high level of public contact with the receiving water, the use of the receiving water for irrigation, and the extensive use of Delta waters as private and public water supplies, any increased risk of illness and infection from exposure to the District's wastewater does not protect beneficial uses.[45] We agree. As we have previously concluded, effluent limitations must protect beneficial uses considering reasonable, worst-case conditions.[46]

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[40] Waste Discharge Requirements Order No. R5-2010-0114, p. F-73.

[41] State Water Board Resolution No. 88-63.

[42] See Progress Report on the Bay Delta Conservation Plan (Nov. 18, 2010), pp. 3-306, 4-15, and figure 3-52. We take official notice of this document (Cal. Code Reg., tit. 23, § 648.2) as it was publicly available and in existence at the time of the Permit's adoption by the Central Valley Water Board.

[43] "Disinfected secondary–2.2 recycled water" is defined as oxidized wastewater that has been disinfected such that the median concentration of total coliform bacteria does not exceed an MPN of 2.2 per 100 milliliters as a 7-day average, and the number of total coliform bacteria does not exceed an MPN of 23 per 100 milliliters in more than one sample in any 30-day period. (Cal. Code Regs., tit. 22, § 60301.220.)

[44] State Water Board Order WQ 2009-0012 (*City of Stockton*) and Order WQO 2004-0010 (*City of Woodland*). As we discussed in the *City of Woodland* order, "[t]ertiary treatment typically involves adding coagulation and filtration to a secondary treatment process. Other processes may also be used to achieve tertiary quality."

[45] Waste Discharge Requirements Order No. R5-2010-0114, p. F-77. U.S. EPA also commented that Title 22 tertiary filtration requirements were necessary for the protection of beneficial uses, specifically municipal and

(Continued)

In summary, a "2.2 MPN" level of treatment was deemed appropriate by the Central Valley Water Board for the following reasons:

1. The tidal influence and reverse flows at the point of discharge can lead to double dosing of the areas around and downstream of the discharge with effluent;
2. The potential for REC-1 and AGR user contact with the discharge at dilution ratios less than 20 to 1 around the point of discharge and within the mixing zone;
3. The relatively high number of solids associated coliform, the lack of a conventional chlorine contact chamber in the District's wastewater treatment plant, and associated issues with pathogen shielding by solids in the effluent may result in inconsistent and inadequate effluent disinfection;
4. The pathogenic load and resulting estimated risks of infection to users exposed to the effluent indicate that the discharge contributes significant numbers of viable pathogens to the receiving waters. The incremental risks of infection resulting from the discharge exceed 1 in 10,000 and, under worst case scenarios, exceed 8 in 1,000;
5. Under double dosing conditions, the approximate combined risk of infection from exposure to *Giardia* and *Cryptosporidium* in the effluent at a hypothetical 20 to 1 dilution ratio may be as high as 2 in 1,000 for 1 swimming exposure and 20 in 1,000 for 10 swimming exposures based on the District's final risk assessment results. The 10 swim exposures estimate, under double dosing conditions, exceeds by approximately 2.5 fold the 8 in 1,000 risk of illness criteria that U.S. EPA utilizes and the risk of illness criteria represented by the Basin Plan water quality objective for fecal coliform;
6. Per the Basin Plan water quality objective, the receiving waters must be maintained at such quality that the risk of illness does not exceed approximately 8 in 1,000. The District's discharge cannot be allowed to cause the receiving waters to exceed this objective nor utilize all of the available assimilative capacity. Under worst case scenarios, the discharge appears to both exceed the 8 in 1,000 threshold and, in light of the upstream monitoring results for fecal coliform noted above, may be utilizing all remaining available assimilative capacity in the receiving waters; and,
7. The proximity and potential impacts to existing and future drinking water intakes that can affect available dilution at the District's outfall and location and operation of drinking water diversions.[47]

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domestic supply. (Letter from Director Alexis Strauss, U.S. EPA, Region IX to Pamela Creedon, Executive Officer, Central Valley Water Board (Oct. 7, 2010), p. 5.)

[46] State Water Board Order WQ 2008-0008 (*City of Davis*), pp. 12-13.

[47] An additional issue with the District's discharge is its effect on existing and future drinking water diversions. The discharge has the potential to affect the existing upstream drinking water intake at Freeport during reverse flow events. Operational agreements between the District and the Freeport Water Authority require the District to stop discharging when 0.1 percent effluent is present at the drinking water intakes. This intake and operational agreement has only been in place for approximately two years. (See Central Valley Water Board, *NPDES Permit Renewal Issues Drinking Water Supply and Public Health* (Dec. 14, 2009).) With the proposed "disinfected tertiary recycled water" level of treatment for the District's discharge, this potential impact to the Freeport drinking water intake would not be present and the operational agreement in place to prevent it may not be necessary.

Future water diversions upstream of the discharge may affect available dilution for the discharge. The draft Bay-Delta Conservation Plan-associated North Delta Tunnel proposal could result in the diversion of significant volumes of water near the District's outfall. (See Progress Report on the Bay Delta Conservation Plan (Nov. 18, 2010), pp. 3-307 through 3-324.) If this were to occur upstream of the District's discharge, daily average dilution at the District's *(Continued)*

Given these concerns, the Permit requires an essentially pathogen-free wastewater discharge. Most technologies necessary to achieve this standard involve filtration to produce a very low-solids effluent. The Central Valley Water Board further found that filtration would have the added benefits of (1) reduction of total organic carbon, (2) substantial reductions in concentrations for copper, mercury, total suspended solids, and biochemical oxygen demand, and (3) potential reduction of other constituents. We conclude that the Central Valley Water Board appropriately adopted effluent limitations for total coliform organisms and filtration requirements at a level necessary to protect existing beneficial uses at and near the outfall as well as existing downstream beneficial uses for the Delta.

Water Code section 13241 Factors

The federal Clean Water Act permits states to establish their own effluent limitations as long as they are not "less stringent" than those set forth in the Clean Water Act.[48] The Porter-Cologne Water Quality Control Act (Porter-Cologne Act) requires regional water boards to implement the Clean Water Act in California and requires them to consider a list of factors when establishing water quality objectives (13241 Factors).[49] When establishing waste discharge requirements pursuant to Water Code, section 13263, the Porter-Cologne Act cross-references this list of factors.[50] The California Supreme Court has concluded that because both laws require regional water boards to comply with federal standards, and because the supremacy clause of the U.S. Constitution requires state law to yield to federal law, a regional water board is only required to consider the 13241 Factors (e.g., a discharger's cost of compliance) when an effluent limitation is more stringent than federal law requires.[51]

Under federal law, a regional water board has an obligation to protect beneficial uses, even if there is no appropriate water quality objective for the affected receiving water or

outfall would be significantly reduced. This may necessitate stricter discharge requirements, consistent with the CDPH Guidelines, at the "disinfected tertiary recycled water" level of treatment to ensure protection of beneficial uses. Additional operational agreements may be required with current and future diverters to ensure they do not intake river water with high concentrations of the District's effluent. Future diversions downstream of the discharge may need to be placed outside of the District's mixing zone to avoid intake of river water with high concentrations of the District's effluent. With the Permit's "disinfected tertiary recycled water" level of treatment, these potential impacts would not be present and additional flexibility in locating intakes would be available.

[48] 33 U.S.C. § 1370.

[49] Wat. Code, § 13241.

[50] See Wat. Code, § 13263, subd. (a) (referring to Wat. Code, § 13241).

[51] *City of Burbank v. State Water Resources Control Bd.* (2005) 35 Cal.4th 613, 618.

the existing water quality objectives are not protective enough.[52] When a regional water board adopts a permit under either of these scenarios, then the regional water board must consider the 13241 Factors. Conversely, when a regional water board adopts a permit that merely implements an existing water quality objective that serves as a federal water quality standard, there is no requirement to consider any of the 13241 Factors.[53] In this case, the Central Valley Water Board established effluent limitations necessary, in part, to protect the REC-1 beneficial use. The limits in the Permit are more stringent than the Basin Plan's existing numeric objective for REC-1 beneficial use.[54] Therefore, the Central Valley Water Board was under an obligation to consider the 13241 Factors.

While the District makes a number of specific contentions about the Central Valley Water Board's findings for each of the 13241 Factors, these contentions can be summarized as "the findings are superficial, incorrect, unsupported by evidence, and not consistent with the requirements of the Water Code."[55] Section 13241 itself, does not specify how a water board must go about considering the factors, nor does it require that a water board make specific findings on each of the specified factors.[56] Instead, courts have required some evidence that a water board has considered the 13241 Factors. In this case, there is ample evidence that the Central Valley Water Board has considered the 13241 Factors.

Beyond the brief findings added to the Permit's Fact Sheet in response to the District's comment on a prior draft of the Permit, the related discussion within the Permit's fact sheet,[57] the various documents and studies in the Central Valley Water Board's administrative record,[58] and the comments received in response to the draft Permit, provide the necessary

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[52] State Water Board Order WQ 2008-0008 (*City of Davis*), pp. 12-13.

[53] *City of Burbank v. State Water Resources Control Bd., supra*, 35 Cal.4th at p. 626.

[54] Basin Plan, p. III-3.00.

[55] District's Petition for Review of Waste Discharge Requirements Order No. R5-2010-0114 (SWRCB/OCC File A-2144(a)), p. 45.

[56] *City of Arcadia v. State Water Resources Control Bd.* (2010) 191 Cal.App.4th 156, 177; see also *Cal. Assn. of Sanitation Agencies v. State Water Resources Control Bd.* (2012) 208 Cal.App.4th 1438.

[57] See Waste Discharge Requirements Order No. R5-2010-0114, pp. F-19, F-30-31, F-73-80, and F-96.

[58] There are numerous studies and memoranda in the administrative record that address one or more of the 13241 Factors. Some examples include: Entrix, Inc., *Economic Analysis of the Advanced Treatment Trains in the Tentative NPDES Permit* (Oct. 8, 2010); Economic & Planning Systems, Inc., *Sacramento Regional County Sanitation District Potential Fee Increase Feasibility Analysis* (Oct. 8, 2010); Michael, Jeffrey, et al., *A retrospective Estimate of the Economic Impacts of Reduced Water Supplies in the San Joaquin Valley in 2009* (Sept. 28, 2010); Garvey, Elisa, *Draft Project Memorandum SRWTP Advanced Treatment Cost Updates* (Aug. 25, 2010); Michael & Pogue, *Advanced Wastewater Treatment for Nutrient Reduction: Impact on Sacramento Income and Employment* (Aug. 23, 2010); PG Environmental, LLC, *Technical Review of Estimated Costs for Proposed Changes to the Sacramento Wastewater Treatment Plant* (Aug. 18, 2010); Trussell, R. Shane, et al., *Ammonia Removal Cost Alternatives for the*

(Continued)

evidence that the Central Valley Water Board considered the 13241 Factors. Additionally, the various presentation materials and the board meeting transcript demonstrate that some of the 13241 Factors, specifically economic considerations, were presented, commented upon, and discussed at some length by Central Valley Water Board staff, the District, the public, and board members during the Permit's adoption meeting. The Central Valley Water Board complied with its requirements under Water Code section 13241 as demonstrated by the Permit's Fact Sheet and the administrative record.

Denial of Mixing Zone for Ammonia

The Permit contains final average monthly and maximum daily effluent limitations for total ammonia nitrogen of 1.8 milligrams per liter (mg/L) as nitrogen and 2.2 mg/L as nitrogen, respectively. The Central Valley Water Board set its limits based on the current U.S. EPA *Update of Ambient Water Quality Criteria for Ammonia*[59] (1999 Criteria) and decided to not allow a mixing zone. Because the Central Valley Water Board denied the use of a mixing zone, it calculated the effluent limitations with no allowance for dilution within the receiving water. The Central Valley Water Board based its decision, in part, on confirmed aquatic life impacts and the need to protect downstream beneficial uses. Generally, the District asserts that its request for a mixing zone and dilution credits was inappropriately denied. It claims that the Central Valley Water Board lacks sufficient evidence and what evidence it does have in the record is unreliable.

The Central Valley Water Board has been examining the effects of ammonia on the Delta for many years and notified dischargers that permits may be modified in the future as information becomes more definitive.[60] However, absolute scientific certainty is not required in order for the Central Valley Water Board to exercise its judgment.[61] Absolute consensus of the experts almost never occurs in science, including consensus as to the demarcation between acceptable versus toxic amounts of ammonia in a system as complex as the Delta. Ammonia's ecological effects are the subject of ongoing study, not just by the Central Valley Water Board,

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Sacramento Regional Wastewater Treatment Plant (May 31, 2010); Larry Walker Associates, *Technical Memorandum: Analysis of Costs and Benefits of Advanced Treatment Alternatives for the Sacramento Regional Wastewater Treatment Plant* (May 2010); Gomez, M., et al., *A Comparative Study of Tertiary Wastewater Treatment by Physico-Chemical-UV Process and Macrofiltration-Ultrafiltration Technologies* (Dec. 23, 2005).

[59] 1999 Update of Ambient Water Quality Criteria for Ammonia (U.S. EPA, Dec. 1999) (EPA-822-R-99-014).

[60] See State Water Board Order WQ 2009-0012 (*City of Stockton*), pp. 8-9.

[61] *In re: City of Attleboro, MA Wastewater Treatment Plant*, 14 E.A.D. ___, 2009 WL 2985479 (U.S. EPA Environmental Appeals Board, Sep. 15, 2009).

but by a multitude of public agencies, including U.S. EPA. Mindful of this backdrop, we inquire whether the Central Valley Water Board, relying on the federal NPDES regulations, relied upon sound science informed by an appropriate exercise of discretion to supplement the 1999 Criteria.

The Permit defines mixing zones as "a limited volume of receiving water that is allocated for mixing with a wastewater discharge where water quality criteria can be exceeded without causing adverse effects to the overall water body."[62] Mixing zones are allowable because "[i]t is not always necessary to meet all water quality criteria within the discharge pipe to protect the integrity of the waterbody as a whole. Sometimes it is appropriate to allow for ambient concentrations above the criteria in small areas near outfalls."[63] The effects of allowing a mixing zone are less stringent effluent limitations and, depending on the constituent involved, additional mass loading of the constituent downstream of the discharge.

For priority pollutants,[64] the state and regional water boards may grant mixing zones and dilution credits to NPDES-permitted discharges in accordance with the provisions in the *Policy for Implementation of Toxics Standards for Inland Surface Waters, Enclosed Bays, and Estuaries of California* (SIP). For non-priority pollutants, such as ammonia and nitrate, the State Water Board has previously held that regional water boards may use the SIP and U.S. EPA's *Technical Support Document for Water Quality-Based Toxics Control* (TSD) as guidance for determining whether and to what extent to allow dilution credits and a mixing zone.[65] When applying SIP and TSD methodologies, a regional water board may not grant a mixing zone if it would "compromise the integrity of the entire water body" or "adversely impact biologically sensitive or critical habitats."[66] A regional water board's authorization of dilution credits or a mixing zone is discretionary and the burden to prove that the approval of either does not violate the SIP or the applicable basin plan falls on the discharger.[67] When reaching a

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[62] Waste Discharge Requirements Order No. R5-2010-0114, p. A-4.

[63] Water Quality Standards Handbook (U.S. EPA, 2d ed., 1994), § 5.1.1, p. 5-5.

[64] Priority pollutants are the 126 toxic pollutants for which U.S. EPA has established test methods and required or established criteria to protect designated uses in the California Toxics Rule. (See 40 C.F.R. § 131.38.)

[65] State Water Board Order WQO 2004-0013 (*Yuba City*), p. 6; see also State Water Board Order WQ 2001-16 (*Napa Sanitation Dist.*), p. 24. The TSD provides technical guidance for assessing and regulating the discharge of toxic pollutants to surface waters. The TSD is intended to be guidance only and does not establish or affect any legal rights or obligations.

[66] SIP, p. 17. We emphasize that when granting a mixing zone pursuant to the SIP, the conditions that "shall not" occur are listed in the disjunctive. A regional water board need only find that a single condition potentially exists to deny a mixing zone pursuant to the SIP.

[67] State Water Board Order WQ 2009-0012 (*City of Stockton*), p. 9; State Water Board Order WQO 2002-0012 (*East Bay Municipal Utility Dist.*), p. 13.

conclusion using SIP methodologies, a regional water board "shall use all available, valid, relevant, representative data and information, *as determined by the [regional water board]*.[68]

Applying SIP methodologies, the Central Valley Water Board first used the 1999 Criteria to translate its narrative toxicity objective to determine whether the discharge has reasonable potential to cause or contribute to a violation of that objective. The Basin Plan's toxicity objective states:

> All waters shall be maintained free of toxic substances in concentrations that produce detrimental physiological responses in human, plant, animal, or aquatic life. This objective applies regardless of whether the toxicity is caused by a single substance or the interactive effect of multiple substances. Compliance with this objective will be determined by analyses of indicator organisms, species diversity, population density, growth anomalies, and biotoxicity tests of appropriate duration or other methods as specified by the Regional Water Board.
>
> The Regional Water Board will also consider all material and relevant information submitted by the discharger and other interested parties and numerical criteria and guidelines for toxic substances developed by the State Water Board, the California Office of Environmental Health Hazard Assessment, the California Department of Health Services, the U.S. Food and Drug Administration, the National Academy of Sciences, the U.S. Environmental Protection Agency, and other appropriate organizations to evaluate compliance with this objective.

Having determined that the District's discharge had a reasonable potential to violate this objective, the Central Valley Water Board then considered whether a mixing zone and dilution were appropriate based on relevant information. It concluded that the allowance of a mixing zone for ammonia would: "compromise the integrity of the entire water body" and "adversely impact biologically sensitive or critical habitats."[69]

The District contends that the Central Valley Water Board must use a proposed state criterion, or an explicit state policy or regulation interpreting its narrative toxicity objective supplemented with other relevant information to establish effluent limitations.[70] The District is incorrect. Pursuant to the relevant federal regulation, when a state has not established a water quality criterion for a specific chemical pollutant, the permitting agency may use one or more of three listed options to establish a water quality-based effluent limitation that implements a narrative criterion.[71] The District claims that the Central Valley Water Board must choose the

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[68] SIP, p. 5 (emphasis added).

[69] These reasons from the SIP have their origin in the TSD and more aptly address the sizing of an approved mixing zone rather than the initial approval or denial of a mixing zone.

[70] District's Petition for Review of Waste Discharge Requirements Order No. R5-2010-0114 (SWRCB/OCC File A-2144(a)), p. 61.

[71] 40 C.F.R. § 122.44(d)(1)(vi).

first option. The Central Valley Water Board instead chose the second option by "[e]stablishing effluent limits on a case-by-case basis, using [U.S.] EPA's water quality criteria, published under section 304(a) of the CWA, supplemented where necessary by other relevant information." It used the 1999 Criteria to establish the numerical water quality-based effluent limitation that interprets its narrative toxicity objective, and supplemented that determination with other relevant information that allowing a mixing zone would not adequately protect beneficial uses or implement the narrative criteria.

The Central Valley Water Board derived effluent limitations, in part, based on other relevant information that granting a mixing zone for the 1999 Criteria are not protective of beneficial uses in the receiving water. A significant portion of the District's petition concerns the "other relevant information" used by the Central Valley Water Board and its interpretation of that information. The District's contention that aquatic life beneficial uses are protected when the 1999 Criteria are met at the edge of the mixing zones is predicated on the assumption that the criteria are adequate to protect beneficial uses. The Central Valley Water Board was mindful that the fully mixed discharge implements the 1999 Criteria. The Permit acknowledges that, "[t]he discharge, when the approved mixing zones are considered, is in compliance with current [1999] USEPA acute and chronic ammonia criteria."[72]

In this case, though, the Central Valley Water Board had before it ample evidence showing that the 1999 Criteria are not sufficiently protective. The record indicates that existing levels of ammonia in the receiving water are not protective of aquatic life beneficial uses downstream of the discharge even though the receiving water does not exceed the 1999 Criteria.[73] The TSD provides guidance that, as in this case, where adverse effects have been observed far downstream, rather than confined to a mixing zone, mixing zones may be denied where such denial is used as a device to compensate for uncertainties in the protectiveness of water quality criteria.[74] In this respect, the Central Valley Water Board appropriately supplemented the available water quality criteria with other relevant information.

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[72] Waste Discharge Requirements Order No. R5-2010-0114, p. J-1.

[73] Werner, I., et al., *The Effects of Wastewater Treatment Effluent - Associated Contaminants on Delta Smelt*, (Sept. 26, 2008); Werner, I., et al., *Acute toxicity of Ammonia/um and Wastewater Treatment Effluent-Associated Contaminant on Delta Smelt*, (2009); Foe, Chris, *Nutrient Concentrations and Biological Effects in the Sacramento-San Joaquin Delta*, (May 2010); Teh, S. et al., *Full Life-Cycle Bioassay Approach to Assess Chronic Exposure of Pseudodiaptomus forbesi to Ammonia/Ammonium*. The technical and scientific bases for these conclusions are discussed more fully below in the discussion of the Draft 2009 Criteria and ammonia's impact on copepods.

[74] TSD, p. 34.

Draft 2009 Ammonia Criteria

The Central Valley Water Board examined U.S. EPA's *Draft 2009 Update Aquatic Life Ambient Water Quality Criteria for Ammonia – Freshwater* (Draft 2009 Criteria) in considering whether to grant a mixing zone. The District contends that this is inappropriate because it is a draft, not peer reviewed, and not available for use in a regulatory setting. The District would be correct if the Central Valley Water Board had used the Draft 2009 Criteria to interpret its narrative toxicity objective, but that is not the case. Instead the Central Valley Water Board used the scientific literature that is the basis for the Draft 2009 Criteria as "other relevant information" to deny a mixing zone.

Once finalized, the Draft 2009 Criteria will update the existing water quality criteria for ammonia and include more stringent chronic toxicity values for ammonia based on studies of ammonia as a toxicant to freshwater mussel species of the family Unionidae (Unionid mussels). The choice of freshwater mussels as a chronic toxicity endpoint in the Draft 2009 Criteria is mainly due to U.S. EPA's current reconsideration of relatively recent, peer-reviewed, scientific literature regarding ammonia toxicity to Unionid mussels.[75] Unionid mussels are indigenous to many freshwater habitats in North America, including the Central Valley. The Permit notes that the freshwater Unionid mussel *Anadonata* sp. is present in the Sacramento watershed upstream of the City of Sacramento and in the Delta.[76] *Anadonata* disperses during a larval stage in which it attaches to passing fish. It is present upstream of the Facility's discharge point and downstream in the Delta. Therefore, *Anadonata* is likely present in the Sacramento River within the vicinity of the outfall. The peer-reviewed scientific literature forming the basis of the Draft 2009 Criteria leads to the conclusion that Unionid mussels, such as *Anadonata,* would exhibit toxic effects from ammonia levels lower than the 1999 Criteria. The peer-reviewed scientific literature provides "other relevant information" that the Central Valley Water Board could rely upon to deny a mixing zone in order to protect local, freshwater mussels.

We conclude that the Central Valley Water Board correctly used the peer-reviewed scientific literature that forms the basis of the Draft 2009 Criteria in determining

[75] See Draft 2009 Criteria, Appx. A and C. The Draft 2009 Criteria rely on several peer-reviewed studies, including: Goudreau, S.E., et al., *Effects of Wastewater Treatment Plant Effluents on Freshwater Mollusks in the Upper Clinch River, Virginia, USA*, (1993); Mummert, A.K., et al., *Sensitivity of Juvenile Freshwater Mussels (Lampsilis fasciola, Villosa iris) to Total and Un-ionized Ammonia*, (2003); Newton, T.J. and Bartsch, M.R., *Lethal and Sublethal Effects of Ammonia to Juvinile lampsilis Mussels (Unionidae) in Sediment and Water-Only Exposures*, (2007); Wang, N., et al., *Contaminant Sensitivity of Freshwater Mussels: Chronic Toxicity of Copper and Ammonia to Juvenile Freshwater Mussels (Unionidae)*, (2007).

[76] Waste Discharge Requirements Order No. R5-2010-0114, p. J-3.

the appropriateness of a mixing zone for ammonia. The Central Valley Water Board appropriately applied its narrative objective for toxicity by considering relevant information supplied by other agencies, researchers, and other sources of credible scientific/technical information as required by its toxicity objective and Code of Federal Regulations, title 40, section 122.44(d)(1)(vi). It also established that Unionid mussels are present in the Sacramento River and are likely present in the immediate vicinity of the outfall. Further, water quality data submitted to the Central Valley Water Board establishes ammonia toxicity that appears to be attributable to the District's outfall. Specifically, the outfall is approximately 4,200 feet upstream of the Cliff's Marina sample station, which has regularly sampled elevated ammonia levels.[77] As noted by the Central Valley Water Board, up to 41 percent of samples obtained annually during 2007-2009 from this location exceeded the Draft 2009 Criteria for Unionid mussels.[78] The Central Valley Water Board appropriately denied the request for a mixing zone, because ammonia toxicity to Unionid mussels is one of the contributing factors compromising the integrity of the waterbody.

Ammonia Toxicity to Copepods Compromises the Integrity of the Entire Waterbody

Evidence of ammonia's toxicity to copepods is another reason that the Central Valley Water Board denied the District's request for a mixing zone. The District contends that the Permit's findings regarding acute and chronic toxicity to Delta copepods (*Eurytemora affinis* and *Pseudodiaptomus forbesi*) are based on preliminary and questionable study results. Specifically, the District contends, in part, that the study's laboratory work was not peer reviewed and it uses novel organisms that have no established protocols or comparable results. We find neither of these arguments persuasive.

The Central Valley Water Board considered Dr. Swee Teh's 31-day full life-cycle bioassay results with *P. forbesi*. It used the results as one reason to deny a mixing zone and support the need for downstream ammonia reduction. The full life-cycle test results were presented at a July 2010 meeting of the Interagency Ecological Program (IEP) Contaminant Work Team.[79] The results demonstrated that ammonia concentrations as low as 0.36 mg/L as nitrogen negatively affected *P. forbesi* reproduction, nauplii (a juvenile life stage for copepods)

[77] In addition to the other upstream regulated point sources, the State Water Board is aware of other undocumented sources of ammonia.

[78] *Id.*, p. J-4.

[79] Dr. Swee Teh, University of California, Davis, Full Life-Cycle Bioassay Approach to Assess Chronic Exposure of *Pseudodiaptomus forbesi* to Ammonia/Ammonium, (July 2010), slides 15-17.

survival, or both. Ammonia concentrations greater than 0.36 mg/L as nitrogen are routinely measured for up to 30 miles downstream of the District's outfall, while concentrations upstream are an order of magnitude lower.[80] Central Valley Water Board staff asked Dr. Teh to repeat the reproduction/nauplii survival part of the bioassay procedure because the previous results showed aquatic toxicity at ammonia concentrations much lower than the 1999 Criteria to protect freshwater aquatic organisms. Dr. Teh did so and his additional studies confirmed earlier preliminary findings that ammonia concentrations as low as 0.36 mg/L as nitrogen impaired *P. forbesi*'s reproduction and juvenile life-stage survival.

The District correctly notes that none of the laboratory work for Dr. Teh's studies was peer reviewed. While peer review can elevate the weight given to scientific work, the lack of peer review is not a reason to exclude scientific data. There is no requirement that laboratory work be peer reviewed. The study was commissioned after comments were received at the fall 2009 Ammonia Summit that the 1999 Criteria might not be protective of freshwater copepods. These comments theorized that part of the reason for the collapse of native fish in the Delta might be because their young were having trouble finding food. *P. forbesi* is an important prey item for both larval Delta smelt and Longfin smelt. The study plan was reviewed by the ammonia subcommittee of the IEP Contaminant Work Team and followed U.S. EPA standard toxicity testing procedures (EPA-821-R-02-012; EPA-821-R-02-013) as much as possible. The results of the full life-cycle test were reviewed by the IEP Contaminant Work Team at a July 2010 meeting.[81] Under these circumstances, the Central Valley Water Board could consider Dr. Teh's laboratory work as relevant evidence to support its decision to deny an ammonia mixing zone. The available scientific evidence indicates that ammonia toxicity to copepods is one of the contributing factors compromising the integrity of the entire waterbody.

Ammonia Toxicity is Adversely Impacting Biologically Sensitive or Critical Habitats

As would be expected, ammonia's toxic effect on copepods also affects those species that feed on copepods. The District contends that the Permit fails to include supported findings to show that its discharge is adversely impacting biologically sensitive or critical

[80] Foe, C., Ballard, A., and S. Fong, Central Valley Water Board, *Nutrient Concentrations and Biological Effects in the Sacramento-San Joaquin Delta*, (May 2010).

[81] The IEP Contaminant Work Team is composed of a number of scientists from various local, state, and federal agencies and regularly works with additional scientists from universities both within and outside of California. While review by the IEP Contaminant Work Team is not a peer review process that complies with Health and Safety Code section 57004, Dr. Teh's work was reviewed by a number of his peers with significant expertise in both this general area of study and the specific issues associated with the Delta.

habitats, either inside or outside the acute and chronic aquatic life mixing zones. Again, we disagree and find that the record supports the Central Valley Water Board's determination that the District's discharge of ammonia affects designated critical habitat for species listed as endangered under the federal Endangered Species Act.[82]

The Sacramento River at Freeport is within the designated critical habitat for several federally listed fish species including winter- and spring-run Chinook salmon (*Oncorhynchus tshawytscha*), Steelhead (*Oncorhynchus mykiss*), Delta smelt (*Hypomesus transpacificus*) and Green sturgeon (*Acipenser medirostris*). In addition, the U.S. Fish and Wildlife Service recently identified the San Francisco Bay-Delta population of the Longfin smelt (*Spirinchus thaleichthys*) as a candidate species for protection under the federal Endangered Species Act.[83] The Central Valley Water Board concluded that:

> ammonia concentrations inhibited diatom primary production rates and caused *P. forbesi* toxicity outside the mixing zone. Inhibition of diatom growth by elevated ammonia concentrations has been documented between Rio Vista and Suisun Bay. This is a primary spawning and nursery area for Delta smelt and Longfin smelt and an important rearing area for striped bass. Ambient ammonia concentrations are also sufficiently high to cause toxicity to the copepod *P. forbesi* as far downstream as Isleton (28 miles downstream of the discharge). The Sacramento River between the discharge and Isleton is a rearing area for striped bass. Phytoplankton, such as diatoms, are a primary food resource for many zooplankton species including *P. forbesi*[84] and these in turn are a major item in the diet of all three of the above fish species. Therefore, the discharge is adversely affecting critical fish habitat by reducing, both directly and indirectly, the amount of available food for the young of these three important fish species. The conclusion that the collapse of these fish populations might be caused by the quantity and quality of available food is not new. The hypothesis was first presented in the peer reviewed literature in 2007 and has been termed the "bottom-up" hypothesis.[85] What is new is the emerging information about the effect of ammonia on diatom production and *P. forbesi* reproduction and survival.[86]

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[82] 16 U.S.C. § 1531 et seq.

[83] 77 Fed. Reg 19756 (Apr. 2, 2012). The U.S. Fish and Wildlife Service found that the available scientific information warranted listing the Bay Delta distinct population segment of Longfin smelt as threatened or endangered, but because of other priorities, the Service would only place the Longfin smelt on the candidate list. We take official notice of the listing (Cal. Code Reg., tit. 23, § 648.2) as it occurred after briefing was complete. The listing is only cumulative of other evidence, though, of vulnerable species and habitat in the lower Sacramento River.

[84] In its response, the Central Valley Water Board clarified that this was not a basis for the ammonia effluent limitations. (See Response to Petitions for Review of Waste Discharge Requirements Order No. R5-2010-0114 (SWRCB/OCC File A-2144(a) and A-2144(b)), p. 53.)

[85] Sommer, Ted, et al., *The Collapse of Pelagic Fishes in the Upper San Francisco Estuary*, (June 2007).

[86] Central Valley Water Board's Response to Petitions for Review of Waste Discharge Requirements Order No. R5-2010-0114 (SWRCB/OCC File A-2144(a) and A-2144(b)), p. 41.

The National Marine Fisheries Service echoed these comments.[87] We concur with the Central Valley Water Board's conclusion that ammonia toxicity to copepods is likely a factor adversely affecting candidate, threatened, or endangered species populations (sometimes referred to as pelagic organism decline) in the Delta and that the Permit's findings are supported by the administrative record.

Final Ammonia Effluent Limitation Calculation

As previously mentioned, the Permit contains final average monthly and maximum daily effluent limitations for total ammonia nitrogen of 1.8 mg/L as nitrogen and 2.2 mg/L as nitrogen, respectively. The Central Valley Water Board made changes to the final adopted version of the Permit in the Fact Sheet discussion of ammonia criteria that are not reflected within effluent limitation calculations shown in Attachment H of the Permit. Originally, the Permit calculated the water quality-based effluent limitation using the 1999 Criteria's acute criterion for ammonia based on a pH of 8.5. This resulted in an acute criterion for ammonia of 2.14 mg/L as nitrogen. Because the District indicated that it can consistently comply with a maximum performance based limitation for pH of 8.0, the Central Valley Water Board changed the maximum effluent limitation for pH to 8.0 and then used a pH of 8.0 and temperature of 22.5°C in determining the applicable ammonia criteria.

Based on a pH of 8.0 and a temperature of 22.5°C cited by the Fact Sheet,[88] when salmonids and early life stages are present, the 1999 Criteria recommend acute and chronic criteria for ammonia nitrogen of 5.62 mg/L as nitrogen and 1.45 mg/L as nitrogen, respectively. The effluent limitations calculated by the Central Valley Water Board in Attachment H are incorrectly based on acute and chronic criteria for ammonia nitrogen of 2.14 mg/L as nitrogen and 1.68 mg/L as nitrogen, respectively. The 2.14 mg/L no longer applies since a pH of 8.5 is no longer applicable. Additionally, the 1.68 mg/L chronic criterion does not appear to coincide with a pH of 8.0 and temperature of 22.5°C. Therefore, in this case where mixing zones and dilution credits are denied, the correct lower chronic criterion of 1.45 mg/L should govern over the correct acute criterion of 5.62 mg/L for the development of ammonia effluent limitations when using the SIP methodology. Using the SIP methodology, considering daily monitoring, and applying the corrected criteria as shown in the Ammonia Effluent

[87] Letter from Maria R. Rea, Central Valley Office Supervisor, National Marine Fisheries Service to James D. Marshall, Senior Water Resources Control Engineer, Central Valley Water Board (Oct. 13, 2010).

[88] Waste Discharge Requirements Order No. R5-2010-0114, p. F-55.

Calculation Table below, the final effluent limitations are calculated to be 1.5 mg/L as the average monthly effluent limitation and 2.0 mg/L as the maximum daily effluent limitation.

These limitations are protective for all of the District's discharges year-round. However, it is appropriate to consider seasonal effluent limitations because ammonia criteria depend on temperature. More appropriate, yet equally protective effluent limitations can apply during the colder months when the receiving water is sustained at lower temperatures; the colder months being November 1 through March 31. Based on downstream receiving water seasonal data from 2000 through 2010 at monitoring station R3, 4,200 feet downstream of the discharge (i.e., Cliff's Marina),[89] the worst case receiving water temperature (warmest temperature) of 14.4°C can apply. For the cold season, the acute criterion is 5.62 mg/L and the chronic criterion is 2.43 mg/L. Under these circumstances the average monthly effluent limitation is 2.4 mg/L and the maximum daily effluent limitation is 3.3 mg/L.

The effluent limitations for ammonia in Table 6, section IV. A. 1.a. of the Permit under Effluent Limitations and Discharge Specifications, are corrected to read as follows:

Table 6. Effluent Limitations

Parameter	Units	Effluent Limitations				
		Average Monthly	Average Weekly	Maximum Daily	Instantaneous Minimum	Instantaneous Maximum
Ammonia Nitrogen, Total (as N) (Apr-Oct)	mg/L	1.5		2.0		
Ammonia Nitrogen, Total (as N) (Nov-Mar)	mg/L	2.4		3.3		

In addition, the Fact Sheet of the Permit is corrected to include the following Tables showing the calculation of seasonal ammonia effluent limitations applying the SIP procedures, considering daily monitoring in the calculations of statistical multipliers, and using data from June 2005 through July 2008.

Ammonia Effluent Limitations Calculation (Apr-Oct)

Description	Ammonia
Effluent Concentrations	
Sample Dates - Begin	Jun-1-2005
Sample Dates - End	Jul-31-2008
At least 80% of data ND?	No

[89] See Sacramento Regional Wastewater Treatment Plant Monthly Discharge Reports (July 2000 - Aug. 2010).

Sample Count	334	
MEC (mg/l)	45.0	
Mean (mg/l)	24.0	
Std. Deviation (mg/l)	3.70	
Coefficient of Variation (CV) (mg/l)	0.1542	
Background Concentrations		
Max Background (mg/l)	1.3	
Are Salmonids Present?	Yes	
Are Early Life Stages Present?	Yes	
Criteria	acute	chronic
Hardness (mg/l as $CaCO_3$)	N/A	N/A
BP Objective (mg/l)(USEPA Ambient)	5.62	1.45
Translator	N/A	N/A
Design pH	8.0	8.0
Temperature, max 30day Avg (^{0}C)	22.5	22.5
Criteria (total recoverable)	5.62	1.455
Effluent Limit Calculations		
Dilution Credit	0	0
ECA (mg/l)	5.62	1.455
σ^2	0.02	0.023
σ_{30}^2	0.0008	0.0008
ECA Multiplier	0.708	N/A
Long-Term Average	3.98	1.455
AMEL Multiplier	**N/A**	1.047
AMEL	**N/A**	**1.5**
MDEL Multiplier	**N/A**	1.41
MDEL	**N/A**	**2.0**

Ammonia Effluent Limitations Calculation (Nov-Mar)

Description	Ammonia
Effluent Concentrations	
Sample Dates - Begin	Jun-1-2005
Sample Dates - End	Jul-31-2008
At least 80% of data ND?	No
Sample Count	334
MEC (mg/l)	45.0
Mean (mg/l)	24.0
Std. Deviation (mg/l)	3.70
Coefficient of Variation (CV) (mg/l)	0.1542
Background Concentrations	
Max Background (mg/l)	1.3

Are Salmonids Present?	Yes	
Are Early Life Stages Present?	Yes	
Criteria	acute	chronic
Hardness (mg/l as $CaCO_3$)	N/A	N/A
BP Objective (mg/l)[USEPA Ambient]	5.62	2.43
Translator	N/A	N/A
Design pH	8.0	8.0
Temperature, max 30day Avg (^0C)	14.4	14.4
Criteria (total recoverable)	5.62	2.43
Effluent Limit Calculations		
Dilution Credit	0	0
ECA (mg/l)	5.62	2.43
σ^2	0.02	0.023
σ_{30}^2	0.0008	0.0008
ECA Multiplier	0.708	N/A
Long-Term Average	3.98	2.43
AMEL Multiplier	**N/A**	1.047
AMEL	**N/A**	**2.4**
MDEL Multiplier	**N/A**	1.41
MDEL	**N/A**	**3.3**

Nitrate (Nutrients)

For the same reasons discussed concerning ammonia, the Central Valley Water Board has the discretion to grant or deny a mixing zone for nitrate using the SIP and TSD methodologies as guidance. The Basin Plan allows the Central Valley Water Board to:

> designate mixing zones . . . for different types of objectives, including, but not limited to, acute aquatic life objectives, chronic aquatic life objectives, [and] human health objectives . . . depending in part on the averaging period *over which the objectives apply.* In determining the size of such mixing zones, the Regional [Water] Board will consider the applicable procedures and guidelines in the [U.S.] EPA's Water Quality Standards Handbook and the [TSD].[90]

In the Permit, the Central Valley Water Board set the final effluent limitation equal to U.S. EPA's primary maximum contaminant level (Primary MCL) for drinking water for nitrate as nitrogen of 10 mg/L without allowance for a mixing zone and dilution credit.[91]

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[90] Basin Plan, p. IV-16.00, col. 2 (emphasis added).

[91] Throughout this discussion, when referring to the nitrate limitation and Primary MCL level of 10 mg/L, we mean the result to be expressed as nitrate as nitrogen, as opposed to the equivalent result of 45 mg/L expressed as NO_3 (nitrate). The reason for the 4.5 factor difference is because the ratio of atomic weights between NO_3 (62.5 mg) and N (14 mg) is approximately 4.5.

Currently, the Facility discharges very low concentrations of nitrate, because the nitrogen discharge is predominantly in the form of ammonia. The Permit, however, now requires the Facility to nitrify in order to meet its ammonia effluent limitations. The Central Valley Water Board concluded that, following full nitrification, the discharge will have reasonable potential to exceed the Primary MCL for nitrate and may necessitate denitrification. Nitrate generates two relevant concerns. First, excessive nitrates in drinking water pose a human health concern, particularly for human fetuses and infants. Second, excessive nitrogen in the form of nitrates can contribute to excessive algal growth and change the ecology of a waterbody. The Central Valley Water Board denied a mixing zone stating that it did so to protect beneficial uses, specifically municipal and domestic supply (MUN), and because a human health mixing zone for nitrate does not comport with the SIP's requirements.

The District contends that an effluent limitation equal to the Primary MCL is unnecessary to protect the MUN beneficial use. We agree with the District to the extent that it relates to protecting human health from nitrate. The Central Valley Water Board states that there is sufficient dilution available in the Sacramento River that, after mixing, the river will not exceed the nitrate drinking water standard.[92] Therefore, it appears that solely for the protection of human health from nitrate, an effluent limitation equal to the Primary MCL was not necessary since the standard of 10 mg/L would have been met at the boundaries of an appropriately sized mixing zone.

The District further contends that the denial of a mixing zone for nitrate is improper, in part, because "the denial [of a human health mixing zone] has nothing to do with the merits of a human health mixing zone."[93] Again, we agree with the District. In this case, the water quality objective for which a mixing zone was denied is based on human health. However, the reasons for denying the mixing zone were related to aquatic and ecological impacts. This does not comport with what the Basin Plan and TSD specify in allowing or denying mixing zones.[94]

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[92] Central Valley Water Board's Response to Petitions for Review of Waste Discharge Requirements Order No. R5-2010-0114 (SWRCB/OCC File A-2144(a) and A-2144(b)), p. 62.

[93] District's Petition for Review of Waste Discharge Requirements Order No. R5-2010-0114 (SWRCB/OCC File A-2144(a)), p. 125.

[94] TSD, p. 33 states: "In the general case, where a State has both acute and chronic aquatic life criteria, as well as human health criteria, independently established mixing zone specifications may apply to each of the three types of criteria. The acute mixing zone may be sized to prevent lethality to passing organisms, the chronic mixing zone sized to protect the ecology of the waterbody as a whole, and the health criteria mixing zone sized to prevent significant human risks. For any particular pollutant from any particular discharge, the magnitude, duration, frequency, and mixing zone associated with each of the three types of criteria will determine which one most limits the allowable discharge."

A mixing zone can be denied if it is determined that the receiving water already exceeds the water quality objective that was used to establish the effluent limitation or "to compensate for uncertainties in the protectiveness of the water quality criteria."[95] With respect to nitrate, however, the receiving water provides assimilative capacity and dilution to meet the water quality objective that protects human health requirements. The Permit's Findings do not support a conclusion that there are uncertainties in the protectiveness of the water quality objective from a human health perspective. As a result, the denial of a mixing zone relying on the Primary MCL for the protection of human health is inappropriate.

The foregoing conclusion with respect to the nitrate mixing zone contrasts with our previous discussion of ammonia because of the manner in which water quality objectives and criteria protect specific uses. Water quality objectives protect specific beneficial uses. The water quality objectives that protect aquatic life are different from those that protect human health, and will create different permit limitations. Similarly, a permit writer must be mindful of the nexus between objectives and uses in each analytical step when deriving a water quality-based effluent limitation to implement a water quality objective. The decision to grant or deny a mixing zone for a pollutant should, in each analytical step, consider the use that is being protected by the applicable water quality objective. With respect to ammonia, the uses were aquatic life, the criteria were designed to protect aquatic life, and the mixing zone was denied based on other relevant information that the recommended 1999 Criteria were not protective of aquatic life. Each step was tied to the aquatic life use. In contrast, with respect to nitrate, the use was MUN beneficial use, the water quality objective was to protect human health, but the mixing zone was denied based on information that nitrate discharges have biostimulatory effects unrelated to drinking water protection through implementation of the Primary MCL. The last analytical step for nitrates uncoupled the use to be protected from the objective providing the protection.

Although we have concluded that the Central Valley Water Board's denial of dilution credits and a mixing zone for nitrate in order to comply with the Primary MCL was not appropriate, that does not conclude our review. Further limitations on nutrient discharges are necessary based on the evidence in the record showing ecological and aquatic impacts from nutrients in the waterbodies downstream of the discharge. Both the Central Valley Water Board's and the San Francisco Bay Regional Water Quality Control Board's (San Francisco Bay Water Board) Basin Plans contain a narrative objective for biostimulatory substances that states

[95] TSD, p. 34.

"[w]ater shall not contain biostimulatory substances which promote aquatic growths in concentrations that cause nuisance or adversely affect beneficial uses."[96] The San Francisco Bay Water Board's narrative objective further states "[c]hanges in chlorophyll a and associated phytoplankton communities follow complex dynamics that are sometimes associated with a discharge of biostimulatory substances. Irregular and extreme levels of chlorophyll a or phytoplankton blooms may indicate exceedance of this objective and require investigation." Therefore, we conclude that there is a need to set effluent limitations for nitrate based, in part, that the District's discharge is contributing to an exceedance of the downstream biostimulatory water quality objectives.

Cultural Eutrophication

Nitrogen, phosphorus, and other elements are vital for a functional aquatic ecosystem. In particular, nitrogen and phosphorus are essential for fueling primary productivity. Inorganic nitrogen sources (e.g., nitrate, nitrite, and ammonia) and organic nitrogen (e.g., urea) are all nutrients for algal growth. Primary producer organisms (organisms that perform photosynthesis, such as algae and plants) can directly use all of these forms of nitrogen to varying degrees to form proteins and other organic compounds necessary for life. Organic nitrogen, in the form of detritus (e.g., decomposing vegetation and animal fecal matter) is broken down by bacteria into inorganic nitrogen. One form of inorganic nitrogen, ammonia, can eventually be oxidized by bacteria into nitrite and then nitrate. Typically, in healthy aquatic ecosystems, nitrate is the most abundant form of nitrogen.

However, excessive nutrient inputs to a waterbody can become too much of a good thing. Cultural eutrophication is a process fueled by unnaturally high concentrations of nitrogen and phosphorus due to human-related activities. When excessive levels of these nutrients are introduced into a water system, algae populations rapidly multiply to nuisance levels. As algal populations "bloom" and die-off in quick succession, dead algae accumulate and decompose. Their nutrient-laden remains further enrich the immediate environment, thereby perpetuating the eutrophication cycle. Increased rates of respiration and decomposition deplete the available dissolved oxygen in the water, threatening other plant and animal life in the system. When dissolved oxygen concentrations drop below what is needed by fish and invertebrates to respire, the waters become host to fish kills and other events which can pose threats to both the aquatic ecosystem and human health. The impacts can cascade through the

[96] Basin Plan, p. III-3.00; San Francisco Bay Basin Water Quality Control Plan, p. 3-3.

trophic levels, changing the ecosystem structure and function, and causing a nuisance or adversely affecting beneficial uses of surface water, including recreational, wildlife, fishery, aquatic life, and drinking water uses.

Cultural eutrophication occurs despite the form of nitrogen being discharged into the ecosystem. The total amount, or load, of nitrogen needs to be reduced in the Delta in order to address the damaging effects of nutrient over-enrichment. Since ammonia and nitrate are the dominant forms of nitrogen from point source discharges, the loads of both forms of nitrogen to waterbodies experiencing excessive biostimulation needs to be reduced. Elevated levels of ammonia are toxic and thus the conversion to nitrate through nitrification is necessary to protect aquatic life beneficial uses. However, converting the dominant form from primarily ammonia to nitrate will still result in cultural eutrophication. Reductions of total nitrogen loads through both nitrification and denitrification is the goal to protect beneficial uses from cultural eutrophication from point source discharges.

The San Francisco Bay and the Delta together is the largest estuarine system in California. There is evidence in the record showing that the San Francisco Bay and Delta are nutrient-enriched, receiving external loads of total nitrogen and total phosphorus from point and non-point sources.[97] The San Francisco Bay and Delta ecosystem (Bay-Delta ecosystem) does not follow the typical paradigm for excess nutrients and cultural eutrophication.[98] This is due to the complexity of the system, with fewer phytoplankton blooms and higher dissolved oxygen than expected when considering the elevated input of nutrients. Co-factors that influence the Bay-Delta ecosystem's response to nutrient loading include elevated turbidity, increased grazing pressures from invasive clams, and decreased freshwater flows.[99] However, the historical resilience of the Bay-Delta ecosystem to excess anthropogenic nutrient loading is weakening and may be nearing an irreversible tipping point.

Protection of beneficial uses includes those beneficial uses that are downstream, and in this case those downstream uses are in the Delta and San Francisco Bay, as well as Suisun Bay.[100] U.S. EPA's current Section 303(d) list of impaired water bodies lists

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[97] Heidel, K., et al., *Conceptual Model for Nutrients in the Central Valley and Sacramento-San Joaquin Delta*, (Sept. 2006).

[98] Parker, A., et al., *Biogeochemical Processing of Anthropogenic Ammonium in the Sacramento River and the Northern San Francisco Estuary*, (Sept. 2010).

[99] Jassby, A.D. et al., *Annual Primary Production: Patterns and Mechanisms of Change in a Nutrient Rich Tidal Estuary*, (2002).

[100] Both the Central Valley Water Board and the San Francisco Bay Water Board should consider similar controls for significant controllable sources of nutrient loading to the Bay-Delta ecosystem.

the Suisun Marsh Wetlands as impaired for nutrients.[101] The Suisun Bay ecosystem provides essential habitat for numerous birds, mammals, and fish, including threatened and endangered species such as winter- and spring-run Chinook salmon, Steelhead, Green sturgeon, Delta smelt, and Longfin smelt.[102] The consequences of excessive nutrients, including changes in phytoplankton and zooplankton communities, negatively impact the survival and success of these threatened and endangered species.[103] The District's discharge contributes substantial nutrients, nitrogen (currently as ammonia) and phosphorus, directly to San Francisco Bay and the Delta.

Additionally, there is enough evidence in the record of cyanobacteria blooms in the Delta, and other phytoplankton blooms in the San Francisco Bay (including blooms of *Heterosigma akashiwo*) to demonstrate that excessive biostimulation is occurring, even if diatom populations in Suisun Bay are not experiencing bloom conditions.[104] Higher than natural primary productivity and algal blooms pose multiple detrimental effects to surface waters: ecosystem changes, depressed dissolved oxygen, cyanotoxin (e.g., microcystin) production, nuisance to recreational uses, and taste and odor issues for drinking water supplies. Evidence is present in the record for each of these indicators of cultural eutrophication in the Delta and San Francisco Bay with the current nutrient loads. The Northern San Francisco Bay, specifically Suisun Bay, has undergone significant changes in ecosystem structure. These changes are presently being attributed to ecosystem perturbations over the past several decades resulting from changes in nutrient ecosystem stoichiometry.[105]

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[101] While the Suisun Marsh is not within the legal boundaries of the Delta, it is hydrologically connected to Suisun Bay and is addressed within the Bay-Delta Conservation Plan. (See Progress Report on the Bay-Delta Conservation Plan (5th ed., Aug. 2, 2011), p. 56; compare Wat. Code, § 12220 with Pub. Resources Code, § 29101.)

[102] Note that the Longfin smelt is currently a candidate species.

[103] See Glibert, Patricia M., *Long-term Changes in Nutrient Loading and Stoichiometry and their Relationships with Changes in the Food Web and Dominant Pelagic Fish Species in San Francisco Estuary, Califomia*, (2010); Sommer, Ted, et al., *The Collapse of Pelagic Fishes in the Upper San Francisco Estuary*, (June 2007). Baxter, R. R., et al., *Pelagic Organism Decline Progress Report: 2007 Synthesis of Results*, (2008); Letter from Maria R. Rea, Central Valley Office Supervisor, National Marine Fisheries Service to James D. Marshall, Senior Water Resources Control Engineer, Central Valley Water Board (Oct. 13, 2010).

[104] See Lehman, P.W., et al., *Initial Impacts of Microcystis aeruginosa Blooms on the Aquatic Food Web In the San Francisco Estuary* (Dec. 2009); Lehman, P.W., et al., *The Influence of Environmental Conditions on the Seasonal Variation of Microcystis Cell Density and Microcystins Concentration in the San Francisco Estuary* (2008); Dugdale, R.C., et al., *The Role of Ammonium and Nitrate in Spring Bloom Development in San Francisco Bay* (2007); Lehman, P.W., et al. *Phytoplankton Biomass, Cell Diameter, and Species Composition in the Low Salinity Zone of Northem San Francisco Bay Estuary* (2000).

[105] Glibert, Patricia M., *Long-term Changes in Nutrient Loading and Stoichiometry and their Relationships with Changes in the Food Web and Dominant Pelagic Fish Species in San Francisco Estuary, Califomia*, (2010).

Historically, Suisun Bay was a diatom-based food web. In 1982, the Facility began operations and began discharging secondarily treated effluent, discharging up to 14 tons of ammonium-nitrogen into the Sacramento River daily. This discharge of ammonium-nitrogen coincided with the Sacramento River and Suisun Marsh shifting from a nitrate-based diatom phytoplankton system, to an ammonium-based small phytoplankton system and shift into a small-sized zooplankton community (*Eurytemora* and *Pseudodiatomus*).[106] Additionally, in 1987 the invasive Asian clam (*Corbula amurensis*) was introduced and diatom-based blooms became rare. Currently, Suisun Bay is an enriched ammonium, low phosphorous ecosystem, which is highly conducive to cyanobacterial blooms.[107]

Cyanobacteria blooms have been detected in the Delta and Suisun Bay since 1999. They can form surface scum, be a nuisance to recreational users, reduce aesthetics and oxygen, and produce microcystins (cyanotoxins).[108] Microcystins have been shown to obstruct zooplankton feeding abilities, growth and fecundity. Additionally, microcystins can be biomagnified through the food web. While a standard for total microcystin is not established in the United States, the World Health Organization (WHO) recommends 1 microgram per liter (µg/L) of total microcystin for drinking water.[109] Effects from microcystins can range from non-fatal neurological impairment to organ damage in humans. Within the Delta, microcystin levels exceeding the WHO guidelines have been detected in the San Joaquin River, while in the Sacramento River microcystins have been detected but not yet at toxic levels.[110]

In addition to ecosystem impacts and microcystin production, cultural eutrophication impacts the taste and odor of drinking water supplies. A portion of the discharge from the District becomes source water for drinking water supplies in the Central Valley, the San Francisco Bay Area, and Southern California. The water exported from the Delta helps supply drinking water for approximately 25 million Californians.[111] Excess primary productivity can clog drains and pumps for water treatment facilities. Elevated primary productivity adds to the levels of dissolved and total organic carbon in the water. High levels of organic carbon in

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[106] *Ibid.*; Dugdale, Richard C., et al., *The Role of Ammonium and Nitrate in Spring Bloom Development in San Francisco Bay*, (Feb. 2007).

[107] Lehman, P.W., et al., *The Influence of Environmental Conditions on the Seasonal Variation of Microcystis Cell Density and Microcystins Concentration in the San Francisco Estuary* (2008).

[108] *Ibid.*

[109] Mioni, C.E., *What Controls Microcystis Bloom & Toxicity in the San Francisco Estuary?* (Summer/Fall 2008 & 2009).

[110] *Ibid.*

[111] Central Valley Water Board staff presentation, (Dec. 9, 2010), slide 9.

source water for drinking water is a concern due to the formation of carcinogenic byproducts during disinfection at water treatment facilities. Some species of algae produce compounds such as geosmin and 2-methylisoborneol that produce objectionable odors and taste in drinking water.[112]

The Central Valley Water Board's Selection of the Nitrate Effluent Limitation

In a prior draft of the Permit, the effluent limitation for nitrate was not the Primary MCL (10.0 mg/L), but a much more stringent performance-based average monthly limit of 0.26 mg/L.[113] The Central Valley Water Board's tentative permitting options stated that full denitrification was necessary in order to protect the aquatic life beneficial use of the Delta. It also concluded that if the "controlling beneficial use" is MUN, the Primary MCL with dilution credit, would result in no additional requirements for nitrate removal than is currently required (i.e., in the 2000 Permit).[114] The prior draft's fact sheet stated that the 0.26 mg/L effluent limitation was based on an analysis prepared for the District.[115]

The District's comments on the prior draft of the Permit state that this effluent limitation is unachievable. Further, the District claims that in the absence of being able to identify or support appropriate numeric criteria to interpret the narrative water quality objective, the Central Valley Water Board is precluded from adopting a final water quality-based effluent limitation for the protection of aquatic life.[116] In response, the Central Valley Water Board acknowledged the District's claim of the inability to achieve the 0.26 mg/L effluent limitation and adopted the current Primary MCL without any dilution. It has been noted that nitrogen-based cultural eutrophication becomes more difficult to address the longer it is left unchecked.[117] Nitrogen loadings accumulate and persist in water systems in a way that can exacerbate future water quality problems.[118] The Central Valley Water Board adopted the 10.0 mg/L effluent limit

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[112] Heidel, K., et al., *Conceptual Model for Nutrients in the Central Valley and Sacramento-San Joaquin Delta*, (Sept. 2006).

[113] Tentative Waste Discharge Requirements Order No. R5-2010-xxxx (Sept. 3, 2010), p. 13.

[114] Tentative NPDES Permitting Options (Sept. 3, 2010), p. 8.

[115] Tentative Waste Discharge Requirements Order No. R5-2010-xxxx (Sept. 3, 2010), pp. F-71-72. The analysis referred to is *Technical Memorandum: Analysis of Costs and Benefits of Advanced Treatment Alternatives for the Sacramento Regional Wastewater Treatment Plant*, prepared by Larry Walker Associates and dated May 2010.

[116] Letter from District Engineer Stan Dean, Sacramento Regional County Sanitation District, to Kathleen Harder (Oct. 11, 2010), pp. 55-56.

[117] *Upper Blackstone Water Pollution Abatement Dist. v. U.S. Environmental Protection Agency* (1st Cir. 2012) 690 F.3d 9, 23.

[118] *Ibid.*

for nitrate to provide the District with a readily achievable effluent limitation that is commonly met within California by other publicly-owned treatment works, yet would require the District to at least partially denitrify its effluent in order to place a partial check on the existing cultural eutrophication problem occurring downstream of the discharge.[119]

The Permit's Existing Effluent Limitation for Nitrate is Reasonable

As previously noted, the Permit has been administratively continued since 2005 and was five years late at the time it was adopted.[120] Neither the Clean Water Act, nor U.S. EPA's regulations allow indefinite delay until better science can be developed, or a statewide policy can be adopted. In almost every case, more data can be collected and the hope or anticipation that better science will materialize is always present in the context of science-based agency decision-making. Congress was aware of this when it nonetheless set a firm deadline for issuing new permits.[121] The U.S. Supreme Court has held that U.S. EPA cannot avoid its statutory obligation by noting the presence of uncertainty.[122] Various appellate courts have held that where a complex statute requires an agency to set a numerical standard or effluent limitation, it will not overturn the agency's choice of a precise figure where it falls within the "zone of reasonableness."[123]

Similarly, where a statute is precautionary in nature and where the evidence difficult to come by, uncertain, or even conflicting because it is on the frontiers of scientific knowledge, a rigorous step-by-step proof of cause and effect is not required.[124] Beneficial Uses must be protected, including downstream beneficial uses.[125] We have previously noted that regional water boards can, and should, take preventative action to regulate discharges that may affect the quality of the waters of the state from degradation.[126] Additionally, the Study Panel to the California State Water Resources Control Board which prepared a report (Study Panel

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[119] Central Valley Water Board Staff Response to Comments, p. 34.

[120] 33 U.S.C. § 1342(a)(3); 40 C.F.R. § 122.46(a)-(b).

[121] *Upper Blackstone Water Pollution Abatement Dist. v. U.S. Environmental Protection Agency, supra*, 690 F.3d at p. 23.

[122] *Massachusetts v. U.S. Environmental Protection Agency* (2007) 549 U.S. 497, 534.

[123] *Upper Blackstone Water Pollution Abatement Dist. v. U.S. Environmental Protection Agency, supra*, 690 F.3d at p. 28; *National Maritime Safety Assn. v. Occupational Safety & Health Admin.* (D.C. Cir. 2011) 649 F.3d 743, 752; *Reynolds Metals Co. v. U.S. Environmental Protection Agency* (4th Cir. 1985) 760 F.2d 549, 559.

[124] *Miami-Dade County v. U.S. Environmental Protection Agency* (11th Cir. 2008) 529 F.3d 1049, 1064-65 (quoting *Ethyl Corp. v. Environmental Protection Agency* (D.C. Cir. 1976) 542 F.2d 1, 28).

[125] State Water Board Order WQ 2008-0008 (*City of Davis*), pp. 12-13.

[126] State Water Board Order No. WQ 82-2 (*Marina County Water Dist.*), p. 16.

Report) on recommended changes in water quality control for the Legislature in March 1969 stated that corrective actions must be initiated before a problem becomes acute and forces are set in motion which may well be irreversible except over very long periods of time.[127]

While the Primary MCL is intended to protect human health and there is adequate dilution available in the receiving water to protect that use, the allowance of dilution credits and a mixing zone will not protect all of the beneficial uses of the receiving waters downstream of the discharge. Since the Delta, Suisun Bay, and the greater San Francisco Bay are presently exhibiting cultural eutrophication at the current nutrient loading levels, without a reduction in the current nutrient loading by the District, nitrification without denitrification will not be protective of downstream beneficial uses and will only exacerbate the ecological decline of the Bay-Delta ecosystem. Nutrient reduction in the Sacramento River is a critical step to restoring the Bay-Delta ecosystem's health and better protecting drinking water supplies. As such, the Central Valley Water Board was correct in requiring denitrification of the District's discharge.

An average monthly effluent limitation of 10.0 mg/L for nitrate as nitrogen is appropriate given the totality of the circumstances and is within the zone of reasonableness. The Central Valley Water Board correctly concluded that this limit is readily achievable using standard nitrate removal technologies.[128] Currently, of the 267 NPDES-permitted publicly-owned treatment works (POTWs) in California, 79 include effluent limitations for nitrate or nitrate plus nitrite. Of those 79 POTWs, 72 have effluent limitations between 5.0 and 10.0 mg/L. The Facility's use of standard nitrate removal technologies will be an important initial step in restoring Bay-Delta ecosystem health.[129]

This is not the first occasion that the State Water Board has upheld a similar effluent limitation for nitrogen in order to reduce nutrient loading and protect downstream receiving waters from exceeding a narrative biostimulatory objective. In *Los Coyotes*, the Los Angeles Regional Water Quality Control Board (Los Angeles Water Board) established a final effluent limitation for total inorganic nitrogen of 8.0 mg/L, based on the performance of a

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[127] Final Report of the Study Panel to the California State Water Resources Control Board, *Recommended changes in Water Quality Control*, (March 1969), pp. 3 and 15.

[128] Central Valley Water Board Staff Response to Comments, p. 34.

[129] Both the Central Valley Water Board and the San Francisco Bay Water Board should recognize that the requirement to control the Facility's nitrogen discharge is simply an initial step. These Boards should consider future regulatory efforts across relevant portions of their regions to limit the total nutrient loading from major sources to the Bay-Delta ecosystem.

different wastewater plant operated by the same discharger.[130] At the time, the Los Angeles Water Board lacked conclusive evidence whether the algae impairment was being caused by excess nitrogen, but knew that the two facilities were major, controllable point sources of nitrogen. In our *Los Coyotes* order, we concluded that it was reasonable for the Los Angeles Water Board to impose the performance-based effluent limitation rather than impose a more stringent water quality-based effluent limitation.[131]

As in *Los Coyotes*, the Facility is a major, controllable point source of nitrogen (currently as ammonium-nitrogen) which is contributing to the cultural eutrophication and exceedance of the downstream biostimulatory objectives. While the Suisun Marsh is currently on U.S. EPA's current Section 303(d) list as impaired for nutrients, neither the San Francisco Bay, nor the Delta are listed as impaired for nutrients. However, we have previously recognized that because a waterbody is not listed does not necessarily mean that the waterbody has assimilative capacity for a pollutant.[132] Additionally, as noted in *Marina County Water District* and the Study Panel Report, a regional water board should take preventative action to regulate discharges before a water quality problem becomes acute and may be irreversible except over very long periods of time. The Central Valley Water Board correctly took action to prevent additional detrimental impacts to the Bay-Delta ecosystem.

Upholding the Permit's average monthly effluent limitation of 10.0 mg/L for nitrate will require the District to include standard nitrate removal technologies at the same time that it upgrades the Facility to comply with the other requirements of the Permit. It may be more cost-effective to construct and operate a combined system (i.e., a system that nitrifies and denitrifies) rather than first constructing a nitrification treatment process and then later constructing a denitrification treatment process.[133] Additionally, an option for a combined system may allow a better use of the District's resources.

An alternate avenue available to the Central Valley Water Board for regulating the District's discharge of total nitrogen was to use U.S. EPA's water quality criteria for nutrients to calculate a water-quality based numeric effluent limitation. U.S. EPA section 304(a) criteria

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[130] State Water Board Order WQO 2003-0012 (*Los Coyotes*), p. 6. The *Los Coyotes* order concerned two NPDES-permits for the Los Coyotes Water Reclamation Plant and the Long Beach Water Reclamation Plant. The 8.0 mg/L effluent limitation was based on the performance of the Whittier Narrows Water Reclamation Plant. All three facilities are owned and operated by the County Sanitation District of Los Angeles.

[131] *Id.* at p. 8.

[132] State Water Board Order WQ 2001-16 (*Napa Sanitation Dist.*), p. 22.

[133] Metcalf & Eddy, Inc., *Wastewater Treatment/Disposal/Reuse*, (3d ed., 1991), pp. 711-727. We take official notice of the reference guide (Cal. Code Reg., tit. 23, § 648.2).

establishes recommended Aggregate Ecoregion I nutrient levels of 0.31 mg/L for total nitrogen.[134] Receiving water concentrations for total nitrogen upstream of the District's discharge range from 0.12 mg/L to 0.89 mg/L and averaging at 0.39 mg/L.[135] This average exceeds the Ecoregion I level of 0.31 mg/L. Because there is no assimilative capacity in the Sacramento River, an end-of-pipe effluent limitation for total nitrogen could be established at 0.31 mg/L as a monthly average. While this nitrogen level is expected to be fully protective of aquatic life beneficial uses, technological and economic considerations are not conducive to using this end-of-pipe effluent limitation. Additionally, an end-of-pipe limit of 0.31 mg/L may not be technologically feasible with standard treatment technologies.[136] A nitrate effluent limitation of 10.0 mg/L as nitrogen is not only protective for human health relative to the MUN beneficial use, but it also provides a technologically attainable performance-based level for protection of aquatic life and the reduction of a major source of nutrients to the Bay-Delta ecosystem. This reduction in nutrient loading will provide an initial step in compliance with the narrative objective for biostimulatory substances.

State and regional water board staffs, working collaboratively with U.S. EPA, have developed a draft science-based approach to translate narrative water quality objectives for biostimulatory substances to numeric target thresholds for inland surface waters. This approach, known as the Nutrient Numeric Endpoint (NNE) framework, establishes a suite of biologically-based numeric endpoints to address nutrient over-enrichment and cultural eutrophication. A draft NNE framework currently exists for streams and lakes. In order to be employed, the NNE framework requires a conceptual model specific to the waterbody. The NNE framework for San Francisco Bay, the Delta, and smaller estuaries is currently under development. Staff will be presenting the NNE framework, in concert with a statewide policy for nutrient control for inland surface waters for future State Water Board consideration. However, it will still take considerable effort after State Water Board adoption of the NNE framework to

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[134] Ambient Water Quality Criteria Recommendations, Rivers and Streams in Ecoregion I (U.S. EPA, Dec. 2001) (EPA 822-B-01-012). Ecoregion I includes the Central Valley and recommends a median concentration of 0.31 mg/L of total nitrogen and 0.047 mg/L of total phosphorus. U.S. EPA developed these nutrient criteria recommendations with the intent that they serve as a starting point for states and Tribes to develop more refined criteria to reflect local conditions. In its response to the petitions, the Central Valley Water Board referred to the incorrect limits for total nitrogen and total phosphorus in the U.S. EPA nutrient criteria and that mistake was repeated in the prior draft of this Order.

[135] Central Valley Water Board, Nutrient Concentrations and Biological Effects in the Sacramento-San Joaquin Delta (July 2010).

[136] As previously noted the District's response to the September 2010 tentative permit stated that a similar effluent limitation (0.26 mg/L) is "unachievable." (See Letter from District Engineer Stan Dean, Sacramento Regional County Sanitation District, to Kathleen Harder (Oct. 11, 2010), pp. 55-56.)

develop the site-specific conceptual model(s) necessary to implement the framework and generate sufficiently protective water quality-based effluent limitations for the District's discharge. Use of the NNE framework will result in scientifically-based thresholds to fully implement the narrative biostimulatory objectives found in the basin plans.

The Central Valley Water Board was certainly justified in being concerned about total nutrient loading from the District's discharge even after nitrification. Among the reasons for concern include:

1. The impairment by nutrients to the Suisun Marsh Wetlands;
2. Data showing that the nutrient concentrations downstream of the discharge are more than double the upstream concentrations;
3. Evidence that the San Francisco Bay and Delta are receiving excessive nutrients despite the existing biostimulatory substances objectives in the basin plans;
4. The Bay-Delta ecosystem has undergone a shift from a nitrate-based diatom phytoplankton system, to an ammonium-based phytoplankton and small-sized zooplankton community;
5. Cultural eutrophication has led to microcystins levels exceeding the World Health Organization's recommended drinking water standards in the Delta;
6. Data showing that excess nutrients are impacting the taste and odor of drinking water supplies; and,
7. Data showing that the levels of total nitrogen and total phosphorus in the discharge consistently exceed U.S. EPA's recommended Aggregate Ecoregion I nutrient levels.

These concerns are appropriate, and we find the Central Valley Water Board sufficiently justified the denial of dilution credits and a mixing zone for nitrate and that the use an end-of-pipe effluent limitation of 10.0 mg/L for nitrate to be within the zone of reasonableness.

Public Notice Requirements

CSPA contends that the Central Valley Water Board violated U.S. EPA's regulations by making significant changes to the Permit after the closure of the public comment period without recirculating the revised permit for comment. We find that this contention lacks merit.

Federal regulations require that draft NPDES permits shall be released to the public for at least a thirty-day public comment period.[137] Courts have noted that a final permit issued by an agency need not be identical to the draft permit, which would be antithetical to the

[137] 40 C.F.R. § 124.10(b).

whole concept of notice and comment.[138] However, a final permit that departs from a proposed permit must be a logical outgrowth of the noticed proposal. If the interested parties reasonably could have anticipated the final version from the draft permit, then an additional notice and comment period is not required.[139] The law does not require that every alteration in a proposed permit result in a new notice and comment period.[140]

The Central Valley Water Board met its NDPES notice obligations when it noticed the draft permit on September 3, 2010. CSPA does not provide any evidence of how the draft permit was modified such that it was beyond the scope of the comments received. We have reviewed the changes made after the close of the comment period. The changes are within the scope of the noticed permit and responsive to comments and information received. Additionally, CSPA has not shown or even alleged that its rights were violated as a result of the modifications. The transcript of the adoption hearing shows that CSPA commented on the revisions.[141] Finally, CSPA incorrectly contends that U.S. EPA's NPDES regulations obligated the Central Valley Water Board to recirculate the revised draft permit for another public comment period. CSPA's reliance on section 124.14 of title 40 of the Code of Federal Regulations is misplaced. That section does not apply to the states, only to U.S. EPA.[142]

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[138] *Natural Resources Defense Council v. U.S. Environmental Protection Agency* (9th Cir. 2002) 279 F.3d 1180, 1186.

[139] *Ibid.*

[140] *First Am. Discount Corp. v. Commodity Futures Trading Comm.* (D.C. Cir. 2000) 222 F.3d 1008, 1015.

[141] Central Valley Water Board Hearing Transcript (Dec. 9, 2010), pp. 304-313.

[142] See 40 C.F.R. § 123.25.

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ORDER

IT IS HEREBY ORDERED that the final effluent limitations for Ammonia Nitrogen (Total as N) and the Ammonia Effluent Limitations Calculation Table in Waste Discharge Requirements Order No. R5-2010-0114 [NPDES No. CA0077682] be amended to be consistent with this Order.

CERTIFICATION

The undersigned, Clerk to the Board, does hereby certify that the foregoing is a full, true, and correct copy of an order duly and regularly adopted at a meeting of the State Water Resources Control Board held on _____.

AYE:

NO:

ABSENT:

ABSTAIN:

DRAFT

_____
Jeanine Townsend
Clerk to the Board