FACT SHEET

Sacramento Regional County Sanitation District's New NPDES Discharge Permit for the Sacramento Regional Wastewater Treatment Plant

January 10, 2011

OVERVIEW

The Sacramento Regional County Sanitation District (SRCSD) owns and operates the Sacramento Regional Water Treatment Plant (SRWTP), a Publicly Owned Treatment Works (POTW) that has been in operation since 1983 and is permitted to discharge an average dry weather flow of 181 million gallons per day (MGD) to the Sacramento River.

The Central Valley Regional Water Quality Control Board (Regional Board) administers SRWTP's National Pollutant Discharge Elimination System (NPDES) permit, which allows treated wastewater to be discharged into the Sacramento River at Freeport. Prior to the recent permit adoption in December 2010, SRWTP was operating under an administratively extended permit since their permit had an original expiration date of August 2005 (Order No. 5-00-188).[1]

A new NPDES permit was adopted by the Regional Board at a Formal Board Hearing on December 9, 2010 (Order No. R5-2010-0114).[2] The changes from the previous permit were significant and resulted in controversy from a wide range of interested stakeholders including local water agencies, southern California water suppliers, municipal dischargers, businesses, farmers, state and federal agencies (including US EPA Region 9), legislators including U.S. Senator Feinstein, and many regional and local politicians, and individual rate payers. The hearing was a formal legal proceeding with testimony provide by the interested parties. It ran from 8 am through 11pm and was contentious.

The recently adopted permit includes new limits for ammonia, nitrate, and total coliform, among others (see Table 1), and results in the need for additional facilities to be built and constructed at significant cost. These facilities include nitrification, denitrification, and Title 22 filtration and disinfection (Figure 1). SRCSD estimates that the total project cost for these facilities is $2.06 billion

[1] Order No. 5-00-188, NPDES No. CA0077682 located at: http://www.waterboards.ca.gov/centralvalley/board_decisions/adopted_orders/sacramento/5-00-188_npdes.pdf

[2] Order No. R5-2010-0114, NPDES No. CA0077682 located at: http://www.waterboards.ca.gov/centralvalley/board_decisions/adopted_orders/sacramento/r5-2010-0114_npdes.pdf

(project costs include all engineering, legal, administrative, and contingencies to deliver a complete project. All costs in January 2009 dollars, ENRCCI 9138).

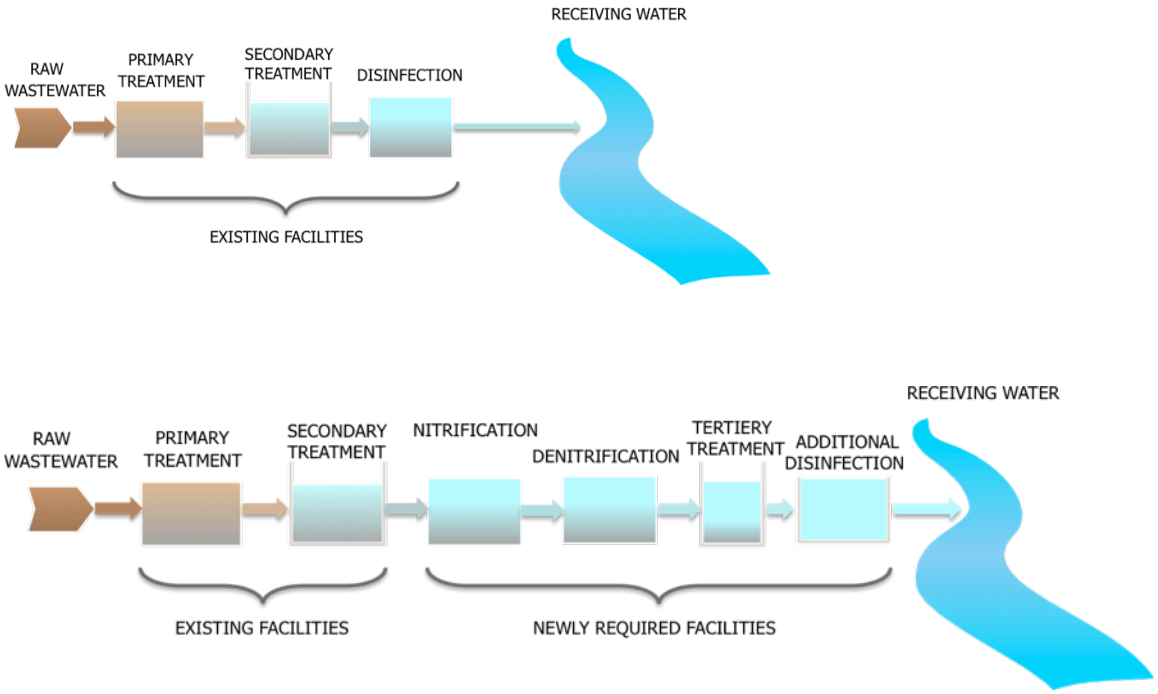
Table 1. New Final Permit Limits[3]

Parameter	Old Limit	New Final Limit	Treatment Required
Ammonia	-	1.8 mg/L - average monthly	Nitrification
Nitrate	-	10 mg/L - average monthly	Denitrification
Total Coliform	23 MPN/100mL weekly median;	2.2 MPN/100mL - 7-day median;	Tertiary Treatment + Additional Disinfection
	500 MPN/100mL daily max not to be exceeded in any two consecutive days	23 MPN/100mL, more than once in any 30-day period;	
		240 MPN/100 mL, at any time	
Total Residual Chlorine	0.011 mg/L monthly average	0.011 mg/L 4-day average	Additional Disinfection
	0.018 mg/L daily average	0.019 mg/L 1-hour average	
Electrical Conductivity (for salinity)	-	900 umhos/cm - annual average	Salinity Evaluation and Minimization Plan
BOD	30 mg/L average monthly	10 mg/L average monthly	Tertiary Treatment
	45 mg/L average weekly	15 mg/L average weekly	
	60 mg/L maximum daily	20 mg/L maximum daily	
TSS	30 mg/L average monthly	10 mg/L average monthly	Tertiary Treatment
	45 mg/L average weekly	15 mg/L average weekly	
	60 mg/L maximum daily	20 mg/L maximum daily	
Chronic Whole Effluent Toxicity	-	There shall be no chronic whole effluent toxicity in the effluent.	

MPN = Most probable number

[3] Not all "new" effluent limits are included. For a complete list of parameters, the can be found in the permit at: http://www.waterboards.ca.gov/centralvalley/board_decisions/adopted_orders/sacramento/r5-2010-0114_npdes.pdf

Figure 1. Schematic of Existing and Newly Required Facilities



The Regional Board's decision to impose these permit requirements is precedent setting. The findings used to justify these new permit limits are based more on prevailing theories by selected scientists, and less on actual data and broad consensus among professionals. Also, a decisive factor in the adoption of the new permit was the political and public pressure put upon Northern California and the Sacramento Region in particular. A major interpretation by the press of the controversy surrounding the permit was that it was "a war between the North and South" over water.[4] This was reinforced during the lengthy permit review process and subsequent Board Hearing when Southern California water interests were given "Designated Party" status and provided substantial and lengthy written and oral testimony in support of the permit.

[4] Sacramento Bee, Thursday December 9, 2010 http://www.sacbee.com/2010/12/09/3247806/sewage-plant-upgrade-ordered.html#mi_rss=Latest%20News, and Friday December 10, 2010: front page.

The major issue that could significantly impact Bay Area POTWs is the requirement for nitrification and denitrification. The prevailing reasons given in the new permit for the need for ammonia reduction are 1) to protect dissolved oxygen levels immediately downstream of the discharge and 2) to protect fishery resources in the Delta and Suisun Bay. Of the two, the second argument is the most significant and precedent setting for Bay Area POTWs.

The second argument is based on an involved hypothesis and theory put forth by some scientists studying the water quality dynamics in the Delta and Suisun Bay, and summarized in the following sections. In short, this controversial theory suggests that the food chain in the Bay is negatively impacted by ammonia. This theory has been advanced to help explain the long decline in pelagic fish species (e.g. salmon, delta smelt and striped bass)[5] that depend on a rich food supply in the Bay during critical times of the year when readying themselves for the long migration upstream.

It is feasible that other Bay Area dischargers may be impacted by the same findings and actions taken in the SRCSD permit, as the underlying rationale is considered new and significant. In fact, Diana White, Assistant Executive Officer of the Bay Area Regional Water Quality Control Board (Region 2), as well as US EPA Region 9 Water Division Director, Alexis Strauss, both testified at the Board Hearing in support of the permit, and both noted that the rationale for nitrification is all based on new information developed in just the last few years (i.e. permits soon up for renewal may now also be subject to the findings from this new information).

Of the Bay Area POTWs that may be the most impacted in the near future by the findings and actions taken in the SRCSD permit is Central Contra Costa Sanitary District (CCCSD). CCCSD discharges to Suisun Bay, and is located such that the area of its discharge could be considered potential drinking water supply during part of the year, depending on the volume of Delta outflow and the associated salinity. Therefore, not only is CCCSD potentially a candidate for new nitrification and denitrification requirements, but Southern California water interests are likely to have a similar interest in their permit as they did in the case of the SRCSD permit, potentially leading to consideration of full filtration.

This fact sheet outlines the new requirements in the permit and relevant information regarding the more controversial changes that may have significance to Bay Area dischargers.

NUTRIENTS

SRCSD's recently adopted permit includes stringent new requirements for both ammonia and nitrate. Ammonia or nitrate limits were not included in SRCSD's previous permit as the SRWTP has consistently met the US EPA aquatic life

[5] Populations of the pelagic organism, delta smelt have significantly declined in the Delta since the early 1980s, resulting in a 2010 listing as endangered by the US Fish and Wildlife Service.

criteria for acute toxicity in their mixing zone allowed in the Sacramento River. Recently though, the Regional Board has become increasingly concerned about reported fish declines in Suisun Bay and the Delta. More specifically, pelagic fish populations - fishes that use open water habitat versus near-shore environments - have declined significantly. This decline in pelagic fish is often referred to as the Pelagic Organism Decline, or POD.

There are confounding issues in Suisun Bay and the Delta surrounding the determination of the cause of this, but a predominant theory is that raised levels of ammonia are significantly contributing to the decline of pelagic organisms. The following briefly describes the Regional Board's position on these issues.

> ***Toxicity:*** The Regional Board has cited concerns by scientists that ammonia levels in the Sacramento River and Delta may be chronically toxic to pelagic organisms and their food supply. Chronic toxicity reduces the chances that an organism will survive in the environment.
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> ***Inhibited Food Supply:*** Phytoplankton such as diatoms are the basis of the ecological food chain for pelagic organisms such as the delta smelt. When elevated levels of ammonia are present, nitrate uptake and growth of diatoms is inhibited. Additionally, ammonia may be shifting food sources from diatoms to less desirable phytoplankton species. Consequently, increased ammonia levels may be contributing to pelagic organism declines by disrupting the food chain in the Delta.
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> ***Decreased Dissolved Oxygen Levels:*** As ammonia is oxidized in the environment, dissolved oxygen is consumed. Hence, greater levels of ammonia decrease dissolved oxygen. Moderate depressions of dissolved oxygen are associated with reduced species diversity, while more severe depressions can produce fish kills.

The underlying theory that ammonia is contributing to fish declines in the greater San Francisco Bay system (Bay) is involved. It begins with the fact that the Bay is a nutrient-rich estuary (primarily in the form of nitrate and organophosphates), yet with historically low net primary productivity rates (i.e. phytoplankton growth). Essentially, the concentrations of phytoplankton and the growth rates of phytoplankton are not as high as would be expected based on the concentrations of nutrients that are available in the Bay.

While eutrophication from high nutrient inputs is a concern in many estuaries, high turbidity levels in the Bay limit the amount of light available to the phytoplankton, resulting in low net primary productivity rates. Sediment supplies from tributaries and rivers into the Bay during the wet season keep turbidity high,

and tidal and wind-driven sediment re-suspension creates high turbidity during the dry season.[6]

Consequently, most Bay Area POTWs do not have effluent ammonia limitations because it was long recognized that ammonia was not contributing to biostimulatory production of algae with its associated nuisance and oxygen demand concerns.

However, more recently, Richard Dugdale, Ph.D. at California State University at San Francisco and other scientists have proposed that normal seasonal changes in the Bay that operate to support primary production at a critical time in the migratory cycle of pelagic fish are interrupted by ammonia contributed from POTWs. Dugdale argues that in the late spring months, when Delta outflows subside and the associated turbulence and turbidity drop significantly, light penetrates far enough in the water column to allow a burst of primary food chain production. This food production coincides with the migratory pattern of fish species, and is beneficial to fish survival. Yet if the ammonia concentrations are too great (i.e. greater than 4 uM / 56 ug/L), the uptake of nitrate in Bay is inhibited. Phytoplankton must now use ammonia, which is rapidly consumed, over nitrate. When ammonia is depleted, the phytoplankton then must switch over to using nitrate to continue growing. The switch of metabolic pathway from ammonia to nitrate takes too long to be accommodated during the short window of quiescent flows and low turbidity. The result is primary food production that is less than sufficient to support pelagic fish.[7]

SRWTP is the largest discharger to the Delta and one of the only few that does not remove ammonia. In August 2009 the Regional Board held a workshop, the Ammonia Summit: Assessing the role of Ammonia in the Delta and Suisun Bay Ecosystem, which brought together researchers and scientists exploring these issues. A consensus at the Summit was that the SRWTP is a major source of ammonia to the Delta. Consequently, the Regional Board believes that ammonia from the SRWTP effluent is contributing to the fish declines in the Delta.

The Regional Board decided not to grant dilution in the calculation of ammonia and nitrate effluent limits. The State Implementation Policy (SIP), which governs dilution, requires that mixing zones (areas where dilution is acceptable) do not;

1. compromise the integrity of the entire water body,
2. adversely impact sensitive or critical habitats, and
3. produce undesirable or nuisance aquatic life.

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[6] McKee, L.J., N.K. Ganju, and D.H. Schoellhamer, 2006. *Estimates of suspended sediment entering San Francisco Bay from the Sacramento and San Joaquin Delta, San Francisco Bay, CA*.

[7] Wilkerson, F. R. Dugdale, V. Hogue, and A. March, 2006. Phytoplankton blooms and nitrogen productivity in San Francisco Bay. Estuaries and Coasts 29(3):401-416., and others. http://www.usc.edu/org/seagrant/Publications/PDFs/Wilkerson_etal_2006.pdf

The Regional Board contends that the effluent discharge would result in all three of these impacts.

The Regional Board has moved forward by taking actions in the SRCSD permit based on these assumptions of fish declines. However, although some unexplained declines in fish populations may be attributed at least in part to phytoplankton dynamics, the declines in Bay fish species is widely agreed to have multiple causes including water exports, pesticides, and invasive species. All of these issues still need to be further studied as potential causes for the unexplained declines before definitive conclusions can be drawn.

Even still, the Regional Board's final conclusion is that the SRWTP discharge is degrading the Sacramento River and Delta and therefore, in accordance with the State Water Resource Control Board's Antidegradation Policy[8], Best Practicable Treatment or Control (BPTC) of the discharge is required. They have considered full nitrification of the effluent to remove ammonia to be BPTC.

In addition, the Regional Board believes further treatment will reduce carcinogenic nitrosoamine compounds (N-nitrosodimethylamine, or NDMA) from the effluent. Nitrosoamines are created when ammonia and other nitrogenous constituents are chlorinated. SRCSD chlorinates its effluent for disinfection. When comparing the SRWTP effluent to California Toxic Rule human health criterion for drinking water, the Regional Board found that the discharge is above the NDMA limit 100-fold.

To meet the new ammonia limits, SRCSD will need to design and construct nitrification facilities that remove ammonia. SRCSD has estimated the project costs of these facilities to be $582 million (project costs include all engineering, legal, administrative, and contingencies to deliver a complete project. All costs in January 2009 dollars, ENRCCI 9138).

The process of removing ammonia through nitrification creates nitrate. Nitrate in drinking water is toxic to fetuses and infants. Also, the addition of nitrate in receiving waters can create excessive plant growth and may further disrupt the ecological nutrient balance. Consequently, the new permit also includes a final total nitrate limit based on the State Drinking Water Standard of 10 mg/L as Nitrogen. In order to meet the limit in the future, SRCSD will need to build denitrification facilities that will remove nitrate from the effluent. SRCSD has estimated the project costs for denitrification facilities to be $200 million (project costs include all engineering, legal, administrative, and contingencies to deliver a complete project. All costs in January 2009 dollars, ENRCCI 9138).

The Regional Board has included a 10-year compliance schedule to allow time to build the new facilities. Interim ammonia limits that expire on November 30, 2020 have been included in the permit:

[8] Resolution No. 68-16
http://www.waterboards.ca.gov/board_decisions/adopted_orders/resolutions/1968/rs68_016.pdf

Interim Ammonia Nitrogen, Total as Nitrogen

33 mg/L average monthly

35 mg/L average weekly

45 mg/L maximum daily

When the nitrification facilities are in operation, it is expected that effluent nitrate levels will increase. At present, the SRWTP discharges low levels of nitrate and can meet the new standard. Therefore, no interim limits for nitrate were included in the permit.

Additionally, due to testimony heard on at the Formal Board Hearing, the Regional Board added a permit reopener that allows for the final nitrate effluent limitation to be modified based on on-going studies to evaluate the effect of nitrogen in the Bay-Delta system and to users of Bay-Delta waters.

DISINFECTION - TITLE 22 TERTIARY TREATMENT

The new permit includes more stringent pathogen effluent limits for the protection of recreation uses in the downstream waters. Title 22[9] tertiary treatment facilities, or equivalent, are required to be designed and constructed to treat SRWTP wastewater to minimize pathogen exposure risks.

US EPA's national risk criteria for human health protection in freshwater is 8 illnesses per 1,000 exposures.[10] Dr. Charles Gerba from the University of Arizona conducted a health risk assessment of the SRWTP discharge on behalf of SRCSD. The study found that the risk of illness downstream of the discharge versus upstream due to cryptosporidium was essentially the same. And, the study concluded that bacteria levels downstream of the discharge are far below US EPA's risk criteria, and that therefore, the discharge is protective of recreation contact use.

The results from the study prompted the Regional Board to request a site-specific recommendation from the California Department of Public Health (DPH)[11] on the appropriate levels of disinfection for protection of full body-contact recreation downstream of the SRCSD discharge. DPH's recommended that pathogen concentrations be reduced until the risk in river waters is no more than 1 illness per 10,000 exposures. This requirement is consistent with US EPA drinking

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[9] DPH reclamation criteria, California Code of Regulations (CCR), Title 22, division 4, chapter 3 (Title 22) requires wastewater for recycled water use be oxidized, coagulated, filtered, and adequately disinfected.

[10] EPA promulgated water quality standards as part of the Beaches Environmental Assessment and Coast Health (BEACH) Act of 2000 on November 16, 2004 rule *Water Quality Standards for Coastal and Great Lakes Recreation Waters*: http://edocket.access.gpo.gov/2004/pdf/04-25303.pdf

[11] The California Department of Public Health (DPH) puts forth disinfection requirements for the protection of public health.

water criteria.[12] SRCSD believes that this requirement is too stringent and contends that even without contributions from their discharge, the Sacramento River does not meet this risk level.

Nevertheless, the Regional Board has required that wastewater receive Title 22 tertiary treatment, or equivalent based on DPH's recommendation. Title 22 requires that wastewater for recycled water use be oxidized, coagulated, filtered, and adequately disinfected (see Appendix A for detailed Title 22 requirements). Title 22 requirements are recycled water standards that do not apply to surface water discharges.

The Regional Board believes that providing tertiary treatment to the discharge will also improve the water quality of drinking water and irrigation water taken from the Sacramento River downstream of the discharge. Additionally, tertiary treatment will improve removal of other pollutants such as heavy metals, total organic carbon, BOD, TSS, phosphorus, and emerging pollutants of concern such as endocrine disruptors.

The 2010 SRCSD Permit includes the total coliform final limits (see Table 1) to be met after a 10-year compliance schedule allowance. SRCSD has estimated the project costs for filtration (i.e. microfiltration) and disinfection (i.e. ultraviolet light disinfection) to be $1.16 billion and $116 million, respectively (project costs include all engineering, legal, administrative, and contingencies to deliver a complete project. All costs in January 2009 dollars, ENRCCI 9138).

The permit includes a 10-year compliance schedule to allow time for the facilities to be designed and constructed. Interim limits for total coliform, which expire on November 20, 2020, are the same as the total coliform limits in the previous permit:

Interim Total Coliform

23 MPN per 100 mL, as a weekly median;

500 MPN/100 mL, in any two consecutive days as a daily maximum

With the technological improvement of tertiary treatment, 5-day Biochemical Oxygen Demand (BOD) and Total Suspended Solids (TSS) levels in the effluent will improve. Consequently, the permit includes new technology-based limits for BOD and TSS as presented in Table 1. These limits will not be able to be met until the tertiary facilities are in operation. Therefore, the permit includes interim limits, which are the same as the previous permit limits:

Interim BOD

30 mg/L average monthly;

45 mg/L average weekly;

[12] Surface Water Treatment Rule http://water.epa.gov/lawsregs/rulesregs/sdwa/swtr/upload/SWTR.pdf

60 mg/L maximum daily.

Interim TSS

30 mg/L average monthly;

45 mg/L average weekly;

60 mg/L maximum daily.

These limits expire at the end of the compliance schedule on November 30, 2020.

Similarly, with improved disinfection facilities, the Regional Board has included new final effluent limits for total residual chlorine (see Table 1) that expire November 30, 2020. In the interim, the limits are the same as the previous permit:

Interim Total Residual Chlorine

0.011 mg/L, as a monthly average;

0.018 mg/L, as a daily average.

Appendix A – Title 22 Disinfected Tertiary Requirements

Title 22 Criteria				
Code Section	**Recycled Water Type**	**Treatment Process**	**Median Coliform (MPN/100mL)**	**Total Coliform (MPN/100mL)**
60301.230	Disinfected Tertiary	Filtered(1) and Disinfected(2)	2.2(3)	23(4) 240(5)

Notes:
MPN – most probable number
(1) "Filtered" means an oxidized wastewater that satisfies (A) or (B) below:
- (A) Has been coagulated and passed through natural soils or filter media with a specified maximum flux rate, depending on the type filtration system, and the turbidity does not exceed any of the following:
  1) A daily average of 2 NTU.
  2) 5 NTU more than 5 percent of the time within a 24-hour period.
  3) 10 NTU at any time.
- (B) Has been passed through a microfiltration, ultrafiltration, nanofiltration, or reverse osmosis membrane so that the turbidity does not exceed any of the following:
  1) 0.2 NTU more than 5 percent of the time within a 24-hour period.
  2) 0.5 NTU at any time.

(2) Disinfected by either:
- a. A chlorine process with continuous CT of 450 mg-min/L with a modal contact time of 90 minutes (based on peak dry weather design flow).
- b. A combined process that inactivates and/or removes 99.999 percent (5-log removal) of F-specific bacteriophage MS-2, or polio virus.

(3) In the last 7 days for which analyses have been completed.
(4) In no more than 1 sample in any 30 day period.
(5) In no samples.