Staff Report

Policy for Toxicity Assessment and Control

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DIVISION OF WATER QUALITY
STATE WATER RESOURCES CONTROL BOARD
CALIFORNIA ENVIRONMENTAL PROTECTION AGENCY

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SECTION I: INTRODUCTION

As directed by the State Water Resources Control Board (State Water Board), staff members are working to replace the toxicity control provisions established in Section 4 of the *Policy for Implementation of Toxics Standards for Inland Surface Waters, Enclosed Bays, and Estuaries of California* (SIP) with a standalone policy. The provisions proposed in the *Policy for Toxicity Assessment and Control* (Policy) include a new method to determine the toxicity of discharges, statewide numeric objectives, and further standardization of toxicity provisions for National Pollutant Discharge Elimination System (NPDES) dischargers and facilities subject to Waste Discharge Requirements (WDR) and conditional waivers.

Toxicity occurs when undefined pollutants or the aggregate effects of known toxicants negatively impact beneficial uses; when originating from an effluent, this aggregate effect is typically referred to as "whole effluent toxicity" (WET). Toxicity tests estimate the potential effects of discharges on the survival, growth and reproduction of test species, and are used to determine compliance with the objectives for toxicity established in the ten Regional Water Quality Control Plans (Basin Plans) adopted by the nine Regional Water Quality Control Boards (Regional Water Boards). Each Basin Plan contains narrative toxicity objectives that require all waters to be maintained free of toxic substances in concentrations that produce detrimental physiological responses in humans, plants, terrestrial animals, and aquatic organisms.

Toxicity Control Provisions in the SIP

The current toxicity provisions in Section 4 of the SIP briefly establish minimum chronic toxicity control requirements for implementing the narrative toxicity objectives found in the Basin Plans. Chronic toxicity tests measure the lethal and sublethal effects (e.g. reduced growth, reproduction, etc.) of a given discharge on specified test organisms. The SIP requires that the Regional Water Boards determine compliance with narrative chronic toxicity objectives using United States Environmental Protection Agency (U.S. EPA) methodology for all inland surface waters, enclosed bays, and estuaries. Some Basin Plans also require permitted facilities to determine the acute toxicity of an effluent or receiving water. Acute toxicity tests determine the concentration of a discharge that is lethal to a group of test organisms during a short-term exposure. While the SIP does not address these particular tests, the U.S. EPA has published approved methodology and recommendations (U.S. EPA 2002a).

The SIP requires chronic toxicity tests to be conducted on at least one species of aquatic plant, one invertebrate, and one vertebrate during an initial screening period; after which the most sensitive organism may be used for monitoring purposes. If repeated tests reveal toxicity or if a discharge causes or contributes to toxicity in a receiving water body, then a toxicity reduction evaluation (TRE) must be performed. The TRE process, used to determine the cause(s) of toxicity, may include a toxicity identification evaluation (TIE) in order to pinpoint specific pollutants in an effluent. The SIP allows multiple dischargers to coordinate TRE implementation when discharging to the same water body. Failure to comply with required toxicity testing and TRE studies within a designated period will result in appropriate enforcement action (State Water Board 2005b).

Project Background

In 2002, NPDES permits for two publicly owned treatment works (POTW) in the Los Angeles County Sanitation District (Los Coyotes Water Reclamation Plant and Long Beach Water Reclamation Plant) came up for renewal. In rewriting the permits, Los Angeles Regional

Water Board staff included numeric effluent limitations intended to implement the narrative chronic toxicity objectives established in the Basin Plan. In response, the Los Angeles County Sanitation District filed a petition challenging these limits and other permit requirements (Los Coyotes Water Reclamation Plant Order Nos. R4-2002-0121 and R4-2002-0122; and Long Beach Water Reclamation Plant Order Nos. R4-2002-0123 and R4-2002-0124). In 2003, the State Water Board ruled on the petition in Order No. 2003-0012, stating that the "propriety of including numeric effluent limitations for chronic toxicity in NPDES permits for publicly-owned treatment works that discharge to inland waters should be considered in a regulatory setting, in order to allow for full public discussion and deliberation." As a result, the State Water Board passed Resolution No. 2005-0019, which required staff to amend the toxicity provisions established in the SIP by January 2006. In the interim, the two POTWs were required to adhere to narrative toxicity effluent limitations with numeric benchmarks that would trigger accelerated monitoring and TREs.

Scoping Meeting

A California Environmental Quality Act (CEQA) scoping meeting was conducted to provide a forum for early public consultation on the preparation of this Staff Report. The scoping meeting was held on January 17, 2006 at the California Environmental Protection Agency Headquarters Building in Sacramento. Comments, both written and oral were provided by stakeholders to help determine the scope and content of the environmental information required by federal and state regulations. The scoping meeting helped to identify the range of actions, alternatives, mitigation measures, and significant effects found within this document.

Purpose of the Staff Report

Pursuant to Title 23, Section 3777 of the California Code of Regulations, this Staff Report is part of the substitute environmental documentation required for the adoption of statewide policies and plans under the California Environmental Quality Act (CEQA). The purpose of this Staff Report is to present the State Water Board's analysis of the need for and the effects of the Policy for Toxicity Assessment and Control.

CEQA authorizes the Secretary for Natural Resources to certify that state regulatory programs meeting certain environmental standards are exempt from CEQA chapters 3 and 4; the requirements for preparing environmental impact reports, negative declarations, and initial studies. The Secretary for Natural Resources has certified the following regulatory programs of the State Water Board as exempt: the adoption or approval of standards, rules, regulations, or plans to be used in the Basin/208 Planning program for the protection, maintenance, and enhancement of water quality in California (California Code of Regulations (CCR), Title 14, §15251(g)). This exemption includes the State Water Board's process to adopt this proposed Policy. All certified regulatory programs must still conduct a meaningful review of a project's environmental impacts. Any environmental impacts that may result from the proposed actions are addressed in Section V, and summarized in the "Environmental Check List Form" contained within Appendix A.

Regulatory Background

In 1969, the Porter-Cologne Water Quality Control Act (Porter-Cologne) was adopted as the principal law governing water quality in California. Named after the late Los Angeles Assemblymember Carley V. Porter and then-Senator Gordon Cologne, Porter-Cologne instituted a comprehensive program to protect the quality and "beneficial uses" (or "designated uses" under federal parlance) of the state's water bodies. Beneficial uses include, but are not limited to, "domestic, municipal, agricultural, and industrial supply; power generation; recreation; aesthetic enjoyment; navigation; and preservation and enhancement of fish, wildlife, and other aquatic resources or preserves" (California Water Code (CWC) §13050(f)). Regulatory protection of beneficial uses is carried out, in part, through water quality objectives established in each Basin Plan (CWC §13241).

In 1972, Congress enacted the Clean Water Act (CWA) with the goal to "restore and maintain the chemical, physical, and biological integrity of the Nation's waters" (Title 33 United States Code (U.S.C.) §1251 (a)). To achieve this goal, the CWA established the NPDES Permit Program to regulate point source discharges of pollutants to waters of the United States (Title 33 U.S.C. §1342). In California the State and Regional Boards issue and administer NPDES permits under a program approved by the U.S. EPA (CWC §13377; Title 33 U.S.C. §1342(b)). NPDES permits are required to contain effluent limitations reflecting pollution reduction achievable through technological means, as well as more stringent limitations necessary to ensure that receiving waters meet state water quality standards (Title 33 U.S.C. §1311(b)(1)(A), (B) and (C)). State water quality standards include the beneficial uses of water bodies, water quality objectives designed to protect those uses, a corresponding implementation plan, and an antidegradation policy.

Section 1313(c)(2)(B) of the CWA requires states to adopt water quality criteria for all priority pollutants established in CWA Section 1317(a). To comply with Section 1313(c)(2)(B), the State Water Board adopted the Inland Surface Waters Plan and Enclosed Bays and Estuaries Plan in April 1991. In 1992, the U.S. EPA promulgated the National Toxics Rule to bring states into compliance with Section 1313(c)(2)(B. In 1993, the State Water Board amended the 1991 plans to achieve compliance with the National Toxics Rule. However, in September 1994, the State Water Board rescinded the two plans in response to a Sacramento County Superior Court ruling in favor of several dischargers that challenged the means by which the 1991 plans were adopted. To reestablish water quality criteria for priority pollutants and to effectively bring California into compliance with the CWA, U.S. EPA promulgated the California Toxics Rule in May 2000. The SIP was then adopted to provide a mechanism to implement the water quality criteria established in the California Toxics Rule.

Mandatory Minimum Penalties

Porter-Cologne requires the imposition of Mandatory Minimum Penalties (MMP) for specified violations of WDRs and NPDES permits. The Regional Water Boards must either assess an administrative civil liability for an MMP or assess an administrative civil liability for a greater amount if applicable. Water Code section 13385(i)(1) requires the Regional Water Boards to assess MMPs of $3,000 per non-serious violation, only after three such violations have been accrued. A non-serious violation occurs if the discharger does any of the following four or more times in any period of six consecutive months: violates a WDR effluent limitation; fails to file a report of waste discharge pursuant to Water Code section 13260; files an incomplete report of waste discharge pursuant to Water Code section 13260 or; violates a toxicity effluent limitation where the WDRs do not contain pollutant specific effluent limitations for toxic pollutants.

Water Quality Enforcement Policy

On February 19, 2002, the State Water Board adopted Resolution No. 2002-0040, approving the revised *Water Quality Enforcement Policy* (Enforcement Policy) on July 30, 2002. An amended Enforcement Policy was subsequently adopted on November 17, 2009 (Resolution

No. 2009-0083) and approved on May 20, 2010. The primary goal of the Enforcement Policy is to create a framework for identifying and investigating instances of noncompliance, for taking enforcement actions that are appropriate in relation to the nature and severity of the violation, and for prioritizing enforcement resources to achieve maximum environmental benefit. Under the new Enforcement Policy, violations of acute or chronic toxicity requirements, where the discharge may adversely affect fish or wildlife, will be considered Class II violations. Class II violations are those violations that pose a moderate, indirect, or cumulative threat to water quality and, therefore, have the potential to cause detrimental impacts on human health and the environment (see State Water Board, *Water Quality Enforcement Policy* (2009), p. 5).

Regional Water Board Basin Plans - Toxicity Objectives

The following is a summary of each Regional Water Board Basin Plan regarding water quality objectives for toxicity. It is important to note that each permit is tailored to account for the details of a specific discharge. Therefore, language between the permit and corresponding Basin Plan may differ.

Region 1

> All waters shall be maintained free of toxic substances in concentrations that are toxic to, or that produce detrimental physiological responses in human, plant, animal, or aquatic life. Compliance with this objective will be determined by use of indicator organisms, analyses of species diversity, population density, growth anomalies, bioassays of appropriate duration, or other appropriate methods as specified by the Regional Water Board.
>
> The survival of aquatic life in surface waters subjected to a waste discharge, or other controllable water quality factors, shall not be less than that for the same water body in areas unaffected by the waste discharge, or when necessary for other control water that is consistent with the requirements for "experimental water" as described in *Standard Methods for the Examination of Water and Wastewater*, 18th Edition (1992). As a minimum, compliance with this objective as stated in the previous sentence shall be evaluated with a 96-hour bioassay.
>
> In addition, effluent limits based upon acute bioassays of effluents will be prescribed. Where appropriate, additional numerical receiving water objectives for specific toxicants will be established as sufficient data become available, and source control of toxic substances will be encouraged (North Coast Regional Water Board (1994), p. 3-4.00).

Region 2

> All waters shall be maintained free of toxic substances in concentrations that are lethal to or that produce other detrimental responses in aquatic organisms. Detrimental responses include, but are not limited to, decreased growth rate and decreased reproductive success of resident or indicator species.
>
> There shall be no acute toxicity in ambient waters. Acute toxicity is defined as a median of less than 90%, or less than 70%, 10% of the time, of test organisms in a 96-hour static or continuous flow test. There shall be no chronic toxicity in ambient waters. Chronic toxicity is a detrimental biological effect on growth rate, reproduction, fertilization

success, larval development, population abundance, community composition, or any other relevant measure of the health of an organism, population, or community.

Attainment of this objective will be determined by analyses of indicator organisms, species diversity, population density, growth anomalies, toxicity tests, or other methods selected by the Water Board. The Water Board will also consider other relevant information and numeric criteria and guidelines for toxic substances developed by other agencies as appropriate.

The health and life history characteristics of aquatic organisms in waters affected by controllable water quality factors shall not differ significantly from those for the same waters in areas unaffected by controllable water quality factors (San Francisco Bay Regional Water Board (1995), §3.3.18).

Region 3

All water shall be maintained free of toxic substances in concentrations which are toxic to, or which produce detrimental physiological responses in human, plant, animal, or aquatic life. Compliance with this objective will be determined by use of indicator organisms, analyses of species diversity, population density, growth anomalies, toxicity bioassays of appropriate duration, or other appropriate methods as specified by the Regional Water Board.

Survival of aquatic life in surface waters subjected to a waste discharge or other controllable water quality conditions, shall not be less than that for the same water body in areas unaffected by the waste discharge, or when necessary, for other control water that is consistent with the requirements for "experimental water" as described in *Standard Methods for the Examination of Water and Wastewater*, latest edition. As a minimum, compliance with this objective as stated in the previous sentence shall be evaluated with a 96-hour bioassay.

In addition, effluent limits based upon acute bioassays of effluents will be prescribed where appropriate, additional numerical receiving water objectives for specific toxicants will be established as sufficient data becomes available, and source control of toxic substances will be encouraged.

The discharge of wastes shall not cause concentrations of unionized ammonia (NH_3) to exceed 0.025 mg/L (as N) in receiving waters (Central Coast Regional Water Board (1994), p. III-4).

Region 4

Toxicity is the adverse response of organisms to chemical or physical agents. When the adverse response is mortality, the result is termed acute toxicity. When the adverse response is not mortality, but instead reduced growth in larval organisms or reduced reproduction in adult organisms (or other appropriate measures), a critical life stage effect (chronic toxicity) has occurred. The use of aquatic bioassays (toxicity tests) is widely accepted as a valid approach to evaluating toxicity of waste and receiving waters.

All water shall be maintained free of toxic substances in concentrations that are toxic to, or that produce detrimental physiological responses in, human, plant, animal, or aquatic life. Compliance with this objective will be determined by use of indicator organisms, analyses of species diversity, population density, growth anomalies, bioassays of appropriate duration or other appropriate methods as specified by the State or Regional Board.

The survival of aquatic life in surface waters, subjected to a waste discharge or other controllable water quality factors, shall not be less than that for the same water body in areas unaffected by the waste discharge or, when necessary, other control water.

There shall be no acute toxicity in ambient waters, including mixing zones. The acute toxicity objective dictates that the average survival in undiluted effluent for any three consecutive 96-hour static or continuous flow bioassay tests shall be at least 90%, with no single test having less than 70% survival when using an established U.S. EPA, State Board, or other protocol authorized by the Regional Board.

There shall be no chronic toxicity in ambient waters outside mixing zones. To determine compliance with this objective, critical life stage tests for at least three species with approved testing protocols shall be used to screen for the most sensitive species. The test species used for screening shall include a vertebrate, an invertebrate, and an aquatic plant. The most sensitive species shall then be used for routine monitoring. Typical endpoints for chronic toxicity tests include hatchability, gross morphological abnormalities, survival, growth, and reproduction.

Effluent limits for specific toxicants can be established by the Regional Board to control toxicity identified under Toxicity Identification Evaluations (TIEs) (Los Angeles Regional Water Board (1995), p. 3-16 – 3-17).

Region 5

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 Boards. 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. EPA, and other appropriate organizations, to evaluate compliance with this objective.

The survival of aquatic life in surface waters subjected to a waste discharge or other controllable water quality factors shall not be less than that for the same water body in areas unaffected by the waste discharge, or, when necessary, for other control water that is consistent with the requirements for “experimental water” as described in Standard Methods for the Examination of Water and Wastewater, latest edition. As a minimum, compliance with this objective as stated in the previous sentence shall be evaluated with a 96-hour bioassay.

In addition, effluent limits based upon acute biotoxicity tests of effluents will be prescribed where appropriate; additional numerical receiving water quality objectives for specific toxicants will be established as sufficient data becomes available; and source control of toxic substances will be encouraged (Central Valley Regional Water Board, Sacramento and San Joaquin River Basin Plan (1995), p. III-8.01 – III-9.00; Tulare Lake Basin Plan (1995), p. III-6 – III-7).

Region 6

All waters shall be maintained free of toxic substances in concentrations that are toxic to, or that produce detrimental physiological responses in human, plant, animal, or aquatic life. Compliance with this objective will be determined by use of indicator organisms, analyses of species diversity, population density, growth anomalies, bioassays of appropriate duration and/or other appropriate methods as specified by the Regional Board.

The survival of aquatic life in surface waters subjected to a waste discharge, or other controllable water quality factors, shall not be less than that for the same water body in areas unaffected by the waste discharge, or when necessary, for other control water that is consistent with the requirements for “experimental water” as defined in Standard Methods for the Examination of Water and Wastewater (Lahontan Regional Water Board (1995), p. 3-6).

Region 7

All waters shall be maintained free of toxic substances in concentrations which are toxic to, or which produce detrimental physiological responses in human, plant, animal, or indigenous aquatic life. Compliance with this objective will be determined by use of indicator organisms, analyses of species diversity, population density, growth anomalies, 96-hour bioassay or bioassays of appropriate duration or other appropriate methods as specified by the Regional Board. Effluent limits based upon bioassays of effluent will be prescribed where appropriate, additional numerical receiving water objectives for specific toxicants will be established as sufficient data become available, and source control of toxic substances will be encouraged.

The survival of aquatic life in surface waters subjected to a waste discharge or other controllable water quality factors, shall not be less than that for the same water body in areas unaffected by the waste discharge, or other control water which is consistent with the requirements for “experimental water” as described in *Standard Methods for the Examination of Water and Wastewater*, 18th Edition. As a minimum, compliance with this objective as stated in the previous sentence shall be evaluated with a 96-hour bioassay.

As described in Chapter 6, the Regional Board will conduct toxic monitoring of the appropriate surface waters to gather baseline data as time and resources allow (Colorado River Basin Regional Water Board (1994), p. 3-2).

Region 8

Toxic substances shall not be discharged at levels that will bioaccumulate in aquatic resources to levels which are harmful to human health.

The concentration of toxic substances in the water column, sediments or biota shall not adversely affect beneficial uses.

The Regional Board requires the initiation of a Toxicity Reduction Evaluation (TRE) if a discharge consistently exceeds its chronic toxicity effluent limit. The Regional Board, to date, has interpreted the "consistently exceeds" trigger as the failures of three successive monthly toxicity tests, each conducted on separate samples. Initiation of a TRE has also been conditioned on a determination that a sufficient level of toxicity exists to permit effective application of the analytical techniques required by a TRE. The Regional Board also encourages the development of scientifically sound toxicity test quality control and standardized interpretation criteria to improve the accuracy and reliability of chronic toxicity determinations (Santa Ana Regional Water Board (1995), p. 4-17, 6-18).

Region 9

All waters shall be maintained free of toxic substances in concentrations that are toxic to, or that produce detrimental physiological responses in human, plant, animal, or aquatic life. Compliance with this objective will be determined by use of indicator organisms, analyses of species diversity, population density, growth anomalies, bioassays of appropriate duration, or other appropriate methods as specified by the Regional Board.

The survival of aquatic life in surface waters subjected to a waste discharge or other controllable water quality factors shall not be less than that for the same water body in areas unaffected by the waste discharge or, when necessary, for other control water that is consistent with requirements specified in U.S. EPA, State Water Resource Control Board, or other protocol authorized by the Regional Board. As a minimum, compliance with this objective as stated in the previous sentence shall be evaluated with a 96-hour acute bioassay.

In addition, effluent limits based upon acute bioassays of effluents will be prescribed where appropriate, additional numerical receiving water objectives for specific toxicants will be established as sufficient data become available, and source control of toxic substances will be encouraged (San Diego Regional Water Board (1995), p. 3-29).

SECTION II: PROJECT DESCRIPTION

This Policy will establish new toxicity objectives, a standardized method of data analysis, corresponding monitoring and reporting requirements, and provisions for compliance determination. The Policy will apply to NPDES permits, WDRs, and conditional waivers that discharge to inland surface waters, enclosed bays, and estuaries, excluding ocean waters of California; ocean discharges are addressed in the California Ocean Plan (State Water Board 2005a.)

The State Water Board's goals for this project are to have the Regional Water Boards convert the Policy's WET objectives into effluent limitations in order to: protect aquatic life beneficial uses; provide regulatory consistency; provide a basis for equitable enforcement; and fulfill the requirements of State Water Board Resolution No. 2005-0019.

If adopted, the Policy will supersede Section 4 of the SIP and the toxicity test provisions established in some Basin Plans. The narrative toxicity objectives established in each of the ten Basin Plans, however, would remain in effect.

SECTION III: ENVIRONMENTAL SETTING

For the purposes of water quality management, section 13200 of Porter-Cologne divides the State into nine different hydrologic regions. Brief descriptions of these Regions and the water bodies addressed by this Staff Report are presented below. The information provided in this section is derived from the ten Basin Plans.

North Coast Region (Region 1)

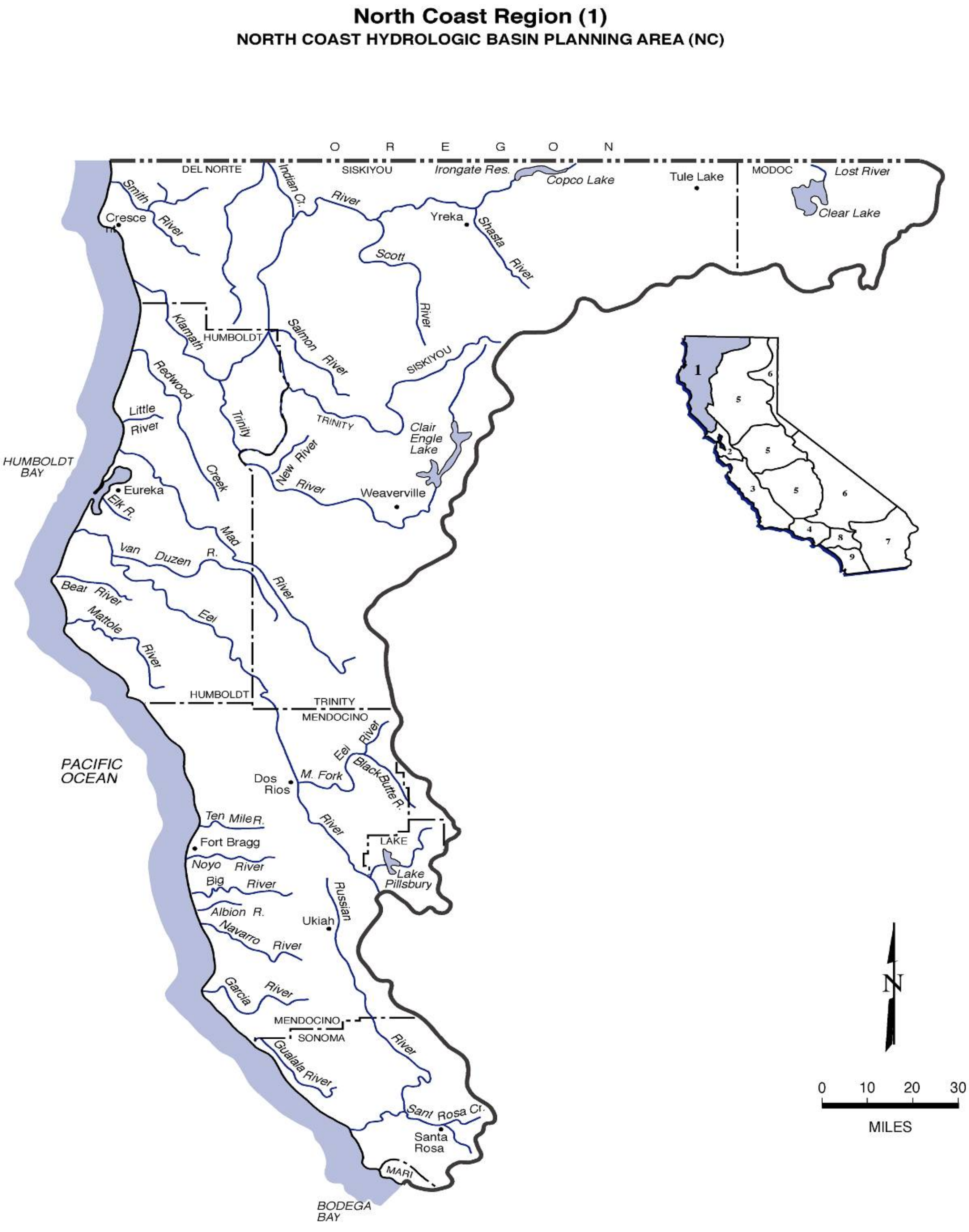
The North Coast Region comprises all regional basins (including Lower Klamath Lake and Lost River Basins) draining into the Pacific Ocean from the California-Oregon state line, southern boundary and includes the watershed of the Estero de San Antonio and Stemple Creek in Marin and Sonoma Counties (Figure 1). The North Coast Region is divided by two natural drainage basins, the Klamath River Basin and the North Coastal Basin. This Region covers all of Del Norte, Humboldt, Trinity, and Mendocino Counties, as well as major portions of Siskiyou and Sonoma Counties and small portions of Glenn, Lake, and Marin Counties. It encompasses a total area of approximately 19,390 square miles, including 340 miles of coastline and remote wilderness areas, as well as urbanized and agricultural areas.

Beginning at the Smith River in northern Del Norte County and heading south to the Estero de San Antonio in northern Marin County, the North Coast Region incorporates a large number of major river estuaries. Other North Coast streams and rivers with significant estuaries include the Klamath River, Redwood Creek, Little River, Mad River, Eel River, Noyo River, Navarro River, Elk Creek, Gualala River, Russian River, and Salmon Creek (this creek mouth also forms a lagoon). Northern Humboldt County coastal lagoons include Big Lagoon and Stone Lagoon. The two largest enclosed bays in the North Coast Region are Humboldt Bay and Arcata Bay (both in Humboldt County). Another enclosed bay, Bodega Bay, is located in Sonoma County near the southern border of the Region.

Distinct temperature zones characterize the North Coast Region. Along the coast, the climate is moderate and foggy with limited temperature variation. Inland, however, seasonal temperature ranges in excess of 100°F have been recorded. Precipitation is greater here than any other part of California, and damaging floods are frequent hazards. Particularly devastating flooding occurred in the North Coast area in December 1955, December 1964, and February 1986. Ample precipitation in combination with the mild climate found over most of the North Coast Region has provided a wealth of fish, wildlife, and scenic resources. The mountainous nature of the Region, with its dense coniferous forests interspersed with grassy or chaparral covered slopes, provides shelter and food for deer, elk, bear, mountain lion, fur bearers, and many upland bird and mammal species. The numerous streams and rivers of the Region contain anadromous fish and the reservoirs, although few in number, support both cold water and warm water fish.

Tidelands and marshes are extremely important to many species of waterfowl and shore birds, both for feeding and nesting. Cultivated land and pasturelands also provide supplemental food for many birds, including small pheasant populations. Tideland areas along the north coast provide important habitat for marine invertebrates and nursery areas for forage fish, game fish, and crustaceans. Offshore coastal rocks are used by many species of seabirds as nesting areas.

Major components of the economy are tourism and recreation, logging and timber milling, aggregate mining, commercial and sport fisheries, sheep, beef and dairy production, and vineyards and wineries. In all, the North Coast Region offers a beautiful natural environment with opportunities for scientific study and research, recreation, sport, and commerce.



Base map prepared by the Division of Water Rights, Graphics Services Unit

Figure 1: North Coast Region Hydrologic Basin

San Francisco Bay Region (Region 2)

The San Francisco Bay Region comprises San Francisco Bay, Suisun Bay beginning at the Sacramento River, and the San Joaquin River westerly, from a line which passes between Collinsville and Montezuma Island (Figure 2). The Region's boundary follows the borders common to Sacramento and Solano Counties and Sacramento and Contra Costa Counties west of the Markely Canyon watershed in Contra Costa County. All basins west of the boundary, described above, and all basins draining into the Pacific Ocean between the southern boundary of the North Coast Region and the southern boundary of the watershed of Pescadero Creek in San Mateo and Santa Cruz Counties are included in the Region.

The Region comprises most of the San Francisco Estuary to the mouth of the Sacramento-San Joaquin Delta. The San Francisco Estuary conveys the waters of the Sacramento and San Joaquin Rivers to the Pacific Ocean. Located on the central coast of California, the Bay system functions as the only drainage outlet for waters of the Central Valley and it marks a natural topographic separation between the northern and southern coastal mountain ranges. The Region's waterways, wetlands, and bays form the centerpiece of the fourth largest metropolitan area in the United States, including all or major portions of Alameda, Contra Costa, Marin, Napa, San Francisco, San Mateo, Santa Clara, Solano, and Sonoma Counties.

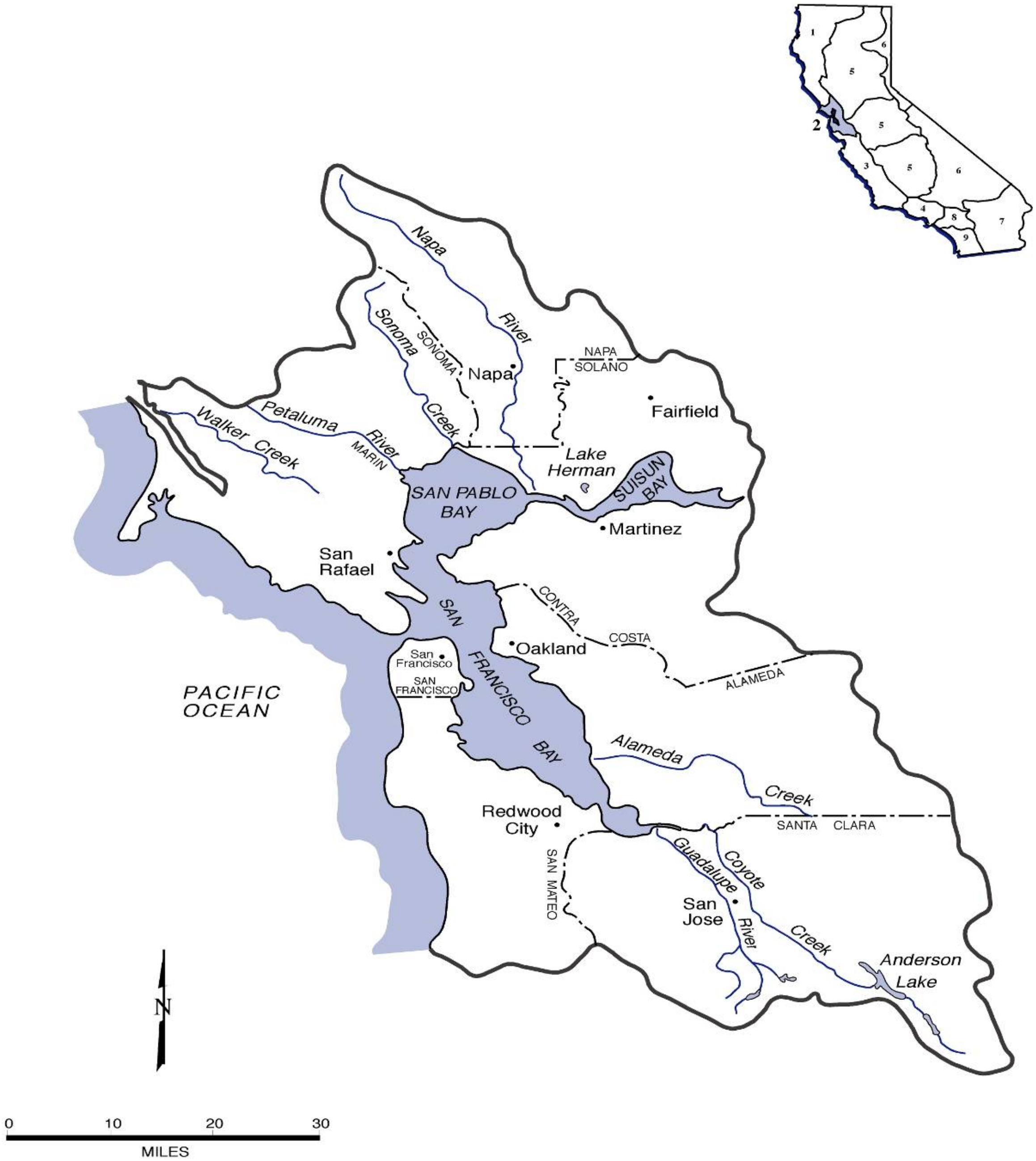
The San Francisco Bay Regional Water Board has jurisdiction over the part of the San Francisco Estuary that includes all of the San Francisco Bay segments extending east to the Delta, including Winter Island near Pittsburg. The San Francisco Estuary sustains a highly dynamic and complex environment. Within each section of the Bay system lie deepwater areas that are adjacent to large expanses of very shallow water. Salinity levels range from hypersaline to freshwater, and water temperature varies widely. The Bay system's deepwater channels, tidelands, marshlands, and freshwater streams and rivers provide a wide variety of habitats within the Region. Coastal embayments, including Tomales Bay and Bolinas Lagoon, are also located in this Region. The Central Valley Regional Water Board has jurisdiction over the Delta and rivers extending further eastward.

The Sacramento and San Joaquin Rivers enter the Bay system through the Delta at the eastern end of Suisun Bay and contribute almost all of the freshwater inflow into the Bay. Many smaller rivers and streams also convey freshwater to the Bay system. The rate and timing of these freshwater flows are among the most important factors influencing physical, chemical, and biological conditions in the Estuary. Flows in the region are highly seasonal, with more than 90% of the annual runoff occurring between November and April.

The San Francisco Estuary is made up of many different types of aquatic habitats that support a great diversity of organisms. Suisun Marsh in Suisun Bay is the largest brackish-water marsh in the United States. San Pablo Bay is a shallow embayment strongly influenced by runoff from the Sacramento and San Joaquin Rivers.

The Central Bay is the portion of the Bay most influenced by oceanic conditions. The South Bay, with less freshwater inflow than the other portions of the Bay, acts more like a tidal lagoon. Together, these areas sustain rich communities of aquatic life and serve as important wintering sites for migrating waterfowl, and spawning areas for anadromous fish.

San Francisco Bay Region (2)
SAN FRANCISCO BAY HYDROLOGIC BASIN PLANNING AREA (SF)



Base map prepared by the Division of Water Rights, Graphics Services Unit

Figure 2: San Francisco Bay Region Hydrologic Basin

Central Coast Region (Region 3)

The Central Coast Region comprises all basins (including Carrizo Plain in San Luis Obispo and Kern Counties) draining into the Pacific Ocean from the southern boundary of the Pescadero Creek watershed in San Mateo and Santa Cruz Counties, to the southeastern boundary of the Rincon Creek watershed, located in western Ventura County (Figure 3). The Region extends over a 300-mile long by 40-mile wide section of the state's central coast. Its geographic area encompasses all of Santa Cruz, San Benito, Monterey, San Luis Obispo, and Santa Barbara Counties as well as the southern one-third of Santa Clara County, and small portions of San Mateo, Kern, and Ventura Counties. Included in the region are urban areas such as the Monterey Peninsula and the Santa Barbara coastal plain; prime agricultural lands such as the Salinas, Santa Maria, and Lompoc Valleys; National Forest lands; extremely wet areas such as the Santa Cruz Mountains; and arid areas such as the Carrizo Plain.

Water bodies in the Central Coast Region are varied. Enclosed bays and harbors in the Region include Morro Bay, Elkhorn Slough, Tembladero Slough, Santa Cruz Harbor, Moss Landing Harbor, San Luis Harbor, and Santa Barbara Harbor. Several small estuaries also characterize the Region, including the Santa Maria River Estuary, San Lorenzo River Estuary, Big Sur River Estuary, and many others. Major rivers, streams, and lakes include San Lorenzo River, Santa Cruz River, San Benito River, Pajaro River, Salinas River, Santa Maria River, Cuyama River, Estrella River and Santa Ynez River, San Antonio Reservoir, Nacimiento Reservoir, Twitchel Reservoir, and Cuchuma Reservoir. The economic and cultural activities in the basin have been primarily agrarian. Livestock grazing persists, but it has since been combined with hay cultivation in the valleys. Irrigation, using local groundwater, is very significant in intermountain valleys throughout the basin. Mild winters result in long growing seasons and continuous cultivation of many vegetable crops in parts of the basin.

While agriculture and related food processing activities are major industries in the Region, oil production, tourism, and manufacturing contribute heavily to its economy. The northern part of the Region has experienced a significant influx of electronic manufacturing, while offshore oil exploration and production have heavily influenced the southern part.

Water quality problems frequently encountered in the Central Coastal Region include excessive salinity or hardness of local groundwater. Increasing nitrate concentration is a growing problem in a number of areas, in both surface water and groundwater. Surface waters suffer from bacterial contamination, nutrient enrichment, and siltation in a number of watersheds. Pesticides are a concern in agricultural areas and associated downstream water bodies.

Figure 3: **Central Coast Region Hydrologic Basin**

Los Angeles Region (Region 4)

The Los Angeles Region comprises all basins draining into the Pacific Ocean between the southeastern boundary of the watershed of Rincon Creek, located in western Ventura County, and a line which coincides with the southeastern boundary of Los Angeles County, from the Pacific Ocean to San Antonio Peak, and follows the divide between the San Gabriel River and Lytle Creek drainages to the divide between Sheep Creek and San Gabriel River drainages (Figure 4).

The Region encompasses all coastal drainages flowing into the Pacific Ocean between Rincon Point (on the coast of western Ventura County) and the eastern Los Angeles County line, as well as the drainages of five coastal islands (Anacapa, San Nicolas, Santa Barbara, Santa Catalina and San Clemente). In addition, the Region includes all coastal waters within three miles of the continental and island coastlines. Two large deepwater harbors (Los Angeles and Long Beach Harbors) and one smaller deepwater harbor (Port Hueneme) are contained in the Region. There are small craft marinas within the harbors, as well as tank farms, naval facilities, fish processing plants, boatyards, and container terminals. Several small-craft marinas also exist along the coast (Marina del Ray, King Harbor, Ventura Harbor); these contain boatyards, other small businesses, and dense residential development.

Several large, primarily concrete-lined rivers (Los Angeles River, San Gabriel River) lead to unlined tidal prisms which are influenced by marine waters. Salinity may be greatly reduced following rains since these rivers drain large urban areas composed of mostly impermeable surfaces. Some of these tidal prisms receive a considerable amount of freshwater throughout the year from POTWs discharging tertiary-treated effluent. Lagoons are located at the mouths of other rivers draining relatively undeveloped areas (Mugu Lagoon, Malibu Lagoon, Ventura River Estuary, and Santa Clara River Estuary). There are also a few isolated brackish coastal water bodies receiving runoff from agricultural or residential areas.

Santa Monica Bay, which includes the Palos Verdes Shelf, dominates a large portion of the open coastal water bodies in the Region. The Region's coastal water bodies also include the areas along the shoreline of Ventura County and the waters surrounding the five offshore islands in the Region.

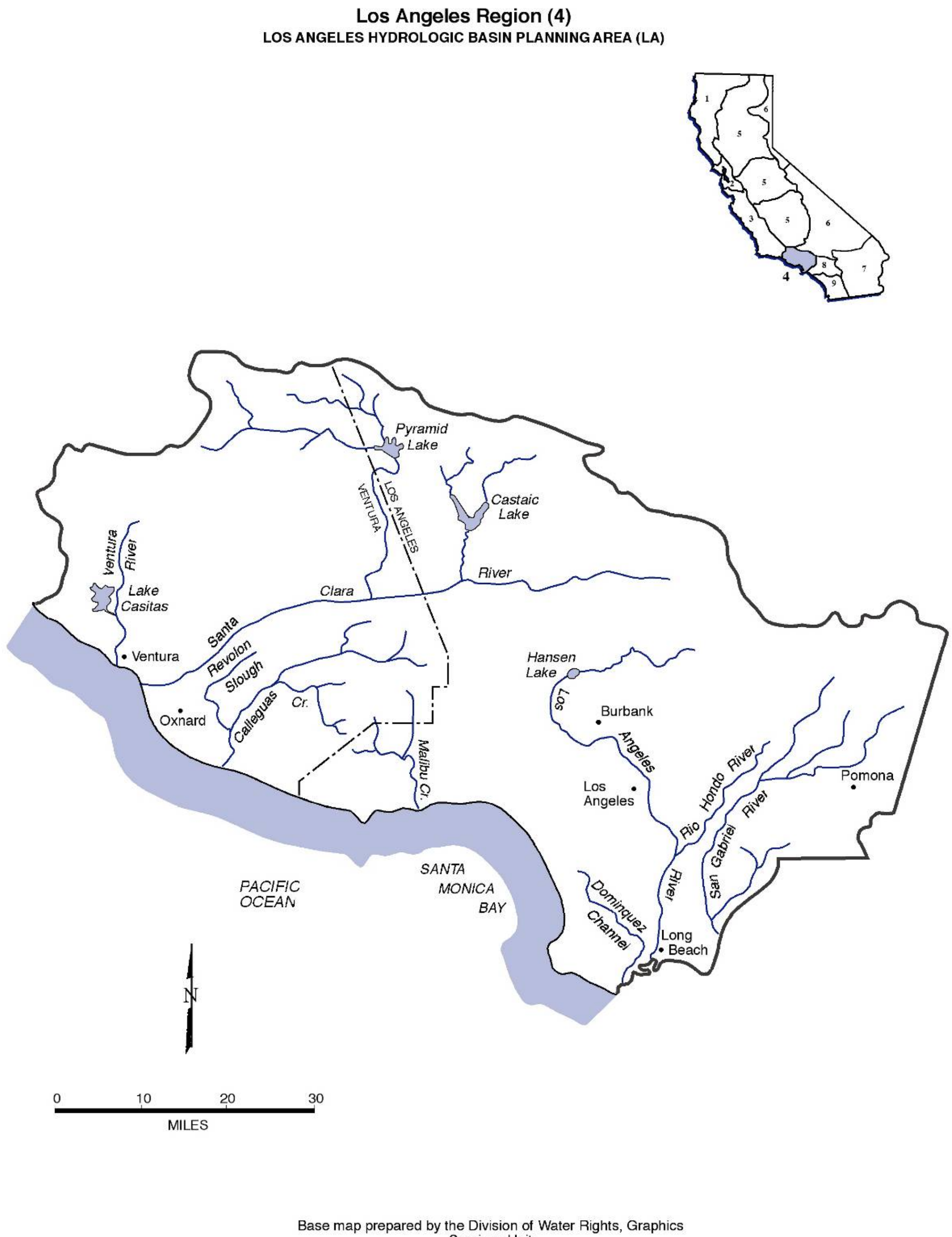


Figure 4: **Los Angeles Region Hydrologic Basin**

Central Valley Region (Region 5)

The Central Valley Region includes approximately 40% of the land in California stretching from the Oregon border to the Kern County/Los Angeles County line. The Region is divided into three basins. For planning purposes, the Sacramento River Basin and the San Joaquin River basin are covered under one Basin Plan, and the Tulare Lake Basin is covered under another.

The Sacramento River Basin covers 27,210 square miles and includes the entire area drained by the Sacramento River (Figure 5). The principal streams are the Sacramento River and its larger tributaries: the Pitt, Feather, Yuba, Bear, and American Rivers to the East; and Cottonwood, Stony, Cache, and Putah Creek to the west. Major reservoirs and lakes include Shasta, Oroville, Folsom, Clear Lake, and Lake Berryessa.

The San Joaquin River Basin covers 15,880 square miles and includes the entire area drained by the San Joaquin River (Figure 6). Principal streams in the basin are the San Joaquin River and its larger tributaries: the Consumnes, Mokelumne, Calaveras, Stanislaus, Tuolumne, Merced, Chowchilla, and Fresno Rivers. Major reservoirs and lakes include Pardee, New Hogan, Millerton, McClure, Don Pedro, and New Melones.

The Tulare Lake Basin covers approximately 16,406 square miles and comprises the drainage area of the San Joaquin Valley south of the San Joaquin River (Figure 7). The planning boundary between the San Joaquin River Basin and the Tulare Lake Basin is defined by the northern boundary of Little Pinoche Creek Basin eastward along the channel of the San Joaquin River to Millerton Lake in the Sierra Nevada foothills, and then along the southern boundary of the San Joaquin River drainage basin. Main Rivers within the basin include the King, Kaweah, Tule, and Kern Rivers, which drain to the west face of the Sierra Nevada Mountains. Imported surface water supplies enter the basin through the San Luis Drain- California Aqueduct System, Friant- Kern Channel, and the Delta Mendota Canal.

The two northern most basins are bound by the crests of the Sierra Nevada on the east and the Coast Range and Klamath Mountains on the west. They extend about 400 miles from the California-Oregon border southward to the headwaters of the San Joaquin River. These two river basins cover about one fourth of the total area of the State and over 30% of the State's irrigable land. The Sacramento and San Joaquin Rivers furnish roughly two-thirds of the State's water supply.

Surface waters from the two drainage basins meet and form the Delta, which ultimately drains into the San Francisco Bay.

The Delta is a maze of river channels and diked islands covering roughly 1,150 square miles, including 78 square miles of water area. Two major water projects located in the South Delta, the Federal Central Valley Project and the State Water Project, deliver water from the Delta to Southern California, the San Joaquin Valley, Tulare Lake Basin, and the San Francisco Bay Area, as well as within the Delta boundaries. The legal boundary of the Delta is described in CWC §12220.

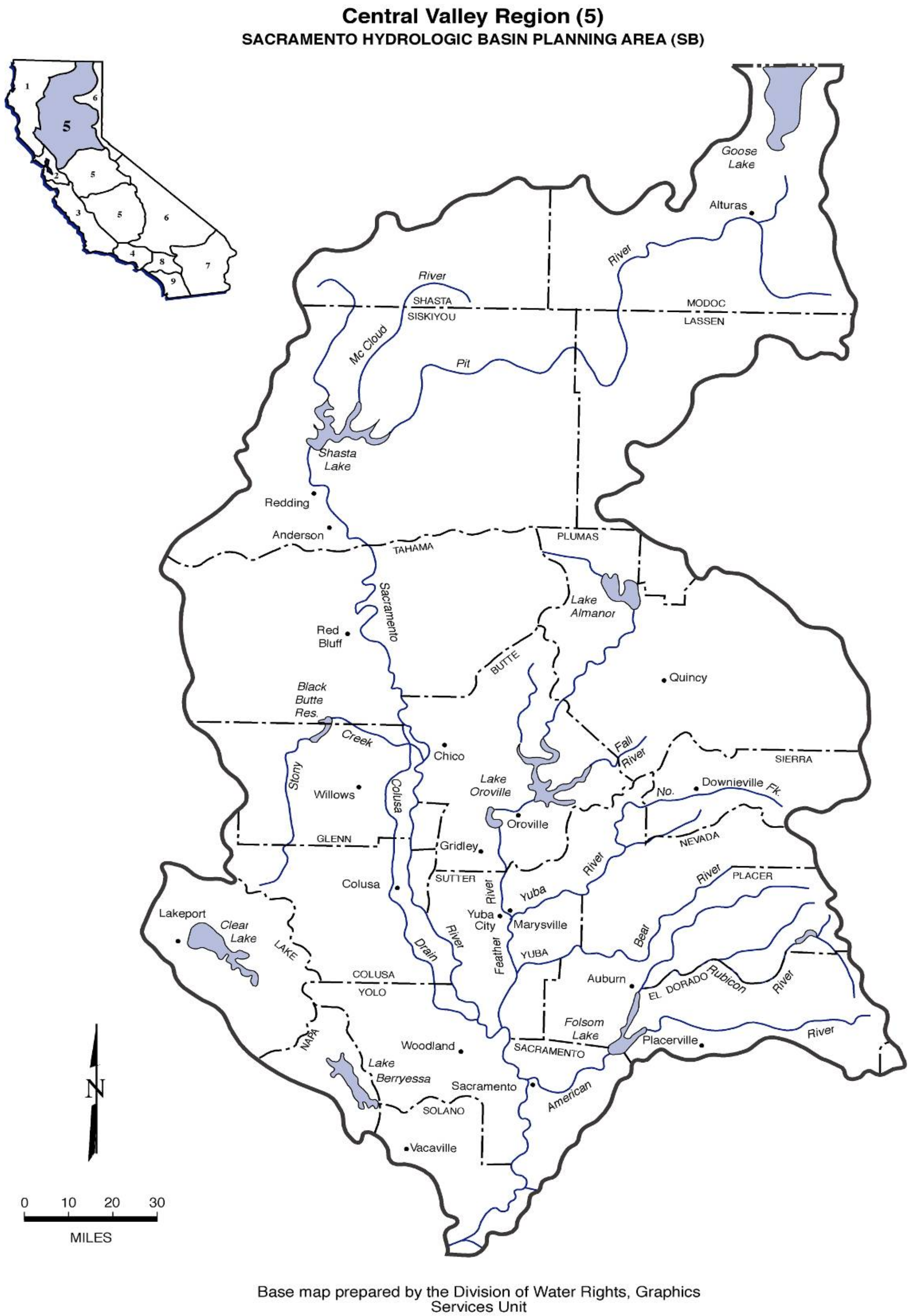


Figure 5: Central Valley Region, Sacramento Region Hydrologic Basin

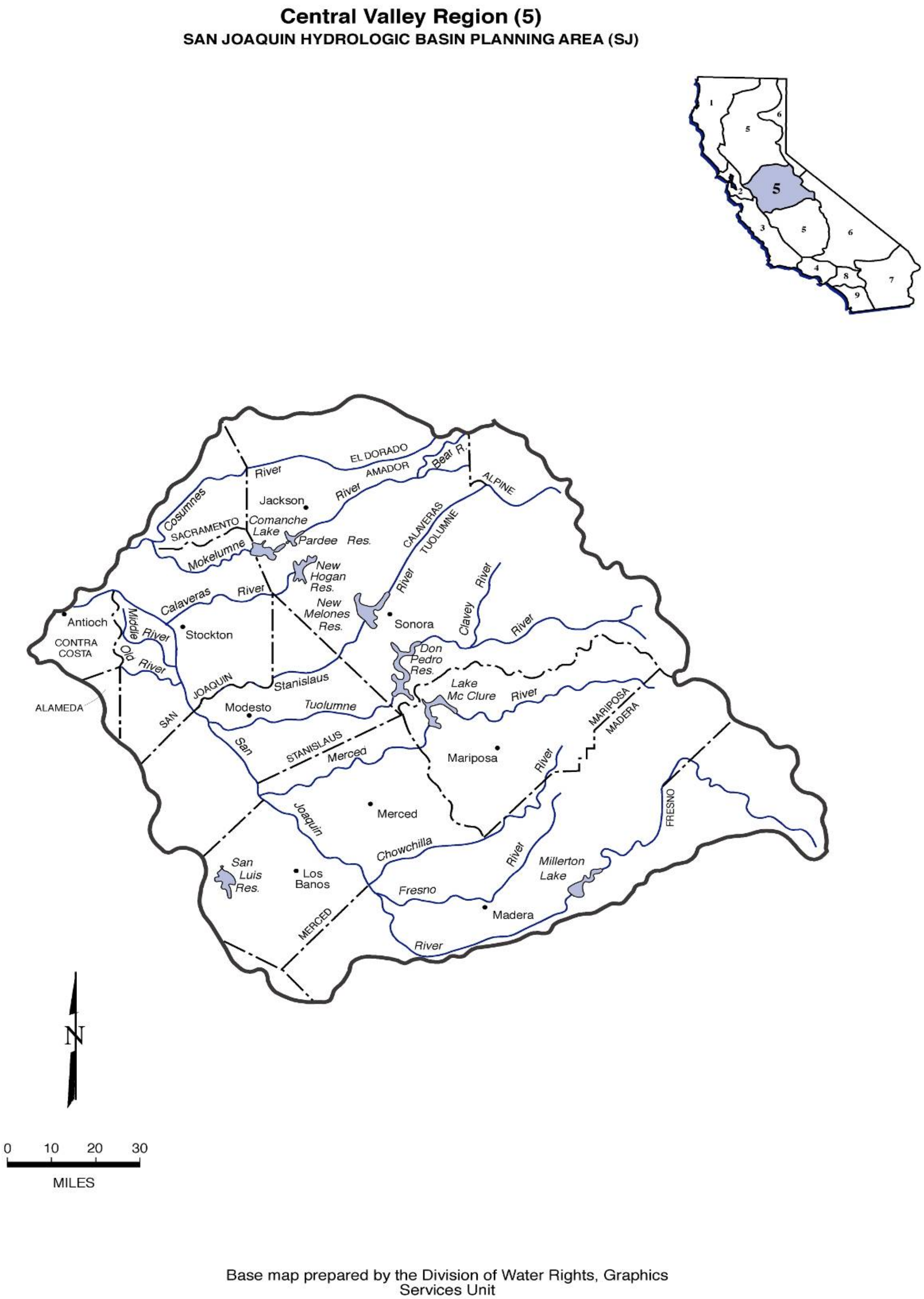
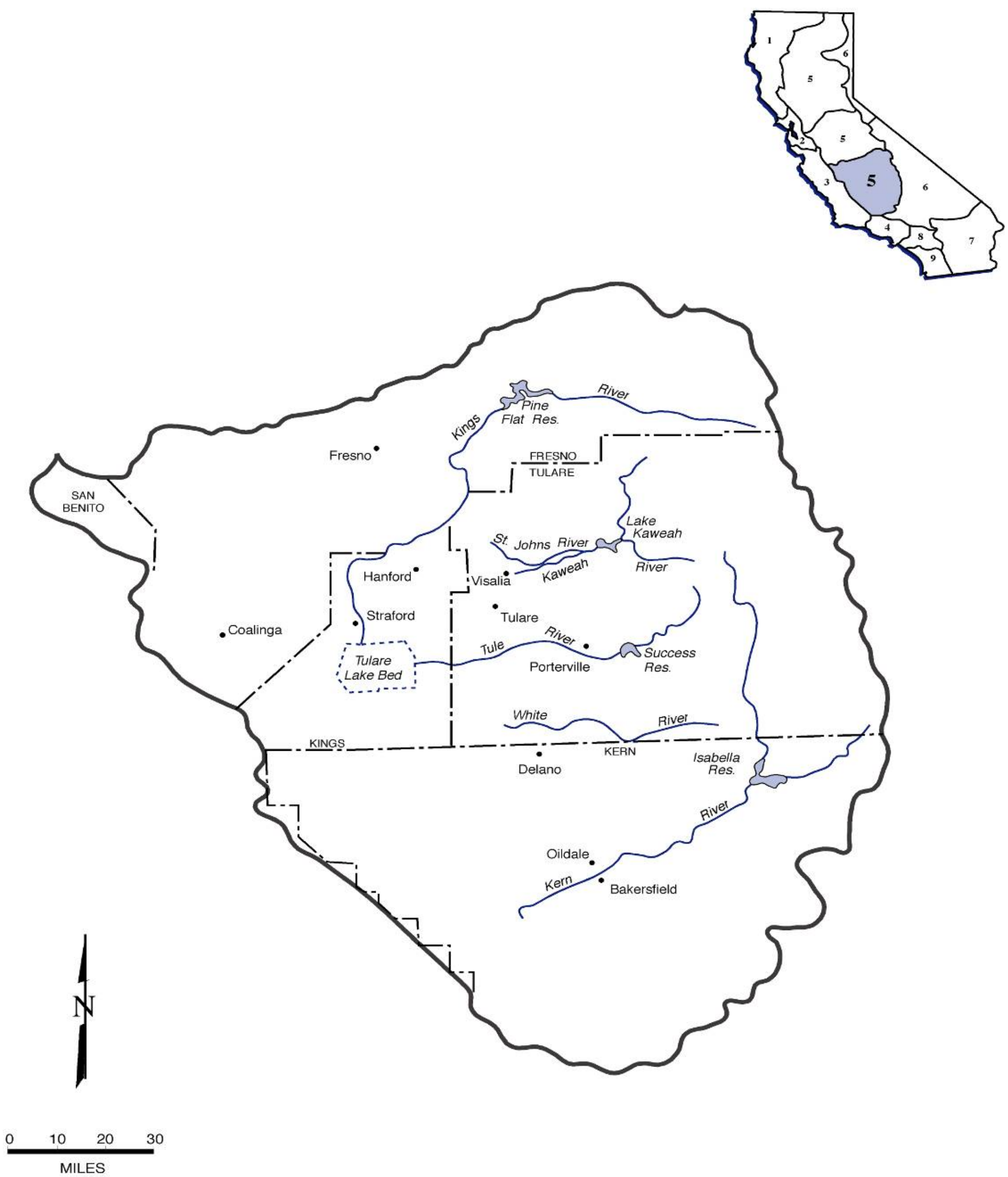


Figure 6: Central Valley Region, San Joaquin Hydrologic Basin

Central Valley Region (5)
TULARE LAKE HYDROLOGIC BASIN PLANNING AREA (TL)



Base map prepared by the Division of Water Rights, Graphics Services Unit

Figure 7: Central Valley Region, Tulare Lake Hydrologic Basin

Lahontan Region (Region 6)

The Lahontan Region has historically been divided into North and South Lahontan Basins at the boundary between the Mono Lake and East Walker River watersheds (Figures 8 and 9). It is about 570 miles long and has a total area of 33,131 square miles. The Lahontan Region includes the highest (Mount Whitney) and lowest (Death Valley) points in the contiguous United States. The topography of the remainder of the Region is diverse, and includes the eastern slopes of the Warner, Sierra Nevada, San Bernardino, Tehachapi and San Gabriel Mountains, and all or part of other ranges including the White, Providence, and Granite Mountains. Topographic depressions include the Madeline Plains, Surprise, Honey Lake, Bridgeport, Owens, Antelope, and Victor Valleys.

The Region is generally in a rain shadow; however, annual precipitation amounts can be significant (up to 70 inches) at higher elevations. Most precipitation in the mountainous areas falls as snow. Desert areas receive relatively little annual precipitation (less than 2 inches in some locations) but this can be concentrated and lead to flash flooding. Temperature extremes recorded in the Lahontan Region range from -45^{o}F at Boca (Truckee River watershed) to 134^{o}F in Death Valley. The varied topography, soils, and microclimates of the Lahontan Region support a corresponding variety of plant and animal communities. Vegetation ranges from sagebrush and creosote bush scrub in the desert areas to pinyon-juniper and mixed conifer forest at higher elevations. Subalpine and alpine communities occur on the highest peaks. Wetland and riparian plant communities (including marshes, meadows, “sphagnum” bogs, riparian deciduous forest, and desert washes) are particularly important for wildlife, given the general scarcity of water in the Region.

The Lahontan Region is rich in cultural resources (archaeological and historic sites), ranging from remnants of Native American irrigation systems to Comstock mining era ghost towns such as Bodie, and 1920s resort homes at Lake Tahoe and Death Valley (Scotty’s Castle). Much of the Lahontan Region is in public ownership, with land use controlled by agencies, such as the U.S. Forest Service, National Park Service, Bureau of Land Management, various branches of the military, the California State Department of Parks and Recreation, and the City of Los Angeles Department of Water and Power. While the permanent resident population (about 500,000 in 1990) of the Region is low, most of it is concentrated in high-density communities in the South Lahontan Basin. In addition, millions of visitors use the Lahontan Region for recreation each year. Rapid population growth has occurred in the Victor and Antelope Valleys and within commuting distance of Reno, Nevada. Principal communities of the North Lahontan Basin include Susanville, Truckee, Tahoe City, South Lake Tahoe, Markleeville, and Bridgeport. The South Lahontan Basin includes the communities of Mammoth Lakes, Bishop, Ridgecrest, Mojave, Adelanto, Palmdale, Lancaster, Victorville, and Barstow. Recreational and scenic attractions of the Lahontan Region include Eagle Lake, Lake Tahoe, Mono Lake, Mammoth Lakes, Death Valley, and portions of many wilderness areas. Segments of the East Fork Carson and West Walker Rivers are included in the State Wild and Scenic River system. Both developed (e.g. camping, skiing, day use) and undeveloped (e.g. hiking, fishing) recreation are important components of the Region’s economy. In addition to tourism, other major sectors of the economy include resource extraction (mining, energy production, and silviculture), agriculture (mostly livestock grazing), and defense-related activities. There is relatively little manufacturing industry in the Region, in comparison to major urban areas of the State. Economically valuable minerals, including gold, silver, copper, sulfur, tungsten, borax, and rare earth metals have been or are being mined at various locations within the Lahontan Region. The Lahontan Region includes over 700 lakes, 3,170 miles of streams, and 1,581 square miles of groundwater basins. There are 12 major watersheds (called “hydrologic units” under the

Department of Water Resources' mapping system) in the North Lahontan Basin. Among these are the Eagle Lake, Susan River/Honey Lake, Truckee, Carson, and Walker River watersheds. The South Lahontan Basin includes three major surface water systems (the Mono Lake, Owens River, and Mojave River watersheds) and a number of separate closed groundwater basins. Water quality problems in the Lahontan Region are largely related to nonpoint sources (including erosion from construction, timber harvesting, and livestock grazing), storm water, and acid drainage from inactive mines and individual wastewater disposal systems.

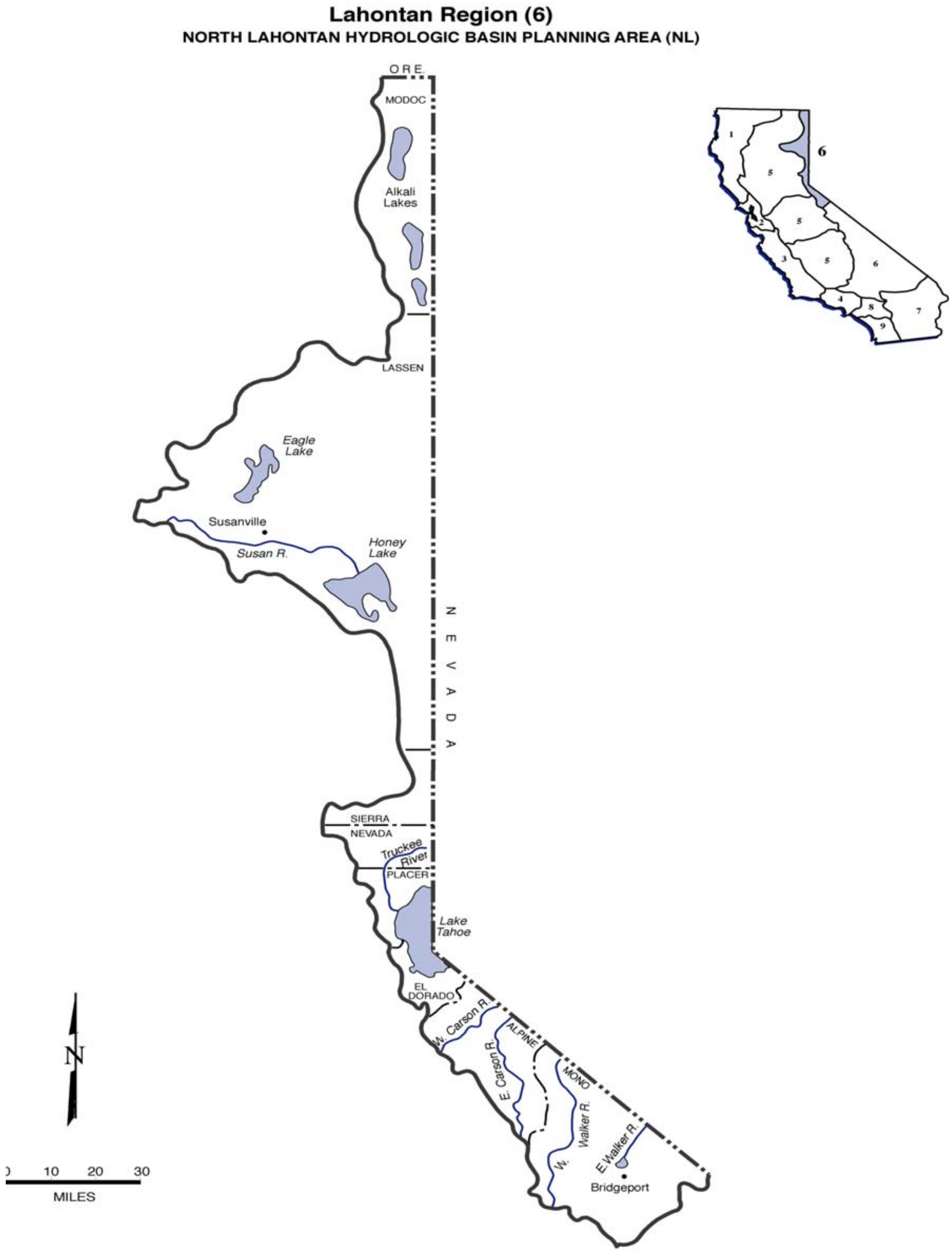


Figure 8: Lahontan Region, North Lahontan Hydrologic Basin

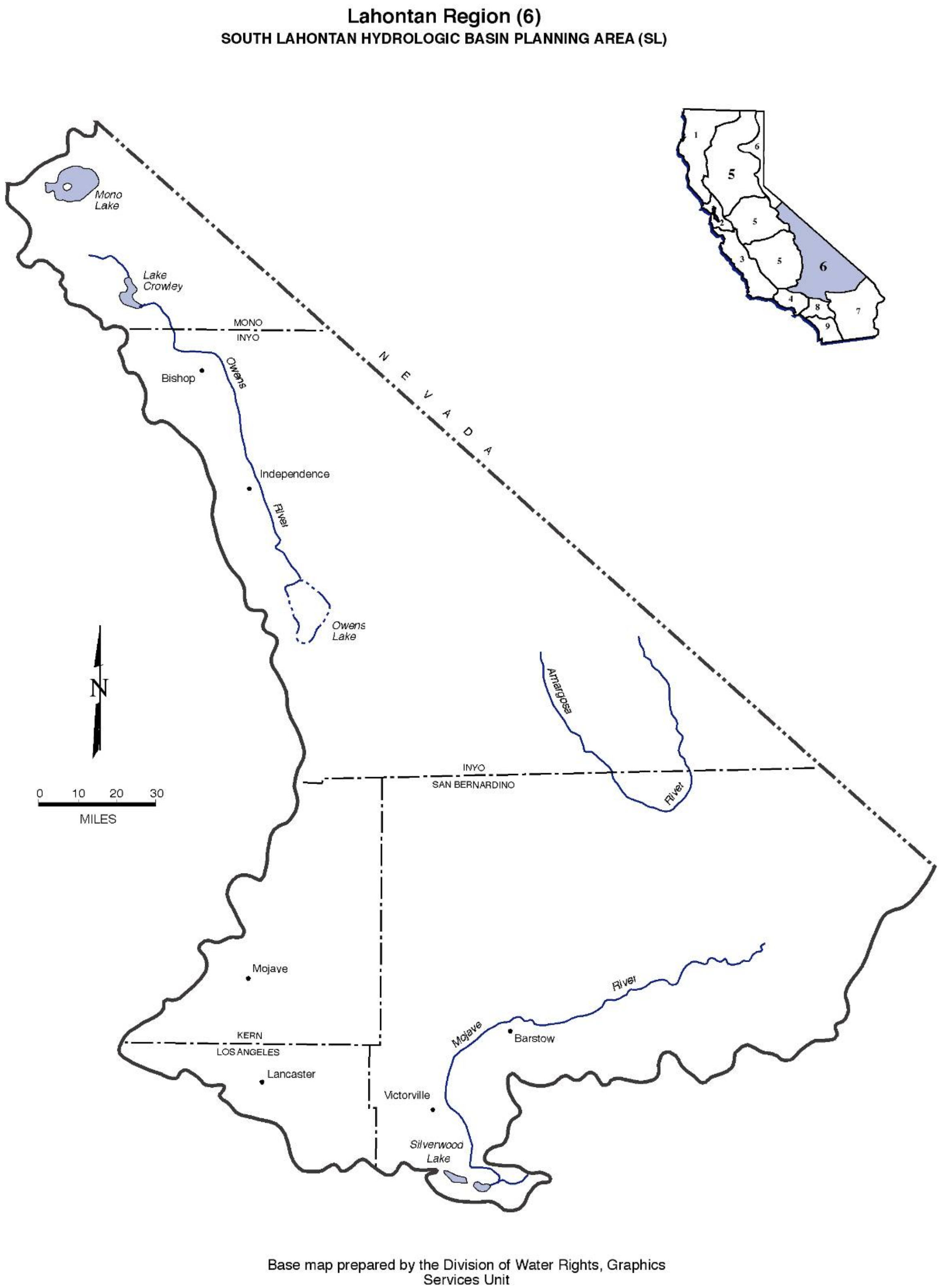


Figure 9: Lahontan Region, South Lahontan Hydrologic Basin

Colorado River Basin Region (Region 7)

The Colorado River Basin Region covers approximately 13 million acres (20,000 square miles) in the southeastern portion of California (Figure 10). It includes all of Imperial County and portions of San Bernardino, Riverside, and San Diego Counties. It shares a boundary for 40 miles on the northeast with the State of Nevada; on the north by the New York, Providence, Granite, Old Dad, Bristol, Rodman, and Ord Mountain ranges; on the west by the San Bernardino, San Jacinto, and Laguna Mountain ranges; on the south by the Republic of Mexico; and on the east by the Colorado River and State of Arizona. Geographically, the Region represents only a small portion of the total Colorado River drainage area, which includes portions of Arizona, Nevada, Utah, Wyoming, Colorado, New Mexico, and Mexico. A significant geographical feature of the Region is the Salton Trough, which contains the Salton Sea and the Coachella and Imperial Valleys. The two valleys are separated by the Salton Sea, which covers the lowest area of the depression. The trough is a geologic structural extension of the Gulf of California.

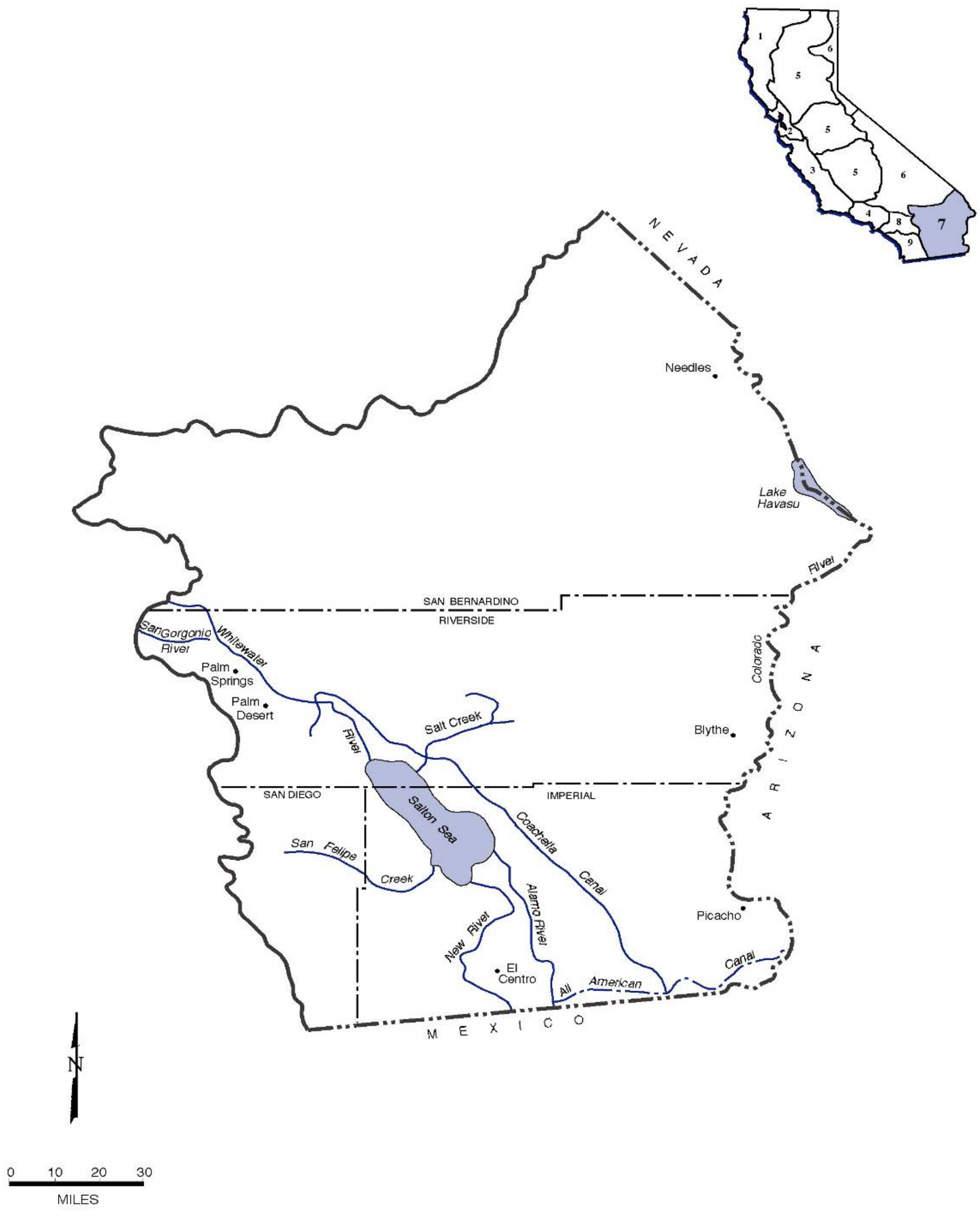
Much of the agricultural economy and industry of the Region is located in the Salton Trough. There are also industries associated with agriculture, such as sugar refining, as well as increasing development of geothermal industries. In the future, agriculture is expected to experience little growth in the Salton Trough, but there will likely be increased development of other industries (such as construction, manufacturing, and services). The present Salton Sea, located on the site of a prehistoric lake, was formed between 1905 and 1907 by overflow of the Colorado River. The Salton Sea serves as a drainage reservoir for irrigation return water and storm water from the Coachella Valley, Imperial Valley, and Borrego Valley, and also receives drainage water from the Mexicali Valley in Mexico. The Salton Sea is California's largest inland body of water and provides a very important wildlife habitat and sport fishery. Development along California's 230 mile reach of the Colorado River, which flows along the eastern boundary of the Region, includes agricultural areas in Palo Verde Valley and Bard Valley; urban centers at Needles, Blythe, and Winterhaven; several transcontinental gas compressor stations; and numerous small recreational communities. In addition, mining operations are located in the surrounding mountains, and the Fort Mojave, Chemehuevi, Colorado River, and Yuma Indian Reservations are located along the river.

This Region has the driest climate in California. The winters are mild and summers are hot. Temperatures range from below freezing to over 120°F. In the Colorado River valleys and the Salton Trough, frost is a rare occurrence and crops are grown year round. Snow falls in the Region's higher elevations, with mean seasonal precipitation ranging from 30 to 40 inches in the upper San Jacinto and San Bernardino Mountains. The lower elevations receive relatively little rainfall. An average of four inches of precipitation occurs along the Colorado River, with much of this coming from late summer thunderstorms moving north from Mexico. Typical mean seasonal precipitation in the desert valleys is approximately 3.2 inches at Indio, and three inches at El Centro. Precipitation over the entire area occurs mostly from November through April, and August through September, but its distribution and intensity are often sporadic. Local thunderstorms may contribute the entire average seasonal precipitation at one time or only a trace of precipitation may be recorded at any locale for the entire season.

The Region provides habitat for a variety of native and introduced species of wildlife. Increased human population and its associated development have adversely affected the habitats of some species, while conversely enhancing others. Animals tolerant of arid conditions, including small rodents, coyotes, foxes, birds, and a variety of reptiles, inhabit large areas within the Region. Along the Colorado River and in the higher elevations of the San Bernardino and San Jacinto

Mountains, where water is more abundant, deer, bighorn sheep, and a diversity of small animals exist. Practically all of the fishes inhabiting the Region are introduced species. The most abundant species in the Colorado River and irrigation canals include largemouth bass, smallmouth bass, flathead and channel catfish, yellow bullhead, bluegill, redear sunfish, black crappie, carp, striped bass, threadfin shad, red shiner, and, in the colder water above Lake Havasu, rainbow trout. Grass carp have been introduced into sections of the All American Canal system for aquatic weed control. Fish inhabiting agricultural drains in the Region generally include mosquito fish, mollies, red shiners, carp, and tilapia, although locally significant populations of catfish, bass, and sunfish occur in some drains. A considerable sport fishery exists in the Salton Sea, with orangemouth corvina, gulf croaker, sargo, and tilapia predominating. The Salton Sea National Wildlife Refuge and state waterfowl management areas are located in and near the Salton Sea. The refuge supports large numbers of waterfowl in addition to other types of birds. Located along the Colorado River are the Havasu, Cibola and Imperial National Wildlife Refuges. The Region provides habitat for certain endangered/threatened species of wildlife including desert pupfish, razorback sucker, Yuma clapper rail, black rail, least Bell's vireo, yellow billed cuckoo, desert tortoise, and peninsular bighorn sheep.

Colorado River Basin Region (7)
COLORADO RIVER HYDROLOGIC BASIN PLANNING AREA (CR)

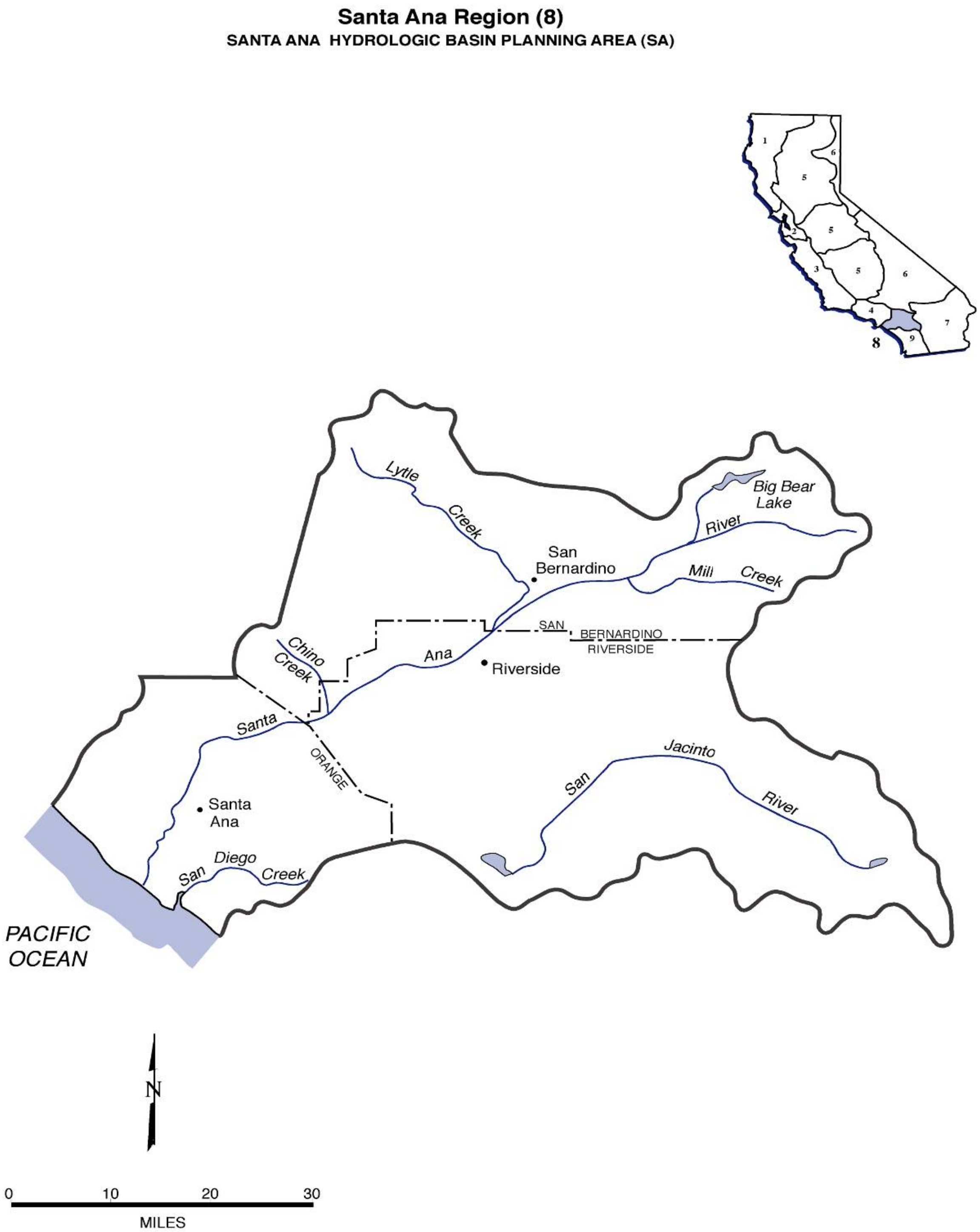


Base map prepared by the Division of Water Rights, Graphics Services Unit

Figure 10: Colorado River Region Hydrologic Basin

Santa Ana Region (Region 8)

The Santa Ana Region comprises all basins draining into the Pacific Ocean between the southern boundary of the Los Angeles Region and the drainage divide between Muddy and Moro Canyons; from the ocean to the summit of San Joaquin Hills; along the divide between lands draining into Newport Bay and Laguna Canyon to Niguel Road; along Niguel Road and Los Aliso Avenue to the divide between Newport Bay and Aliso Creek drainages; along the divide and the southeastern boundary of the Santa Ana River drainage to the divide between Baldwin Lake and Mojave Desert drainages; and to the divide between the Pacific Ocean and Mojave Desert drainages (Figure 11). Geographically, the Santa Ana Region is the smallest of the nine regions in the state (2,800 square miles) and is located in southern California, roughly between Los Angeles and San Diego. The climate of the Santa Ana Region is classified as Mediterranean: generally dry in the summer with mild, wet winters. The average annual rainfall in the Region is about 15 inches, with most precipitation occurring between November and March. The enclosed bays in the Region include Newport, Bolsa (including Bolsa Chica Marsh), and Anaheim Bay. Principal rivers include Santa Ana, San Jacinto and San Diego. Lakes and reservoirs include Big Bear, Hemet, Mathews, Canyon Lake, Lake Elsinore, Santiago Reservoir, and Perris Reservoir.



Base map prepared by the Division of Water Rights, Graphics Services Unit

Figure 11: Santa Ana Region Hydrologic Basin

San Diego Region (Region 9)

The San Diego Region comprises all basins draining into the Pacific Ocean between the southern boundary of the Santa Ana Region and the California-Mexico boundary (Figure 12). The San Diego Region is located along the coast of the Pacific Ocean from the Mexican border to north of Laguna Beach. The San Diego Region is rectangular in shape and extends approximately 80 miles along the coastline and 40 miles eastward towards the crest of the mountains. This Region includes portions of San Diego, Orange, and Riverside Counties, and the population of the Region is heavily concentrated along the coastal strip. Two harbors, Mission Bay and San Diego Bay, support major recreational and commercial boat traffic. Coastal lagoons are found along the San Diego County coast at the mouths of creeks and rivers.

Weather patterns are Mediterranean in nature with an average rainfall of approximately ten inches per year occurring along the coast during the winter. The Pacific Ocean generally has cool water temperatures due to upwelling, and this nutrient-rich water supports coastal beds of giant kelp. The cities of San Diego, National City, Chula Vista, Coronado, and Imperial Beach surround San Diego Bay in the southern portion of the Region.

San Diego Bay is long and narrow; 15 miles in length and approximately one mile across. A deep-water harbor capable of mooring up to 9,000 vessels, San Diego Bay has experienced waste discharge from former sewage outfalls, industries, and urban runoff. San Diego Bay also hosts four major U.S. Navy bases with approximately 80 surface ships and submarines. Coastal waters include bays, harbors, estuaries, beaches, and open ocean. Deep draft commercial harbors include San Diego Bay and Oceanside Harbor, and shallower harbors include Mission Bay and Dana Point Harbor. Tijuana Estuary, Sweetwater Marsh, San Diego River Flood Control Channel, Kendal-Frost Wildlife Reserve, San Dieguito River Estuary, San Elijo Lagoon, Batiquitos Lagoon, Agua Hedionda Lagoon, Buena Vista Lagoon, San Luis Rey Estuary, and Santa Margarita River Estuary are the important estuaries of the Region.

There are thirteen principal stream systems in the Region originating in the western highlands and flowing to the Pacific Ocean. From north to south these are Aliso Creek, San Juan Creek, San Mateo Creek, San Onofre Creek, Santa Margarita River, San Luis Ray River, San Marcos Creek, Escondido Creek, San Dieguito River, San Diego River, Sweetwater River, Otay River, and the Tijuana River. Most of these streams are interrupted in character having both perennial and ephemeral components due to the rainfall pattern in the Region. Surface water impoundments capture flow from almost all the major streams.

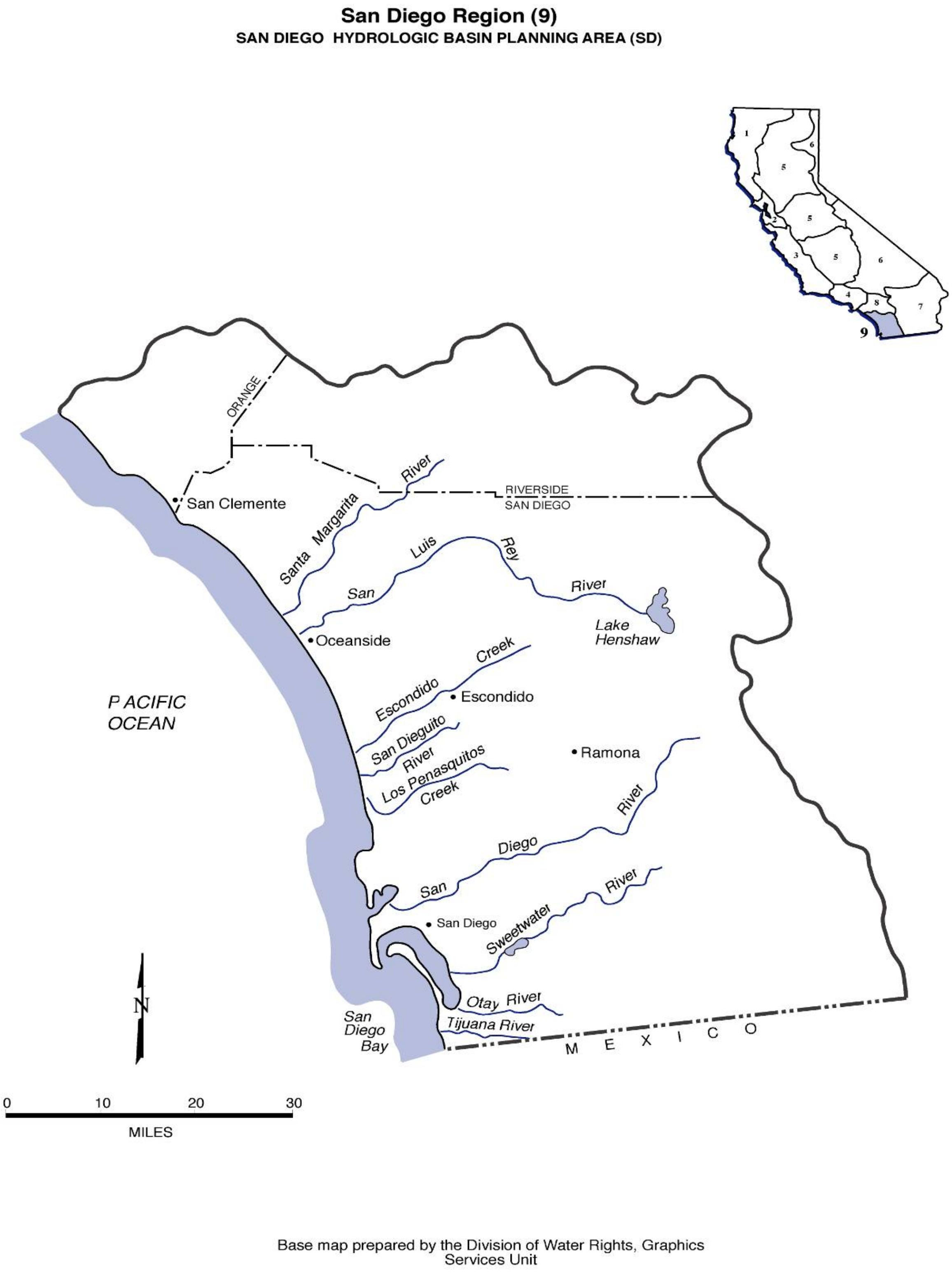


Figure 12: San Diego Region Hydrologic Basin

SECTION IV: ANALYSES OF ISSUES AND ALTERNATIVES

This section presents analyses of the issues being considered in the development of the proposed Policy.

ISSUE 1: OBJECTIVES FOR TOXICITY

This Section briefly describes and compares the alternatives that State Water Board staff identified for developing toxicity objectives.

The toxicity provisions contained in the ten Basin Plans establish requirements for narrative toxicity permit limits. Chronic toxicity test requirements for these limits are derived from Section 4 of the SIP. However, the current regulatory framework lacks a consistent approach to toxicity control and monitoring, which has ultimately weakened the protection of aquatic life beneficial uses in water bodies throughout California. In order to provide regulatory consistency, provide a basis for equitable enforcement, and protect aquatic life beneficial uses, State Water Board staff proposes the adoption of statewide numeric objectives and enhanced monitoring procedures for chronic and acute toxicity.

Issue 1A: Toxicity Monitoring

Present Statewide Policy

Chapter 4 of the SIP requires dischargers to conduct chronic toxicity tests using the procedures established by the U.S. EPA. These procedures are dependent upon the inclusion of toxicity provisions in the applicable Regional Board's Basin Plan.

Issue Description

Discrepancies exist in NPDES wastewater permits and point source WDRs between, and within, Regions. Some dischargers are permitted to conduct only chronic or acute toxicity tests, while others are required to monitor both forms of toxicity. There are also a number of dischargers that are not subject to any toxicity limits at all. Such inconsistencies compromise water quality and perpetuate an inequitable distribution of costs among dischargers. It is therefore necessary to establish a uniform approach to toxicity monitoring that can be applied on a statewide level.

Alternatives

1. **No action.** If the status quo is upheld, the Regional Water Boards will continue to implement the toxicity provisions established in their Basin Plans and permits. The aquatic life beneficial uses of receiving waters might be compromised under this option because some permits are currently devoid of toxicity provisions, while others require only acute toxicity testing. The omission of toxicity monitoring requirements in permits prevents Regional Water Board staff from assessing the aggregate effects of multiple pollutants; acute toxicity testing, though effective, fails to account for the sublethal effects of the

multiple constituents in wastewater effluent. Additionally, the widely divergent requirements for toxicity monitoring in current NPDES wastewater permits and point source WDRs are unnecessarily promoting an inequitable distribution of costs and penalties among facilities that discharge at comparable frequencies.

2. **Require statewide toxicity monitoring.** This option would establish uniform toxicity monitoring requirements for all NPDES permits, WDRs, and conditional waivers in California upon issuance, reissuance, or reopener after the effective date of the Policy. At a minimum, dischargers would be required to conduct routine chronic toxicity testing at a frequency determined by the category of discharge (see Issues 1D, 1E, and 2C). The State and Regional Water Boards, however, would be granted the authority to establish supplemental acute toxicity monitoring requirements at their discretion (see Issue 1C).

   A standardized approach to toxicity monitoring would improve the level of protection to aquatic life beneficial uses because current discrepancies between Basin Plans and permits have resulted in regulatory gaps and inequities. Furthermore, a provision requiring chronic toxicity testing would ensure that the most sensitive form of toxicity monitoring is used, while the optional acute toxicity monitoring program would provide an additional means of effluent characterization when needed.

Recommendation
Adopt Alternative 2.

Issue 1B: Statistical Method

Present Statewide Policy

The State Water Board has not established a policy requiring specific statistical methods or endpoints for toxicity analysis. These decisions are currently up to the discretion of the Regional Water Boards.

Issue Description

Toxicity test compliance is determined by statistical methods that are expressed as biological measurements known as "endpoints." These endpoints are derived from hypothesis tests (e.g. Dunnett's Test, Steel's Many-One Rank Test) and point estimate techniques (e.g. Probit Analysis, Spearman-Karber Method, Trimmed Spearman-Karber, Linear Interpolation and Graphical methods). Nonquantal measurements, such as reproduction and growth, are used to derive the No Observed Effect Concentration (NOEC), Lowest Observed Effect Concentration (LOEC), and Inhibition Concentration (IC) endpoints (U.S. EPA 1995; U.S. EPA 2002a; U.S. EPA 2002b). NOEC results describe the highest tested concentration of effluent or toxicant that has no adverse effect on a test organism, while LOEC values denote the lowest effluent concentration that produces an adverse effect on a test organism. ICs describe toxicant concentrations that cause a given percent reduction in a continual biological measurement. Quantal endpoints (e.g. survival or fertilization) are expressed as Effect Concentrations (EC), Lethal Concentrations (LC), or No Observable Adverse Effect Concentrations (NOAEC). An EC denotes the effluent or toxicant concentration responsible for causing an observable, adverse effect in a specified percentage of test organisms. When mortality rates are measured, the EC is frequently expressed as an LC. Similarly, the NOAEC expresses the lowest effluent concentration at which survival does not significantly differ from the control. In addition, Pass/Fail hypothesis tests can be used to assess both quantal and nonquantal effects. In a Pass/Fail analysis, a test "passes" if 90% or more of the test organisms are unaffected by both the treatment and the control. Any percentage below this threshold (assuming the control also meets this minimum requirement) "fails."

Use of the hypothesis method for determining compliance with toxicity provisions has become a topic of frequent discussion because several studies have raised concerns about the limitations of this approach, and offered alternatives to it (Grothe et al. 1995; Shukla et al. 2000; Erickson and McDonald 1995). The effects of large and small within-test variability are at the center of the debate, as the statistical power of hypothesis-based toxicity testing will, as a result, decrease or increase respectively. These issues are of particular importance because hypothesis testing, under the traditional approach, does not address the rate of false negative results (Type II or β errors), and thereby does not control test power. β errors pose a significant threat to water quality because false negatives result in unidentified toxic samples. An α error rate of 0.05 (5%), however, has been established by U.S. EPA for all hypothesis tests. Although a β error rate has not been established, the U.S. EPA requires the calculation of a minimum significant difference (MSD) value to measure within-test variability and improve statistical power (U.S. EPA 2000).

The MSD describes the magnitude of difference from a control that can be detected statistically. This value is based on the established alpha error rate, number of replicates, and within-test variability. In toxicity testing, the MSD is expressed as the percentage of the toxicological endpoint in the control response, and denoted as the percent minimum significant difference (PMSD). The PMSD is determined by multiplying the MSD by 100 and dividing the product by the control mean. The consequent value is then compared to the PMSD bounds derived from numerous toxicity test results compiled by the U.S. EPA.

In order to address the concerns associated with traditional hypothesis testing, the U.S. EPA has developed a new approach for toxicity tests deemed the "Test of Significant Toxicity" (TST). Drawing heavily from the bioequivalence approach used by the Food and Drug Administration and researchers worldwide, this modified hypothesis test is designed to compare the instream waste concentration (IWC) with a control using bioequivalent, percentage-based effect thresholds denoted as *b* values, and referred to as "regulatory management decisions." Chronic toxicity tests are assigned a *b* value of 0.75, so as to establish an effect level consistent with the IC_{25} endpoint (i.e. 25%), while the *b* value for acute toxicity is set at 0.80 in order to provide aquatic biota with added protection from lethal discharges. Effect thresholds provide a clearer means of evaluating organism response than that of traditional hypothesis testing as the NOEC and LOEC endpoints do not specify a level of biological impact (U.S. EPA 2010a).

The TST utilizes a restated null hypothesis that assumes an effluent is not bioequivalent to the control (i.e. toxic) and, in turn, reverses α and β errors. Restating the null hypothesis provides the dischargers positive incentive to generate high quality data and improve test performance (i.e. lower within-test variability). The TST uses a fixed false positive (β) rate of 0.05 (the same alpha rate as that of the current approach) to ensure adequate statistical power, and a test-specific false negative rate (α) which had not been established for the traditional hypothesis test method.

Results obtained from the TST are reported as either a "pass" or "fail," further simplifying compliance determination (U.S. EPA 2010a). Moreover, an established α error rate will ensure that toxic events are detected. The following "Alternatives" section provides brief descriptions of chronic and acute toxicity endpoints calculated using hypothesis and point estimate methods. Examples of these procedures can be found in Appendix D.

Alternatives

1. **No action.** The permitting authority (State or Regional Water Board) would continue to determine the correct method and endpoint to use for toxicity evaluations. Under this option, inaccuracies and false negative results will likely persist if the permitting authority does not incorporate the TST method into permits. Inadequate protection of aquatic life in receiving waters will, therefore, continue if the use of the traditional hypothesis testing method is maintained. The advantage of this option resides in the flexibility it offers the permitting authority.

2. **Adopt a hypothesis test method as a statewide protocol.** Current hypothesis testing procedures offer several means of determining compliance with toxicity objectives. The following is a brief summary of these methods. Additional information can be found in *Methods for Measuring the Acute Toxicity of Effluents and Receiving Waters to Freshwater and Marine Organisms* (5th Edition), *Short-term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms* (4th Edition), and *Short-term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to West Coast Marine and Estuarine Organisms* (1st Edition); all of which are published by the U.S. EPA.

   Pass/Fail
   A multi-step pathway is used to identify chronic or acute toxicity in a single-concentration effluent test design. Analysis begins by transforming the raw data (expressed as the proportion unaffected) by the arcsine square root transformation. This calculation is commonly used on proportionality data to stabilize the variance and satisfy the normality requirement, which is typically completed with the Shapiro-Wilk test. If the data set does not meet the normality requirements, the non-parametric Wilcoxen Rank Sum Test can be used to analyze the data. If the data is normal, an F-test is performed to determine the homogeneity of variance. Should the data exhibit homogeneity, a normal t-test will be used for evaluation. If the data is not homogeneous, a modified t-test (where the pooled variance is adjusted for equal variance) is used (U.S. EPA 2002a).

   NOAEC
   This method is used for multi-concentration acute toxicity tests with an equal number of replicates per treatment. The NOAEC endpoint is determined from Dunnett's test if the data is parametric, or Steel's Many-One Rank test if the data is non-parametric. Data is transformed to arcsine and then put through various tests to determine normality and homogeneity (U.S. EPA 2002a). (Note: the statistical procedures are identical to the calculation of the NOEC and LOEC endpoints).

   NOEC and LOEC
   The No Observed Effect Concentration endpoint can be derived for multi-concentration chronic toxicity tests. Similar to the NOAEC, the NOEC is calculated using Dunnett's Procedure or Bonferroni's adjustment for multiple comparisons when an unequal number of replicates are used. If normality assumptions are not met, Steel's Many-one Rank Test is used in place of Dunnett's Procedure, and the Wilcoxon Rank Sum test is paired with Bonferroni's adjustment. The NOEC endpoint is obtained from the highest concentration of

an effluent that does not cause an observable, adverse effect on the test organisms. Derived in conjunction with the NOEC, the LOEC denotes the lowest concentration of effluent at which the test species are adversely affected (U.S. EPA 1991; U.S. EPA 2002a; U.S. EPA 2002b). Results are typically reported as chronic or acute "Toxicity Units" (denoted as TUc and TUa respectively) that are calculated by dividing 100 by the NOEC.

Utilizing the endpoints based upon the hypothesis test method provides several advantages. Traditional hypothesis tests are computationally simple and well-suited for comparing treatments to controls; consequently facilitating a schedule of frequent monitoring. Significant disadvantages associated with this method, however, overshadow these benefits. The NOEC and NOAEC endpoints rely upon a prior determination of effluent concentrations which can impede attempts to find a response range. Furthermore, confidence intervals cannot be calculated for hypothesis tests, and nonmonotonic data sets can be difficult to interpret. The most problematic aspect of traditional hypothesis testing, however, has been the lack of established statistical power. Insufficient statistical power significantly influences test sensitivity thereby resulting in a higher rate of β errors (inability to declare a truly toxic sample as toxic). This shortcoming can, however, be mitigated somewhat by setting acceptable upper and lower bounds of PMSDs (U.S. EPA 2000).

3. **Adopt a point estimate method as a statewide protocol.** Point estimate techniques are another option for determining compliance with toxicity objectives. A brief summary of these calculations follow. Additional information can be found in *Methods for Measuring the Acute Toxicity of Effluents and Receiving Waters to Freshwater and Marine Organisms* (5th Edition), *Short-term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms* (4th Edition), and *Short-term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to West Coast Marine and Estuarine Organisms* (1st Edition); all of which are published by the U.S. EPA.

EC

The Effect Concentration refers to a quantity of treatment at which a certain percentage of a given number of test species exhibit a negative quantal response (e.g. death or immobilization). This percentage, established in a discharger's permit, is denoted in the acronym, (e.g. 25% is represented as EC_{25}). The EC is useful for a multi-concentration toxicity test and is evaluated using point estimate techniques. This method is akin to a linear regression, but rather than exhibiting a linear fit, the data is incorporated using a log-normal function. Due to the complexity of this method, a Probit software program is typically utilized for data that fits the required parameters. The Spearman-Karber, Trimmed Spearman-Karber, and Graphical methods may be used in place of Probit for data sets that exhibit specific characteristics (U.S. EPA 2002b).

LC

The Lethal Concentration endpoint measures the quantity of an effluent that causes death in a predetermined percentage of test organisms. Similar to the EC, this quantity is identified in the acronym. Probit software is frequently utilized to perform the difficult calculations required for the LC endpoint. Acute toxicity data that neither meets the normality assumption nor contains at least two mortalities, however, cannot be entered into a Probit analysis. For these data sets, the Spearman-Karber, Trimmed Spearman-Karber, and Graphical methods are employed (Denton et al. 2007).

IC
Used to measure the chronic, non-quantal effects of a discharge, the Inhibition Concentration is computed from the actual effluent dilutions at which negative impacts were observed. Akin to the EC and LC, the formula for calculating the IC (Linear Interpolation) is dependent upon the characteristics of the available data, and the percentage of test organisms affected by an effluent sample is also designated in the acronym. As with all point estimate techniques, intra-laboratory and inter-laboratory variability can be determined by calculating the coefficient of variation (CV) percentage (U.S. EPA 1991; U.S. EPA 2002b).

Point estimate techniques offer benefits over traditional hypothesis testing. The appertaining endpoints are not dependent upon pre-determined effluent concentrations, so effect values can be interpolated at any point in the concentration-response dataset using appropriate computer programs. These values can be used to quantify precision within and between tests. The EC, LC and IC endpoints also provide a wide selection of regression models that can be used for numerous applications including risk assessment and effect-based, probabilistic modeling. Additionally, certain models may be successfully applied to nonmonotonic results arising from hormesis and datasets affected by outliers (Grothe et al. 1995).

The limitations associated with point estimate techniques have, in part, reduced their use in toxicity test analyses. Bias may be introduced into point estimate interpolations through the use of poorly chosen dilution series, ill-fitting parametric regression models, and the data "smoothing" procedures used for nonparametric methods. Current statistical models require specific procedures to generate confidence intervals and test power needs to be considered. Additionally, Probit analyses cannot be conducted with fewer than two partial responses, and the Spearman-Karber, Trimmed Spearman-Karber, and Graphical methods are incapable of calculating endpoints below a 50% effect level (Grothe et al. 1995; U.S. EPA 2002b).

4. **Adopt the TST method as a statewide protocol.** The TST was designed to statistically compare a test species response to the IWC and a control. Data is analyzed using Welch's t-test and quantal data is appropriately transformed prior to doing so. If the calculated t-value is less than the critical t-value (or table t-value), a sample is declared "toxic" and the test result is a "fail". A sample is deemed "not toxic" and the test result is a "pass" if the calculated t-value is greater than that of the critical t-value.

   The biological effect levels (*b* values) incorporated into the TST define unacceptable risks to aquatic organisms and substantially decrease the uncertainties associated with the applicability of results obtained from the NOEC and LOEC endpoints. Furthermore, the TST reduces the need for multiple test concentrations which, in turn, will reduce laboratory costs for dischargers while concurrently improving data interpretation. The most significant improvement the TST offers over that of traditional hypothesis testing, however, is the inclusion of an acceptable false negative rate. While calculating a range of PMSDs provides an indirect measure of power for traditional hypothesis tests, setting an appropriate β level (or α level using the TST method) establishes explicit test power and provides motivation to decrease within-test variability which will significantly reduce the risk of unreported toxic events (U.S. EPA 2010a). In addition to its benefits over traditional hypothesis test methods, the TST is simpler to use than point estimate methods as it is less computationally intensive and not model-fit dependent (Grothe et al. 1995).

Taken together, these refinements simplify toxicity analyses, provide dischargers with the positive incentive to generate high quality data, and afford greater protection to aquatic life.

Recommendation
Adopt Alternative 4.

Issue 1C: Objective Type

Present Statewide Policy

Currently, The Regional Water Boards' Basin Plans contain narrative objectives for toxicity control provisions. While the current objectives provide the basis for regulating toxicity in applicable permits, the requirements may vary between dischargers.

Issue Description

Toxicity testing is a necessary means to evaluate the effects of combined and non-regulated pollutants on the overall ecosystem (U.S. EPA 1991). To adequately protect California's aquatic biota, it is appropriate for the State Water Board to replace the current toxicity control provisions in the SIP with statewide numeric objectives for both chronic and acute toxicity. Staff intends each Regional Water Board to directly apply these objectives as effluent limits in permits, which will provide statewide consistency and ensure the protection of aquatic life beneficial uses throughout California.

Alternatives

1. **No action.** Under this option, the Regional Water Boards will continue to follow the guidelines from the SIP and their Basin Plan objectives. This approach has led to regulatory inconsistency, enforcement difficulties, and potential impacts to aquatic life beneficial uses. If the State Water Board does not act, and the Regional Water Boards are required to amend their respective Basin Plans in order to comply with Resolution No. 2005-0019, the workload for staff will be significant and burdensome. Amendments require research, fieldwork, document preparation, CEQA compliance, and an extensive public process. Moreover, regulatory inconsistencies among the Regions would likely arise, effectively undermining one of the primary goals of the Policy.

2. **Adopt statewide narrative objectives for toxicity control.** Narrative objectives used to control toxicity generally state that toxic substances must not be present in toxic amounts in receiving waters. Narrative toxicity objectives are frequently accompanied by a numeric monitoring trigger which, when exceeded, requires a regimen of accelerated toxicity testing and possibly a TRE to reduce and control the source(s) of toxicity. Therefore, dischargers found to have reasonable potential to cause or contribute to in-stream toxicity would be issued permits containing the narrative toxicity objectives, numeric monitoring triggers, accelerated monitoring requirements, and TRE implementation. The primary benefit of narrative objectives is the reduced number of violations assigned to dischargers that are genuinely attempting to reduce toxicity through an aggressive TRE process. Narrative objectives, however, do not provide a clear measurement of compliance and thus represent

resources that would be required to ensure water quality objectives are met under such a policy would deplete the Regional Water Boards' resources, and the potential for ecological harm would likely increase as a result of these vague objectives.

3. **Adopt statewide numeric objectives for toxicity control.** Drawing from the U.S. EPA's National Pollutant Discharge Elimination System Test of Significant Toxicity Implementation Document, statewide numeric objectives for toxicity would be based on effect levels and expressed as a null hypothesis using regulatory management decisions: "mean response [IWC] $\leq$ 0.75 × mean response [control]" for chronic toxicity, and "mean response [IWC] $\leq$ 0.80 × mean response [control]" for acute toxicity (the term "response" refers to the biological endpoint(s) in a given toxicity test). Therefore, an IWC exhibiting an effect level at or above 0.25 of the control would demonstrate chronic toxicity, and acute toxicity would be confirmed at or above an effect level of 0.20. Use of a 0.25 effect threshold for chronic toxicity is consistent with the IC_{25} endpoint established by the U.S. EPA, while a higher effect threshold is warranted for the more severe impacts of acute toxicity.

   These objectives would allow dischargers to conduct single-concentration toxicity tests using the IWC and a control upon issuance, reissuance, or reopener of an NPDES wastewater permit or point source WDR. In accordance with the TST method, IWC samples that result in a "pass" would effectively reject the null hypothesis-based objectives, and the discharger would be in compliance with the Policy. IWC samples that result in a "fail," however, demonstrate significant toxicity (an effect level equal to or greater than 0.20 or 0.25) and would be considered an excursion of the objectives (U.S. EPA 2010a).

   Numeric toxicity objectives are an efficient regulatory tool when expressed as effluent limits because the measurement of compliance is clearly defined. In this scenario, the duty of achieving and maintaining compliance lies entirely with the discharger. Once a permit limit is exceeded, the discharger must implement accelerated monitoring, the TRE process, and any other steps necessary to avoid further violations (see Issue 2E). Numeric objectives represent a compliance-driven model of toxicity control that provides clearly defined requirements and adequate protection of aquatic life.

   The use of numeric effluent limits in permits can, however, become problematic when a noncompliant discharger continues to accrue violations despite aggressively pursing the necessary steps to identify and reduce the source(s) of the observed toxicity. A discharger with an NPDES permit or WDR that relies solely on toxicity limits to control pollution could potentially receive a MMP of $3,000 after the fourth violation, and each violation thereafter, within any consecutive six-month period. This provision, however, applies only to those facilities with permits that do not contain effluent limitations for specific toxic pollutants (CWC §13385(i)). The transition to numeric objectives will be a significant regulatory change that may require certain facilities to carry out a TRE before compliance can be achieved. Furthermore, the application of numeric effluent limits to storm water and non-NPDES dischargers is not currently practicable (see Issues 1D and 1E). Despite these difficulties, a Policy that sets forth statewide numeric toxicity objectives would provide an efficient means of regulation that will assure the protection of aquatic life beneficial uses.

Recommendation
Adopt Alternative 3.

Issue 1D: Storm Water Requirements

Present Statewide Policy

CWA section 402(p) and CWC section 13376 authorize the State Water Board to issue individual and general NPDES permits for storm water discharges. Municipalities serving between 100,000 and 250,000 people are required to apply for Phase I Municipal Separate Storm Sewer System (MS4) permits, while smaller municipalities are issued Phase II MS4 permits. Storm water discharges arising from projects carried out by the California Department of Transportation (Caltrans) require a unique MS4 permit, while general permits are issued to most industries and construction projects that disturb one or more acres of soil. Individual permits are issued to industries that are either ineligible for the Industrial Activities Storm Water General Permit or require an individual permit in addition to the general permit.

State-issued NPDES storm water permits require toxicity monitoring in varying degrees. For example, MS4 dischargers are expected to control pollutants to the “maximum extent practical” (MEP) using structural and nonstructural mitigation measures known as “best management practices” (BMP). Industrial storm water dischargers are instructed to control toxicants released from their facilities using the “best available technology economically achievable” and the “best conventional pollutant control technology.” Dischargers of storm water associated with construction and land disturbance activities are required to conduct acute toxicity testing whenever use of an active treatment system is required.

The SIP does not apply to any storm water dischargers.

Issue Description

Municipal storm water discharges are a major source of impairment in water bodies throughout the United States. Urban runoff, resulting from roads, bridges, and other impermeable surfaces, carries pollutants through municipal conveyances and discharges them to receiving waters untreated. In California, storm water discharges from MS4s and industries have been identified as a probable source of impairment in an estimated 1,326.27 miles of rivers, streams, and creeks (U.S. EPA, updated 2010 Sept. 7). Presently, only a portion of MS4 and individually permitted industrial storm water dischargers are required to conduct toxicity monitoring, and these monitoring requirements vary among dischargers. It is therefore necessary to address the issue of urban runoff in the proposed Policy as such discrepancies may endanger aquatic life beneficial uses.

Alternatives

1. **No action.** If the State Water Board remains silent on this issue, statewide toxicity requirements will not be established for storm water discharges. As a result, dischargers that have inadequate toxicity monitoring requirements, or no such monitoring requirements at all, may contribute to toxicity in receiving water bodies. This “no action” alternative, however, would not preclude future permits from including requirements for toxicity.

2. **Require NPDES permits for MS4 and individual industrial storm water dischargers to include numeric effluent limitations for chronic toxicity.** This option would require the permitting authority to include the proposed chronic toxicity objective as a numeric effluent limitation in all Phase I and II MS4 permits (including the Caltrans General Permit), and

individual permits issued to industrial storm water dischargers that do not discharge to a permitted MS4 (referred to in the Policy as "individual industrial storm water dischargers"); inclusion of the proposed acute toxicity objective as a numeric effluent limitation would be left to the discretion of the applicable Water Board. Due to the highly variable nature of storm water runoff, these dischargers may be assigned reasonable potential to exceed the proposed chronic toxicity objective, or be required to conduct a reasonable potential analysis using the TST method. Should reasonable potential exist, MS4 and individual industrial storm water dischargers would be required to monitor chronic toxicity during each year of their permit using a minimum of two wet season samples, two dry season samples, and the test species demonstrating the highest level of sensitivity (determined by the method outlined in the recommended alternative for Issue 2A). Dischargers would be obligated to retrieve samples from monitoring locations established by the applicable Water Board, while data analysis would necessitate the use of the TST. As compliance with numeric limitations may prove to be a significant hardship for many MS4 and individual industrial storm water dischargers, compliance schedules may be granted to eligible permit holders. In addition, exemptions may be granted to eligible storm water dischargers (see Issue 2F). A toxicity test resulting in a "fail" would be considered a violation of effluent limitations, requiring submittal of a TRE Work Plan to the appropriate Regional Water Board. Upon approval, dischargers would be required to conduct a TRE using samples from the same storm event that caused the exceedance (if practicable), or the event immediately following it.

With continual monitoring requirements and compulsory TREs for violators, the application of numeric chronic toxicity effluent limitations may help reduce the effects of toxicity in urban storm water runoff. However, the inclusion of numeric effluent limitations in storm water permits has proven to be a contentious issue, punctuated by regulatory amendments, water quality orders, and court cases.

In 1990, the State Water Board received two petitions from environmental advocacy groups seeking review of MS4 permits issued by the San Francisco and Los Angeles Regional Water Boards. The petitioners argued that the permits violated federal law by failing to include numeric effluent limits and that storm water discharges were violating water quality standards. In response, the State Water Board issued two water quality orders refuting the claims made in both petitions. The State Water Board contended that permits, storm water discharge prohibitions, BMPs, and SWMPs constituted "effluent limitations" and were therefore in accordance with the CWA. The State Water Board also determined that the inherent variability of storm water discharges, in addition to the limited number of treatment technologies and extremely high costs to implement them, made numeric effluent limits impractical (State Water Board Order Nos. 91-03 (*Citizens for a Better Environment et al.*); 91-04 (*Natural Resources Defense Council*). In 1999, the Ninth Circuit Court of Appeals held that MS4 permit compliance was to be based solely on the MEP standard unless the State or Regional Water Boards specifically require a stricter adherence to water quality standards (*Defenders of Wildlife v. Browner* (9th Cir. 1999) 191 F.3d 1159).

Remaining a controversial issue, the State Water Board convened a panel of experts to reexamine the feasibility of numeric effluent limits in storm water permits in 2005 and 2006. In regards to municipal storm water discharges, the panel identified several drawbacks to the current regulatory approach, including a lack of BMP oversight and evaluation, maintenance concerns, and the difficulty associated with identifying factors contributing to beneficial use impairment. In order to resolve these issues, the panel suggested a more rigorous approach to the selection and design of BMPs, as well as an enforceable maintenance program. Even with these suggested improvements, however, the panel deemed numeric effluent limits infeasible for MS4 permits, citing BMP shortcomings and a high level of variation among storm water discharges. Conversely, the panel determined that numeric limits are still feasible for some industrial storm water dischargers, provided that a more appropriate method of industry classification is established in addition to a reliable database detailing emissions and BMP performance (Currier et al. 2006).

Given the significant difficulty associated with numeric effluent limit compliance, MS4 dischargers and individual industrial storm water dischargers run the risk of accruing MMPs and other violations despite their best efforts to control toxic runoff. While a compliance schedule might aid implementation efforts, the highly variable nature of storm water, coupled with the multitude of point sources within a municipality would likely render such preparation ineffective. Furthermore, storm water conveyances may require extensive upgrades and alterations in order to meet the proposed numeric effluent limits which may, in turn, place an unreasonable financial burden upon municipalities. While numeric effluent limits are technically feasible for most industrial storm water dischargers, the Water Board would likely need to develop a detailed database, as recommended by the expert panel. Establishing such a database, however, would require a significant amount of the Water Boards' resources and would likely take several years to complete.

3. **Require MS4 and individual industrial storm water dischargers to include chronic toxicity monitoring.** Under this option, all individual industrial storm water dischargers and Phase I and II MS4 dischargers (including Caltrans) that discharge to inland surface waters, enclosed bays, and estuaries would be subject to minimum toxicity monitoring requirements. As opposed to imposing numeric effluent limitations, the permitting authority would have a greater flexibility imposing minimum monitoring requirements, because it would be responsible for establishing remediation measures required for compliance with the proposed objectives. This may or may not result in changes to the abatement and mitigation measures currently contained in MS4 permits and individual industrial storm water permits.

   The monitoring requirements proposed by staff would be applied in two separate stages. Phase I and II MS4 dischargers, and individual industrial storm water dischargers that are currently required to monitor for toxicity would be sent 13383 letters requiring the use of the TST method for all toxicity data analyses within one year from the effective date of the Policy during this first stage of implementation. Phase I and II MS4 dischargers, and individual industrial storm water dischargers not subject to toxicity monitoring provisions on the effective date of the Policy would be exempt from this requirement for the remainder of their current permit cycles. Permits that are issued, reissued, or reopened after the Policy is adopted would be required to include a toxicity monitoring program for the second stage of implementation. These monitoring programs would, at a minimum, require each discharger to conduct four chronic toxicity tests during each year of the permit cycle using samples from the first storm event of the wet season, a subsequent storm event, and two dry season samples. Dischargers would also be required to follow the methods outlined in the alternative recommended for Issue 2A in order to determine the most sensitive test species for toxicity monitoring. Additionally, the TST method would be required for all toxicity data analyses, and the applicable Water Board would have discretion to apply compliance schedules to assist dischargers in implementing a monitoring program pursuant to the Policy (see Issue 2D).

Apart from improving toxicity data interpretation, this alternative provides three important benefits. First, a statewide toxicity monitoring program for urban runoff will ensure that all municipalities and industries are assessing the environmental impact of their storm water discharges and taking appropriate action when necessary. Such an approach provides a feasible alternative to numeric effluent limitations and increases protections for aquatic life beneficial uses. Second, minimum monitoring requirements allow the permitting authority to tailor implementation plans to each MS4 and individual industrial storm water discharger. This monitoring framework could also be applied to storm water discharges from construction and industrial sites subject to the general NPDES permit. Third, this option avoids the imposition of MMPs if MS4 dischargers exceed the proposed objectives despite meeting MEP requirements. Nevertheless, this option will not preclude the Water Boards from establishing numeric effluent limits for toxicity in Phase I and II MS4 permits, and individual industrial storm water permits if it is deemed appropriate.

Despite the aforementioned benefits, this alternative harbors the potential to be underprotective of aquatic life beneficial uses as it fails to establish standardized methods of remediation. Permits without BMP design requirements may result in unsatisfactory or inappropriate implementation measures, and the omission of BMP performance standards could lead to poor maintenance and neglect. In addition, dischargers may have difficulty determining the source of toxicity in storm water runoff if clear and concise TRE/TIE requirements are omitted from permits.

Recommendation:
Adopt Alternative 3.

Issue 1E: Channelized Dischargers

Present Statewide Policy

Non-point source (NPS) discharges are a significant cause of water pollution in California and the U.S. Diffuse in nature, NPS pollution originates primarily from land use activities such as those associated with agriculture, silviculture, and hydromodification, and it is generally transported via rainfall, snowmelt, and irrigation water. Agricultural operations are one of the primary sources of NPS pollution in California, contributing to the impairment of approximately 34,099.01 miles of rivers, streams, and creeks; 706,990.47 acres of lakes, ponds, and reservoirs; and 646.32 square miles of bays and estuaries (U.S. EPA, updated 2010 Sept. 7). In order to control polluted runoff and comply with section 1329 of the CWA, the State Water Board developed the NPS Management Plan in 1988. While NPS discharges are not regulated under the NPDES Permit Program, the State and Regional Water Boards are authorized to issue WDRs, conditional waivers, and conditional prohibitions that require the implementation of various management measures.

Issue Description

While some agricultural operations and other NPS dischargers are required to conduct toxicity monitoring, there are presently no statewide toxicity objectives that apply to these dischargers.

Toxicity monitoring may be infeasible for inconspicuous NPS runoff, but addressing the effects of perceptible NPS discharges directed or conveyed through channels or other defined pathways (referred to in the Policy as “channelized dischargers regulated exclusively under Porter-Cologne” or “channelized dischargers”) is necessary if the proposed policy is to adequately protect aquatic life beneficial uses in California’s water bodies.

Alternatives

1. **No action.** The Water Boards will continue to establish toxicity monitoring requirements on an individual or program-wide level. While this approach affords a high degree of flexibility to Water Board staff, toxicity provisions may remain absent from many NPS WDRs and conditional waivers. Such omissions further erode regulatory consistency and are not protective of aquatic life beneficial uses.

2. **Require WDRs and conditional waivers for channelized dischargers to include numeric effluent limitations for chronic toxicity.** Under this option, the permitting authority would be required to apply the proposed chronic toxicity objective as a numeric effluent limitation to all channelized dischargers. Direct application of the acute toxicity objective as a permit limitation would be left to the discretion of the applicable Water Board, while reasonable potential would be assigned, due to the numerous, unknown constituents and diffuse sources of these discharges. At a minimum, channelized dischargers would be required to conduct four chronic toxicity tests during each year of the WDR or conditional waiver cycle, but the sampling times and locations would be determined on a case-by-case basis due to the widely varying nature of NPS discharges. Test species sensitivity would be assessed using the recommended alternative for Issue 2A, and the TST method would be required for all toxicity data analyses. Given the potential for financial hardships stemming from monitoring costs and possible fines, compliance schedules would be granted to eligible channelized dischargers. In addition, exemptions may be granted to eligible storm water dischargers (see Issue 2F). A toxicity test resulting in a “fail” would be interpreted as a violation, requiring implementation of a TRE after a Work Plan is approved by the appropriate Regional Water Board.

   Numeric effluent limitations would establish a compliance-driven approach to toxicity control and provide channelized dischargers with further incentive to reduce toxicity. The ability of these dischargers to meet the proposed objectives, however, remains questionable. For example, NPS pollution often results from numerous, diffuse sources that may be difficult to locate and control. Coordinating with the more than 20 other state agencies responsible for various aspects of NPS pollution would also be challenging for Water Board staff. While some channelized dischargers may successfully identify and reduce non-point source pollution, the costs to do so may be unduly burdensome on some operations.

3. **Require WDRs and conditional waivers for channelized dischargers to include chronic toxicity monitoring requirements.** Rather than require WDRs and conditional waivers to include numeric effluent limitations, State Water Board staff may choose to establish minimum monitoring requirements for chronic toxicity. Similar to the provisions outlined in Alternative 3 of Issue 1D, channelized dischargers presently obligated to carry out toxicity testing would be sent 13267 letters requiring the use of the TST method for all toxicity data analyses within one year of the effective date of the Policy. Compliance schedules would not be granted to these dischargers as a change in the methodology used for data analysis is not expected to pose a significant hardship. Channelized dischargers devoid of chronic toxicity monitoring provisions would be exempt from this requirement for

the remainder of their current WDR or conditional waiver cycle; after which they would be required to adhere to a chronic toxicity monitoring program developed by the appropriate Regional Water Board. Following the test species screening method outline in the recommended alternative to Issue 2A, dischargers would be obligated to use the most sensitive test species for routine monitoring and results would be analyzed using the TST. A minimum of four toxicity tests would be required during each year of the WDR or conditional waiver cycle. The permitting authority would determine sampling times and locations as well as the BMPs, oversight procedures, and remediation measures to be employed by the discharger. The applicable Water Board would also be provided discretion to apply compliance periods to assist dischargers implementing a monitoring program pursuant to the Policy (see Issue 2D).

The advantages and disadvantages of this approach are similar to those listed in Alternative 3 of the previous Issue. Requiring the use of the TST method will improve data interpretation, while minimum monitoring requirements will facilitate permit consistency. In addition, the Water Boards would retain the authority to establish numeric effluent limitations as deemed appropriate. This discretion will prevent unnecessary enforcement actions against dischargers incapable of meeting the proposed objectives despite their best attempts to do so. However, this approach harbors the potential to be less protective because minimum requirements for BMPs, oversight procedures, and remediation measures for toxicity may not be specified in a WDR or conditional waiver.

Recommendation:
Adopt Alternative 3.

ISSUE 2: COMPLIANCE DETERMINATION

Many aspects of toxicity monitoring are currently left to the discretion of the Regional Water Boards. As a result, the frequency of tests, permit limits, and violations differ not only between the nine regions, but among dischargers within the same region as well. Successful implementation of the proposed objectives will require a uniform approach to toxicity monitoring and enforcement. The following Issues explore the options available to the State Water Board for establishing such an approach.

Issue 2A: Reasonable Potential

Present Statewide Policy

Section 1 of the SIP outlines a procedure to determine whether a discharge causes, or has reasonable potential to cause or contribute to an excursion above applicable objectives for priority pollutants. In this process, effluent data is reviewed to determine the observed maximum effluent concentration (MEC) for a given pollutant (facilities are required to obtain the necessary monitoring data prior to conducting this analysis). If the MEC is greater than or equal to the pollutant objective, then an effluent limit is required. If the MEC is less than the applicable objective, the ambient data is reviewed to determine the observed maximum ambient background concentration for the pollutant. If the maximum background concentration of the pollutant is found to be above the pollutant objective and any amount of the pollutant is detected in the effluent, then an effluent limit is required for the discharge. Periodic monitoring may be required if the pollutant is not detected in the effluent or if the ambient background sample and applicable detection limit are greater than or equal to the receiving water concentration. For a more detailed description of this analysis, see Section 1.3 of the SIP.

Issue Description

The reasonable potential formula established in the SIP was developed for specific chemical constituents and is, therefore, difficult to apply to toxicity objectives. Designation of a new reasonable potential assessment that is both consistent and simple to use would greatly aid the Regional Water Boards during the permit writing process.

The following "Alternatives" section provides brief descriptions of three methods for assessing reasonable potential. Examples of these procedures can be found in Appendix F. In addition to determining the toxicity of a discharge, a reasonable potential assessment also detects the test species with the highest degree of sensitivity to chronic or acute toxicity. As such, each of the five alternatives presented will continue the U.S. EPA's recommended use of one vertebrate, one invertebrate, and one aquatic plant for chronic toxicity assessments, while one vertebrate and one invertebrate will continue to be utilized for acute toxicity assessments (Denton et al. 2007).

Alternatives

1. **No action.** Under this option, the reasonable potential assessment, as outlined in Chapter 1 of the SIP, will continue to be used. This analysis is designed explicitly for individual pollutants with a measurable concentration. The inherent difficulty of quantifying toxicity into

a measurable unit would require an extensive amount of time, effort, and expertise on behalf of the Water Boards.

2. **Adopt the California Ocean Plan guidelines.** Appendix VI of the California Ocean Plan provides an outline of the steps needed to determine whether a pollutant causes, or has the reasonable potential to cause or contributes to an excursion above ocean water quality objectives in accordance with 40 CFR section 122.44(d)(1)(iii). The Ocean Plan requires the Regional Water Boards to utilize all available information to characterize pollutant discharges using a statistical method that accounts for the limitations associated with sparse data sets and non-detects. In addition to freshwater and marine discharges, this method applies to both toxicity and individual pollutants. The Ocean Plan also includes suggestions for assessing the reasonable potential of facilities devoid of toxicity monitoring data, and requirements for each outcome of the test.

3. **Adopt the recommendations in the TSD.** Incorporating effluent variability data, this method relies upon the use of a CV that is either calculated or assigned (depending upon the quantity of toxicity test results), and a probability-based maximum effluent value derived from a list of multipliers. The TSD also provides guidance for evaluating the reasonable potential of facilities lacking toxicity monitoring data. This approach would enable Water Board staff to assess the need for permit limitations for toxicity in an accurate and comprehensive manner. The intricacy of this analysis, however, would require a substantial amount of time and resources from Water Board staff.

4. **Assign reasonable potential for all major POTWs.** Because POTWs accept a steady, voluminous flow of effluent from a variety of municipal discharges containing numerous unknown constituents, these facilities harbor the potential to adversely impact aquatic biota. A Policy provision that assumes reasonable potential for all major POTWs (facilities with an average daily discharge greater than one million gallons per day) would provide a higher level of ecological protection from the voluminous discharges of these facilities than that of an isolated test. Selecting this alternative, however, would require the concurrent adoption of a reasonable potential screening method for all other dischargers.

5. **Adopt the recommendations in the TST.** Reasonable potential analyses are conducted in a manner similar to routine toxicity testing under U.S. EPA's TST method. This approach requires dischargers to conduct a minimum of four, single-concentration toxicity tests, after which the TST method is used to determine the results. The data from each test resulting in a "pass" must then be used in another formula that calculates the potential to cause toxicity (and determines the most sensitive test species) by comparing the mean effect level at the IWC to a 10% mean effect threshold. Regardless of the initial outcome of the toxicity tests, reasonable potential to cause acute or chronic toxicity is demonstrated when a test sample exhibits a mean effect above the 10% threshold. This reasonable potential analysis is simpler to use than that of the California Ocean Plan or the TSD, yet highly accurate. Furthermore, adoption of this approach will maintain consistency with routine TST analyses, and the reduction in sample concentrations will save dischargers money.

Recommendation:
Adopt Alternatives 4 and 5

Issue 2B: Effluent Limitation Derivation

Present Statewide Policy

A statewide effluent limitation derivation method has not been established.

Issue Description

The narrative toxicity objectives established in the Basin Plans are currently expressed as permit triggers that, if exceeded, can result in an accelerated monitoring schedule and/or the TRE process. The adoption of numeric objectives for toxicity will necessitate a formula from which numeric effluent limitations can be calculated. Establishing a statewide method to do so will further promote uniformity among dischargers and the Regional Water Boards.

Alternatives

1. **No action.** Should the current permitting process remain unchanged, Regional Water Boards will continue to impose narrative chronic and acute permit limitations. As a result, data interpretation and enforcement measures may vary between Regions. These inconsistencies would hamper the Policy's goal of regulatory uniformity and may ultimately weaken protections to aquatic life beneficial uses.

2. **Adopt U.S. EPA's two-value steady state model.** Under this option, the Regional Water Boards would be required to calculate waste load allocations (WLA) using the mass balance equation to establish effluent limitations for chronic and acute toxicity. A WLA, when derived from water quality standards, defines the appropriate effluent discharge level that subsequently determines the target long-term average (LTA) for a facility. When applied in conjunction with the CV of a given discharge, the target LTA can be used to establish effluent limits. These permit limits, in turn, are expressed as both maximum daily limits (MDL) and average monthly limits (AML) for all dischargers, excluding POTWs (which supplant MDLs for weekly averages). When using the statistical method to impose limits for chronic and acute toxicity, however, the MDL is interpreted as the maximum result for the calendar month, while the AML serves as the average of individual toxicity test results obtained over a calendar month (required for accelerated monitoring and the TRE process). MDL derivation relies upon the CV of the monthly or quarterly discharge, and the most stringent LTA (obtained from two or three-value, steady-state WLAs) would be translated into upper bound percentile values for effluent quality (U.S. EPA 1991). Examples of this method can be found in Appendix G.

   This approach would further standardize toxicity control provisions throughout the state in a manner that effectively accounts for the variation in effluent discharges, and it would provide sufficient protection for aquatic life. However, applying this procedure to such a broad spectrum of facilities would require a substantial amount of effluent data and Regional Water Board resources. Additionally, quantifying toxicity in this manner may prove difficult because such data is derived exclusively from biological responses.

3. **Adopt the statistical method established in the SIP.** Nearly identical to the U.S. EPA's steady-state model, the effluent limitation formula detailed in Section 1.4 of the SIP is based upon an effluent concentration allowance (ECA), rather than a WLA. An ECA calculation tends to be simpler than that of a WLA, as evidenced by the example in Appendix G.

Another minor difference exists in the parlance used for effluent limitations, as the SIP refers to MDLs as MDELs (maximum daily effluent limitations), and AMLs as AMELs (average monthly effluent limitations). Additionally, MDELs would need to be adapted for monthly and quarterly monitoring, while AMELs would be utilized for accelerated monitoring schedules. Adopting the ECA method would simplify the process of calculating effluent limitations because it requires less data accumulation than that of a WLA and would remain consistent with the current methodology required in the SIP. The lack of information regarding upstream and critical flows, however, may produce effluent limitations that are less accurate than those calculated from WLAs. Moreover, this approach is not readily applied to toxicity data.

4. **Directly apply the objectives as effluent limits.** Rather than establishing an effluent limitation formula based upon WLAs or ECAs, the State Water Board may deem these approaches "impracticable" due to the difficulty associated with toxicity quantification. In so doing, the State Water Board would require the direct translation of the proposed chronic objective as an effluent limit, while the proposed acute objective would be applied to permits and WDRs at the discretion of the permitting authority. Dischargers would, therefore, be obligated to meet these objectives/limits at the IWC. By foregoing the use of averages, this alternative acts in a manner similar to that of an "instantaneous maximum" by prohibiting excursions of the proposed objectives altogether; thus affording a higher level of protection than the aforementioned approaches. When paired with the TST formula, this option becomes a statistically and biologically sound approach that simplifies the permit limit derivation process for the Water Boards.

Recommendation:
Adopt Alternative 4.

Issue 2C: Monitoring Frequency

Present Statewide Policy

A statewide toxicity testing schedule for dischargers has not been established.

Issue Description

As it stands, monitoring frequency for toxicity limits varies widely between and the numerous dischargers located throughout the state. These inconsistencies harbor the potential to undermine the aquatic life beneficial uses of receiving waters and may offer unfair economic advantages to those dischargers that are seldom required to conduct toxicity tests. In addition to establishing a consistent regulatory framework, a uniform quantity of routinely scheduled toxicity tests would improve the biological integrity of receiving waters and strive to balance the costs associated with toxicity monitoring.

Alternatives

1. **No action.** The permitting authority would retain the discretion to establish the frequency of toxicity testing for all dischargers. While the Regional Water Board staff members possess an in-depth knowledge of the water bodies located within their jurisdiction, requirements will continue to vary among dischargers, resulting in an unequal distribution of costs associated

with toxicity monitoring. Furthermore, these discrepancies may not provide adequate protection for aquatic biota.

2. **Establish minimum statewide monitoring requirements.** Under this option, the State Water Board would require uniform monitoring for dischargers found to have reasonable potential to cause, or contribute to excursions of the toxicity objectives. Facilities that continuously discharge at a rate equal to or greater than one million gallons per day would be required to conduct monthly monitoring, while facilities that continuously discharge at a lower rate would be obligated to conduct quarterly monitoring. Monthly monitoring would also be required of facilities that discharge at a rate equal to or greater than one million gallons per day, but do so non-continuously. For these facilities, monthly monitoring is required only during the months of discharge. Facilities that non-continuously discharge at a rate less than one million gallons per day would be obligated to conduct one toxicity test per three month discharge period (rounding up whenever the discharge period is not a multiple of three). The permitting authorities, however, would retain the ability to require additional testing whenever a given discharge warrants more frequent monitoring.

   Monthly toxicity tests are necessary to protect aquatic organisms from the discharges of facilities that harbor the potential to release a high volume of toxic constituents, such as major POTWs. Quarterly monitoring is appropriate for smaller dischargers as these facilities pose less of a threat to aquatic biota than their larger counterparts. Dischargers that do not possess reasonable potential to exceed toxicity objectives, as well as those dischargers deemed "insignificant," pose little threat to aquatic life beneficial uses and therefore require only sparse monitoring, if any at all.

   The establishment of statewide standards for monitoring frequencies will further strengthen the Policy by promoting a consistent approach to toxicity testing that will help reduce cost discrepancies between facilities of similar size.

3. **Adopt more stringent/less stringent statewide monitoring requirements.** With this alternative, toxicity testing frequency would be increased to weekly requirements for facilities discharging a million gallons a day or more, while smaller dischargers would be required to initiate a monthly monitoring schedule. While such stringent requirements might offer a higher level of ecological protection, the costs associated with this quantity of tests would place an unreasonable financial burden upon dischargers. Moreover, the limited volumes of effluent discharged by smaller facilities are unlikely to warrant such high levels of monitoring.

   Conversely, decreasing the required frequency of toxicity tests would negatively impact receiving water bodies. Large facilities, such as major POTWs, continuously discharge vast quantities of effluent that frequently contain unknown constituents that fluctuate and react in unpredictable ways. Responses from wastewater treatment systems, as well as their overall efficacy, may also influence effluent variation. While provisions requiring major POTWs to conduct quarterly, semi-annual, or annual toxicity monitoring would reduce the costs dischargers incur to comply with the proposed toxicity objectives, the potential to degrade aquatic life beneficial uses would greatly increase as the toxicity present in the effluent matrix may exceed effluent limits prior to scheduled testing. While minor POTWs and comparably sized facilities independently discharge smaller volumes of effluent, a cluster of these dischargers can have the same effect on a water body as that of a large facility (Denton et al. 2007). Therefore, reducing the monitoring frequency of smaller dischargers to a semi-annual or annual basis may compromise aquatic life uses in some water bodies.

Recommendation:
Adopt Alternative 2.

Issue 2D: Compliance Schedules

Present Statewide Policy

In accordance with provisions detailed in the SIP, and later revised in the *Policy for Compliance Schedules in NPDES Permits* (2008) (Compliance Schedule Policy), compliance schedules are granted at the discretion of the Regional Water Boards to existing dischargers capable of demonstrating the infeasibility of achieving immediate compliance with new or revised water quality standards. Compliance schedules are included in permits and WDRs, and are comprised of a series of enforceable actions, each with a specific deadline that must be met in order to demonstrate compliance. Interim requirements, consisting of temporary numeric limits, are added to compliance schedules that are in excess of one year. Depending upon whichever is the more stringent of the two, these requirements are either determined by the capabilities of the facility or the limitations established in the existing permit. In either instance, no more than one year will be allotted between interim assignment dates. The duration of a compliance schedule itself, however, varies among permits and WDRs, but cannot exceed ten years. Those contained within the five-year cycle include the final effluent limitations in the permit provisions, while schedules that exceed permit length incorporate effluent limits in the permit findings. The purpose of these findings is to document the water quality objective to be achieved, an explanation as to why the final effluent limitation will not presently be established as an enforceable permit requirement, and a statement confirming the intent to create a final water quality-based effluent limit in a succeeding permit (State Water Board 2005b).

Issue Description

Compliance schedules remain an option for existing dischargers that are incapable of immediately meeting the objectives established in this Policy. Therefore, it is necessary to determine the means by which the Water Boards will incorporate compliance schedules into existing NPDES wastewater permits and point source WDRs.

Alternatives

1. **No action.** Pursuant to the Compliance Schedule Policy, existing dischargers that successfully demonstrate their need for additional time to comply with “a permit limit more stringent than the effluent limitation previously imposed” may be granted a compliance schedule upon permit renewal, reopener, or revision. In order to qualify, dischargers must provide records documenting, among other things, efforts made to quantify pollutant levels and control the sources of pollution, an evaluation of facility performance to determine the stringency of interim effluent limitations, and the highest quality of discharge that can reasonably be achieved until final compliance is met. The Water Boards will retain the ability to require immediate compliance with this, or any other policy. The various means by which the Regional Water Boards can establish compliance schedules, however, have the propensity to create discrepancies among dischargers and may postpone the implementation of the proposed objectives.

2. **Adopt a statewide compliance schedule for NPDES wastewater dischargers and point source WDR dischargers.** This alternative would designate a specific amount of time during which NPDES wastewater dischargers and point source WDR dischargers would be required to achieve compliance. Dischargers that are not presently required to monitor toxicity would have the opportunity to receive a compliance schedule of up to two years. Given that the proposed provisions do not specifically require substantive changes to infrastructure or test procedures, the option to receive a two-year compliance schedule would expire ten years from the effective date of the Policy. Facilities discharging under an NPDES permit or WDR that contains toxicity monitoring provisions will not be eligible to receive a compliance schedule. This approach will expedite the implementation process for dischargers, thereby strengthening the protections afforded to aquatic biota at a faster pace. State Water Board staff is confident that dischargers can fulfill the proposed requirements in a timely manner.

3. **Adopt a statewide compliance schedule for storm water dischargers and channelized dischargers.** Similar to the aforementioned alternative, this option would establish a specified amount of time during which storm water dischargers (as identified in Issue 1D) and channelized dischargers (as identified in Issue 1E) would be required to achieve compliance with the Policy. During the first stage of implementation, compliance schedules would not be authorized because the required use of the TST does not increase the stringency of permit requirements or necessitate a significant change in discharger operations. Implementation of the monitoring program established pursuant to the Policy may, however, prove to be time consuming to those storm water dischargers and channelized dischargers that were not previously required to conduct toxicity testing. Therefore, compliance schedules with a maximum duration of two years may be granted to these dischargers during the second stage of implementation. The ability to authorize compliance schedules would expire ten years from the effective date of the Policy. Exemptions may also be granted to eligible storm water dischargers and channelized dischargers (see Issue 2F).

4. **Prohibit compliance schedules for the Policy.** The State Water Board may decide to prohibit compliance schedules for the Policy. However, this alternative may be unpopular with dischargers that are unfamiliar with toxicity monitoring as they may find immediate compliance difficult to achieve, and their inability to meet the proposed objectives may result in enforcement actions that might otherwise have been avoided through the adoption of compliance schedules.

Recommendation:
Adopt Alternatives 2 and 3.

Issue 2E: Exceedances

Present Statewide Policy

As established in the SIP, dischargers must conduct a TRE if repeated toxicity tests reveal chronic or acute toxicity in receiving waters. Multiple facilities that discharge to the same receiving water body may be allowed to coordinate TREs at the discretion of the applicable Regional Water Board. Additionally, permits must include a provision that requires a discharger to take every reasonable step to control toxicity once the source is identified, and a statement addressing potential enforcement action for any facility that fails to conduct a TRE.

Issue Description

Current provisions maintain only a loose framework of actions required of facilities that exceed chronic toxicity limitations. While this approach has provided a great deal of flexibility for Water Board staff, many regulatory discrepancies have arisen among dischargers as a result, including the use and duration of accelerated monitoring schedules prior to TRE implementation. The establishment of statewide provisions to manage toxicity excursions will promote uniformity and reduce these disparities.

Alternatives

1. **No action.** If no action is taken on this aspect of the Policy, the existing provisions in the SIP will be maintained and deadlines for TRE proposals and accelerated monitoring schedules will continue to vary between permits. As a result, certain facilities may enjoy unfair economic advantages, while lenient compliance provisions and deadlines may weaken protections for aquatic biota. This approach, however, affords a great deal of flexibility to the permitting authority.

2. **Establish statewide excursion/exceedance provisions.** Under this alternative, the State Water Board will impose uniform requirements for NPDES wastewater dischargers and point source discharges subject to WDRs.

   Toxicity tests that result in a fail at the IWC would be interpreted as an exceedance of effluent limitations and an excursion above the proposed objectives. Dischargers would be required to institute an accelerated monitoring schedule within 14 days of this exceedance. At a minimum, an accelerated monitoring schedule would consist of six toxicity tests conducted at approximately two-week intervals over a 12-week period. In order to better characterize the discharge and fulfill federal requirements, accelerated monitoring would necessitate the use of five effluent concentrations (plus control) with the test species used for routine monitoring. Should any of these tests result in a fail, the discharger will receive a Class II violation and be required to initiate a TRE. Prior to TRE implementation, dischargers would be required to submit a TRE Work Plan to the applicable Water Board no later than 30 days from the date of the accelerated monitoring violation. Dischargers would be expected to follow U.S. EPA recommendations when developing TREs, with exceptions granted by the State or Regional Water Boards on a case-specific basis. Upon approval from the applicable Water Board, the discharger would be required to implement the TRE Work Plan in order to identify the chemical constituents responsible for the toxicity, isolate the sources of these chemicals, and determine an effective means of controlling them.

   Although these provisions may reduce the compliance options currently available to Water Board staff and dischargers, the consistency achieved through this alternative would further aid in the implementation of this Policy. Additionally, this provision would improve the health of aquatic ecosystems by ensuring TREs are implemented by all NPDES wastewater dischargers and point source WDR dischargers in violation of the proposed objectives/limits. Phase I and II MS4s, individual industrial dischargers, and channelized dischargers would not be subject to this alternative, but the Policy does not preclude the permitting authority from applying such remediation measures as necessary (see Issues 1D and 1E).

Recommendation:
Adopt Alternative 2.

Issue 2F: Exceptions

Present Statewide Policy

Section 5.3 of the SIP authorizes the Water Boards to grant categorical and case-by-case exceptions to priority pollutant objectives. Under this SIP provision, eligible dischargers can fulfill statutory requirements if they receive short-term or seasonal categorical exceptions to manage pests, weeds, vectors, or fisheries. Additionally, categorical exceptions may be granted to eligible dischargers in order to comply with the federal Safe Drinking Water Act, the California Health and Safety Code, and/or for maintenance of structures related to municipal water supply and conveyance. To obtain a categorical exception, eligible dischargers must submit the following documentation to the Executive Officer of the appropriate Regional Water Board for approval: a detailed description of the proposed action, including the proposed method of completing the action; a time schedule; a discharge and receiving water quality monitoring plan (before project initiation, during the project, and after project completion, with the appropriate quality assurance and quality control procedures); CEQA documentation; contingency plans; identification of alternate water supply (if needed); and residual waste disposal plans. Eligible dischargers must also notify the affected public and governmental agencies. Upon completion of each project, dischargers are required to provide certification by a qualified biologist that the beneficial uses of the receiving waters have been restored.

Case-by-case exceptions to priority pollutant objectives may be granted to facilities discharging to water bodies that differ significantly from statewide conditions, provided that the public interest will be served and the exception will not compromise the beneficial uses of enclosed bay, estuarine, and inland surface waters. These exceptions also require compliance with CEQA, a public hearing, and U.S. EPA approval (State Water Board 2005b).

Issue Description

The Water Boards acknowledge that certain discharge activities pose little risk to beneficial uses when properly conducted. In addition to those activities eligible for exceptions under the SIP, dischargers categorized as being “low threat” are often granted some form of exception by the Regional Water Boards. Generally, low threat discharges are episodic in nature, of minimal volume, and not dependent upon dilution to be protective of beneficial uses. Examples include, but are not limited to, construction dewatering, geothermal well maintenance, and hydrostatic testing. It is necessary to consider whether or not the exceptions currently granted by the Water Boards, if any, should apply to the Policy.

Alternatives

1. **No action.** By remaining silent on this issue, exceptions to the monitoring provisions proposed in the Policy will not be granted. However, dischargers would retain the ability to challenge permit requirements via the petition process and, in response, the Regional Boards could adopt site-specific objectives for toxicity with State Water Board approval. While this process could potentially exempt low threat dischargers from certain aspects of

the Policy, the amount of time and staff resources required for such an undertaking is extensive. Moreover, many dischargers that would qualify for an exception would unnecessarily be required to pay for a reasonable potential analysis.

2. **Incorporate the categorical and case-by-case exceptions in Section 5.3 of the SIP into the Policy.** Under this alternative, all dischargers subject to the Policy, including dischargers of storm water, would be given the opportunity to file for a categorical or case-by-case exception to the proposed provisions established in the Policy. Necessary for pest management and compliance with the Safe Drinking Water Act and the California Health and Safety Code, categorical exceptions allow public agencies to conduct critical services for the state without unnecessary impedance. Case-by-case exceptions allow facilities to work with the Water Boards to determine whether or not compliance with an objective is appropriate, given the conditions of the receiving waters. When properly applied, these exceptions can exempt qualifying dischargers from the provisions of the Policy without posing a threat to aquatic life beneficial uses.

3. **Allow exceptions for insignificant dischargers.** This option would grant the applicable Water Board the discretion to exempt low threat dischargers (referred to as "insignificant dischargers" in the Policy) from the provisions proposed in the Policy. Unlike the categorical or case-by-case exceptions set forth in the SIP, the permitting authority would have the discretion to determine insignificant discharger status, provided the dischargers meet the minimum qualifications proposed in the Policy. In order to be eligible, NPDES wastewater dischargers and point source WDR dischargers must discharge less than one million gallons a day on a non-continuous basis. All non-traditional MS4s and municipalities with populations below 50,000 are assigned insignificant discharger status unless the State Water Board determines that runoff from these dischargers substantially impacts inland surface waters, enclosed bays, or estuaries. In essence, this approach would preserve the guidelines the Water Boards currently use to exempt low threat dischargers from Basin Plan requirements, and maintain the monitoring exceptions currently extended to Phase II MS4s. In addition, channelized discharges that do not substantially impact applicable water bodies may also be granted insignificant discharger status. Apart from the high degree of flexibility this discretionary authority yields, granting insignificant discharger status reduces the costs associated with the requirements of Section 5.3 of the SIP and expedites the approval process for these minor discharges.

Recommendation:
Adopt Alternatives 2 and 3.

SECTION V: ENVIRONMENTAL EFFECTS OF PROPOSED POLICY

This Section provides an analysis of the potential adverse environmental effects that may arise from the adoption of the "Policy for Toxicity Assessment and Control." In accordance with the requirements of CEQA, an Environmental Checklist Form is included in Appendix A.

Antidegradation

Any relaxation of water quality standards that may occur as a result of the Policy must comply with the U.S. EPA's Antidegradation Policy, which requires the full protection of all existing beneficial uses (40 CFR § 131.12). If the initial water quality exceeds that which is necessary to fully protect every beneficial use, the water quality can be lowered, as long as certain criteria are met. Dischargers are not allowed to degrade water bodies to levels below that which is necessary to protect existing beneficial uses. In addition to antidegradation requirements, the Policy must comply with all other applicable state and federal water quality standards.

The toxicity provisions presently in the SIP provide minimal protection of aquatic life beneficial uses because they lack numeric objectives and a comprehensive methodology. Additionally, the inconsistencies that exist among the toxicity requirements established in NPDES permits, WDRs, conditional waivers, and Basin Plans have the potential to further weaken water quality standards. As noted in a 2008 study of 42 major dischargers in the Los Angeles Region, there were 15 permits containing numeric limits, nine containing narrative limits, 15 incorporating monitoring triggers, and three possessing no limits at all. Furthermore, 472 chronic and acute toxicity exceedances were reported between 2000 and 2008 (Stevenson et al. 2009). The proposed Policy seeks to resolve permit discrepancies by establishing uniform numeric objectives for chronic and acute toxicity. Doing so will improve water quality and increase the protection of aquatic biota inhabiting the state's inland surface waters, enclosed bays, and estuaries.

Effects on Existing Environmental Conditions

No adverse environmental effects are expected to result from the implementation of the Policy, as its principal goal is to protect aquatic biota from the effects of toxicity. The numeric objectives and methodology proposed in the Policy will improve upon the toxicity provisions established in the SIP and further reduce the negative impacts of effluent discharges on receiving water bodies by providing an accurate and reliable means to measure toxicity. Requiring all dischargers with reasonable potential to regularly conduct applicable toxicity testing will also ensure that effluent will be monitored consistently. Furthermore, adopting a statewide remediation program for violators will hasten compliance with the proposed objectives.

Reasonable Means of Compliance

Adverse environmental impacts will not directly result from the provisions established in the Policy. While compliance with the proposed objectives may necessitate facility upgrades that negatively affect the surrounding environment in some manner, such assumptions are purely speculative and would be addressed during project level CEQA analyses (see Appendix A for more information).

Growth-Inducing Impacts

Defined under section 15126(g) of the CEQA guidelines, growth-inducing impacts are either direct or indirect conditions that could foster economic development, an increase in population size, or the construction of housing in the surrounding environment. State Water Board staff has determined that the Policy would not affect any of these parameters.

Cumulative Impacts

CEQA guidelines section 15355 provides the following definition of cumulative impacts:

"… two or more individual effects which, when considered together, are considerable or which compound or increase other environmental impacts.

a. The individual effects may be changes resulting from a single project or a number of separate projects.

b. The cumulative impact from several projects is the change in the environment which results from the incremental impact of the project when added to other closely related past, present, and reasonably foreseeable probable future projects. Cumulative impacts can result from individually minor but collectively significant projects taking place over a period of time."

In order to comply with the CEQA guidelines established in Title 14 of the CCR, a list of past, present, and reasonably foreseeable future projects related to the Policy must be developed if any have the potential for cumulative impacts. Given that the Policy is specifically developed to enhance the protection of aquatic life beneficial uses, State Water Board staff has found no possibility of cumulative impacts arising from the implementation of the Policy.

Regional Impacts

In accordance with CWC Section 13241, the Water Boards are required to "ensure the reasonable protection of beneficial uses and the prevention of nuisance" when adopting water quality objectives. In doing so, the following effects are to be considered: past, present, and probable future beneficial uses of water; environmental characteristics of the hydrographic unit under consideration, including the quality of water available thereto; water quality conditions that could reasonably be achieved through the coordinated control of all factors which affect water quality in the area; economic considerations; the need for developing housing within the region; and the need to develop and use recycled water.

Under the Policy, aquatic life beneficial uses of California's water bodies will be protected from the effects of toxicity. The beneficial uses associated with aquatic biota include, but are not limited to: warm freshwater habitat, cold freshwater habitat, wildlife habitat, estuarine habitat, commercial and sport fishing, marine habitat, inland saline water habitat, and wetland habitat. The Policy will have no detrimental impact upon any past, present or probable future beneficial uses of water.

The environmental characteristics of the state's nine hydrologic regions are provided in Section III of this document. Water quality, throughout California, is expected to improve if the Policy is implemented.

The potential economic impacts of the Policy are not expected to extend beyond the dischargers that must comply with the objectives (see Appendix H for a detailed analysis of these impacts). Financial assistance may, however, be available to small, disadvantaged communities through the State Water Board revolving fund and other grants. The Policy will not affect the development of housing or the use of recycled water.

Greenhouse Gas Impacts

Compliance with CEQA guidelines Section 15064.4 requires the State Water Board to address aspects of the Policy that may result in an increase or reduction of greenhouse gas emissions, as well as any provisions that may conflict with existing statewide, regional, or local greenhouse gas regulations. State Water Board staff has determined that the Policy will have no effect on greenhouse gas emissions or existing greenhouse gas regulations. Furthermore, climate change resulting from greenhouse gas emissions will not affect the proposed Policy because the toxicity objectives contained therein are to be directly applied as effluent limitations regardless of critical low flow periods or variation.

SECTION VI: PEER REVIEW

Staff has determined that the scientific aspects of the Policy are based on source material that has already been peer reviewed. The proposed Amendment is itself just a new application of earlier, adequately peer-reviewed work products, specifically, U.S. EPA's TST (U.S. EPA 2010a, US EPA 2010b). The proposed Policy does not depart from the scientific approach of the TST. This section provides detail on peer review requirements, U.S. EPA's peer review process, and how the scientific basis of the Policy conforms to the TST, thus satisfying the peer review requirement of Health and Safety Code Section 57004 and alleviating any need for additional peer review.

Legal Basis for Peer Review

According to the Health and Safety Code, Section 57004(d):

> No board, department, or office within the agency shall take any action to adopt the final version of a rule unless [the Board] submits the scientific portions of the proposed rule, along with a statement of the scientific findings, conclusions, and assumptions on which the scientific portions of the proposed rule are based and the supporting scientific data, studies, and other appropriate materials, to the external scientific peer review entity for its evaluation.

The State Water Board Administrative Procedures Manual, Section 8 1II.D. clarifies that:

> Peer review is not needed for source documents that have been previously peer reviewed by a recognized expert or body of experts.

U.S. EPA Peer Review Process

U.S. EPA conducted external peer review of the TST procedures. This review was intended to ensure that the scientific and technical work products received appropriate levels of peer review by both U.S. EPA's scientific and technical experts and independent external experts in the field. The peer review was conducted in accordance with U.S. EPA's 2006 peer review handbook, *Science Policy Council's Peer Review Handbook*, 3rd Edition (U.S. EPA, 2006). The handbook is intended to ensure that U.S. EPA uses credible and appropriate science including the evaluation of toxicity test method applications and implementation under U.S. EPA's NPDES permit program.

Conformity with U.S. EPA's TST Methodology

The Policy includes the following three distinct scientific elements: selection of numeric toxicity objectives, statistical methods, and reasonable potential analysis. As discussed below, the approach taken in the Policy for each of these elements does not depart significantly from U.S. EPA's scientific approach.

Numeric Toxicity Objectives

The numeric objectives included in the Policy are simply a concise statement of several elements in U.S. EPA's TST document. Regulatory management decisions and unacceptable levels of acute and chronic toxicity come from the *National Pollutant Discharge Elimination System Test of Significant Toxicity Implementation Document* (TST Implementation Document), Section 2.1. The null hypothesis is a restatement of the statistical method found in the TST Implementation Document appendix and is discussed below.

Statistical Method

The Statistical method, including critical values of the t-distribution, is taken from the TST Implementation Document, Appendix A ("Step-By-Step Procedure for Analyzing Valid Wet Data using the TST Approach"). The statistical method and table of critical values used in the Policy are identical.

The α values found in Table 1 of the Policy were taken from Table 2-2 of the TST Implementation Document (U.S. EPA 2010a). In addition, the TST Technical document (U.S. EPA 2010b) provides directions on how to derive α values for additional test methods, and U.S. EPA peer reviewers were explicitly asked to comment on the use of the methodology for future derivations of α values. This methodology was subsequently used by U.S. EPA to derive an α value for *Oncorhynchus mykiss* (rainbow trout), *Salvelinus fontinalis* (brook trout), and *Hyalella azteca* (amphipod), and these α values was provided to the State Water Board for use in the Policy.

Reasonable Potential Analysis

The Reasonable Potential Analysis in the TST Implementation Document, Appendix E ("Whole Effluent Toxicity Reasonable Potential Analysis Using the Test of Significant Toxicity Approach") is itself simply an application of the peer reviewed TST methodology. The method used in the Policy to determine reasonable potential is identical.

APPENDICES

APPENDIX A: Environmental Checklist

(CEQA REGULATIONS, 23 CCR §3720-§3782)

PROJECT

1. Project title:

   Policy for Toxicity Assessment and Control

2. Lead agency name and address:

   State Water Resources Control Board
   Division of Water Quality
   1001 I Street, 15th Floor
   Sacramento, CA
   95814

3. Contact person and phone number:

   Brian Ogg
   (916) 323-9689

4. Project location:

   California

5. Description of project:

   In response to the State Implementation Policy revisions required by Resolution No. 2005-0019, staff has developed a stand alone policy to protect California's aquatic life uses from the deleterious effects of toxicity. The draft Policy for Toxicity Assessment and Control proposes numeric objectives and uniform monitoring requirements for chronic and acute toxicity, as well as provisions requiring the use of U.S. EPA's new statistical method, the Test of Significant Toxicity.

EVALUATION OF THE ENVIRONMENTAL IMPACTS IN THE CHECKLIST

1. The State Water Board must complete an environmental checklist prior to adoption of plans or policies. The checklist becomes a part of the Substitute Environmental Documentation (SED).
2. For each environmental category in the checklist, the State Water Board must determine whether the project will cause any adverse impact. If there are potential impacts that are not included in the sample checklist, those impacts should be added to the checklist.
3. If the State Water Board determines that a particular adverse impact may occur as a result of the project, then the checklist boxes must indicate whether the impact is "Potentially Significant," "Less than Significant with Mitigation Incorporated," or "Less than Significant." "Potentially Significant Impact" applies if there is substantial evidence that an effect may be significant. If there are one or more "Potentially Significant Impact" entries on the checklist, the SED must include, for instance, an examination of feasible alternatives and mitigation measures for each such impact, similar to the requirements for preparing an Environmental Impact Report. "Less than Significant with Mitigation Incorporated" applies where the board incorporates, or another agency will incorporate, mitigation measures that will reduce an effect from "Potentially Significant Impact" to a

"Less than Significant Impact." The State Water Board must either require the specific mitigation measures or be certain of application by another agency. "Less than Significant" applies if the impact will not be significant, and mitigation is therefore not required. If there will be no impact, check the box under "No impact."

4. The State Water Board must provide a brief explanation for each "Potentially Significant," "Less than Significant with Mitigation Incorporated," "Less than Significant," or "No Impact" determination in the checklist. The explanation may be included in the written report described in section 3777(a)(1) or in the checklist itself. The explanation of each issue should identify: (a) the significance criteria or threshold, if any, used to evaluate each question; and (b) the specific mitigation measure(s) identified, if any, to reduce the impact to "Less than Significant." The State Water Board may determine the significance of the impact by considering factual evidence or agency standards or thresholds. If the "No Impact" box is checked, the State Water Board should briefly provide the basis for that answer. If there are types of impacts that are not listed in the checklist, those impacts should be added to the checklist.

5. The State Water Board must include mandatory findings of significance if required by CEQA Guidelines Section15065.

6. The State Water Board should provide references used to identify potential impacts, including a list of information sources and individuals contacted.

ISSUES

	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
I. AESTHETICS -- Would the project:				
a) Have a substantial adverse effect on a scenic vista?	❐	❐	❐	X
b) Substantially damage scenic resources, including, but not limited to, trees, rock outcroppings, and historic buildings within a state scenic highway?	❐	❐	❐	X
c) Substantially degrade the existing visual character or quality of the site and its surroundings?	❐	❐	❐	X
d) Create a new source of substantial light or glare which would adversely affect day or nighttime views in the area?	❐	❐	❐	X
II. AGRICULTURE AND FOREST RESOURCES: In determining whether impacts to agricultural resources are significant environmental effects, lead agencies may refer to the California Agricultural Land Evaluation and Site Assessment Model (1997) prepared by the California Dept. of Conservation as an optional model to use in assessing impacts on agriculture and farmland. In determining whether impacts to forest resources, including timberland, are significant environmental effects, lead agencies may refer to information compiled by the California Department of Forestry and Fire Protection regarding the state's inventory of forest land, including the Forest and Range Assessment Project and the Forest Legacy Assessment Project; and forest carbon measurement methodology provided in Forest Protocols adopted by the California Air Resources Boards. Would the project:				
a) Convert Prime Farmland, Unique Farmland, or Farmland of Statewide Importance (Farmland), as shown on the maps prepared pursuant to the Farmland Mapping and Monitoring Program of the California Resources Agency, to non-agricultural use?	❐	❐	❐	X
b) Conflict with existing zoning for agricultural use, or a Williamson Act contract?	❐	❐	❐	X
c) Conflict with existing zoning for, or cause rezoning of, forest land (as defined in Public Resources Code section 12220(g)), timberland (as defined by Public Resources Code section 4526), or timberland zoned Timberland Production (as defined by Government Code section 51104(g))?	❐	❐	❐	X

	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
d) Result in the loss of forest land or conversion of forest land to non-forest use?	❐	❐	❐	X
e) Involve other changes in the existing environment which, due to their location or nature, could result in conversion of Farmland, to non-agricultural use or conversion of forest land to non-forest use?	❐	❐	❐	X

III. AIR QUALITY -- Where available, the significance criteria established by the applicable air quality management or air pollution control district may be relied upon to make the following determinations. Would the project:

a) Conflict with or obstruct implementation of the applicable air quality plan?	❐	❐	❐	X
b) Violate any air quality standard or contribute substantially to an existing or projected air quality violation?	❐	❐	❐	X
c) Result in a cumulatively considerable net increase of any criteria pollutant for which the project region is non-attainment under an applicable federal or state ambient air quality standard (including releasing emissions which exceed quantitative thresholds for ozone precursors)?	❐	❐	❐	X
d) Expose sensitive receptors to substantial pollutant concentrations?	❐	❐	❐	X
e) Create objectionable odors affecting a substantial number of people?	❐	❐	❐	X

IV. BIOLOGICAL RESOURCES -- Would the project:

a) Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special status species in local or regional plans, policies, or regulations, or by the California Department of Fish and Game or U.S. Fish and Wildlife Service?	❐	❐	❐	X
b) Have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, regulations or by the California Department of Fish and Game or US Fish and Wildlife Service?	❐	❐	❐	X

	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
c) Have a substantial adverse effect on federally protected wetlands as defined by Section 404 of the Clean Water Act (including, but not limited to, marsh, vernal pool, coastal, etc.) through direct removal, filling, hydrological interruption, or other means?	❐	❐	❐	X
d) Interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites?	❐	❐	❐	X
e) Conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance?	❐	❐	❐	X
f) Conflict with the provisions of an adopted Habitat Conservation Plan, Natural Community Conservation Plan, or other approved local, regional, or state habitat conservation plan?	❐	❐	❐	X
V. CULTURAL RESOURCES -- Would the project:				
a) Cause a substantial adverse change in the significance of a historical resource as defined in § 15064.5?	❐	❐	❐	X
b) Cause a substantial adverse change in the significance of an archaeological resource pursuant to § 15064.5?	❐	❐	❐	X
c) Directly or indirectly destroy a unique paleontological resource or site or unique geologic feature?	❐	❐	❐	X
d) Disturb any human remains, including those interred outside of formal cemeteries?	❐	❐	❐	X
VI. GEOLOGY AND SOILS -- Would the project:				
a) Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving:	❐	❐	❐	X
i) Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the State Geologist for the area or based on other substantial evidence of a known fault? Refer to Division of Mines and Geology Special Publication 42.	❐	❐	❐	X

	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
ii) Strong seismic ground shaking?	❐	❐	❐	X
iii) Seismic-related ground failure, including liquefaction?	❐	❐	❐	X
iv) Landslides?	❐	❐	❐	X
b) Result in substantial soil erosion or the loss of topsoil?	❐	❐	❐	X
c) Be located on a geologic unit or soil that is unstable, or that would become unstable as a result of the project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction or collapse?	❐	❐	❐	X
d) Be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code (1994), creating substantial risks to life or property?	❐	❐	❐	X
e) Have soils incapable of adequately supporting the use of septic tanks or alternative waste water disposal systems where sewers are not available for the disposal of waste water?	❐	❐	❐	X

VII. GREENHOUSE GAS EMISSIONS -- Would the project:

a) Generate greenhouse gas emissions, either directly or indirectly, that may have a significant impact on the environment?	❐	❐	❐	X
b) Conflict with any applicable plan, policy or regulation of an agency adopted for the purpose of reducing the emissions of greenhouse gases?	❐	❐	❐	X

VIII. HAZARDS AND HAZARDOUS MATERIALS -- Would the project:

a) Create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials?	❐	❐	❐	X
b) Create a significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment?	❐	❐	❐	X

	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
c) Emit hazardous emissions or handle hazardous or acutely hazardous materials, substances, or waste within one-quarter mile of an existing or proposed school?	❒	❒	❒	X
d) Be located on a site which is included on a list of hazardous materials sites compiled pursuant to Government Code Section 65962.5 and, as a result, would it create a significant hazard to the public or the environment?	❒	❒	❒	X
e) For a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project result in a safety hazard for people residing or working in the project area?	❒	❒	❒	X
f) For a project within the vicinity of a private airstrip, would the project result in a safety hazard for people residing or working in the project area?	❒	❒	❒	X
g) Impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan?	❒	❒	❒	X
h) Expose people or structures to a significant risk of loss, injury or death involving wildland fires, including where wildlands are adjacent to urbanized areas or where residences are intermixed with wildlands?	❒	❒	❒	X

IX. HYDROLOGY AND WATER QUALITY -- Would the project:

	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
a) Violate any water quality standards or waste discharge requirements?	❒	❒	❒	X
b) Substantially deplete groundwater supplies or interfere substantially with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table level (e.g., the production rate of pre-existing nearby wells would drop to a level which would not support existing land uses or planned uses for which permits have been granted)?	❒	❒	❒	X
c) Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, in a manner which would result in substantial erosion or siltation on- or off-site?	❒	❒	❒	X

	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
d) Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner which would result in flooding on- or off-site?	❒	❒	❒	X
e) Create or contribute runoff water which would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff?	❒	❒	❒	X
f) Otherwise substantially degrade water quality?	❒	❒	❒	X
g) Place housing within a 100-year flood hazard area as mapped on a federal Flood Hazard Boundary or Flood Insurance Rate Map or other flood hazard delineation map?	❒	❒	❒	X
h) Place within a 100-year flood hazard area structures which would impede or redirect flood flows?	❒	❒	❒	X
i) Expose people or structures to a significant risk of loss, injury or death involving flooding, including flooding as a result of the failure of a levee or dam?	❒	❒	❒	X
j) Inundation by seiche, tsunami, or mudflow?	❒	❒	❒	X

X. LAND USE AND PLANNING - Would the project:

a) Physically divide an established community?	❒	❒	❒	X
b) Conflict with any applicable land use plan, policy, or regulation of an agency with jurisdiction over the project (including, but not limited to the general plan, specific plan, local coastal program, or zoning ordinance) adopted for the purpose of avoiding or mitigating an environmental effect?	❒	❒	❒	X
c) Conflict with any applicable habitat conservation plan or natural community conservation plan?	❒	❒	❒	X

XI. MINERAL RESOURCES -- Would the project:

a) Result in the loss of availability of a known mineral resource that would be of value to the region and the residents of the state?	❒	❒	❒	X

	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
b) Result in the loss of availability of a locally-important mineral resource recovery site delineated on a local general plan, specific plan or other land use plan?	❒	❒	❒	X
XII. NOISE -- Would the project result in:				
a) Exposure of persons to or generation of noise levels in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies?	❒	❒	❒	X
b) Exposure of persons to or generation of excessive groundborne vibration or groundborne noise levels?	❒	❒	❒	X
c) A substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project?	❒	❒	❒	X
d) A substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project?	❒	❒	❒	X
e) For a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project expose people residing or working in the project area to excessive noise levels?	❒	❒	❒	X
f) For a project within the vicinity of a private airstrip, would the project expose people residing or working in the project area to excessive noise levels?	❒	❒	❒	X
XIII. POPULATION AND HOUSING -- Would the project:				
a) Induce substantial population growth in an area, either directly (for example, by proposing new homes and businesses) or indirectly (for example, through extension of roads or other infrastructure)?	❒	❒	❒	X
b) Displace substantial numbers of existing housing, necessitating the construction of replacement housing elsewhere?	❒	❒	❒	X
c) Displace substantial numbers of people, necessitating the construction of replacement housing elsewhere?	❒	❒	❒	X

	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
XIV. PUBLIC SERVICES				
a) Would the project result in substantial adverse physical impacts associated with the provision of new or physically altered governmental facilities, need for new or physically altered governmental facilities, the construction of which could cause significant environmental impacts, in order to maintain acceptable service ratios, response times or other performance objectives for any of the public services:				
Fire protection?	❐	❐	❐	X
Police protection?	❐	❐	❐	X
Schools?	❐	❐	❐	X
Parks?	❐	❐	❐	X
Other public facilities?	❐	❐	❐	X
XV. RECREATION				
a) Would the project increase the use of existing neighborhood and regional parks or other recreational facilities such that substantial physical deterioration of the facility would occur or be accelerated?	❐	❐	❐	X
b) Does the project include recreational facilities or require the construction or expansion of recreational facilities which might have an adverse physical effect on the environment?	❐	❐	❐	X
XVI. TRANSPORTATION/TRAFFIC -- Would the project:				

	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
a) Conflict with an applicable plan, ordinance or policy establishing measures of effectiveness for the performance of the circulation system, taking into account all modes of transportation including mass transit and non-motorized travel and relevant components of the circulation system, including, but not limited to intersections, streets, highways and freeways, pedestrian and bicycle paths, and mass transit?	❐	❐	❐	X
b) Conflict with an applicable congestion management program, including, but not limited to level of service standards and travel demand measures, or other standards established by the county congestion management agency for designated roads or highways?	❐	❐	❐	X
c) Result in a change in air traffic patterns, including either an increase in traffic levels or a change in location that results in substantial safety risks?	❐	❐	❐	X
d) Substantially increase hazards due to a design feature (e.g., sharp curves or dangerous intersections) or incompatible uses (e.g., farm equipment)?	❐	❐	❐	X
e) Result in inadequate emergency access?	❐	❐	❐	X
f) Conflict with adopted policies, plans, or programs regarding public transit, bicycle, or pedestrian facilities, or otherwise decrease the performance or safety of such facilities?	❐	❐	❐	X

XVII. UTILITIES AND SERVICE SYSTEMS -- Would the project:

a) Exceed wastewater treatment requirements of the applicable Regional Water Quality Control Board?	❐	❐	❐	X
b) Require or result in the construction of new water or wastewater treatment facilities or expansion of existing facilities, the construction of which could cause significant environmental effects?	❐	❐	❐	X
c) Require or result in the construction of new storm water drainage facilities or expansion of existing facilities, the construction of which could cause significant environmental effects?	❐	❐	❐	X
d) Have sufficient water supplies available to serve the project from existing entitlements and resources, or are new or expanded entitlements needed?	❐	❐	❐	X

	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
e) Result in a determination by the wastewater treatment provider which serves or may serve the project that it has adequate capacity to serve the project's projected demand in addition to the provider's existing commitments?	❐	❐	❐	X
f) Be served by a landfill with sufficient permitted capacity to accommodate the project's solid waste disposal needs?	❐	❐	❐	X
g) Comply with federal, state, and local statutes and regulations related to solid waste?	❐	❐	❐	X

XVIII. MANDATORY FINDINGS OF SIGNIFICANCE

	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
a) Does the project have the potential to degrade the quality of the environment, substantially reduce the habitat of a fish or wildlife species, cause a fish or wildlife population to drop below self-sustaining levels, threaten to eliminate a plant or animal community, reduce the number or restrict the range of a rare or endangered plant or animal or eliminate important examples of the major periods of California history or prehistory?	❐	❐	❐	X
b) Does the project have impacts that are individually limited, but cumulatively considerable? ("Cumulatively considerable" means that the incremental effects of a project are considerable when viewed in connection with the effects of past projects, the effects of other current projects, and the effects of probable future projects)?	❐	❐	❐	X
c) Does the project have environmental effects which will cause substantial adverse effects on human beings, either directly or indirectly?	❐	❐	❐	X

Explanations of Impact Assessment

I. a, b, c, e
The Policy, addressing numeric objectives and test methodology for toxicity, does not require land alteration. While excursions of the proposed objectives may necessitate facility upgrades, it is unlikely that the aesthetics of the natural environment would be adversely affected by improvements to existing infrastructure. Compliance may, however, require some facilities to expand their operations. Given the uniqueness of facilities, their locations, and necessary modifications, further examination of these potential scenarios would be purely speculative.

II. a, b, c, d
The Policy will not affect agriculture or farmland in this manner as it does not alter zoning laws or require land use.

III. a, b, c
The Policy proposes water quality objectives that will not affect air quality.

IV. a, b, c, d, e, f
The purpose of the Policy is to improve current toxicity provisions and, in turn, extend greater protection to aquatic organisms inhabiting California's inland surface waters, enclosed bays, and estuaries. The Policy, therefore, poses no threat to biological resources.

V. a, b, c, d
The provisions contained in the Policy will neither change nor destroy any cultural resources.

VI. a, b, c, d, e
It is unlikely that the Policy will adversely affect the integrity of soils or earthquake faults as it does not address land alteration. Facility upgrades intended to reduce toxicity may, however, result in erosion or fault ruptures. The variability of facilities, locations, and the modifications required for compliance make further examination purely speculative.

VII. a, b
The Policy will not conflict with a plan, policy, or regulation adopted for the purpose of reducing greenhouse gas emissions. Heavy equipment harbors the potential to increase greenhouse gas emissions during the construction of any facility upgrades that might occur, and the resultant additions or modifications may draw additional electricity from fossil-fuel power plants as well. Furthermore, the Policy would increase toxicity monitoring frequency for some dischargers that may, in turn, result in additional deliveries to a laboratory and an increase in vehicular emissions. Given the uniqueness of potential scenarios associated with these issues, further examination would be purely speculative.

VIII. a, b, c, d, e, f, g, h
The Policy will have no effect on hazardous material transportation, handling, accidents, or hazardous emissions. Moreover, the proposed TST method will improve the interpretation of toxicity data if an upset occurs at a facility.

IX. a, b, c, d, e, f, g, h, i, j
Hydrology, storm water drainages, and groundwater supplies would not be altered through implementation of the Policy. In addition, the Policy will not affect housing in any way, nor would it increase the risk of flooding. Current toxicity requirements would change through the Policy, but no existing water quality standards will be violated as a result. Furthermore, the quality of inland surface waters, enclosed bays, and estuaries will likely improve if the Policy is adopted.

X. a, b, c
The Policy would not affect communities, land use plans or policies, or conservation plans.

XI. a, b
Mineral resources will not be impacted by the Policy.

XII. a, b, c, d, e, f
Implementation of the Policy will not directly result in an increase in noise levels. Whether or not additional noise would result from treatment upgrades necessary to comply with the proposed objectives is unknown, and further exploration would be purely speculative.

XIII. a, b, c
The Policy will not induce population growth, affect housing, or displace individuals.

XIV. a
The Policy will not adversely impact public facilities or services.

XV. a, b
Recreational facilities will not experience an increase or decrease in size, or the number of visitors as a result of the Policy.

XVI. a, b, c, d, e, f
The Policy will not affect transportation, roadways, air traffic, or emergency access.

XVII. a, b, c, d, e, f, g
The Policy will strengthen, not exceed, the wastewater treatment requirements of the Regional Water Boards.

Compliance with the proposed numeric objectives may necessitate treatment upgrades at some facilities. While it is likely that such upgrades would be built upon existing infrastructure with minimal environmental effects, the numerous factors influencing a discharger’s course of action (e.g. facility uniqueness, location, treatment technology) render further explorations purely speculative.

Although MS4 dischargers are required to remediate toxicity excursions, such efforts are unlikely to result in the construction or expansion of storm water drainage facilities. The State and Regional Water Boards may, however, require some municipalities to upgrade their storm water conveyances in order to reduce toxicity, but analyzing the potential for such a scenario would be purely speculative, given the multiple variables involved.

The State or Regional Water Boards may require NPS dischargers to carry out remediation efforts as well. Because these mitigation measures are expected to vary widely, any attempts to analyze the effects of their implementation would be purely speculative.

The Policy will not affect water supplies, POTW capacity, or solid waste.

XVIII. a, b, c
Intended to protect aquatic biota from toxic discharges, the Policy will neither degrade the environment nor harm plant or animal communities.

Adoption of the Policy will not result in cumulatively considerable impacts.

The Policy will not, in any way, cause substantial adverse effects on human beings.

PRELIMINARY STAFF DETERMINATION

X The proposed project COULD NOT have a significant effect on the environment, and, therefore, no alternatives or mitigation measures are proposed.

❐ The proposed project MAY have a significant or potentially significant effect on the environment, and therefore alternatives and mitigation measures have been evaluated.

Note: Authority cited: Sections 21083 and 21087, Public Resources Code. Reference: Sections 21080(c), 21080.1, 21080.3, 21082.1, 21083, 21083.3, 21093, 21094, 21151, Public Resources Code; *Sundstrom v. County of Mendocino*, 202 Cal.App.3d 296 (1988); *Leonoff v. Monterey Board of Supervisors*, 222 Cal.App.3d 1337 (1990).

APPENDIX B: Acronyms

AML	Average Monthly Limit
BMP	Best Management Practices
CCR	California Code of Regulations
CEQA	California Environmental Quality Act
CFR	Code of Federal Regulations
CWA	Clean Water Act
CWC	California Water Code
CV	Coefficient of Variation
EC	Effect Concentration
IC	Inhibition Concentration
IWC	In-stream Waste Concentration
LC	Lethal Concentration
LOEC	Lowest Observed Effect Concentration
MDL	Maximum Daily Limit
MEC	Maximum Effluent Concentration
MEP	Maximum Extent Practical
MMP	Mandatory Minimum Penalty
MS4	Municipal Separate Storm Sewer System
MSD	Minimum Significant Difference
NOAEC	No Observed Adverse Effect Concentration
NOEC	No Observed Effect Concentration
NPDES	National Pollutant Discharge Elimination System
NPS	Nonpoint Source
PMSD	Percent Minimum Significant Difference
POTW	Publicly Owned Treatment Works
SED	Substitute Environmental Documentation
SIP	Policy for Implementation of Toxics Standards for Inland Surface Waters, Enclosed Bays, and Estuaries of California (State Implementation Policy)
TIE	Toxicity Identification Evaluation
TRE	Toxicity Reduction Evaluation
TST	Test of Significant Toxicity
TU_a	Toxicity Units—Acute
TU_c	Toxicity Units—Chronic
U.S. EPA	United States Environmental Protection Agency
WDR	Waste Discharge Requirements
WET	Whole Effluent Toxicity

APPENDIX C: Definition of Terms

Acute Toxicity Test
A test to determine the concentration of effluent or receiving water that is lethal to a group of test organisms during a short-term exposure (e.g. 24, 48, or 96 hours).

Average Monthly Limit (AML) / Average Monthly Effluent Limitation (AMEL)
The highest allowable average of daily discharges over a calendar month, calculated as the sum of all daily discharges measured during a calendar month divided by the number of daily discharges measured during that month.

Best Management Practices (BMP)
Any program, process, siting criteria, operating method, measure or device which controls, prevents, removes, or reduces nonpoint source pollution.

Channelized Discharger
Dischargers subject to the Irrigated Lands Regulatory Program and other nonpoint source discharges, directed through a channel, that are not regulated under the NPDES Permit Program.

Chronic Toxicity Test
A short-term test, typically four to seven days in duration, in which sublethal effects (e.g. significantly reduced growth, reproduction, etc.) are measured. Certain chronic toxicity tests include an additional measurement of lethality.

Coefficient of Variation (CV)
A standard statistical measure of the relative variation of a distribution or set of data, defined as the standard deviation divided by the mean, (also referred to as the relative standard deviation). The CV can be used as a measure of precision within and between laboratories, or among replicates for each treatment concentration.

Effect Concentration (EC)
A point estimate of the toxicant concentration that would cause an observable adverse effect (e.g. death, immobilization, or serious incapacitation) in a given percentage of the test organisms, calculated from a continuous model (e.g. Probit Model).

Hypothesis Testing
A statistical technique (e.g. Dunnett's test) used to determine whether a tested concentration results in a statistically different response from that observed in the control. The endpoints derived from hypothesis testing are the No Observed Effect Concentration (NOEC), Lowest Observed Effect Concentration (LOEC), No Observed Adverse Effect Concentration (NOAEC), and Pass/Fail.

Inhibition Concentration (IC)
A point estimate of the toxicant concentration that would cause a given percent reduction in a sublethal biological measurement of the test organisms, such as reproduction or growth.

In-stream Waste Concentration (IWC)
Also referred to as the receiving water concentration, the in-stream waste concentration describes the concentration of a toxicant in the receiving water after mixing.

Lethal Concentration (LC)
The concentration of effluent or receiving water that causes death in a pre-determined percentage of test organisms over a specified period of time.

Lowest Observed Effect Concentration (LOEC)
The lowest concentration of an effluent or receiving water sample with an effect different from the control effect according to the statistical test used for analysis of toxicity that results in adverse effects on the test organisms.

Maximum Daily Limit (MDL) / Maximum Daily Effluent Limitation (MDEL)
The highest allowable discharge measured during a calendar day or a 24-hour period representing a calendar day. When used to impose limits for chronic and acute toxicity, the MDL is frequently interpreted as the maximum result for the calendar month.

Minimum Significant Difference (MSD)
The measure of test sensitivity that establishes the minimum difference required between a control and a test treatment in order for that difference to be considered statistically significant.

Municipal Separate Storm Sewer System (MS4)
A conveyance or system of conveyances (including roads with drainage systems, municipal streets, catch basins, curbs, gutters, ditches, man-made channels, or storm drains) designed or used for collecting or conveying storm water, which is not a combined sewer; and which is not part of a publicly owned treatment works.

Non-point Source (NPS)
A category of waste discharge that does not emanate from a single, identifiable point source.

No Observed Adverse Effect Concentration (NOAEC)
A hypothesis test endpoint expressing the highest effluent or receiving water concentration at which the survival of the test organisms is not significantly different from that of the control.

No Observed Effect Concentration (NOEC)
The highest tested concentration of an effluent or receiving water sample that causes no observable adverse effect on the test organisms.

National Pollutant Discharge Elimination System (NPDES)
The U.S. EPA program responsible for regulating discharges to the nation's waters. Discharge permits issued under this program are required by U.S. EPA regulation to contain, where necessary, effluent limitations based on water quality criteria for the protection of aquatic life and human health.

Point Estimate
A statistical inference that estimates the true value of a parameter by computing a single value of a statistic from a set of sample data.

Publicly Owned Treatment Works (POTW)
A wastewater treatment facility owned by a public entity, such as a city, a county, or a special sanitary district.

Regulatory Management Decision
The decision that represents the maximum allowable error rates and thresholds for toxicity and non-toxicity that would result in an acceptable risk to aquatic life. Regulatory management decisions are denoted as *b* values in the Test of Significant Toxicity and are expressed as 0.80 for acute toxicity methods, and 0.75 for chronic toxicity methods.

Response
The measured biological endpoint(s) used in a toxicity test method established in 40 Code of Federal Regulations Section 136.3 (revised as of July 1, 2005) and *Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to West Coast Marine and Estuarine Organisms*, *First Edition* (EPA-600-R-95-136).

Storm Event
A precipitation event which results in a total measured precipitation accumulation equal to, or greater than one-quarter (0.25) of an inch of rainfall.

Test of Significant Toxicity (TST)
A statistical method, based on hypothesis testing, that utilizes a restated null hypothesis, acceptable α and β error rates, and a bioequivalence value to determine toxicity.

Toxicity Identification Evaluation (TIE)
A set of site-specific procedures used to identify the specific chemical(s) causing toxicity.

Toxicity Reduction Evaluation (TRE)
A site-specific study conducted in a step-wise process to identify the causative agents of toxicity, isolate the source of toxicity, evaluate the effectiveness of toxicity control options, and then confirm the reduction in toxicity after the control measures are put in place.

Toxicity Units—Acute (TUa)
A measure of toxicity that is 100 times the reciprocal of the effluent or receiving water concentration that causes 50% of the organisms to die in an acute toxicity test (TUa = 100/LC50). The larger the TUa value, the greater the acute toxicity.

Toxicity Units—Chronic (TUc)
A measure of toxicity that is 100 times the reciprocal of the effluent or receiving water concentration that causes no observable effect on the test organisms in a chronic toxicity test (TUc = 100/NOEC or 100/EC_{25}). The larger the TUc value, the greater the chronic toxicity.

Type I Error (α Error)
The rejection of the null hypothesis (H_0) when it is, in fact, true.

Type II Error (β Error)
The acceptance of the null hypothesis (H_0) when it is, in fact, not true.

Waste Discharge Requirement (WDR)
Regulations pertaining to various categories of discharges to State waters. A WDR is equivalent to the term “permit” as defined in the Federal Water Pollution Control Act.

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APPENDIX E: Endpoint Examples

Pass/Fail Method

Sample Calculation taken from U.S. EPA 2002a.

Table: Acute single-concentration toxicity test data from *Ceriodaphnia dubia*.

	Replicate	**Control**	**PROPORTION SURVIVNG** **100% Effluent Concentration**
Raw Data	A	1.00	0.40
	B	1.00	0.30
	C	0.90	0.40
	D	0.90	0.20
Arc Sine Transformed Data	A	1.412	0.685
	B	1.412	0.580
	C	1.249	0.685
	D	1.249	0.464
$\overline{X}$		1.330	0.604
S^2		0.0088	0.0111

The data presented in this graph is the response proportion (RP) for each replicate:

RP = (number of surviving organisms) / (number exposed)

Transform each RP to arc sine based on the following scenarios:

a) For 0 < RP < 1

Angle (in radians, rad) = arc sine $\sqrt{(RP)}$

For replicate A (100% effluent) = 0.40

Angle (rad) = $\text{sine}^{-1}\sqrt{(0.40)}$ = 0.685 rad

b) For RP = 0

Angle (in radians, rad) = arc sine $\sqrt{1/4n}$

where n = number of organisms used for each replicate
(e.g., $n = 10$, angle (rad) $\text{sine}^{-1}\sqrt{1/(4*10)}$ = 0.159 rad

c) For RP = 1

Angle = 1.5708 rad – (radians for RP = 0)

Angle (rad) = 1.5708 – 0.159 = 1.412 rad

Next, determination of normality is completed using the Shapiro-Wilk equations

$$D = \sum_{i=1}^{8}\left(X_i - \overline{X}\right)^2$$

where

Xi	=	the i^{th} centered observation = (replicate # – mean)
$\overline{X}$	=	overall mean of centered observations = ($X_1 \ldots X_8$) / 8
D	=	denominator of test statistic

For this example, D = 0.06.

Then, the test statistic W, is calculated by

$$W = \frac{1}{D}\left[\sum_{i=1}^{k} a_i\left(X^{(n-i+1)} - X^{(1)}\right)\right]^2$$

where

a_i	=	table value based on n and i

$X^{(n-i+1)} - X^{(1)}$ = differences between the centered observations, i.e. $X^{(8)} - X^{(1)}$

For this example, W = 0.807. The table value for α = 0.01 and n = 8 is W = 0.749. Because the experimental W is greater than the table value, the data set is normally distributed. With a normal distribution, it is acceptable to continue to an F-test to verify the two data sets for homogeneity of variance.

$$F = \frac{S^2_{100\%}}{S^2_{control}} = \frac{0.0111}{0.0088} = 1.2614$$

At a 0.01 level of significance and 3 degrees of freedom, F = 47.467, which is much greater than the experimental F-value. Therefore, the data is homogeneous. Finally, the t-test is completed for this data set and compared to a table value.

Calculate the following test statistic:

$$t = \frac{\overline{X}_1 - \overline{X}_2}{S_p\sqrt{\frac{1}{n_1} + \frac{1}{n_2}}}$$

where

$\overline{X_1}$ = mean for the control

$\overline{X_2}$ = mean for the effluent concentration

$$S_p = \frac{\sqrt{(n_1-1)S_1^2+(n_2-1)S_2^2}}{n_1+n_2-2}$$

S_1^2 = variance for the control

S_2^2 = variance for the effluent concentration

n_1 = number of replicates for control

n_2 = number of replicates for effluent concentration

The calculated t-value is 10.298 and the critical t-value is 1.9432. As the calculated t-value is greater it is assumed that the control and 100% effluent sample are significantly different with respect to survival.

NOAEC Method

Sample Calculation taken from U.S. EPA 2002a.

Table: *Pimephales promelas* survival data.

	Replicate	Control	EFFLUENT CONCENTRATION (µg/L) 32	64	128	256	512
Raw Data	A	1.00	0.80	0.90	0.90	0.70	0.40
	B	1.00	0.80	1.00	0.90	0.90	0.30
	C	0.90	1.00	1.00	0.80	1.00	0.40
	D	0.90	0.80	1.00	1.00	0.50	0.20
Arc Sine Transformed Data	A	1.412	1.107	1.249	1.249	0.991	0.685
	B	1.412	1.107	1.412	1.249	1.249	0.580
	C	1.249	1.412	1.412	1.107	1.412	0.685
	D	1.249	1.107	1.412	1.412	0.785	0.464
$\overline{Y}_i$		1.330	1.183	1.371	1.254	1.109	0.604
S_1^2		0.0088	0.0232	0.0066	0.0155	0.0768	0.0111
i		1	2	3	4	5	6

The arcsine transformed value was calculated in a similar manner to the single-concentration example above. To test for normality, the Shapiro-Wilk test is utilized. The centered observations for arc sine results are presented in the following table.

Replicate	Control	EFFLUENT CONCENTRATION (µg/L) 32	64	128	256	512
A	0.082	-0.076	-0.122	-0.005	-0.118	0.081
B	0.082	-0.076	0.041	-0.005	0.140	-0.024
C	-0.081	0.229	0.041	-0.147	0.303	0.081
D	-0.081	-0.076	0.041	0.158	-0.324	-0.140

Note: Centered observations = Yi – Y, where Yi is the individual and Y is the average.
For example, the centered observation for Replicate A, Control is 1.412 – 1.330 = 0.082.

Based on this data, the calculated D value is 0.4265.

The centered observations are then ordered from smallest to largest to calculate the W statistic for the Shapiro-Wilk test. This gives a W value of 0.974. The table value for n = 24 and a significance value of 0.01 is 0.884. As the calculated W value is greater than the table value, the data set is considered to be normally distributed.

In order to determine the homogeneity of variance across all concentration levels and control, Bartlett's Test is used.

$$B = \frac{\left[\left(\sum_{i=1}^{p} V_i\right) 1nS^{-2} - \sum_{i=1}^{p} V_i 1nS_1^2\right]}{C}$$

where

V_i	=	degrees of freedom for each toxicant and control, $V_i = (n_i - 1)$
n_i	=	the number of replicates for concentration i
ln	=	$\log_e$
i	=	1, 2, …., p where p is the number of concentrations including control

$$S^{-2} = \frac{\left(\sum_{i=1}^{p} V_i S_i^{\,2}\right)}{\sum_{i=1}^{p} V_i}$$

$$C = 1 + [3(p-1)]^{-1}\left[\sum_{i=1}^{p}\frac{1}{V_i} - \left(\sum_{i=1}^{p} V_i\right)^{-1}\right]$$

For the data in this example, all data types have the same number of replicates ($n_i = 4$ for all i) so $V_i = 3$ for all i. After substituting the correct information into the equation, B = 6.036. The critical value (table value) at a significance level of 0.01 and 5 degrees of freedom is 15.086. Because the calculated value of B is less than the table value, the data is considered homogeneous with respect to variance.

As a result of this information, the data is now processed via Dunnett's Procedure. If this step proved to have non-homogeneous variance, the non-parametric Steel's Many-one Rank test would be employed.

Dunnett's Procedure uses pooled variance, which requires the construction of an ANOVA table.

Source	**Degrees of Freedom (DF)**	**Sum of Squares (SS)**	**Mean Square (SS / DF)**
Between	p – 1	SSB	S_B^2 = SSB / (p – 1)
Within	N – p	SSW	S_W^2 = SSW / (N – p)
Total	N – 1	SST	

where

p = number of toxicant concentrations including the control
N = total number of observations $n_1 + n_2 \ldots + n_P$
n_i = number of observations in concentration i

$$SST = \sum_{i=1}^{p}\sum_{j=1}^{n_i} Yij^2 - \frac{G^2}{N}$$ Total sum of squares

$$SSB = \sum_{i=1}^{p}\frac{T_i^2}{n_i} - \frac{G^2}{n}$$ Between sum of squares

SSW = SST – SSB Within sum of squares

G = the grand total of all sample observations, $G = \sum_{i=1}^{p} T_i$

Ti = the total of the replicate measurements for concentration "i"
Yij = the j^{th} observation for concentration "i" (represents the proportion surviving for toxicant concentration i in test chamber j)

For this example:

$n_1 = n_2 = n_3 = n_4 = n_5 = n_6 = 4$

N = 24

$T_1 = Y_{11} + Y_{12} + Y_{13} + Y_{14} = 5.322$

$T_2 = Y_{21} + Y_{22} + Y_{23} + Y_{24} = 4.733$

$T_3 = Y_{31} + Y_{32} + Y_{33} + Y_{34} = 5.485$

$T_4 = Y_{41} + Y_{42} + Y_{43} + Y_{44} = 5.017$

$T_5 = Y_{51} + Y_{52} + Y_{53} + Y_{54} = 4.437$

$T_6 = Y_{61} + Y_{62} + Y_{63} + Y_{64} = 2.414$

$G = T_1 + T_2 + T_3 + T_4 + T_5 + T_6 = 27.408$

$SST = 33.300 – (27.408)^2 / 24 = 2.000$

$SSB = (131.495) / 4 – (27.408)^2 / 24 = 1.574$

$SSW = 2.000 – 1.574 = 0.4260$

$S_B^2 = 1.574 / (6 – 1) = 0.3150$

$S_W^2 = 0.426 / (24 – 6) = 0.024$

The ANOVA information is needed to calculate the t statistic for this data set. In order to interpret the data, each individual concentration is compared to the control with the following equation:

$$t_i = \frac{\overline{Y}_1 - \overline{Y}i}{S_W \sqrt{[(1/n_1) + (1/n_i)]}}$$

where

$\overline{Y}_i$	=	mean proportion surviving for concentration i
$\overline{Y}_1$	=	mean proportion surviving for the control
S_w	=	square root of the within mean square
n_1	=	number of replicates for control
n_i	=	number of replicates for concentration i

Effluent Concentration (µg/L)	i	t_i
32	2	1.341
64	3	-0.374
128	4	0.693
256	5	2.016
512	6	6.624

The goal of these calculations is to test for a reduction in proportion surviving. For this reason, a one-sided test is appropriate. For an overall α of 0.05, 18 degrees of freedom for error and 5 concentrations (excluding the control), the critical value is 2.41. The mean proportion surviving is significantly different when the calculated t value is greater than the critical value. This occurs at 512 µg/L. Hence, the NOAEC for survival is 256 µg/L.

Lastly, the sensitivity of the test is quantified with the minimum significant difference (MSD).

$$MSD = dS_w\sqrt{[(1/n_1) + (1/n)]}$$

where

d	=	the critical value for the Dunnett's procedure
S_w	=	the square root of the within mean square
n	=	the common number of replicates at each concentration (assuming equal replication at each concentration)
n_1	=	the number of replicates in the control

In the case of this example,

$$MSD = 2.41(0.155)\sqrt{(1/4 + 1/4)} = 0.264$$

This answer is in transformed units. To transform it to survival units, use the following steps:

1) Subtract the MSD from the transformed control mean.

$$1.330 – 0.264 = 1.066$$

2) Obtain the untransformed values for the control mean and difference calculated in step 1).

$$[\text{sine}\ (1.330)]^2 = 0.943$$

$$[\text{sine}\ (1.066)]^2 = 0.766$$

3) The untransformed MSD (MSD_u) is determined by subtracting the untransformed values from 2.

$$MSD_u = 0.943 – 0.766 = 0.177$$

This indicates that minimum difference in mean proportion surviving between the control and any toxicant concentration that can be detected as statistically significant is 0.177. This represents a decrease in survival of 19% from the control.

NOEC Method

Sample Calculation taken from U.S. EPA 2002b.

Table: *Pimephales promelas* larval growth data.

		EFFLUENT CONCENTRATION (µg/L)			
Replicate	**Control**	**32**	**64**	**128**	**256**
A	0.711	0.517	0.602	0.566	0.455
B	0.662	0.501	0.669	0.612	0.502
C	0.646	0.723	0.694	0.410	0.606
D	0.690	0.560	0.676	0.672	0.254
Mean ($\bar{Y}_i$)	0.677	0.575	0.660	0.565	0.454
Total (T_i)	2.709	2.301	2.641	2.260	1.817

One way to obtain an estimate of the pooled variance is to construct an ANOVA table including all sums of squares, using the following formulas:

where

p = number of effluent concentrations including:

$$SST = \sum_{ij} Y_{ij}^2 - G^2 / N \qquad \text{Total sum of squares}$$

$$SSB = \sum_{i} T_i^2 / n_i - G^2 / N \qquad \text{Between sum of squares}$$

$$SSW = SST - SSB \qquad \text{Within sum of squares}$$

G = the grand total of all sample observations; $G = \sum_{i=1}^{P} T_i$

T_i = the total of the replicate measures for concentration i

N = total sample size; $N = \sum_{i} n_i$

n_i = the number of replications for concentration i

Y_{ij} = the j^{th} observation for concentration i

For the data in this example:

$n_1 = n_2 = n_3 = n_4 = n_5 = 4$

$N = 20$

$T_1 = Y_{11} + Y_{12} + Y_{13} + Y_{14} = 2.709$

$T_2 = Y_{21} + Y_{22} + Y_{23} + Y_{24} = 2.301$

$T_3 = Y_{31} + Y_{32} + Y_{33} + Y_{34} = 2.641$

$T_4 = Y_{41} + Y_{42} + Y_{43} + Y_{44} = 2.260$

$T_5 = Y_{51} + Y_{52} + Y_{53} + Y_{54} = 1.817$

$G = T_1 + T_2 + T_3 + T_4 + T_5 = 11.728$

$SST = 7.146 – (11.728)^2 / 20 = 0.2687$

$SSB = \frac{3}{4}(28.017 – 11.728)^2 / 20 = 0.1270$

$SSW = 0.2687 – 0.1270 = 0.1417$

Dunnett's Procedure uses pooled variance, which requires the construction of an ANOVA table (see NOAEC example).

Source	Degrees of Freedom	Sum of Squares	Mean Square
Between	5 – 1 = 4	0.1270	0.0318
Within	20 – 5 = 15	0.1417	0.0094
Total	19	0.2687	

To perform the individual comparisons, calculate the t-statistic for each concentration and control combination as follows:

$$t = \frac{\overline{Y}_1 - \overline{Y}i}{S_W \sqrt{[(1/n_1) + (1/n_i)]}}$$

where

$\overline{Y}_i$	=	mean for concentration i
$\overline{Y}_1$	=	mean for the control
S_w	=	square root of the within mean square
n_1	=	number of replicates for control
n_i	=	number of replicates for concentration i

Table: Calculated t-values.

Effluent Concentration (µg/L)	i	t_i
32	2	1.487
64	3	0.248
128	4	1.633
256	5	3.251

Since the purpose of the test is only to detect a decrease in growth from the control, a one-sided test is appropriate. The critical value for the one-sided comparison (2.36), with an overall α level of 0.05, 15 degrees of freedom and four concentrations excluding the control is read from the table of Dunnett's t-values (Table C.5 in U.S. EPA 2002b). The mean weight for concentration i is considered significantly less than the mean weight for the control if t_i is greater than the critical value. Since T_5 is greater than 2.36, the 256 µg/L concentration has significantly lower growth than the control. Hence the NOEC and LOEC for growth are 128 µg/L and 256 µg/L, respectively.

TST Method

Sample Calculations taken from U.S. EPA 2010.

Example 1: Chronic *Ceriodaphnia dubia* reproduction test with low within-test variability.

Replicate/Statistic	Control	Treatment
1	29	31
2	38	28
3	31	25
4	34	28
5	36	22
6	35	21
7	30	27
8	31	26
9	36	29
10	34	30
Mean	33.4	26.7
Standard Deviation	2.989	3.268
# of Replicates (n)	**10**	**10**

Each endpoint must be calculated independently (e.g. reproduction, survival, etc.)

1) Transform data with arcsine square root transformation if applicable (not necessary for this data).

2) Conduct Welch's t-test.

$$t = \frac{\overline{Y_t} - b * \overline{Y_c}}{\sqrt{\frac{S_t^2}{n_t} + \frac{b^2 S_c^2}{n_c}}} = \frac{26.7 - (0.75 * 33.4)}{\sqrt{\frac{10.68}{10} + \frac{(0.75)^2(8.93)}{10}}} = 1.32$$

3. Adjust the degrees of freedom.

$$v = \frac{\left(\frac{S_t^2}{n_t} + \frac{b^2 S_c^2}{n_c}\right)^2}{\frac{\left(\frac{S_t^2}{n_t}\right)^2}{n_t - 1} + \frac{\left(\frac{b^2 S_c^2}{n_c}\right)^2}{n_c - 1}} = \frac{\left(\frac{10.68}{10} + \frac{(0.75)^2(8.93)}{10}\right)^2}{\frac{\left(\frac{10.68}{10}\right)^2}{10 - 1} + \frac{\left(\frac{(0.75)^2(8.93)}{10}\right)^2}{10 - 1}} = 16$$

4. Compare the calculated t-value with the critical t-value.

Given 16 degrees of freedom and an alpha level set at 0.20, the critical t-value = 0.86 (obtained from Table E-1 in U.S. EPA 2010).

1.32 > 0.86 = pass

The calculated t-value is greater than the critical t-value. Therefore, the effluent is declared “not toxic” and the test result is a “pass.”

Example 2: Chronic *Ceriodaphnia dubia* reproduction test with high within-test variability.

Replicate/Statistic	Control	Treatment
1	27	32
2	38	28
3	27	25
4	34	28
5	37	20
6	35	15
7	30	27
8	31	31
9	36	31
10	39	30
Mean	33.4	26.7
Standard Deviation	4.402	5.417
# of Replicates (n)	**10**	**10**

Each endpoint must be calculated independently (e.g. reproduction, survival, etc.)

1) Transform data with arcsine square root transformation if applicable (not necessary for this data).

2) Conduct Welch’s t-test.

$$t = \frac{\overline{Y_t} - b * \overline{Y_c}}{\sqrt{\frac{S_t^2}{n_t} + \frac{b^2 S_c^2}{n_c}}} = \frac{26.7 - (0.75 * 33.4)}{\sqrt{\frac{29.34}{10} + \frac{(0.75)^2(19.38)}{10}}} = 0.82$$

3) Adjust the degrees of freedom.

$$v = \frac{\left(\frac{S_t^2}{n_t} + \frac{b^2 S_c^2}{n_c}\right)^2}{\frac{\left(\frac{S_t^2}{n_t}\right)^2}{n_t - 1} + \frac{\left(\frac{b^2 S_c^2}{n_c}\right)^2}{n_c - 1}} = \frac{\left(\frac{29.34}{10} + \frac{(0.75)^2(19.38)}{10}\right)^2}{\frac{\left(\frac{29.34}{10}\right)^2}{10 - 1} + \frac{\left(\frac{(0.75)^2(19.38)}{10}\right)^2}{10 - 1}} = 15$$

3) Compare the calculated t-value with the critical t-value.

Given 15 degrees of freedom and an alpha level set at 0.20, the critical t-value = 0.87 (obtained from Table E-1 in U.S. EPA 2010).

$$0.82 < 0.87 = \text{fail}$$

The calculated t-value is less than the critical t-value. Therefore, the effluent is declared "toxic" and the test result is a "fail."

APPENDIX F: Reasonable Potential Analysis

California Ocean Plan Method

Step 1: Identify C_o; the applicable water quality objective for the pollutant.

Step 2: Does the information about the receiving water body or the discharge support a reasonable potential assessment (RPA) without characterizing facility-specific effluent monitoring data? If yes, go to Step 13 to conduct an RPA based on best professional judgment (BPJ). Otherwise, proceed to Step 3.

Step 3: Is facility-specific effluent monitoring data available? If yes, proceed to Step 4. Otherwise, go to Step 13.

Step 4: Adjust all effluent monitoring data C_e, including censored (Non-detect (ND) or Detected, but not quantified (DNQ)) values to the concentration X expected after complete mixing. For pollutants, use $X = (C_e + D_m C_s) / (D_m + 1)$; for acute toxicity use $X = C_e / (0.1D_m + 1)$; where D_m is the minimum probable initial dilution expressed as parts seawater per part wastewater and C_s is the background seawater concentration. For ND values, C_e is replaced with $<$MDL; for DNQ values C_e is replaced with $<M_L$. Go to step 5.

Step 5: Count the total number of samples n, the number of censored (ND or DNQ) values, c and the number of detected values, d, such that n = c + d.

Is any detected pollutant concentration after complete mixing greater than C_o? If yes, the discharge causes an excursion of C_o; go to Endpoint 1. Otherwise, proceed to Step 6.

Step 6: Does the effluent monitoring data contain three or more detected observations ($d \geq 3$)? If yes, proceed to Step 7 to conduct a parametric RPA. Otherwise go to Step 11 to conduct a nonparametric RPA.

Step 7: Conduct a parametric RPA. Assume data are lognormally distributed, unless otherwise demonstrated. Does the data consist entirely of detected values (c/n =0)? If yes, calculate summary statistics M_L and S_L, the mean and standard deviation of the natural logarithm transformed effluent data expected after complete mixing, ln(X), and go to Step 9. Otherwise, proceed to Step 8.

Step 8: Is the data censored by 80% or less ($c/n \leq 0.8$)? If yes, calculate summary statistics ML and SL using the censored data analysis method of Helsel and Cohn (1988) and go to Step 9. Otherwise, proceed to Step 11.

Step 9: Calculate the UCB i.e. the one-sided, upper 95% confidence bound for the 95th percentile of the effluent distribution after complete mixing. For lognormal distributions, use $UCBL_{(0.95,0.95)} = \exp(M_L + S_L g'(0.95, 0.95, n))$, where g' is a normal tolerance factor obtained from the table (Ocean Plan, Table VI-1). Proceed to Step 10.

Step 10: Is the UCB greater than C_o? If yes, the discharge has a reasonable potential to cause an excursion of C_o; go to Endpoint 1. Otherwise, the discharge has no reasonable potential to cause an excursion of Co; go to Endpoint 2.

Step 11: Conduct a non-parametric RPA. Compare each data value X to C_o. Reduce the sample size n by 1 for each tie (i.e. inconclusive censored value result) present. An adjusted ND value $C_o < \text{MDL}$ is a tie. An adjusted DNQ value having $C_o < \text{ML}$ is also a tie.

Step 12: Is the adjusted $n > 15$? If yes, the discharge has no reasonable potential to cause an excursion of C_o; go to Endpoint 2. Otherwise, go to Endpoint 3.

Step 13: Conduct an RPA based on BPJ. Review all available information to determine if a water quality-based effluent limitation is required, notwithstanding the above analysis in Steps 1-12, to protect beneficial uses. Information that may be used includes: the facility type, the discharge type, solids loading analysis, lack of dilution, history of compliance problems, potential toxic impact of discharge, fish tissue residue data, water quality and beneficial uses of the receiving water, CWA 303(d) listing for the pollutant, the presence of endangered or threatened species or critical habitat, and other information.

Is data or other information unavailable or insufficient to determine if a water quality-based effluent limitation is required? If yes, go to Endpoint 3. Otherwise, go to either Endpoint 1 or 2 based on BPJ.

Endpoint 1: An effluent limitation must be developed for the pollutant. Effluent monitoring for the pollutant, consistent with the monitoring frequency (State Water Board 2005a, Appendix III), is required.

Endpoint 2: An effluent limitation is not required for the pollutant. Effluent monitoring is not required for the pollutant; the Regional Board, may require occasional monitoring for the pollutant or for whole effluent toxicity as appropriate.

Endpoint 3: The RPA is inconclusive. Monitoring for the pollutant or whole effluent toxicity testing, consistent with the monitoring frequency (State Water Board 2005a, Appendix III), is required. An existing effluent limitation for the pollutant shall remain in the permit, otherwise the permit shall include a reopener clause to allow for subsequent modification of the permit to include an effluent limitation if the monitoring establishes that the discharge causes, has the reasonable potential to cause, or contributes to an excursion above a water quality objective.

TSD Method

Determining reasonable potential for excursions above ambient criteria using factors other than facility-specific effluent data monitoring data

When determining the "reasonable potential" of a discharge to cause an excursion above a state water quality standard, the regulatory authority must consider all the factors listed in 40 CFR 122.44(d)(1)(ii). Examples of the types of information relating to these factors are listed below.

<u>Existing controls on point and nonpoint sources of pollution</u>

- Industry type: Primary, secondary, raw materials used, products produced, best management practices, control equipment, treatment efficiency, etc.

- Publicly owned treatment work type: Pretreatment, industrial loadings, number of taps, unit processes, treatment efficiencies, chlorination/ammonia problems, etc.

<u>Variability of the pollutant or pollutant parameter in the effluent</u>

- Compliance history

- Existing chemical data from discharge monitoring reports and applications

<u>Sensitivity of the species to toxicity testing</u>

- Adopted state water quality criteria or EPA criteria

- Any available in-stream survey data applied under independent application of water quality standards

- Receiving water type and designated/existing uses

<u>Dilution of the effluent in the receiving water</u>

- Dilution calculations

Determining reasonable potential for excursions above ambient criteria using effluent data only

Step 1: Determine the number of total observations (n) for a particular set of effluent data (concentrations or toxic units [TUs]), and determine the highest value from that data set.

Step 2: Determine the coefficient of variation for the data set. For a data set where $n<10$, the coefficient of variation (CV) is estimated to equal 0.6, or the CV is calculated from data obtained from a discharger. For a data set where $n>10$, the CV is calculated as the standard deviation/mean. For less than 10 items of data, the uncertainty in the CV is too large to calculate a standard deviation or mean with sufficient confidence.

Step 3: Determine the appropriate ratio from the Table (in this case, it is Table 3-1 or Table 3-2 in the TSD).

Step 4: Multiply the highest value from a data set by the table ratio value. Use this value with the appropriate dilution to project a maximum receiving water concentration (RWC).

Step 5: Compare the projected maximum RWC to the applicable standard (criteria maximum concentration, criteria continuous concentration [CCC], or reference ambient concentration). The U.S. EPA recommends that permitting authorities find reasonable potential when the projected RWC is greater than the ambient criterion.

Example: Consider the following results of toxicity measurements of an effluent that is being characterized: 5 TU_c, 2 TU_c, 9 TU_c and 6 TU_c. Assume that the effluent is diluted to 2% at the edge of the mixing zone. Further assume that the CV is 0.6, the upper bound of the effluent distribution is the 99^{th} percentile, and the confidence level is 99%.

Step 1: There are four samples, and the maximum value of the sample results is 9 TU_c.

Step 2: The value of the CV is 0.6.

Step 3: The value of the ratio for 4 pieces of data and a CV of 0.6 is 4.7.

Step 4: The value that exceeds the 99^{th} percentile of the distribution (ratio times x_{max}) after dilution is calculated as:

$$[9\ TU_c \times 4.7 \times 0.02] = 0.85\ TU_c$$

Step 5: 0.85 TU_c is less than the ambient criteria concentration of 1.0 TU_c. There is no reasonable potential for this effluent to cause an excursion above the CCC.

Outcome 1: The discharge causes or contributes to an excursion above a numeric or narrative water quality criterion for WET and a WQBEL for WET is required;

Outcome 2: The discharge has the reasonable potential to cause or contribute to an excursion above a numeric or narrative water quality criterion for WET and a WQBEL for WET is required;

Outcome 3: The discharge does not [have the reasonable potential to] cause or contribute to an excursion above a numeric or narrative water quality criterion for WET and a WQBEL for WET is not required; however, WET permit triggers used in conjunction with accelerated monitoring and TREs are recommended by EPA; or

Outcome 4: There is inadequate information to determine whether or not the discharge causes, has the reasonable potential to cause, or contributes to an excursion above a numeric or narrative water quality criterion for WET and a WQBEL for WET is not required; however, WET permit triggers used in conjunction with accelerated monitoring and TREs are recommended by EPA.

TST Method

All valid WET test data generated during the current permit term and any additional valid data are analyzed, according to the TST approach, using the IWC and control test concentrations. If the TST indicates that the IWC is toxic in any WET test, reasonable potential has been demonstrated. In order to further address reasonable potential concerns, a second test is applied even if all TST test results initially pass:

$$\%\text{ Effect at IWC} = \frac{\text{Mean Control Response} - \text{Mean Response at IWC}}{\text{Mean Control Response}} * 100$$

The regulatory management decision threshold for non-toxicity is 10% effect at the IWC. At or below this percent effect level, the TST approach is designed to declare a test sample *not toxic*, at least 95% of the time, to help control for false positives. Therefore, a test sample with an effect level greater than 10% at the IWC demonstrates reasonable potential to cause toxicity.

The current TST approach results in four outcomes with respect to reasonable potential at the IWC:

1) Caused (sample is toxic): Reasonable potential is demonstrated if any one test fails.

2) Potential to Cause (sample has reasonable potential to cause toxicity): If any test sample exhibits an effect at the IWC higher than 10%, as compared to the control response, reasonable potential is demonstrated (regardless of the initial test result).

3) No reasonable potential (sample is not toxic at the IWC): Effluent does not cause or have potential to cause toxicity if the tests pass and the effect at the IWC is always less than 10%.

Table: Various outcomes of the TST reasonable potential approach using data from *Ceriodaphnia* chronic survival and reproduction WET tests.

Example	Pass Fail Based on TST Analysis	Mean Control Response	Mean Response at IWC	% Effect at IWC	Reasonable Potential?
A	Fail	26.3	17.0	35.4	**Yes**
B	Pass	26.3	23.4	11.0	**Yes**
C	Pass	28.6	22.0	23.1	**Yes**
D	Pass	22.4	20.9	6.7	**No**

APPENDIX G: Permit Limit Derivation

U.S. EPA Method

The following examples, adopted from EPA Region 9 and 10 Toxicity Training Tool demonstrate the method for calculating chronic and acute toxicity WLAs.

Mass Balance Equation

Cr Qr	=	Ce Qe + Cs Qs

where

C	=	critical value for WET (in units of TUc or TUa)
Q	=	critical value for flow (in units of cfs or MGD)
r	=	effluent plus upstream after discharge
e	=	effluent discharge
s	=	upstream before discharge
Sa	=	critical dilution factor authorized by Permitting Authority
	=	(1 + Qs / Qe) or output from dilution model
Ce	=	wasteload allocation (WLA) in units of TUc, TUa, or TUa,c
	=	Cr + [(Qs / Qe) (Cr – Cs)]
	=	Cr + [(Sa – 1) (Cr – Cs)]

The wasteload allocation (WLAc) for chronic toxicity in the effluent discharge is calculated using the mass-balance equation.

Cr	=	criterion continuous concentration (CCC) to protect against chronic effects
	=	1.0 TUc
Cs	=	critical value for WET upstream before discharge
	=	0 TU
Sa_c	=	chronic critical dilution factor
	=	(1 + $Qs_{7Q10\ (or\ 4B3)}$ / Qe)
	=	8
Ce	=	WLA in units of TUc
	=	Cr + (Sa – 1) (Cr – Cs)
	=	1 + (8 – 1) (1 – 0)
	=	8 TUc

The wasteload allocation for acute toxicity in the effluent discharge is expressed in chronic toxic units (WLAa,c) and calculated using the mass-balance equation and an acute-to-chronic ratio.

ACR	=	acute-to-chronic ratio in TSD Section 1.3.4
	=	LC_{50} / NOEC
	=	TUc / TUa
	=	10
TUa,c	=	10 × TUa, where acute toxicity is expressed in chronic toxic units (TUa,c)
Cr	=	criterion maximum concentration (CMC) to protect against acute effects
	=	0.3 TUa
Cs	=	critical value for WET upstream before discharge
	=	0 TU
Sa_a	=	acute critical dilution factor
	=	(1 + $Qs_{1Q10\ (or\ 1B3)}$ / Qe)
	=	1
Ce	=	WLA in units of TUa,c
	=	[Cr + (Sa – 1) (Cr – Cs)] × ACR
	=	[0.3 + (1 – 1) (1 – 0)] × 10
	=	3 TUa,c

The following is an example of the two-value steady state WLA permit limit formula adapted from Box 5-2 of the U.S. EPA's Technical Support Document for Water Quality-based Toxics Control.

where

CV	=	coefficient of variation
σ	=	standard deviation
WLAa,c	=	acute wasteload allocation in chronic toxic units
WLAa	=	acute wasteload allocation in acute toxic units
WLAc	=	chronic wasteload allocation in chronic toxic units
LTAa,c	=	acute long-term average wasteload in chronic units
LTAc	=	chronic long-term average wasteload
TUa	=	acute toxic units
TUc	=	chronic toxic units
ACR	=	acute-to-chronic ratio
MDL	=	maximum daily limit
AML	=	average monthly limit
z	=	z statistic

Step 1:

$$WLAac \text{ (in TUc)} = WLAa \text{ (in TUa)} \times ACR$$

Step 2:

$$LTAa,c = WLAa,c \times {}_e[0.5\,\sigma^2 - z\sigma]$$

where

$\sigma^2 = 1n\,(CV^2 + 1)$
$z = 1.645$ for 95th percentile probability basis and,
$z = 2.326$ for 99th percentile probability basis

$$LTAc = WLAc \times {}_e[0.5\,\sigma_4^{\,2} - z\sigma_4]$$

where

$\sigma_4^{\,2} = 1n\,(CV^2 / 4 + 1)$
$z = 1.645$ for 95th percentile probability basis and,
$z = 2.326$ for 99th percentile probability basis

Step 3:

$$LTA = \min\,(LTAc,\ LTAa,c)$$

Step 4:

$$MDL = LTA \times {}_e[z\sigma - 0.5\sigma^2]$$

where

$\sigma^2 = 1n\,(CV^2 + 1)$
$z = 1.645$ for 95th percentile probability basis and,
$z = 2.326$ for 99th percentile probability basis

$$AML = LTA \times {}_e[z\sigma_n - 0.5\sigma_n^{\,2}]$$

where

$\sigma_n^{\,2} = 1n\,(CV^2 / n + 1)$
$z = 1.645$ for 95th percentile probability basis and,
$z = 2.326$ for 99th percentile probability basis

SIP Method

Effluent Concentration Allowance (ECA) = C + D (C – B) when C ≥ B, and
ECA = C when C ≤ B

where

C = the priority pollutant criterion/objective, adjusted (as described in Section 1.2 of the SIP), if necessary, for hardness, pH, and translators (as described in section 1.4.1 of the SIP).

D = the dilution credit (as determined in section 1.4.2 of the SIP)

B = the ambient background concentration. The ambient background concentration shall be the observed maximum (as determined in accordance with section 1.4.3.1 of the SIP) with the exception that an ECA calculated from a priority pollutant criterion/objective that is intended to protect human health from carcinogenic effects shall use the ambient background concentration as an arithmetic mean (determined in accordance with section 1.4.3.2. of the SIP).

APPENDIX H: Economic Impacts

State Water Board staff contracted with Scientific Applications International Corporation (SAIC) to complete the economic analysis required by Section 13241 of the CWC. The following report is based upon a previous draft of the proposed Policy and, as such, contains references that are no longer applicable. These discrepancies, however, are inconsequential and all of the economic projections contained in the analysis remain relevant.

ECONOMIC CONSIDERATIONS OF PROPOSED WHOLE EFFLUENT TOXICITY CONTROL POLICY FOR CALIFORNIA

December 2009

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Table of Contents

List of Exhibits

Acronyms and Abbreviations

BMP	Best management practice
CTR	California Toxics Rule
CWA	Clean Water Act
CWC	California Water Code
EPA	Environmental Protection Agency
MEP	Maximum extent practicable
mgd	Million gallons per day
MS4	Municipal separate storm sewer system
NPDES	National Pollutant Discharge Elimination System
NSEC	No significant effect concentration
PCS	Permit compliance system
POTW	Publicly owned treatment works
RTA	Refractory toxicity assessment
SIC	Standard industrial classification
SIP	Policy for Implementation of Toxics Standards for Inland Surface Waters, Enclosed Bays and Estuaries
SWMP	Storm water management plan
TIE	Toxicity identification evaluation
TMDL	Total maximum daily load
TRE	Toxicity reduction evaluation
TST	Test of significant toxicity
TU	Toxicity unit
WDR	Waste discharge requirement
WET	Whole effluent toxicity
WRP	Water reclamation plant
WWTP	Wastewater treatment plant

Introduction

This report discusses the economic considerations associated with the State Water Resources Control Board's (State Water Board) proposed statewide numeric whole effluent toxicity (WET) objectives for aquatic life beneficial use protection and the minimum requirements for implementation (the Policy).

Background

The Clean Water Act (CWA) directs states, with oversight by the U.S. Environmental Protection Agency (EPA), to adopt water quality standards to protect the public health and welfare, enhance the quality of water, and serve the purposes of the CWA. Under Section 303, state water quality standards must include: (1) designated uses for all water bodies within their jurisdictions, (2) water quality criteria sufficient to protect the most sensitive of the uses, and (3) an antidegradation policy consistent with the regulations at 40 CFR 131.12. The CWA also requires states to hold public hearings once every three years for the purpose of reviewing applicable water quality standards and, as appropriate, modifying and adopting standards. The results of this triennial review must be submitted to EPA, and EPA must approve or disapprove any new or revised standards.

In implementing the CWA, the State Water Board and the Regional Water Quality Control Boards (Regional Water Boards; together the Water Boards) follow the integrated approach to water quality-based toxics control recommended by EPA. This approach combines the use of chemical-specific and WET limits to control the discharge of toxics to surface waters. Chemical-specific limits provide control of known pollutants in a discharge; WET limits provide control of unknown pollutants and the aggregate effects of combined pollutants in a discharge. Both chemical-specific and WET limits are crucial to water quality-based control in California.

The California Toxics Rule (CTR) establishes chemical-specific criteria applicable to inland surface waters, enclosed bays, and estuaries. The Policy for Implementation of Toxics Standards for Inland Surface Waters, Enclosed Bays, and Estuaries of California (SIP) provides procedures for implementing the criteria in National Pollutant Discharge Elimination System (NPDES) permits. The SIP also addresses toxicity control. As directed by the State Water Board, the Policy will revise the toxicity control provisions in the SIP to clarify the appropriate form of WET effluent limits in NPDES permits and standardize implementation in the permitting process. The Policy also applies to Waste Discharge Requirements (WDR) and the irrigated lands regulatory program and supersedes existing Basin Plan requirements.

Scope of the Analysis

The California Water Code (CWC) requires the Regional Water Boards to take "economic considerations," among other factors, into account when they establish water quality objectives. In doing so, State Water Board (1999; 1994) concluded that, at a minimum, the Water Boards must analyze:

- Whether the proposed objective is currently being attained
- If not, what methods are available to achieve compliance

- The cost of those methods.

If the economic consequences of adoption are potentially significant, the Regional Water Boards must explain why adoption is necessary to ensure reasonable protection of beneficial uses or prevent nuisance. The Regional Water Boards can adopt objectives despite significant economic consequences; there is no requirement for a formal cost-benefit analysis.

Consistent with State Water Board (1999; 1994) guidance, this analysis evaluates whether dischargers are likely to be able to comply with the Policy, the potential control methods to achieve compliance for dischargers that would be in violation, and the potential cost of such controls. The evaluation is based on currently available data only, and needed controls and costs reflect only incremental expenditures associated with the Policy (not controls needed to comply with existing regulatory requirements). This analysis does not address potential benefits of the policy.

Organization of Report

This remainder of this report is organized as follows:

Section 2: Current Regulatory Framework – describes the current applicable toxicity criteria and implementation procedures that provide the baseline for the analysis of the incremental impact of the Policy.

Section 3: Proposed Policy – describes the toxicity control policy.

Section 4: Method for Evaluating Compliance and Costs – describes the method for evaluating compliance under the current regulatory framework and the Policy, and estimating potential incremental Policy costs.

Section 5: Results of the Analysis – provides the estimates of compliance and costs, and discusses the uncertainties associated with the estimates.

Section 6: References – provides the references used in the analysis.

The appendices provide detailed analyses and additional information:

Appendix A: provides information on individual sample facilities and the detailed compliance analyses.

Appendix B: provides information on whole effluent toxicity sample costs.

Separate spreadsheets provide the detailed data and analyses for the sample facilities.

This section identifies the current framework for regulating discharges to inland surface waters, enclosed bays, and estuaries. The current regulatory framework is the baseline against which cost changes associated with the Policy are determined. Thus, only costs that are greater or less than the costs associated with the baseline (i.e., incremental costs) would be attributable to the Policy.

Existing Toxicity Provisions

The SIP contains minimum chronic toxicity control requirements for implementing the narrative toxicity objectives for aquatic life protection contained in Regional Water Board Basin Plans. Under the SIP, Regional Water Boards impose chronic toxicity limits for discharges that have the reasonable potential (RP) to cause instream chronic toxicity. Compliance with toxicity objectives and limits is determined through short-term chronic toxicity tests performed on at least three test species (a plant, an invertebrate, and a vertebrate) during a screening period, after which the most sensitive species can be used alone.

If repeated toxicity tests reveal toxicity or if a discharge causes or contributes to chronic toxicity in a receiving water body, the SIP requires that dischargers perform a toxicity reduction evaluation (TRE) study, which may include a toxicity identification evaluation (TIE). The TRE study is used to identify the sources of toxicity, after which the discharger must take all reasonable steps necessary to eliminate the toxicity. Permit writers should assign chemical-specific permit limits for pollutants identified by the TRE. Failure to comply with required toxicity testing and TRE studies within a designated period will result in the addition of chronic toxicity limits in the permit or appropriate enforcement action.

The provisions in the SIP supplement Basin Plan requirements and do not supersede existing Regional Water Board toxicity requirements shown in **Exhibit 2-1**.

Exhibit 2-1. Existing Regional Water Board Toxicity Provisions

Regional Water Board	Basin Plan Toxicity Provisions
North Coast (1)	• All waters shall be maintained free of toxic substances in concentrations that are toxic to, or that produce detrimental physiological responses in human, plant, animal, or aquatic life. • The survival of aquatic life in surface waters subjected to a waste discharge, or other controllable water quality factors, shall not be less than that for the same water body in areas unaffected by the waste discharge, or when necessary for other control water that is consistent with the requirements for "experimental water" as described in Standard Methods for the Examination of Water and Wastewater. As a minimum, compliance with this objective shall be evaluated with a 96-hour bioassay. • Effluent limits based on acute bioassays of effluents will be prescribed. Where appropriate, additional numerical receiving water objectives for specific toxicants will be established as sufficient data become available, and source control of toxic substances will be encouraged.

Exhibit 2-1. Existing Regional Water Board Toxicity Provisions

Regional Water Board	Basin Plan Toxicity Provisions
San Francisco Bay (2)	• All waters shall be maintained free of toxic substances in concentrations that are lethal to or that produce other detrimental responses in aquatic organisms, including but not limited to, decreased growth rate and reproductive success of resident or indicator species. • There shall be no acute toxicity in ambient waters, defined as a median of less than 90% survival, or less than 70% survival, 10% of the time, of test organisms in a 96-hour static or continuous flow test. • There shall be no chronic toxicity in ambient waters, defined as a detrimental biological effect on growth rate, reproduction, fertilization success, larval development, population abundance, community composition, or any other relevant measure of the health of an organism, population, or community. • The health and life history characteristics of aquatic organisms in waters affected by controllable water quality factors shall not differ significantly from those in areas unaffected by controllable water quality factors.
Central Coast (3)	• All waters shall be maintained free of toxic substances in concentrations which are toxic to, or which produce detrimental physiological responses in, human, plant, animal, or aquatic life. • Survival of aquatic life in surface waters subjected to a waste discharge or other controllable water quality conditions, shall not be less than that for the same water in areas unaffected by the waste discharge or, when necessary, for other control water that is consistent with the requirements for "experimental water" described in Standard Methods for the Examination of Water and Wastewater. As a minimum, compliance with this objective shall be evaluated with a 96-hour bioassay. • Effluent limits based on acute bioassays of effluents will be prescribed; where appropriate, numeric receiving water objectives for specific toxicants will be established as sufficient data become available, and source control of toxic substances is encouraged.
Los Angeles (4)	• All waters shall be maintained free of toxic substances in concentrations which are toxic to, or which produce detrimental physiological responses in, human, plant, animal, or aquatic life. • Survival of aquatic life in surface waters subjected to a waste discharge or other controllable water quality conditions shall not be less than that for the same water in areas unaffected by the discharge or, when necessary, for other control water. • There shall be no acute toxicity in ambient waters, including mixing zones. The acute toxicity objective for discharges dictates that the average survival in undiluted effluent for any 3 consecutive 96-hour static or continuous flow bioassay tests shall be at least 90%, with no single test having less than 70% survival when using an established EPA, State Board, or other protocol authorized by the Regional Water Board. • There shall be no chronic toxicity in ambient waters outside of mixing zones. To determine compliance with this objective, critical life stage tests for at least three test species with approved testing protocols shall be used to screen for the most sensitive species. The test species used for screening shall include a vertebrate, an invertebrate, and an aquatic plant. The most sensitive test species shall then be used for routine monitoring. • Effluent limits for specific toxicants can be established by the Regional Water Board to control toxicity identified under TIEs.

Exhibit 2-1. Existing Regional Water Board Toxicity Provisions

Regional Water Board	Basin Plan Toxicity Provisions
Central Valley (5)	• 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. • The survival of aquatic life in surface waters subjected to a waste discharge or other controllable water quality factors shall not be less than that for the same water in areas unaffected by the waste discharge, or, when necessary, for other control water consistent with the requirements for "experimental water" as described in Standard Methods for the Examination of Water and Wastewater. As a minimum, compliance with this objective shall be evaluated with a 96-hour bioassay. • In addition, effluent limits based on acute biotoxicity tests of effluents will be prescribed where appropriate; additional numerical receiving water quality objectives for specific toxicants will be established as sufficient data become available; and source control of toxic substances will be encouraged.
Lahontan (6)	• All waters shall be maintained free of toxic substances in concentrations that are toxic to, or that produce detrimental physiological responses in human, plant, animal, or aquatic life. • The survival of aquatic life in surface waters subjected to a waste discharge, or other controllable water quality factors, shall not be less than that for the same water in areas unaffected by the waste discharge, or when necessary, for other control water consistent with the requirements for "experimental water" as defined in Standard Methods for the Examination of Water and Wastewater. • For acute toxicity, compliance shall be determined by short-term toxicity tests on undiluted effluent using an established protocol. • For chronic toxicity, compliance shall be determined using the critical life stage toxicity tests. At least three approved species shall be used to measure compliance with the toxicity objective: a vertebrate, an invertebrate, and an aquatic plant. After an initial screening period, monitoring may be reduced to the most sensitive species.
Colorado River (7)	• All waters shall be maintained free of toxic substances in concentrations which are toxic to, or which produce detrimental physiological responses in, human, plant, animal, or indigenous aquatic life. • Effluent limits based on bioassays of effluent will be prescribed where appropriate, additional numerical receiving water objectives for specific toxicants will be established as sufficient data become available, and source control of toxic substances will be encouraged. • The survival of aquatic life in surface waters subjected to a waste discharge or other controllable water quality factors, shall not be less than that for the same water in areas unaffected by the waste discharge, or other control water which is consistent with the requirements for "experimental water" as described in Standards Methods for the Examination of Water and Wastewater. As a minimum, compliance with this objective shall be evaluated with a 96-hour bioassay.

Exhibit 2-1. Existing Regional Water Board Toxicity Provisions

Regional Water Board	Basin Plan Toxicity Provisions
Santa Ana (8)	• Toxic substances shall not be discharged at levels that will bioaccumulate in aquatic resources to levels which are harmful to human health. • The concentrations of toxic substances in the water column, sediments, or biota shall not adversely affect beneficial uses. • The Regional Water Board requires the initiation of a TRE if a discharge consistently exceeds its chronic toxicity effluent limit. The Regional Water Board, to date, has interpreted the "consistently exceeds" trigger as the failures of three successive monthly toxicity tests, each conducted on separate samples. Initiation of a TRE has also been conditioned on a determination that a sufficient level of toxicity exists to permit effective application of the analytical techniques required by a TRE.
San Diego (9)	• All waters shall be maintained free of toxic substances in concentrations that are toxic to, or that produce detrimental physiological responses in human, plant, animal, or aquatic life. • The survival of aquatic life in surface waters subjected to a waste discharge or other controllable water quality factors, shall not be less than that for the same water in areas unaffected by the waste discharge or, when necessary, for other control water consistent with requirements specified in EPA, State Water Board, or other protocol authorized by the Regional Water Board. As a minimum, compliance with this objective shall be evaluated with a 96-hour acute bioassay. • Effluent limits based on acute bioassays of effluents will be prescribed where appropriate, additional numerical receiving water objectives for specific toxicants will be established as sufficient data become available, and source control of toxic substances will be encouraged.

Affected Dischargers

The types of discharges potentially affected by the Policy include NPDES-permitted dischargers (municipal and industrial wastewater dischargers, storm water discharges, and certain general permitted dischargers) and irrigated agriculture.

Municipal and Industrial Wastewater Dischargers

In municipal wastewater effluents, toxicity has been attributed to several chemicals commonly found in or added during treatment including chlorine used for disinfection and ammonia produced from the breakdown of organic substances (SETAC, 2004). Indirect industrial or commercial dischargers may also contribute to effluent toxicity if discharging toxic chemicals in violation of pretreatment limits or that are not removed with conventional wastewater treatment controls. In addition, toxicity may result from household chemicals that are improperly disposed of down the drain, including organic solvents and pesticides or commonly used soaps and detergents that can be highly toxic if inadequately treated prior to discharge.

In industrial wastewater, effluent toxicity can result from the use of chemicals known as biocides (e.g., chlorine) added to control nuisance biological growth in plumbing or cooling water systems (SETAC, 2004). Also, ions such as potassium, magnesium, and calcium can be toxic when the ions are added or taken out of water during various industrial processes (SETAC, 2004). Industrial chemicals or byproducts, if not treated properly, can cause effluent toxicity as well.

Most pollutants in the effluents of municipal and industrial wastewater treatment facilities that may cause instream acute or chronic toxicity are currently regulated through the NPDES permit program. However, effluents may still be toxic despite compliance with existing permit limits due to interactions of regulated pollutants as well as the presence of unregulated pollutants (alone or in combination).

There are 571 individually permitted facilities (not including storm water) that discharge to inland surface waters, enclosed bays, and estuaries (excluding ocean waters) in California. Of these facilities, approximately 67% are minor discharges. Data in EPA's permit compliance system (PCS) database indicate that most major dischargers have effluent limits and/or monitoring requirements for acute and chronic toxicity in their NPDES permits; PCS does not contain limits or effluent data for minor dischargers. However, the form of the effluent limits (e.g., narrative or numeric) and the monitoring frequencies vary significantly among dischargers.

Exhibit 2-2 summarizes these facilities.

Exhibit 2-2. Summary of Potentially Affected Facilities

Discharger Category	Number of Dischargers[1]	
	Major Dischargers	Minor Dischargers
Municipal Wastewater	146	82
Chemicals and Allied Products	1	7
Metals Manufacturing and Finishers	2	2
Petroleum Refineries	8	15
Pulp and Paper	1	15
Other Industrial	33	259
Total	191	380

1. Source: U.S. EPA (2008).

Storm Water Dischargers

Regional Water Boards regulate most storm water discharges under general permits. General permits often require compliance with standards through an iterative approach based on storm water management plans (SWMP), rather than through the use of numeric effluent limits. In other words, permittees implement best management practices (BMPs) identified in their SWMPs. Then, if those BMPs do not result in attainment of water quality standards, Regional Water Boards would require additional practices until pollutant levels are reduced to the necessary levels. Because Regional Water Boards use this iterative approach that increases requirements until water quality objectives are met, current levels of implementation may not reflect the maximum level of control required to meet existing standards. The State Water Board has four existing programs for controlling pollutants in storm water runoff to surface waters: municipal, industrial, construction, and California Department of Transportation (Caltrans).

Municipal

The State Water Board's municipal program regulates storm water discharges from municipal separate storm sewer systems (MS4s). The MS4 permits require the discharger to develop and implement a SWMP, with the goal of reducing the discharge of pollutants to the maximum extent practicable (MEP). MEP is the performance standard specified in Section 402(p) of the Clean Water Act. The management programs specify BMPs addressing public education and outreach; illicit discharge detection and elimination; construction and post-construction; and good housekeeping. In general, medium and large municipalities must conduct chemical monitoring, but not small municipalities.

Larger MS4s usually represent a group of copermittees encompassing an entire metropolitan area. There are 26 area-wide medium and large MS4 permitted discharges in California that discharge, at least in part, to inland waters, enclosed bays, or estuaries (SWRCB, 2009). Some of the permittees monitor chronic and/or acute toxicity in receiving waters; others monitor specific pollutants identified as causing toxicity (e.g., diazinon and chlorpyrifos). **Exhibit 2-3** shows existing toxicity requirements in permits for large and medium MS4s.

Exhibit 2-3. Toxicity Requirements in Large and Medium MS4 Permits[1]

Region	Name (NPDES #)	Requirements
1	Santa Rosa and County of Sonoma (CA0025038)	Chronic tests twice per year during storm events, three locations in receiving waters and downstream from discharge outfalls; test species shall be *Pimephales promelas*, *Ceriodaphnia dubia*, and *Selenastrum capricornutum*.
2	Alameda County (CAS029831)	Participates in the SFEI RMP.[2]
2	Contra Costa Clean Water Program (CAS029912)	Participates in the SFEI RMP.[2]
2	Fairfield Suisun Sewer District (CAS612005)	Participates in the SFEI RMP.[2]
2	San Mateo County (CAS029921)	Participates in the SFEI RMP.[2]
2	Santa Clara Valley (CAS029718)	Participates in the SFEI RMP.[2]
2	Vallejo (CAS612006)	Participates in the SFEI RMP.[2]
3	Salinas (CA0049981)	Monitoring background and receiving water sites for chronic toxicity once during the first runoff of the wet season, one more runoff event, and twice during dry weather for *Ceriodaphnia dubia*, *Pimephales promelas*, and *Selenastrum capricornutum*. If receiving water samples are toxic, the permittee shall conduct a TRE.
4	Long Beach (CAS004003)	Multiple species toxicity testing (*Americamysis bahia*, *Ceriodaphnia dubia*, and (*Strongylocentrotus purpuratus*) and TIE studies as part of study of Los Angeles and San Gabriel River Watersheds.

Exhibit 2-3. Toxicity Requirements in Large and Medium MS4 Permits[1]

Region	Name (NPDES #)	Requirements
4	County of Los Angeles (CAS004001)	Multiple concentration chronic WET tests from two storm events and two dry weather events from each station per year for one freshwater (*Ceriodaphnia dubia*) and one marine (*Strongylocentrotus purpuratus*) species. A TIE should be conducted if any sample is above 1 TUc. Once pollutants causing at least 50% of toxic responses are identified through TIE, a TRE should be conducted.
4	Ventura County (CAS004002)	Toxicity monitoring during at least one storm per year until baseline information has been collected, and then discontinue. A TIE shall be performed when acute toxicity results are greater than 1 TUa (conducted on the most sensitive of fathead minnow and *Ceriodaphnia dubia*) or chronic toxicity tests result in exceedances in (1) two consecutive wet weather samples or (2) any dry weather flow sample.
5	Bakersfield-Kern County (CA00883399)	Narrative receiving water limit; no specific toxicity monitoring requirements.
5	Contra Costa Clean Water (CA0083313)	Narrative receiving water limit; no specific toxicity monitoring requirements.
5	Fresno (CA0083500)	Narrative receiving water limit; no specific toxicity monitoring requirements.
5	Modesto (CAS083526)	Chronic toxicity monitoring of *Pimephales promelas* and *Ceriodaphnia dubia*. If 100% mortality is detected, must conduct dilution series; if statistically significant toxicity is detected and a greater than or equal to 50% increase in either mortality, or reduction in reproduction compared to the control is observed, then TIEs shall be conducted on the initial sample that caused toxicity.
5	Port of Stockton (CAS084077)	Chronic toxicity monitoring of *Pimephales promelas* and *Ceriodaphnia dubia*. If 100% mortality is detected, must conduct dilution series; if statistically significant toxicity is detected, then TIEs shall be conducted on the initial sample that caused toxicity.
5	Sacramento (CAS082597)	Conduct toxicity testing at each receiving water station during two of the five fiscal years of the Order including samples from two storm events and one during the dry season from each receiving water station; species should be *Pimephales promelas* and *Ceriodaphnia dubia*. If 100% mortality is detected within 24 hours of test initiation, then a dilution series shall be initiated. If statistically significant toxicity is detected and there is more than a 50% increase in mortality compared to the laboratory control, then TIEs shall be conducted; a TRE shall be conducted whenever a toxicant is successfully identified through the TIE.

Exhibit 2-3. Toxicity Requirements in Large and Medium MS4 Permits[1]

Region	Name (NPDES #)	Requirements
5	Stockton and San Joaquin County (CAS083470)	Chronic toxicity monitoring of *Pimephales promelas* and *Ceriodaphnia dubia*. If 100% mortality is detected, must conduct dilution series; if statistically significant toxicity is detected and a greater than or equal to 50% increase in either mortality, or reduction in reproduction compared to the control is observed, then TIEs shall be conducted on the initial sample that caused toxicity.
6	South Lake Tahoe, El Dorado and Placer County (CAG616001)	The survival of aquatic life in surface waters subjected to a waste discharge shall not be less than that for the same water body in areas unaffected by the waste discharge or, when necessary, for other control water that is consistent with the requirements for "experimental water" as described in the American Public Health Association's Standard Methods for the Examination of Water and Wastewater, latest edition; no monitoring frequency specified.
7	Riverside County (CAS617002)	No toxicity provisions.
8	Orange County (CAS618030)	*Ceriodaphnia dubia* and *Strongylocentrotus purpuratus* shall be used to evaluate toxicity from the first rain event, plus one other wet weather sample and two dry weather samples; TIEs and TREs if monitoring indicates studies are needed.
8	Riverside County (CAS618033)	*Ceriodaphnia dubia*, *Pimephales promelas*, and *Selenastrum capricornutum* shall be used to evaluate toxicity on the sample from the first rain event, plus one other wet weather sample. In addition, where applicable, collect two dry weather samples or propose equivalent procedures in the CMP. Identify criteria which will trigger the initiation of TIEs and TREs.
8	San Bernardino County (CAS618036)	Collect a minimum of one sample per year during the dry weather index period using *Ceriodaphnia dubia* or *Hyalella azteca* if conductivity is too high for survival of control organisms.
9	Orange County (CAS108740)	Toxicity testing must be conducted for each monitoring event at each station according to Table 2. Toxicity Testing for Mass Loading, Urban Stream Bioassessment, and Ambient Coastal Receiving Waters Stations.
9	Riverside County (CAS108766)	The Permittees shall analyze all storm samples (at least three annually) using three species: *Ceriodaphnia dubia* (water flea); *Hyalella azteca* (freshwater amphipod); and *Pseudokirchneriella subcapitata*, (unicellular algae). TIEs shall be used to determine the cause of toxicity, and TREs shall be used to identify sources and implement management actions to reduce pollutants in urban runoff causing toxicity.
9	San Diego (CAS108758)	The following toxicity testing shall be conducted for each monitoring event at each station as follows: (1) 7-day chronic test with *Ceriodaphnia dubia* (2) Chronic test with the freshwater algae *Selenastrum capricornutum* (3) Acute survival test with amphipod *Hyalella azteca*. TIEs shall be conducted to determine the cause of toxicity.

Exhibit 2-3. Toxicity Requirements in Large and Medium MS4 Permits[1]

Region	Name (NPDES #)	Requirements

CMP = Coordinated Monitoring Program
NPDES = National Pollutant Discharge Elimination System
RMP = Regional Monitoring Program
SFEI = San Francisco Estuary Institute
TIE = Toxicity identification evaluation
TRE = Toxicity reduction evaluation
TU = toxicity unit (chronic or acute)
1. Permits at http://www.swrcb.ca.gov/water_issues/programs/stormwater/phase_i_municipal.shtml.
2. Under the SFEI RMP, aquatic toxicity is only sampled once every five years because there has been little toxicity over the past several years. For example, aquatic toxicity was not observed in the 2007 samples and therefore, aquatic toxicity will not be conducted again until 2012.

The State Water Board adopted a general permit for smaller municipalities, including nontraditional small MS4s such as military bases, public campuses, and prison and hospital complexes. To date, 208 of the over 250 small MS4s covered by the statewide general permit have submitted SWMPs to Regional Boards or the State Water Board for approval. Few of these permittees currently monitor for toxicity as part of their SWMPs.

Industrial

Under the industrial program, the State Water Board issues a general NPDES permit that regulates discharges associated with ten broad categories of industrial activities. This general permit requires the implementation of management measures that will achieve the performance standard of best available technology economically achievable (BAT) and best conventional pollutant control technology (BCT). The permit also requires that dischargers develop a Storm Water Pollution Prevention Plan (SWPPP) and a monitoring plan. Through the SWPPP, dischargers are required to identify sources of pollutants, and describe the means to manage the sources to reduce storm water pollution. For the monitoring plan, facility operators may participate in group monitoring programs to reduce costs and resources.

Construction

The construction program requires dischargers whose projects disturb one or more acres of soil or whose projects disturb less than one acre but are part of a larger common plan of development that in total disturbs one or more acres to obtain coverage under the storm water general permit for construction activity. The construction general permit requires the development and implementation of a SWPPP that lists BMPs the discharger will use to protect storm water runoff and the placement of those BMPs. Additionally, the SWPPP must contain a visual monitoring program; a chemical monitoring program for nonvisible pollutants to be implemented if there is a failure of BMPs; and a sediment monitoring plan if the site discharges directly to a water body impaired for sediment.

The permit also contains specific toxicity provisions for active treatment system dischargers. Any of these dischargers operating in batch treatment mode must initiate acute toxicity testing using *Pimephales promelas* or *Oncorhynchus mykiss* for effluent samples representing effluent from each batch prior to discharge. The permit does not contain specific toxicity requirements for any other discharger types.

Caltrans

Caltrans is responsible for the design, construction, management, and maintenance of the state highway system, including freeways, bridges, tunnels, Caltrans' facilities, and related properties. Before July 1999, storm water discharges from Caltrans' storm water systems were regulated by individual NPDES permits issued by the Regional Water Boards. On July 15, 1999, the State Water Board issued a statewide permit (Order No. 99-06-DWQ) which regulated all storm water discharges from Caltrans-owned MS4s, maintenance facilities and construction activities.

The existing permit allows Caltrans to implement BMPs rather than require compliance with numeric effluent limits. The BMPs must reflect pollutant reduction based on either MEP (MS4s) or BAT/BCT (construction activities), whichever is applicable. In addition, if receiving water quality standards are exceeded, Caltrans is required to submit a written report providing additional BMPs or other measures to be taken that will be implemented to achieve water quality standards. The permit also requires Caltrans to develop and implement a SWMP describing the procedures and practices used to reduce or eliminate the discharge of pollutants to storm drainage systems and receiving waters.

Irrigated Agricultural Lands

Agricultural activities that may affect aquatic life can be caused by (SWRCB, 2006b):

- Farming activities that cause excessive erosion, resulting in sediment entering receiving waters
- Improper use and over application of pesticides
- Over application of irrigation water resulting in runoff of sediments and pesticides.

Agricultural dischargers do not receive NPDES permits. In California, the Water Boards regulate discharges from irrigated land including storm water runoff, irrigation tailwater, and tile drainage through WDRs or waivers of WDRs. CWC Section 13269 allows the Regional Water Boards to waive WDRs if it is in the public interest.

Most historical waivers require that discharges not cause violations of water quality objectives, but do not require water quality monitoring. In 1999, Senate Bill 390 amended CWC Section 13269 and required Regional Water Boards to review and renew waivers or replace them with WDRs by January 1, 2003; otherwise, the waivers expired.

The Central Coast, Los Angeles, Central Valley, and San Diego Regional Water Boards have established conditional waivers for agricultural discharges. Central Coast Regional Water Board's group and individual waivers require monitoring focused on nutrients and toxicity. Toxicity testing is used to determine if applied pesticides and other constituents are impacting beneficial uses. More detailed characterization, involving additional toxicity testing, chemical analysis, analysis of pesticide application data, and/or TIEs are required as necessary in areas where toxicity problems are documented (CCRWQCB, 2006a).

The Los Angeles Regional Water Board's conditional waiver requires dischargers to monitor for toxicity and other parameters twice during wet weather and twice during dry weather conditions. If the chronic toxicity in receiving water exceeds 1.0 TUc, the discharger must implement additional toxicity testing for the next two consecutive months. If the toxicity exceedances persist, the discharger must conduct a TIE to identify the sources of toxicity, and implement measures to reduce toxicity. In addition, if Basin Plan or CTR objectives or total maximum daily load (TMDL) allocations are not attained, the waiver requires that the discharger submit a Corrective Action Plan that identifies time-specific management modifications (LARWQCB, 2005).

Central Valley Regional Water Board issues both group and individual waivers for agricultural growers with emphasis on group participation. Under the group and individual waivers, growers must implement management practices, as necessary, to improve and protect water quality and to achieve compliance with applicable water quality standards. The waivers require that water column toxicity analyses be conducted on 100% (undiluted) samples for the initial screening. If toxicity is detected, the grower must initiate at a minimum, a Phase I TIE to determine the general class (e.g., metals, non-polar organics, and polar organics) of the chemical causing toxicity (CVRWQCB 2006a; 2006b). Growers may also use Phase II TIEs to confirm and identify specific toxic agents.

The San Diego Regional Water Board adopted a conditional waiver for agricultural and nursery operations requiring these dischargers to implement BMPs to minimize or eliminate the discharge of pollutants and form or join a monitoring group by December 31, 2010. Operators must also prevent the direct or indirect discharge of products used in operations (e.g., pesticides) into surface waters (SDRWQCB, 2007).

The Santa Ana Regional Water Board is proposing that all operators of irrigated or dry-farmed land, and other agricultural or livestock operations not already regulated by the Regional Water Board, enroll in the Conditional Waiver for Agricultural Discharges (CWAD) program. The CWAD program allows agricultural operators to discharge waste to waters of the state from their operations, provided they also comply with TMDLs by paying implementation fees, taking steps to implement BMPs to reduce the pollutant load of their discharge, and regularly report and monitor water quality (SARWQCB, 2009). The CWAD program will allow some conditions to be met through the collective action of a group or groups of agricultural operators who are enrolled in the program, or by a third party representing a coalition of enrollees. Agricultural operators who do not enroll in the program will be required to apply for individual WDRs, and will have full responsibility for their own compliance (SARWQCB, 2009).

The North Coast and Colorado Regional Water Boards have conditional prohibitions for agriculture in their Basin Plans as part of TMDL implementation, and the San Francisco Bay and Lahontan Regional Water Boards do not have waivers for agricultural discharges.

Exhibit 2-4 summarizes the routine toxicity monitoring requirements specified in the agricultural waivers. Monitoring requirements may vary based on whether farmers are enrolled in group/cooperative programs or individual programs.

Exhibit 2-4. Routine Toxicity Monitoring Requirements for Agriculture Waivers

Regional Water Board	Group Monitoring Requirements	Individual Monitoring Requirements
North Coast	No toxicity provisions.	No toxicity provisions.
San Francisco Bay	NA	NA
Central Coast	Quarterly toxicity monitoring at 50 sites for *Ceriodaphnia dubia*, *Pimephales promelas*, and *Selenastrum capricornutum*	Twice annual toxicity monitoring of tailwater, tile drain water, and storm water for *Ceriodaphnia dubia*, *Pimephales promelas*, and *Selenastrum capricornutum*
Los Angeles	Twice per year (once during dry season and once immediately following pesticide application) for most sensitive species (after one year of 3-species monitoring)	Twice per year (once during dry season and once immediately following pesticide application) for most sensitive species (after one year of 3-species monitoring)
Central Valley	Monthly 3-species single-concentration toxicity monitoring (coalitions expected to expand number of sites each year to be able to assess all waters within boundaries)	Acute testing of *Ceriodaphnia dubia* and *Pimephales promelas* may be required during storm and irrigation seasons; testing shall also be performed when the water quality results exceed the LC50.
Lahontan	NA	NA
Colorado River	No toxicity provisions.	No toxicity provisions.
Santa Ana	Provisions under development.	Provisions under development.
San Diego	No toxicity provisions.	No toxicity provisions.

NA = not applicable (no conditional waiver)

Description of Proposed Policy

This section describes the draft Policy which revises the toxicity control provisions contained in the SIP. The Policy supersedes any and all toxicity objectives and implementation provisions for toxicity in Regional Basin Plans and the SIP.

Objectives

The following toxicity objectives apply to all inland surface waters, enclosed bays, and estuaries to protect freshwater and saltwater aquatic life:

Acute WET:	1.0 Toxicity Unit – Acute (TUa)
Chronic WET:	1.0 Toxicity Unit – Chronic (TUc)

Implementation Procedures

The Policy establishes minimum requirements for implementing the numeric toxicity objectives that apply to discharges to inland surface waters, enclosed bays, and estuaries covered under NPDES permits, WDRs, or the irrigated lands regulatory program. The requirements supersede existing Regional Water Board Basin Plan requirements.

Reasonable Potential

The Policy requires all dischargers to conduct four acute (applicable for dilution ratios of greater than 1,000 to 1) or chronic (applicable for dilution ratios at or below a ratio of 1,000 to 1) WET test for each species prior to permit issuance and reissuance. Chronic WET test species must, at a minimum, include one aquatic plant, one vertebrate, and one invertebrate; acute WET tests must include one vertebrate and one invertebrate. WET test results must be analyzed using the Test of Significant Toxicity (TST; U.S. EPA, 2009), and dischargers must send the results to the appropriate Regional Water Board for RP determination. Dischargers may submit any WET data generated during the current permit term provided it meets all Policy requirements to the Regional Water Boards for the RP analysis.

Due to the uncertainty of influent constituents and volume of discharges, all major wastewater treatment plants (WWTPs) have RP under the Policy. Thus, the RP monitoring results serve to identify or confirm the test species most sensitive to these fluctuating discharges.

For industrial dischargers and minor WWTPs, if a WET test result is a "fail," or the test result is a "pass" and the mean effect level is greater than 10%, the discharger has RP and will receive a numeric permit limit for chronic or acute WET; routine effluent monitoring for WET is also required. If the WET test result is a "pass" and the mean effect level is less than 10%, neither a numeric effluent limit nor routine monitoring is required. The mean effect level is calculated as the difference between the mean control response and the mean response at the instream waste concentration (IWC) divided by the mean control response.

Effluent Limits

The Policy requires that Regional Water Boards apply the objectives for acute and chronic WET directly in permits as numeric limits for dischargers with RP. Dischargers must meet these permit limits using the calculated IWC of their receiving waters.

Mixing Zones

To the extent authorized by the applicable Basin Plan, a permitting authority may grant a mixing zone for toxicity. Allowance of a mixing zone is discretionary. If a Regional Water Board grants a mixing zone, the objectives for toxicity shall be met throughout the receiving water except within the mixing zone.

Routine Monitoring

The Policy requires dischargers with RP to conduct routine WET monitoring using the test species that demonstrates the highest level of sensitivity during RP screening. Routine WET monitoring includes a minimum of a single sample consisting of the IWC and an approved control. Continuous dischargers, categorized as major facilities, must conduct one short-term, chronic or acute WET test every calendar month; major seasonal and intermittent dischargers must conduct monthly testing only during periods of discharge. Minor facilities must monitor for WET on a quarterly basis, with seasonal and intermittent dischargers conducting quarterly WET tests during periods of discharge.

Compliance

If a WET test reveals an exceedance of the toxicity limits established in a NPDES permit or WDR (i.e. fails), the discharger must conduct a subsequent, single-concentration WET test within five business days. Should this test also fail, the discharger will be in violation of their permit limits and must initiate an accelerated monitoring schedule approved by the Regional Water Board. At a minimum, an accelerated monitoring schedule must consist of 6 multiple-concentration WET tests, conducted at approximately 2-week intervals, over a 12-week period. The test species used for accelerated monitoring must include a minimum of one aquatic plant, one vertebrate, and one invertebrate for chronic WET tests; the test species for acute WET tests must include one vertebrate and one invertebrate.

A discharger in violation of WET permit limits is also obligated to conduct a TRE in order to characterize and control the toxic constituents in the discharge. Prior to implementing a TRE, a discharger must submit a TRE Work Plan to the applicable Regional Water Board, for approval, within 30 days of the violation.

Storm Water

Under the Policy, all MS4s and activities subject to the Caltrans storm water permit program have RP to cause or contribute to chronic WET exceedances and will, therefore, be required to conduct chronic WET monitoring during storm events. Applicable permittees must comply with the chronic WET objective of 1.0 TUc. Permit writers will determine monitoring locations and frequencies on a permit-specific basis. Data must be analyzed using the TST method, and results are to be sent to the appropriate Regional Water Board for evaluation. In addition, a TRE is necessary any time a sample fails a chronic WET test.

Irrigated Lands

Under the Policy, dischargers subject to the Irrigated Lands Regulatory Program have RP to cause or contribute to chronic WET exceedances and must comply with the chronic WET objective of 1.0 TUc. Dischargers will be required to conduct chronic WET monitoring; Regional Water Boards will determine WET test frequency on an individual basis for each waiver. Data must be analyzed using the TST method, and results must be included in the appropriate monitoring report. In addition, a TRE is necessary any time a sample fails a chronic WET test.

This section describes the method for evaluating compliance with the Policy. **Appendix A** contains the detailed analyses for NPDES point sources and the attached spreadsheets provide the data used in the analyses.

Municipal and Industrial Wastewater

The method for evaluating potential compliance with WET requirements for municipal and industrial wastewater dischargers under the Policy is based on a sample of facilities and involved determining RP, projecting effluent limits, determining the potential for exceedance of those limits based on existing data analyzed using the TST, and estimating the cost of controls necessary for compliance.

Selecting a Sample

There are a total of 571 (191 major and 380 minor) individually-permitted NPDES dischargers in the state that discharge wastewater to inland surface waters, enclosed bays, and estuaries. Most of these facilities currently have WET provisions in their permits, and could be affected by the Policy. However, minor dischargers are not as likely as majors to discharge toxic pollutants in toxic amounts. For example, the State Water Board and EPA are reclassifying one major industrial facility as a minor discharger because it had substantially improved operations and effluent quality. Minor municipal dischargers have, by definition, capacities below 1 million gallons per day (mgd); they also treat wastewater primarily from the residential sector which is not likely to contain as many toxics as indirect industrial and commercial dischargers, if any. Thus, compliance analysis of the affected major dischargers is likely to capture most, if not all, of the potential compliance-related costs.[1]

Factors that may affect the potential magnitude of compliance costs include:

- Facility type (municipal/industrial)
- Flow for municipal dischargers
- Standard industrial classification (SIC) code for industrial dischargers
- Dilution allowances.

Municipal dischargers are required to have secondary treatment or an equivalent, and most majors treat wastewater from a combination of residential, commercial, and industrial sources. Thus, treatment controls are likely to be similar across municipal dischargers. Larger flows are typically associated with the largest treatment costs, although per-unit costs may decrease due to economies of scale.

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1 Analysis of major facilities also likely captures the bulk of incremental monitoring costs. Available permits from different Regions indicate a wide range of existing WET monitoring requirements for minors, including frequencies of none to monthly; for either acute or chronic to both; and using single- and multiple-concentration tests. Under the Policy, requirements are standardized to include quarterly single-concentration monitoring of either acute or chronic.

For industrial dischargers, minimum treatment requirements vary based on the type of industry. Treatment processes and potential effluent quality also vary based on industry type. Categories of concern for WET include chemical manufacturers, metal manufacturers and finishers, petroleum refineries, and pulp and paper mills. Indeed, effluent data from major dischargers in California in EPA's PCS database indicate that some of the facilities in these categories have violated current toxicity permit limits.

The availability of dilution may also be indicative of compliance costs. In waters for which mixing zones would not be allowed (e.g., ephemeral and low flow streams, impaired water bodies), the IWC would be based on 100% effluent samples. Ephemeral and low flow streams are more common in the southern region of the state due to a drier climate. However, impairments in the San Francisco and Delta region may also preclude mixing zones.

Given these considerations, to evaluate potential compliance costs we evaluated the potential impact of the Policy on major facilities. For major municipal dischargers, we selected the largest facility in the north and the largest facility in the south to incorporate the facilities with highest potential for cost in the two regions.2 For remaining municipal facilities, we selected a representative sample based on flow (six facilities). To reflect the importance of industrial type for major industrial discharges, we selected a stratified random sample using five industrial categories: chemicals products, metals manufacturers and finishers, petroleum refineries, pulp and paper mills, and other industries.

Exhibit 4-1 summarizes the facilities by discharge category.

Exhibit 4-1. Summary of Potentially Affected Facilities and Sample

Discharger Category	Number of Dischargers	
	Total Major Dischargers[1]	Sample for Evaluation
Municipal Wastewater	146	8
Chemicals and Allied Products	1	1
Metals Manufacturing and Finishers	2	1
Petroleum Refineries	8	2
Pulp and Paper	1	1
Other Industrial	33	2
Total	191	15

1. Source: U.S. EPA (2008).

Exhibit 4-2 lists the sample facilities.

Exhibit 4-2. Summary of Sample Facilities

NPDES Number	Name	Discharge Category	Flow (mgd)[1]
Certainty Sample			
CA0077682	Sacramento Regional Sanitation District WWTP	Municipal	181

2 Because the probability of selecting each of the facilities was one (100%), these two facilities represent a certainty sample.

Exhibit 4-2. Summary of Sample Facilities

NPDES Number	Name	Discharge Category	Flow (mgd)[1]
CA0053911	LA County Sanitation District, San Jose Creek WRP (East and West)	Municipal	100
Municipal Wastewater			
CA0037575	San Bernardino WWTP	Municipal	28
CA0079243	Victor Valley Regional WWTP	Municipal	14
CA0037810	Davis WWTP	Municipal	7.5
CA0053961	Lompoc Regional WWTP	Municipal	5
CA0077836	Red Bluff WWTP	Municipal	2.5
CA0022721	Camrosa Water District WWTP	Municipal	1.5
Industrial Wastewater			
CA0004910	Dow Chemical Corporation, Pittsburg Plant	Chemicals and Allied Products	0.5
CA0005002	USS POSCO Industries	Metal Manufacturing and Finishing	20
CA0005789	Shell Oil, Martinez Refinery	Petroleum Refinery	2.7
CA0005134	Chevron, Richmond Refinery	Petroleum Refinery	13
CA0004821	Pactiv Corporation, Molded Pulp Mill	Pulp and Paper	20
CA0004111	Aerojet General Corporation, Sacramento Facility[2]	Other	35.8
CA0059188	Department of Water Resources, Warne Power Plant	Other	1.75

mgd = million gallons per day
WRP = water reclamation plant
WWTP = wastewater treatment plant
1. Source: U.S. EPA (2008).
2. Compliance not evaluated due to data issues.

Evaluating Compliance with Existing Requirements

The method for evaluating compliance with existing WET requirements for the sample facilities involved obtaining current NPDES permits and recent toxicity test results, and determining the frequency of violations, exceedance of monitoring triggers, and exceedance of TIE/TRE triggers, if applicable.

Current permit requirements range from numeric acute and/or chronic limitations to accelerated monitoring and/or TIE/TRE triggers only. The expression of limits and triggers also range from thresholds for single test results to median values for a series of consecutive tests. Limits and triggers for some facilities reflect dilution credits while those for other facilities do not.

Reasonable Potential

Under the Policy, all WWTPs have RP to cause or contribute to instream toxicity. For industrial facilities, we estimated RP based on evaluation of the last three years of existing data analyzed using the TST (as a proxy for the potential outcome of the acute or chronic WET tests submitted to the Regional Water Board for RP determination under the Policy) and the mean effect level.

Under the Policy, mean effect levels greater than 10% indicate potential to contribute to instream toxicity and thus, RP.

Projected Effluent Limits

All of the sample facilities have dilution ratios less than 1000 to 1. Therefore, we estimated that these dischargers will receive chronic WET limits of TUc = 1.0. (Only dischargers with dilution ratios greater than 1000:1 would receive acute WET limits.)

Compliance Determination

For all WWTPs and industrial facilities in the sample with RP, we evaluated potential compliance with projected effluent limits based on the last three years of existing data analyzed using the TST. For those facilities that may receive dilution, we evaluated compliance with the projected effluent limit based on the effluent percent that corresponds to the dilution ratio. For example, for a facility that received 10:1 dilution we compared the 10% effluent sample to the control using the TST method.

Note that under the Policy, dischargers may have incentive to increase the number of replicates tested. Thus, actual compliance may differ from that estimated from existing data.

Estimating Potential Controls and Costs

The potential for incremental actions under the Policy reflects a comparison of test compliance under the current permit compared to the Policy. Under the Policy, incremental differences in test evaluation may result from use of the TST compared to the statistical evaluations currently in use. For the sample facilities, we compared the current (baseline) and Policy results to identify potential changes in compliance status.

Toxicity Reduction Evaluations

Dischargers that are out of compliance with WET permit limits must conduct a TRE. EPA defines a TRE as a site-specific study conducted in a stepwise process designed to identify the causative agents of effluent toxicity, isolate the sources of toxicity, evaluate the effectiveness of toxicity control options, and confirm the reduction in effluent toxicity (U.S. EPA, 1991). TREs comprise all measures taken to reduce WET to required levels. TREs can involve many steps and are seldom the same for all situations. Major components of a TRE include (U.S. EPA, 1999):

- Information and data acquisition
- Facility performance evaluation
- Toxicity identification evaluation
- Toxicity source evaluation
- Toxicity control evaluation
- Toxicity control implementation.

The exact components of a TRE will vary for each discharger. For example, if toxicity occurred after the addition of a new treatment chemical or process change, the investigation can likely be conducted in-house and for a minimal cost. However, in many situations simply examining operational records is of little value without knowledge of the specific toxicant causing the problem (Pillard and Hockett, 2002). Identifying the toxicant of concern often increases treatment and control options while decreasing total control costs.

A TIE is a set of procedures that uses physical and chemical treatments to identify or classify the specific chemical compounds causing toxicity in an effluent sample (U.S. EPA, 2001). EPA recommends that permittees conduct TIEs early in the TRE process (U.S. EPA, 2001). TIE procedures are commonly performed in three phases: characterization, identification, and confirmation. The phases can be performed sequentially (using the results of one phase to influence the next) or simultaneously. TIE costs vary based on effluent complexity and the number of phases conducted. For example, Nautilus Environmental (2007) indicates that a Phase I TIE would cost $4,500 to $6,000; however, costs for Phase II and III TIEs are site-specific. Similarly, ENSR cites Phase I TIE costs ranging from $2,000 to $4,000 (Pillard and Hockett, 2002).

The difficulty in conducting a TIE, and the time required to complete it, will likely increase in direct proportion to the complexity of toxicants in wastewater. As the number of chemical constituents in wastewater increases, the interactions of those chemicals (e.g., with biological and analytical systems and with each other in the wastewater) can increase the difficulty of identifying toxicants (U.S. EPA, 2001). However, TIE studies do not need to be prohibitively expensive. ENSR indicates that relatively low-cost investigations can be extremely useful in providing cost-effective solutions to effluent toxicity problems (Pillard and Hockett, 2002).

Based on TIE results, the permittee may decide to conduct treatability tests on the effluent or source investigations to determine the appropriate control actions. However, not all TREs need to include TIEs. In some cases, dischargers may first conduct treatability tests that use bench-scale treatment units to identify process changes that reduce toxicity through changes in treatment type, arrangement, or method. While these tests may not identify which toxicant is being removed or reduced, they can still be effective in reducing WET.

Costs for a TRE (not including implementation of specific control actions) can range from $25,000 to $40,000 (Pillard and Hockett, 2002). For example, the City of Bryan (Texas) received bids from two laboratory service providers to perform a TRE of $36,222 and $28,560, plus up to an additional $5,000 for all 3 phases of a TIE.

Control Actions

EPA considers any technically reasonable actions taken to resolve WET as TRE activities (EPA, 2001). Such actions may include chemical substitution/addition, process optimization or enhancements, pretreatment modifications, or treatment of process streams.

Chemical substitution removes the source of toxicity in effluents. Common chemicals for which substitution may be an option include cooling tower slimicides, ammonia nutrients, lime, polymers, and oxidizing agents (U.S. EPA, 1989). Adding chemicals to the treatment process may also improve toxicant or toxicity removal. EPA (1999) provides a number of examples:

- Nutrients can be added to influent wastewaters that have low nutrient levels (relative to their organic strength) to improve biological treatment
- Lime or caustic chemicals can be used to adjust wastewater pH for optimal biological treatment or for coagulation and precipitation treatment
- Other chemical coagulants are used to aid in removal of insoluble toxicants and to improve sludge settling
- Powdered activated carbon may be applied in activated sludge systems to remove toxic organic compounds.

Process optimization entails modifying existing operations and facilities to improve operation, maintenance, and performance (Metcalf and Eddy, 2003). Optimization usually involves two main steps: process analysis and process modifications. Process analysis is an investigation of the performance-limiting factors of the treatment process and is a key factor in achieving optimum treatment efficiency. Process modifications include activities short of adding new treatment technology units (conventional or unconventional) to the treatment train. For example, modifications could include modifying baffles, adding chemicals to enhance coagulation and solids removal, equalizing flow, training operators, and installing automation equipment including necessary hardware and software. Potential modifications vary based on the type of facility and existing treatment train.

The primary advantages of pretreatment control of toxicity are that a smaller volume of waste can be managed by addressing individual sources and the costs are usually the responsibility of the industrial users. Pretreatment requirements may involve a public education effort or the implementation of narrative or numerical limitations for dischargers to WWTPs. In cases where the problem toxicant is not already regulated under the existing pretreatment program, municipalities may need to (U.S. EPA, 1999):

- Investigate public education approaches, if the toxicant is widely used in the service area (e.g., organophosphate insecticides)
- Perform an allowable headworks loading analysis
- Decide whether to establish local limits or implement a more directed approach, such as industrial user management or case-by-case requirements
- Develop a monitoring program to evaluate compliance with the requirements.

Treatment of wastewater is another option for controlling effluent toxicity. However, end-of-pipe treatment can be costly, making dischargers more likely to first pursue lower cost options such as process optimization and pollution prevention (e.g., chemical substitution and pretreatment modifications). The treatment technology selected will depend on the toxicant of concern. For example, enhanced biological nutrient removal technologies target reductions in nutrients such as ammonia, whereas, reverse osmosis primarily removes dissolved contaminants (e.g., mercury and pesticides).

Exhibit 4-3 provides examples of the types of control actions that may be necessary for different discharger categories.

Exhibit 4-3. Examples of WET Control Actions

Discharger Category	Pollutants of Concern	Control Actions	Source
Municipal wastewater	Copper	Implemented additional pretreatment controls/requirements	U.S. EPA (1999)
Municipal wastewater	Diazinon and chlorpyrifos	Public awareness program; source control program; identify processes and operations that remove organophosphate insecticides	U.S. EPA (1999)
Municipal wastewater	Surfactants	Pretreatment to minimize or eliminate industrial chemicals	U.S. EPA (1999)
Municipal wastewater	Ammonia, non-polar organic compounds, surfactants	Developed pretreatment limits specific to ammonia and general toxicity limits for non-ammonia pollutants	U.S. EPA (1999)
Municipal wastewater	Bacteria regrowth in effluent samples	Replaced old auto samplers; revised sample tubing replacement protocol; optimized sample collection to reduce bacterial growth	SRCSD (2008)
Petroleum refinery	Organic chemicals	Installed granular activated carbon to treat 5-10 mgd (in addition to existing biological treatment)	Calgon Carbon (no date)
Petroleum refinery	Semi-volatile aromatics, high MW aliphaties, substituted phenols, aromatic amine and indole compounds, long-chain fatty acid esters, and substituted PAHs	Added more aeration horsepower to combined equalization/aeration tank; modified secondary clarifiers; and added new permanent pumps, piping, instrumentation, and controls for return and waste activated sludge flow control	Stover and Walls (2004)
Petroleum refinery	Neutral organic Chemicals	Ammonia recovery and foul water stripper; preliminary bench scale testing indicated that activated carbon will reduce final effluent toxicity to acceptable levels	U.S. EPA (1989)
Steel production	Bacteria	Improved housekeeping and increased frequency of clarifier cleaning and floc removal	Hall and Lockwood (2004)
Latex production	Mixture of nitrite and ammonia	Upgrades in solids pretreatment and the biological nitrification system (i.e., an anoxic basin and additional nitrification)	Hall and Lockwood (2004)
Organic chemicals	Calcium and chloride salts	Implemented source controls	Hall and Lockwood (2004)
Gas-fired power plant	Copper	Using commercial additive containing EDTA chelating agent	ENSR (2008)

Control costs are highly site-specific. However, in general, pretreatment modifications, source controls, and process optimization are less costly to implement than end-of-pipe treatment. As shown in the exhibit, in certain cases, such as removal of organics from petroleum refinery wastewater, end-of-pipe treatment may be the most technologically and economically feasible alternative for compliance.

Monitoring

Incremental monitoring costs could result from routine, follow-up, or accelerated monitoring. Unit costs vary with species and test type (e.g., acute or chronic, single-concentration or multiple dilutions). **Exhibit 4-4** shows average unit costs for various species and test types for the sample facilities. **Appendix B** provides detailed data on these average costs.

Exhibit 4-4. Unit Costs for Calculation of Incremental Monitoring Costs under the Policy

Species	Species Type	Test Type	Unit Cost[1]
Acute			
Oncorhynchus mykiss	Vertebrate	Single-concentration	$347
Pimephales promelas	Vertebrate	Single-concentration	$308
Chronic			
Ceriodaphnia dubia	Invertebrate	Multiple concentrations	$1,221
Ceriodaphnia dubia	Invertebrate	Single-concentration	$639
Pimephales promelas	Vertebrate	Multiple concentrations	$1,290
Pimephales promelas	Vertebrate	Single-concentration	$725
Selenastrum capricornutum	Aquatic Plant	Multiple concentrations	$813
Selenastrum capricornutum	Aquatic Plant	Single-concentration	$463
Haliotus rufescens	Invertebrate	Multiple concentrations	$1,363
Haliotus rufescens	Invertebrate	Single-concentration	$655
Holmesimysis costata	Invertebrate	Multiple concentrations	$1,938
Holmesimysis costata	Invertebrate	Single-concentration	$1,000
Macrocystis pyrifera	Aquatic Plant	Multiple concentrations	$1,433

1. Represents average test cost across static and renewal tests.

In addition, costs for 3-species chronic WET testing and 2-species acute WET testing to determine the most sensitive species are needed for those sample facilities not currently conducting such tests. **Exhibit 4-5** summarizes these unit costs based on average species type costs for freshwater and marine tests.

Exhibit 4-5. Unit Costs for Three-Species Chronic and Acute WET Tests

Test Type	Single-Concentration	Multiple Dilutions
Chronic		
Freshwater 3-species	$1,769	$3,273
Marine 3-species	$2,338	$4,370
Acute		
Freshwater 2-species	$671	$1,367
Marine 2-species	$802	$1,585

Storm Water Discharges

All MS4 permittees and activities subject to the Caltrans storm water permit program have RP under the Policy and will be required to conduct chronic WET monitoring during storm events. However, because the frequency and monitoring locations will be defined by permit writers on a site-specific basis, it is not possible to estimate the change, if any, between existing and Policy conditions. In addition, there are no WET monitoring data available from which to determine compliance with the proposed objectives, and thus, the incremental controls that may be needed under the Policy.

As shown in Exhibit 2-5, most of the Phase I MS4 permits already required chronic toxicity monitoring during storm events. If monitoring locations and frequency for these permittees remain the same under the Policy, incremental costs may be minimal or there could be a cost savings associated with a switch from multiple dilutions testing to single-concentration testing or three-species tests to a single species. For the permittees with only acute toxicity monitoring requirements, incremental costs could also be minimal under the Policy resulting from a switch from routine acute monitoring to chronic monitoring.

For permittees with no existing toxicity monitoring requirements, including most of the Phase II MS4s, incremental costs depend on the number of monitoring locations and sampling frequency specified in the revised permit. On a statewide level, these incremental costs could be offset by potential cost savings associated with decreased monitoring requirements for permittees with existing toxicity requirements.

Irrigated Lands

Dischargers subject to the Irrigated Lands Regulatory Program have RP under the Policy and will be required to conduct chronic WET monitoring. Thus, all agricultural lands in the Central Coast, Los Angeles, and Central Valley regions and agricultural lands covered by applicable TMDLs in the North Coast, Colorado River, and Santa Ana regions are subject to the Policy.

Under the Policy, WET test frequency will be determined on an individual basis and specified in each waiver. The conditional waivers in the Central Coast, Los Angeles, and Central Valley regions already contain toxicity monitoring requirements and TRE/TIE provisions for addressing potential toxicity. Thus, to the extent that existing toxicity provisions would remain unchanged, incremental compliance costs could be minimal in these regions.

The North Coast, Colorado River, and San Diego Regional Water Boards' conditional waivers for agriculture do not contain any specific monitoring or control requirements for toxicity. Thus, if permit writers require specific toxicity provisions in the waiver as a result of the Policy, there could be some incremental cost associated with compliance. However, the magnitude of this incremental cost, if any, is uncertain due to uncertainty associated with baseline activities for individual growers and estimates of the number of growers covered by each waiver.

The Santa Ana Regional Water Board's conditional agriculture waiver is still being developed and implemented. Thus, it is uncertain whether baseline conditions would include toxicity monitoring provisions and whether incremental costs are likely. In addition, it is uncertain how many farmers are covered by the waiver and whether they would participate in the group or individual monitoring programs.

The San Francisco Bay and Lahontan Regional Water Boards do not currently have conditional waivers for agricultural lands. Thus, the Policy and any WET monitoring requirements do not apply. However, because all of the Regional Boards are required to implement an agriculture discharge program, the Policy will apply to these regions in the future. Whether those waivers would have required toxicity monitoring in the absence of the Policy is uncertain.

Results

This section summarizes the potential incremental policy actions and statewide costs. Incremental impacts represent the costs of activities above and beyond those that would be necessary in the absence of the policy under baseline conditions. This section also discusses the limitations and uncertainties associated with the analysis.

Municipal and Industrial Wastewater

Exhibit 5-1 summarizes the annual incremental costs to the sample facilities of complying with the Policy.

Exhibit 5-1. Potential Incremental Policy Costs for the Sample Facilities per Year

Name	Monitoring[1]	Compliance Actions[2]	Total
Municipal Wastewater			
Sacramento Regional County Sanitation District WWTP	-$21,600	$0	-$21,600
Los Angeles County Sanitation District, San Jose Creek WRP (East and West)	-$9,000	$0	-$9,000
Camrosa Water District WWTP	$0	ND	$0
Colton/San Bernardino RIX	-$5,900	$0	-$5,900
Davis WWTP	-$23,800	$0	-$23,800
Lompoc Regional WWTP	-$1,900	$0	-$1,900
Red Bluff WWTP	-$200	$0	-$200
Victor Valley Regional WWTP	$6,100	$6,400 to $9,400	$12,600 to $15,600
Industrials			
Aerojet	$3,400	ND	$3,400
Chevron, Richmond Refinery	-$23,800	$0	-$23,800
Pactiv Corporation, Molded Pulp Mill	-$2,900	$0	-$2,900
Dow Chemical Company	-$7,000	$0	-$7,000
DWR, Warne Power Plant	$2,200 to $16,800	$0	$2,200 to $16,800
Shell Oil, Martinez Refinery	-$13,800	$1,000 to $9,700	-$4,400 to -$12,800
USS POSCO Industries	-$6,600 to -$9,000	$0	-$6,600 to -$9,000

ND = No data to evaluate compliance
WRP = water reclamation plant
WWTP = wastewater treatment plant
1. Includes cost of routine monitoring and species sensitivity screening.
2. Includes cost of follow-up monitoring, accelerated monitoring, and TREs.

Based on the number of dischargers in each category (e.g., municipal wastewater, chemicals products, metals manufacturers and finishers, petroleum refineries, pulp and paper mills, and other industries), the results from the sample facilities can be extrapolated to estimate the incremental statewide costs associated with the Policy.

Exhibit 5-2 shows the calculation of statewide costs.

Exhibit 5-2. Extrapolation of Compliance Costs for Major Dischargers[1]

Discharger Category	Total Cost to Sample Dischargers	Number of Sample Dischargers	Average Cost per Discharger	Number of Dischargers Statewide	Total Statewide Cost
Certainty Sample	-$30,600	2	NA	2	-$30,600
Municipal Wastewater	-$16,200 to -$19,200	6	-$3,200 to -$3,800	144	-$467,200 to -$553,600
Chemicals and Allied Products	-$7,000	1	-$7,000	1	-$7,000
Metals Manufacturing and Finishers	-$6,600 to -$9,000	1	-$6,600 to -$9,000	2	-$13,200 to -$18,000
Petroleum Refineries	-$27,800 to -$36,500	2	-$13,900 to -$18,300	8	-$111,200 to -$146,100
Pulp and Paper	-$2,900	1	-$2,900	1	-$2,900
Other Industrial	$5,600 to $20,200	2	$2,800 to $10,100	33	$92,200 to $333,400
Total	NA	15	NA	191	-$298,800 to -$666,100

Note: detail may not add to total due to independent rounding.
NA = not applicable
1. Includes cost of routine monitoring, follow-up monitoring, accelerated monitoring, and TRE implementation; does not include cost of treatment controls because information on specific pollutant(s) causing toxicity is not available.

Storm Water Dischargers

Incremental costs to storm water discharges affected by the Policy are uncertain due to a lack of details on monitoring requirements and locations for individual municipalities. In addition, analysis of WET test results using the TST method under the Policy could result in greater or fewer exceedances of toxicity objectives. Effluent data would be needed to determine potential changes to control scenarios. Thus, incremental costs to storm water dischargers under the Policy are uncertain.

Irrigated Lands

Incremental costs to discharges from irrigated lands are uncertain due to a lack of WET data and information on potential monitoring requirements under the Policy. In regions where agricultural waivers already require WET testing, incremental monitoring costs may be minimal. However, in regions with existing waivers that do not specify toxicity testing requirements or without agricultural waivers, there is potential for increased costs due to WET monitoring. In any case, if monitoring requirements increase, those farmers covered under individual monitoring or waiver programs could switch to the group programs, reducing or eliminating the increase in monitoring costs.

Limitations and Uncertainties

There are a number of limitations and uncertainties associated with the analysis of potential compliance costs. **Exhibit 5-3** summarizes the key uncertainties and the potential effect on estimated costs.

Exhibit 5-3. Key Limitations and Uncertainties in the Analysis of Compliance and Costs

Issue or Assumption	Impact on Costs	Comments
Treatment controls not included in TRE costs.	–	If a TRE is necessary, dischargers will likely incur some costs for reducing effluent toxicity. However, without information on the pollutants causing the toxicity, the magnitude of those costs cannot be estimated.
Potential Policy compliance based on existing WET tests.	?	Dischargers may test additional replicates and different species (due to rescreening and changes in acceptable test species) under the Policy, which could change compliance results.
Incremental costs are not estimated for storm water and irrigated land discharges because permit requirements under the Policy are uncertain and there are no WET data from which to determine compliance.	?	Costs to dischargers with existing toxicity provisions may be minimal or there may be cost savings. Dischargers with no existing toxicity provisions could incur costs under the Policy; however, such costs could be offset by potential cost savings from other dischargers.

'?' = uncertain
'+' = estimated costs may be overstated
'-' = estimated costs may be understated

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Facility Analyses

A.1 Aerojet-General Corporation

The following sections document the incremental compliance analysis for the sample facility.

A.1.1 Facility Information

The following exhibit summarizes general information about the facility.

General Information: Aerojet-General Corporation

Name	Aerojet-General Corporation
NPDES No.	CA0004111
Category	Major industrial (other)
Flow (mgd)	35.8
Receiving water	Buffalo Creek (Outfalls 001, 002, 003, and 004)
Existing treatment level	Primary
Existing treatment train	Retention ponds

A.1.2 Existing Permit Requirements

The following exhibit summarizes the existing permit requirements related to WET testing for the sample facility.

WET Permit Requirements: Aerojet-General Corporation

Permit issue date	7/31/2008
Permit expiration date	7/31/2013
Dilution	None
Acute monitoring	Twice per year; 1 species (*Pimephales promelas*)
Acute limits	None
Chronic monitoring	Annually; three species (*Ceriodaphnia dubia*, survival and reproduction test; *Pimephales promelas*, larval survival and growth test; *Selenastrum capricornutum*, growth test); 100% effluent
Chronic limits	None
Accelerated monitoring trigger	The numeric toxicity monitoring trigger is > 1 TUc (where TUc = 100/NOEC).
TIE/TRE trigger	If the result of any accelerated toxicity test exceeds the monitoring trigger, the Discharger shall cease accelerated monitoring and initiate a TRE to investigate the cause(s) of, and identify corrective actions to reduce or eliminate effluent toxicity.
Resume regular testing condition	If the results of four consecutive accelerated monitoring tests do not exceed the monitoring trigger, the Discharger may cease accelerated monitoring and resume regular chronic toxicity monitoring.

A.1.3 Compliance

Data are not available from which to evaluate compliance with baseline or Policy requirements.

There will be no acute monitoring under the Policy, as shown in the table below. Chronic monitoring will be monthly, but with one species (most sensitive). In addition, there is no incremental cost associated with initial RP monitoring (chronic three-species testing) because the permit already requires three-species testing annually.

Routine Monitoring: Aerojet-General Corporation

Component	Baseline	Policy	Incremental
Acute			
Frequency	2/yr	NA	NA
# Species	1	NA	NA
Test type	Single concentration	NA	NA
Unit cost	$308 (*Pimephales promelas*)	NA	NA
Annual cost	$615	NA	-$615
Chronic			
Frequency	1/yr	12/yr	NA
# Species	3	1	NA
Test type	Single concentration	Single concentration	NA
Unit costs	$1,221 (*Ceriodaphnia dubia*) $1,290 (*Pimephales promelas*) $813 (*Selenastrum capricornutum*)	$609 (Uncertain[1])	NA
Annual cost	$3,324	$7,309	$3,985

NA = not applicable.
1. Most sensitive species is uncertain; cost represents the average unit cost of single-concentration tests for *Ceriodaphnia dubia*, *Pimephales promelas*, and *Selenastrum capricornutum*.

Thus, total incremental costs for the discharger may be $3,370 per year.

A.2 Camrosa WRP

The following sections document the incremental compliance analysis for the sample facility.

A.2.1 Facility Information

The following exhibit summarizes general information about the facility.

General Information: Camrosa WRP

Name	Camrosa WRP
NPDES No.	CA0059501
Category	Major municipal
Flow (mgd)	1.5
Receiving water	Calleguas Creek
Existing treatment level	Tertiary
Existing treatment train	Bar screen, headworks lift station, denitrification extended aeration system, anoxic denitrification, secondary clarification, upflow sand filtration, chlorination, and impoundment for reclamation.

A.2.2 Existing Permit Requirements

The following exhibit summarizes the existing permit requirements related to WET testing for the sample facility.

WET Permit Requirements: Camrosa WRP

Permit issue date	12/4/2003
Permit expiration date	11/10/2008
Dilution	Not applicable
Acute monitoring	Quarterly; 1 species (*Pimephales promelas*); 100% effluent
Acute limits	Survival of aquatic organisms in 96-hour bioassays of undiluted waste shall be no less than 70% for one bioassay, and the average for any three or more consecutive bioassays shall be no less than 90%.
Chronic monitoring	Monthly; 1 species with re-screening every 15 months (*Ceriodaphnia dubia*, *Pimephales promelas*, *Selenastrum capricornutum*); 100% effluent
Chronic limits	Monthly median of 1.0 TUc (100/NOEC)
Accelerated monitoring trigger	Exceed either acute or chronic limits
TRE trigger	Any 2 of the 6 accelerated acute tests are less than 90% survival; the initial acute test and any of the additional 6 acute toxicity bioassay tests result in less than 70 % survival; or any 3 out of the initial chronic tests and the 6 accelerated tests exceed 1.0 TUc
Resume regular testing condition	If implementation of the initial investigation TRE Workplan indicates the source of toxicity (e.g., a temporary plant upset, etc.), toxicity is in compliance with the limitations in all of the 6 additional tests required, or a TRE/TIE is initiated prior to completion of the accelerated testing schedule then the Discharger shall return to the normal sampling frequency

A.2.3 Baseline Compliance

There are no effluent toxicity data available for this facility because it has not discharged since 1998.

A.2.4 Policy Compliance

There are no data available from which to determine compliance with the Policy because the facility has not discharged to surface water since 1998.

A.2.5 Potential Incremental Impact Summary

The potential for compliance with WET requirements is similar under the Policy compared to the current permit. Thus, incremental control costs are zero. In addition, monitoring costs are zero because the facility is not currently discharging.

A.3 Chevron, Richmond Refinery

The following sections document the incremental compliance analysis for the sample facility.

A.3.1 Facility Information

The following exhibit summarizes general information about the facility.

General Information: Chevron, Richmond Refinery

Name	Chevron, Richmond Refinery
NPDES No.	CA0005134
Category	Major industrial (petroleum refining)
Flow (mgd)	13
Receiving water	San Pablo Bay
Existing treatment level	Tertiary
Existing treatment train	The treatment system first consists of oil and water separators. Wastewater is then routed to a bioreactor that consists of 4 quadrants. The first 2 quadrants provide biological treatment through aeration, while the next 2 quadrants are used as settling basins. After the settling basins, the Discharger routes a portion of bioreactor effluent to its water enhancement wetland. The remaining bioreactor effluent, and typically all wetland effluent, is routed through granular activated carbon before discharge through a deepwater diffuser.

A.3.2 Existing Permit Requirements

The following exhibit summarizes the existing permit requirements related to WET testing for the sample facility.

WET Permit Requirements: Chevron, Richmond Refinery

Permit issue date	6/14/2006
Permit expiration date	6/13/2011
Dilution	10:1
Acute monitoring	Weekly; 1 species (*Oncorhynchus mykiss*)
Acute limits	The survival of organisms in undiluted effluent not less than an 11-sample median of not less than 90%, and an 11-sample 90th percentile value of not less than 70%.
Chronic monitoring	Quarterly; 1 species (*Macrocystis pyrifera*); 100%, 50%, 25%, 10%, and 5%, and 2.5% dilutions; screening phase monitoring data from within 5 years of permit expiration date required in application for permit reissuance
Chronic limits	3-sample median < 10 TUc, and a single-sample value < 20 TUc.
Accelerated monitoring trigger	3-sample median >=10 TUc, or single-sample value >= 20 TUc. Accelerate frequency to monthly.
TRE trigger	2 consecutive data points > 10 TUc
Resume regular testing condition	If data from accelerated monitoring data points are found to be in compliance with the evaluation parameter, then regular monitoring shall be resumed.

A.3.3 Baseline Compliance

The following tables summarize WET data from 8/23/06 – 5/7/08 under the existing permit.

Baseline Compliance, Acute Toxicity: Chevron, Richmond Refinery

Species	*Oncorhynchus mykiss*
Test	Survival
# of tests	9
# exceeding limit[1]	0

1. Based on incomplete data from PCS.

Baseline Compliance, Chronic Toxicity: Chevron, Richmond Refinery

Species	*Macrocystis pyrifera*
Test	Germination and growth
# of tests[1]	8
# exceeding limit	0
# exceeding accelerated monitoring trigger	0
# exceeding TRE trigger	0

The discharger is in compliance under the existing permit.

A.3.4 Policy Compliance

Regional Water Boards can allow dilution at their discretion. However, assuming that the facility would receive a dilution ratio of 10:1 as in the existing permit, the IWC would represent a 10% effluent sample.

The following table summarizes WET data from 8/23/06 – 5/7/08 under the Policy based on comparison of 10% effluent sample to a control.

Effluent Data Analysis under the Policy, Chronic Toxicity: Chevron, Richmond Refinery

Species	*Macrocystis pyrifera*
Test	Germination and growth
# of tests[1]	8
# of exceedances	0
# with mean effect >10%	0

Based on existing chronic monitoring data, the discharger would not have RP under the Policy because there are not exceedances of the criterion and all the mean effect percentages are below 10%.

A.3.5 Potential Incremental Impact Summary

The discharge is in compliance with baseline requirements and would not have RP (and thus, would not receive effluent limits or need controls) under the Policy. Thus, incremental control costs are zero.

There will be no acute monitoring under the Policy, as shown in the table below and no routine monitoring because the discharger does not have RP under the Policy. In addition, incremental cost savings associated with initial RP monitoring (chronic three species testing) would likely be minimal because the permit already requires at least three multiple dilution tests per species for permit renewal (the policy requires four single concentration tests per species).

Routine Monitoring: Chevron, Richmond Refinery

Component	Baseline	Policy	Incremental
Acute			
Frequency	52/yr	NA	NA
# Species	1	NA	NA
Test type	Single concentration	NA	NA
Unit cost	$347 (*Oncorhynchus mykiss*)	NA	NA
Annual cost	$18,018	NA	-$18,018
Chronic			
Frequency	4/yr	NA	NA
# Species	1	NA	NA
Test type	Multiple dilutions	NA	NA
Unit costs	$1,433 (*Macrocystis pyrifera*)	NA	NA
Annual cost	$5,733	NA	-$5,733

NA = not applicable.
1. Assuming *Macrocystis pyrifera* remains the most sensitive species.

Thus, total incremental cost savings for the discharger may be approximately $23,751 per year.

A.4 Colton/San Bernardino Regional Tertiary Treatment Facility

The following sections document the incremental compliance analysis for the sample facility.

A.4.1 Facility Information

The San Bernardino WWTP is a secondary plant that discharges (along with the Colton WWTP) to the Colton-San Bernardino Regional Tertiary Plant. Toxicity monitoring is required for the regional plant and not the individual plants. The following exhibit summarizes general information for the regional treatment facility.

General Information: Colton/San Bernardino Regional Tertiary Treatment Facility

Name	Colton/San Bernardino Regional Tertiary Treatment Facility
NPDES No.	CA0105392
Category	Major municipal
Flow (mgd)	28
Receiving water	Santa Ana River
Existing treatment level	Tertiary
Existing treatment train	The treatment system at the San Bernardino WWTP consists of screening, grit removal, primary clarification, secondary activated sludge (biological oxidation) with nitrification and denitrification, secondary clarification, and chlorination. Treatment at the regional tertiary facility is rapid infiltration and extraction (RIX), which consists of infiltration into a series of ponds, and extraction along with native groundwater for discharge.

A.4.2 Existing Permit Requirements

The following exhibit summarizes the existing permit requirements related to WET testing for the sample facility.

WET Permit Requirements: Colton/San Bernardino Regional Tertiary Treatment Facility

Permit issue date	9/30/2005
Permit expiration date	9/1/2010
Dilution	None
Acute monitoring	None
Acute limits	None
Chronic monitoring	Monthly; 1 species (*Ceriodaphnia dubia*); at least five dilutions (within 60% to 100% effluent concentration) and a control
Chronic limits	None
Accelerated monitoring trigger	Any single test > 1 TUc
TIE/TRE trigger	2-month median test value >1 TUc for survival or reproduction endpoint; any single test value >1.7 TUc for survival endpoint
Resume regular testing condition	2 consecutive data points result in 1.0 TUc, or when the results of the Initial Investigation Reduction Evaluation have adequately addressed the identified toxicity problem

A.4.3 Baseline Compliance

The following table summarizes WET data from 6/5/06 – 6/3/08 under the existing permit.

Baseline Compliance, Chronic Toxicity: Colton/San Bernardino Regional Tertiary Treatment Facility

Species	*Ceriodaphnia dubia*
Test	Survival and reproduction
# of tests	27
# exceeding accelerated monitoring trigger	2
# exceeding TIE/TRE trigger	4

The discharger exceeded accelerated monitoring and TIE/TRE triggers over the period of the data.

A.4.4 Policy Compliance

The discharger has RP under the Policy because it is a WWTP; the projected chronic toxicity effluent limit is 1 TUc. The following table summarizes WET data from 6/5/06 – 6/3/08 under the Policy.

Effluent Data Analysis under the Policy, Chronic Toxicity: Colton/San Bernardino Regional Tertiary Treatment Facility

Species	*Ceriodaphnia dubia*
Test	Survival and reproduction
# of tests	27
# exceedances	3

Under the Policy, the discharger will have to conduct three-species screening to determine the most sensitive species for chronic monitoring. Existing data is only available for *Ceriodaphnia dubia*. The discharger would have exceeded the projected effluent limit over the period of the data based on 100% effluent sample.

A.4.5 Potential Incremental Impact Summary

The evaluation of WET test data is similar under the existing permit and the Policy, indicating a need to conduct accelerated monitoring and a TRE. Thus, incremental controls costs are likely zero.

Chronic monitoring will be monthly with one species (most sensitive), but with a single-concentration test.

Routine Monitoring: Colton/San Bernardino Regional Tertiary Treatment Facility

	Baseline	Policy	Incremental
Frequency	12/yr	12/yr	NA
# Species	1	1	NA
Test type	Multiple dilutions	Single concentration	NA

Routine Monitoring: Colton/San Bernardino Regional Tertiary Treatment Facility

	Baseline	Policy	Incremental
Unit costs	$1,221 (*Ceriodaphnia dubia*)	$609 (Uncertain[1])	NA
Annual cost	$14,654	$7,309	-$7,345

NA = not applicable.
1. Sensitive species is uncertain; cost represents average of three freshwater species.

Thus, incremental cost savings associated with routine monitoring would be $7,345 per year. However, there will also be an incremental cost associated with initial RP monitoring (chronic three-species testing) of approximately $7,078 (based on four samples per species and average single-concentration chronic test costs for freshwater vertebrates, invertebrates, and aquatic plants) at the beginning of each permit cycle, or $1,416 per year (assuming a 5-year permit cycle). Thus, total incremental cost savings may be $5,930 per year.

A.5 Davis WWTP

The following sections document the incremental compliance analysis for the sample facility.

A.5.1 Facility Information

The following exhibit summarizes general information about the facility.

General Information: Davis WWTP

Name	Davis WWTP
NPDES No.	CA0079049
Category	Major municipal
Flow (mgd)	7.5
Receiving water	Willow Slough Bypass (Outfall 001) and Conaway Ranch Toe Drain (Outfall 002)
Existing treatment level	Secondary
Existing treatment train	The treatment system consists of a mechanical bar screen, an aerated grit tank, three primary sedimentation tanks, a primary anaerobic digester, a secondary anaerobic digester, three sludge lagoons, two aeration ponds (typically used in winter), three facultative oxidation ponds, a Lemna pond, an overland flow system, a chlorine contact tank, and restoration wetlands (used when discharging to Conaway Toe Drain). Biosolids are dewatered in on-site lagoons and the dried biosolids are land applied on-site in the overland flow fields.

A.5.2 Existing Permit Requirements

The following exhibit summarizes the existing permit requirements related to WET testing for the sample facility.

WET Permit Requirements: Davis WWTP

Permit issue date	10/25/2007
Permit expiration date	10/1/2012
Dilution	None
Acute monitoring	Monthly; 1 species (*Oncorhynchus mykiss*); 100% effluent
Acute limits	Survival of aquatic organisms in 96-hr bioassays of undiluted waste shall be no less than: 70%, minimum for any one bioassay; and 90%, median for any three consecutive bioassays.
Chronic monitoring	Quarterly; 3 species (*Ceriodaphnia dubia*, *Pimephales promelas*, *Selenastrum capricornutum*) control plus 5 dilutions (100%, 75%, 50%, 25%, 12.5%)
Chronic limits	None
Accelerated monitoring trigger	1 TUc (where TUc = 100/NOEC)
TRE trigger	1 TUc (where TUc = 100/NOEC)

WET Permit Requirements: Davis WWTP

Resume regular testing condition	If the results of 4 consecutive accelerated monitoring data points do not exceed the monitoring trigger, the Discharger may cease accelerated monitoring and resume regular chronic toxicity monitoring. However, notwithstanding the accelerated monitoring results, if there is adequate evidence of a pattern of effluent toxicity, the Executive Officer may require that the Discharger initiate a TRE.

A.5.3 Baseline Compliance

The following tables summarize WET data from 5/31/06 – 7/8/08 under the existing permit for Outfall 001 and Outfall 002.

Baseline Compliance, Acute Toxicity: Davis WWTP Outfall 001

Species	*Oncorhynchus mykiss*
Test	Survival
# of tests	7
# exceeding limit	0
# exceeding accelerated monitoring trigger	0
# exceeding TRE trigger	0

Baseline Compliance, Acute Toxicity: Davis WWTP Outfall 002

Species	*Oncorhynchus mykiss*
Test	Survival
# of tests	7
# exceeding limit	0
# exceeding accelerated monitoring trigger	0
# exceeding TRE trigger	0

Baseline Compliance, Chronic Toxicity: Davis WWTP Outfall 001

Ceriodaphnia dubia	
Test	Survival and reproduction
# of tests	7
# exceeding accelerated monitoring trigger	1
# exceeding TRE trigger	1
Pimephales promelas	
Test	Survival and growth
# of tests	7
# exceeding accelerated monitoring trigger	1
# exceeding TRE trigger	1
Selenastrum capricornutum	
Test	Growth
# of tests	7
# exceeding accelerated monitoring trigger	1
# exceeding TRE trigger	1

Baseline Compliance, Chronic Toxicity: Davis WWTP Outfall 002

Ceriodaphnia dubia	
Test	Survival and reproduction

Baseline Compliance, Chronic Toxicity: Davis WWTP Outfall 002

# of tests	2
# exceeding accelerated monitoring trigger	1
# exceeding TRE trigger	1
Pimephales promelas	
Test	Survival and growth
# of tests	2
# exceeding accelerated monitoring trigger	0
# exceeding TRE trigger	0
Selenastrum capricornutum	
Test	Growth
# of tests	1
# exceeding accelerated monitoring trigger	1
# exceeding TRE trigger	1

The discharger exceeded both accelerated monitoring and TRE triggers for chronic toxicity at both outfalls over the period of the data.

A.5.4 Policy Compliance

The discharger has RP under the Policy because it is a WWTP; the projected chronic toxicity effluent limit is 1 TUc. The following tables summarize WET data from 5/31/06 – 7/8/08 under the Policy for Outfall 001 and Outfall 002.

Effluent Data Analysis under the Policy, Chronic Toxicity: Davis WWTP Outfall 001

Ceriodaphnia dubia	
Test	Survival and reproduction
# of tests	7
# exceedances	0
Pimephales promelas	
Test	Survival and growth
# of tests	7
# exceedances	0
Selenastrum capricornutum	
Test	Growth
# of tests	7
# exceedances	1

Effluent Data Analysis under the Policy, Chronic Toxicity: Davis WWTP Outfall 002

Ceriodaphnia dubia	
Test	Survival and reproduction
# of tests	2
# exceedances	0
Pimephales promelas	
Test	Survival and growth
# of tests	2
# exceedances	0
Selenastrum capricornutum	

Effluent Data Analysis under the Policy, Chronic Toxicity: Davis WWTP Outfall 002

Test	Growth
# of tests	1
# exceedances	1

Based on the analysis of effluent data under the Policy, *Selenastrum capricornutum* may be the most sensitive for Outfall 001 and Outfall 002. The analysis also indicates that there are exceedances of the projected effluent limits for both outfalls.

A.5.5 Potential Incremental Impact Summary

The evaluation of test results is similar under the Policy method compared to the baseline method; the facility would need to conduct accelerated monitoring and may need a TRE depending on the outcome of the accelerated monitoring. Thus, incremental controls costs are likely zero.

There will be no acute monitoring under the Policy, as shown in the table below. Chronic monitoring will be monthly, but with one species (most sensitive) and single-concentration tests. In addition, there is no incremental cost associated with initial RP monitoring (chronic three-species testing) because the permit already requires such testing quarterly.

Routine Monitoring: Davis WWTP

Component	Baseline	Policy	Incremental
Acute			
Frequency	12/yr (at 2 outfalls)	NA	NA
# Species	1	NA	NA
Test type	Single concentration	NA	NA
Unit cost	$347 (*Oncorhynchus mykiss*)	NA	NA
Annual cost	$8,316	NA	-$8,316
Chronic			
Frequency	4/yr (at 2 outfalls)	12/yr (at 2 outfalls)	NA
# Species	3	1	NA
Test type	Multiple dilutions	Single concentration	NA
Unit costs	$1,221 (*Ceriodaphnia dubia*) $1,290 (*Pimephales promelas*) $813 (*Selenastrum capricornutum*)	$463 (*Selenastrum capricornutum* [1])	NA
Annual cost	$26,590	$11,112	-$15,478

NA = not applicable.
1. Based on *Selenastrum capricornutum* as most sensitive species for both outfalls.

Thus, total incremental cost savings for the discharger may be $23,794 per year.

A.6 Dow Chemical Company, Pittsburgh Plant

The following sections document the incremental compliance analysis for the sample facility.

A.6.1 Facility Information

The following exhibit summarizes general information about the facility.

General Information: Dow Chemical Company, Pittsburgh Plant

Name	Dow Chemical Company, Pittsburg Plant
NPDES No.	CA0004910
Category	Major industrial (chemicals)
Flow (mgd)	0.5
Receiving water	Suisun Bay
Existing treatment level	Tertiary
Existing treatment train	Clarification, filtration, pH adjustment, and reverse osmosis

A.6.2 Existing Permit Requirements

The following exhibit summarizes the existing permit requirements related to WET testing for the sample facility.

WET Permit Requirements: Dow Chemical Company, Pittsburgh Plant

Permit issue date	11/28/2001
Permit expiration date	10/31/2006
Dilution	10:1
Acute monitoring	Quarterly; 1 species (most sensitive)
Acute limits	The survival of organisms in undiluted effluent 11-sample median of not less than 90% survival, and 11-sample 90th percentile value not less than 70%.
Chronic monitoring	Quarterly; 1 species (*Thalassiosira pseudonana*); 100%, 75%, 50%, 25%, and 12.5% dilutions; rescreening for sensitive species each permit cycle
Chronic limits	None
Accelerated monitoring trigger	Monthly (accelerated) monitoring upon 3-sample median exceeding 10 TUc or single sample >= 20 TUc
TRE trigger	If accelerated monitoring confirms consistent toxicity above either "trigger", initiate toxicity identification evaluation/toxicity reduction evaluation.
Resume regular testing condition	Return to routine monitoring after appropriate elements of TRE workplan are implemented and either the toxicity drops below "trigger" levels, or, based on the results of the TRE, the Executive Officer authorizes a return to routine monitoring.

A.6.3 Baseline Compliance

The following tables summarize recent acute and chronic monitoring data for the facility from 7/25/06 to 4/21/08.

Baseline Compliance, Acute Toxicity: Dow Chemical Company, Pittsburgh Plant

Pimephales promelas	
Test	Survival
# of tests	9
# exceeding limit	0
# exceeding accelerated monitoring trigger	0
Oncorhynchus mykiss	
Test	Survival
# of tests	8
# exceeding limit	0
# exceeding accelerated monitoring trigger	0

NA = not applicable.

Baseline Compliance, Chronic Toxicity: Dow Chemical Company, Pittsburgh Plant

Thalassiosira pseudonana	
Test	Growth
# of tests[1]	7
# exceeding accelerated monitoring trigger	0
# exceeding TRE trigger	0

NA = not applicable.
1. One test result is for *Selenastrum capricornutum*.

Evaluation of WET results indicates that the discharger is in compliance with the current permit over the period of data.

A.6.4 Policy Compliance

Regional Water Boards can allow dilution at their discretion. However, assuming that the facility would receive a dilution ratio of 10:1 as in the existing permit, the IWC would represent a 10% effluent sample.

The following table summarizes WET data from 7/28/06 to 1/24/08 under the Policy based on comparison of 10% effluent sample to a control.

Analysis of Effluent Data under the Policy, Chronic Toxicity: Dow Chemical, Pittsburgh Plant

Thalassiosira pseudonana	
Test	Growth
# of tests[1]	7
# exceedances[2]	0
# with mean effect >10%	0

1. One test result is for *Selenastrum capricornutum*.
2. TST analysis based on b and α values for *Selenastrum capricornutum*.

The discharger would not have RP under the Policy because there are no exceedances of the criteria and all of the results have a mean effect less than 10%.

A.6.5 Potential Incremental Impact Summary

The discharger is in compliance with baseline requirements and would not have RP under the Policy. Thus, it is likely that incremental control costs would be zero.

There will be no routine acute or chronic monitoring under the Policy because the discharge does not have RP, as shown in the table below. In addition, incremental cost savings associated with initial RP monitoring (chronic three species testing) would likely be minimal because the permit already requires at least three multiple dilution tests per species for permit renewal (the policy requires four single concentration tests per species).

Routine Monitoring: Dow Chemical, Pittsburgh Plant

Component	Baseline	Policy	Incremental
Acute			
Frequency	4/yr	NA	NA
# Species	1	NA	NA
Test type	Single concentration	NA	NA
Unit cost	$327 (most sensitive[1])	NA	NA
Annual cost	$1,308	NA	-$1,308
Chronic			
Frequency	4/yr	NA	NA
# Species	1	NA	NA
Test type	Multiple dilutions	NA	NA
Unit costs	$1,433 (*Thalassiosira pseudonana*)[2]	NA	NA
Annual cost	$5,733	NA	-$5,733

NA = not applicable.
1. Represents average of *Pimephales promelas* and *Oncorhynchus mykiss*.
2. No unit costs available for *Thalassiosira pseudonana*; cost represents unit costs for *Macrocystis pyrifera* (marine aquatic plant).

Thus, total incremental cost savings for the discharger under the Policy may be $7,042 per year.

A.7 California Department of Water Resources, Warne Power Plant

The following sections document the incremental compliance analysis for the sample facility.

A.7.1 Facility Information

The following exhibit summarizes general information about the facility.

General Information: California DWR, Warne Power Plant

Name	California Department of Water Resources, Warne Power Plant
NPDES No.	CA0059188
Category	Major industrial (other)
Flow (mgd)	1.752
Receiving water	Pyramid Lake (Outfalls 001 and 002)
Existing treatment level	Secondary
Existing treatment train	Chlorination, polymer flocculation, and filtration

A.7.2 Existing Permit Requirements

The following exhibit summarizes the existing permit requirements related to WET testing for the sample facility.

WET Permit Requirements: California DWR, Warne Power Plant

Permit issue date	12/13/2004
Permit expiration date	11/10/2009
Dilution	None
Acute monitoring	Annually; 1 species (*Pimephales promelas*).
Acute limits	Survival of aquatic organisms in 96-hr bioassays of undiluted waste shall be no less than: 70%, minimum for any one bioassay; and 90%, average for any three consecutive bioassays.
Chronic monitoring	None
Chronic limits	None
Accelerated monitoring trigger	Average survival in undiluted effluent of 3 consecutive 96-hr bioassay data points < 90% OR single test less than 70% survival.
TIE/TRE trigger	If the initial test and any of the additional six acute toxicity bioassay data points result in less than 70% survival, including the initial test, OR if the results of any two of the six accelerated data points are less than 90% survival, the Discharger shall immediately begin a TIE.
Resume regular testing condition	If the additional data points indicate compliance with acute toxicity limitation, the Discharger may resume regular testing.

A.7.3 Baseline Compliance

The following table summarizes WET data from 2/22/07 – 4/23/08 under the existing permit.

Baseline Compliance, Acute Toxicity: California DWR, Warne Power Plant

Species	*Pimephales promelas*
Test	Survival

Baseline Compliance, Acute Toxicity: California DWR, Warne Power Plant

# of tests	14
# exceeding limit[2]	1
# exceeding accelerated monitoring trigger	1
# exceeding TIE/TRE trigger[3]	0

1. It is uncertain which outfall(s) the data represent.
2. Average of 3 consecutive observations from 2/22/07 was 83% survival.
3. Accelerated monitoring data have survivals of greater than 95%.

The discharger has exceeded the limit and accelerated monitoring trigger over the period of the data.

A.7.4 Policy Compliance

There are no chronic WET test data with which to evaluate potential compliance under the Policy for this facility. Thus, it is uncertain whether the discharger would have RP or be in compliance with projected effluent limits under the Policy.

A.7.5 Potential Incremental Impact Summary

There will be no routine acute monitoring under the Policy, as shown in the table below. In addition, if the discharger does not have RP, there will not be routing chronic monitoring. However, if the discharger has RP, chronic monitoring will be monthly, with one species (most sensitive) and single-concentration tests, as shown in the exhibit below.

Routine Monitoring: California DWR, Warne Power Plant

Component	Baseline	Policy	Incremental
Acute			
Frequency	1/yr at 2 outfalls	NA	NA
# Species	1	NA	NA
Test type	Single concentration	NA	NA
Unit cost	$308 (*Pimephales promelas*)	NA	NA
Annual cost	$615	NA	-$615
Chronic			
Frequency	NA	12/yr at 2 outfalls	NA
# Species	NA	1	NA
Test type	NA	Single concentration	NA
Unit costs	NA	$609 (Uncertain[1])	NA
Annual cost	NA	$14,618	$14,618

NA = not applicable.
1. The most sensitive species is uncertain; costs represent average across freshwater species.

Thus, incremental routine monitoring costs may be $14,003 per year. There will also be a cost of initial RP monitoring of approximately $14,155 (based on average single-concentration chronic test costs for freshwater vertebrates, invertebrates, and aquatic plants) for Outfalls 001 and 002 at the beginning of each permit cycle, or $2,831 per year (assuming a 5-year permit cycle). Thus, total incremental costs may range from approximately $2,216 per year if there is no RP to approximately $16,834 per year under a scenario of RP.

A.8 LACSD San Jose Creek WRP

The following sections document the incremental compliance analysis for the sample facility.

A.8.1 Facility Information

The following exhibit summarizes general information about the facility.

General Information: LACSD San Jose Creek WRP

Name	LACSD San Jose Creek WWRP
NPDES No.	CA0053911
Category	Major municipal
Flow (mgd)	100 (62.5 mgd East Plant and 37.5 mgd West Plant)
Receiving water	San Gabriel River (Outfalls 001 and 003) and San Jose Creek (Outfall 002)
Existing treatment level	Tertiary
Existing treatment train	Facility consists of two treatment plants with separate sewer systems. Treatment trains for both plants are the same and consist of primary sedimentation, nitrification-denitrification (NDN) activated sludge biological treatment, secondary sedimentation with coagulation, inert media filtration, chlorination and dechlorination. Sewage solids separated from the wastewater are returned to the trunk sewer for conveyance to Joint Water Pollution Control Plant for treatment and disposal.

A.8.2 Existing Permit Requirements

The following exhibit summarizes the existing permit requirements related to WET testing for the sample facility.

WET Permit Requirements: LACSD San Jose Creek WRP

Permit issue date	6/10/2004
Permit expiration date	5/10/2009
Dilution	None
Acute monitoring	Annually; 1 species (*Pimephales promelas* for fresh water discharges and *Atherinops affinis* for brackish discharges)
Acute limits	Average survival in undiluted effluent for any 3 consecutive 96-hr static, static-renewal, or continuous flow bioassay data points of at least 90%, and no single test producing <70% survival.
Chronic monitoring	Monthly; 1 species with re-screening for most sensitive species every 24 months (*Ceriodaphnia dubia*, *Pimephales promelas*, *Selenastrum capricornutum*); 100% effluent and control
Chronic limits	1.0 TUc (where 1 TUc = 100/NOEC)
Accelerated monitoring trigger	Average survival in undiluted effluent of 3 consecutive 96-hr bioassay data points < 90% or single test <70% survival.
TRE trigger	>1.0 TUc (where 1 TUc = 100/NOEC)

WET Permit Requirements: LACSD San Jose Creek WRP

Resume regular testing condition	If the additional data points indicate compliance with acute toxicity limitation, the Discharger may resume regular testing. However, if the results of any two of the six accelerated data points are < 90% survival, then the Discharger shall begin a TIE.

A.8.3 Baseline Compliance

The following tables summarize WET data from 5/11/06 – 6/5/08 under the existing permit for each of the treatment plants.

Baseline Compliance, Acute Toxicity: LACSD San Jose Creek WRP East

Species	*Pimephales promelas*
Test	Survival
# of tests	2
# exceeding limit	0
# exceeding accelerated monitoring trigger	0
# exceeding TIE/TRE trigger	0

Baseline Compliance, Acute Toxicity: LACSD San Jose Creek WRP West

Species	*Pimephales promelas*
Test	Survival
# of tests	2
# exceeding limit	0
# exceeding accelerated monitoring trigger	0
# exceeding TRE trigger	0

Baseline Compliance, Chronic Toxicity: LACSD San Jose Creek WRP East

Ceriodaphnia dubia	
Test	Survival and reproduction
# of tests	2
# exceeding limit	0
# exceeding accelerated monitoring trigger	0
# exceeding TIE/TRE trigger	0
Pimephales promelas	
Test	Survival and growth
# of tests[1]	27
# exceeding limit	1
# exceeding accelerated monitoring trigger	1
# exceeding TIE/TRE trigger	0
Selenastrum capricornutum	
Test	Growth
# of tests	2
# exceeding limit	0
# exceeding accelerated monitoring trigger	0
# exceeding TIE/TRE trigger	0

Baseline Compliance, Chronic Toxicity: LACSD San Jose Creek WRP West

Ceriodaphnia dubia	
Test	Survival and reproduction
# of tests	4
# exceeding limit	1
# exceeding accelerated monitoring trigger	1
# exceeding TRE trigger	0
Pimephales promelas	
Test	Survival and growth
# of tests	32
# exceeding limit	4
# exceeding accelerated monitoring trigger	4
# exceeding TRE trigger	2
Selenastrum capricornutum	
Test	Growth
# of tests	3
# exceeding limit	0
# exceeding accelerated monitoring trigger	0
# exceeding TRE trigger	0

The discharger exceeded limits, accelerated monitoring triggers, and TRE triggers for chronic toxicity under the existing permit.

A.8.4 Policy Compliance

The discharger has RP under the Policy because it is a WWTP; the projected chronic toxicity effluent limit is 1 TUc. The following table summarizes WET data from 5/11/06 – 6/5/08 under the Policy.

Effluent Data Analysis under the Policy, Chronic Toxicity: LACSD San Jose Creek WRP East

Ceriodaphnia dubia	
Test	Survival and reproduction
# of tests	2
# exceedances	0
Pimephales promelas	
Test	Survival and growth
# of tests	27
# exceedances	0
Selenastrum capricornutum	
Test	Growth
# of tests	2
# exceedances	0

Effluent Data Analysis under the Policy, Chronic Toxicity: LACSD San Jose Creek WRP West

Ceriodaphnia dubia	
Test	Survival and reproduction

Effluent Data Analysis under the Policy, Chronic Toxicity: LACSD San Jose Creek WRP West

# of tests	4
# exceedances	1
Pimephales promelas	
Test	Survival and growth
# of tests	32
# exceedances	1
Selenastrum capricornutum	
Test	Growth
# of tests	3
# exceedances	0

Based on the analysis of effluent data under the Policy, *Ceriodaphnia dubia* may be the most sensitive species and would be used to assess compliance with the projected effluent limit. The discharger would have one exceedance of the projected effluent limit at the West plant based on 100% effluent sample.

A.8.5 Potential Incremental Impact Summary

Effluent data indicate that under the baseline the discharger would need to conduct accelerated monitoring at both treatment plants and a TRE at the West plant. However, under the Policy, accelerated monitoring and a TRE may only be needed at the West plant. Thus, incremental costs attributable to the Policy are likely zero.

There will be no acute monitoring under the Policy, as shown in the table below. Chronic monitoring will be monthly, but with one species (most sensitive) and single-concentration tests. In addition, there is no incremental cost associated with initial RP monitoring (chronic three-species testing) because the permit already requires such testing biannually.

Routine Monitoring: LACSD San Jose Creek WRP

Component	Baseline	Policy	Incremental
Acute			
Frequency	1/yr at 3 outfalls	NA	NA
# Species	1	NA	NA
Test type	Single concentration	NA	NA
Unit cost	$308 (*Pimephales promelas*)	NA	NA
Annual cost	$923	NA	-$923
Chronic			
Frequency	12/yr for most sensitive species; 3 samples every 2 years for other 2 species; for 3 outfalls	12/yr at 3 outfalls	NA
# Species	Varies	1	NA
Test type	Single concentration	Single concentration	NA
Unit costs	$639 (*Ceriodaphnia dubia*) $725 (*Pimephales promelas*) $463 (*Selenastrum capricornutum*)	$639 (*Ceriodaphnia dubia*)	NA
Annual cost	$31,060	$23,014	-$8,046

Routine Monitoring: LACSD San Jose Creek WRP

Component	Baseline	Policy	Incremental

NA = not applicable.

Thus, total incremental cost savings for the discharger may be $8,969 per year.

A.9 Lompoc Regional WWTP

The following sections document the incremental compliance analysis for the sample facility.

A.9.1 Facility Information

The following exhibit summarizes general information about the facility.

General Information: Lompoc Regional WWTP

Name	Lompoc Regional WWTP
NPDES No.	CA0048127
Category	Major municipal
Flow (mgd)	5
Receiving water	Santa Miguelito Creek
Existing treatment level	Secondary
Existing treatment train	Mechanical bar screens, primary clarifiers, biotower, aeration tank, secondary clarifiers, and a chlorine contact tank.

A.9.2 Existing Permit Requirements

The following exhibit summarizes the existing permit requirements related to WET testing for the sample facility.

WET Permit Requirements: Lompoc Regional WWTP

Permit issue date	7/7/2006
Permit expiration date	7/7/2011
Dilution	None
Acute monitoring	Monthly; 1 species (*Pimephales promelas*); 100% effluent
Acute limits	No differential mortality between 100% effluent and controls.
Chronic monitoring	Quarterly; 3 species screening (*Ceriodaphnia dubia*, *Pimephales promelas*, *Selenastrum capricornutum*), after which may be reduced to most sensitive; dilutions of 100%, 85%, 70%, 50%, and 25%
Chronic limits	1.0 TUc
Accelerated monitoring trigger	Statistically different at 95% confidence
TRE trigger	>1.0 TUc
Resume regular testing condition	Test species shall include a vertebrate, and invertebrate, and an aquatic plant. After a three-month screening period, monitoring may be reduced to the most sensitive species.

A.9.3 Baseline Compliance

The following tables summarize WET data from 6/7/06 – 9/13/08 under the existing permit.

Baseline Compliance, Acute Toxicity: Lompoc Regional WWTP

Pimephales promelas	
Test	Survival
# of tests	24

Baseline Compliance, Acute Toxicity: Lompoc Regional WWTP

# exceeding limit	1
# exceeding accelerated monitoring trigger	1
# exceeding TRE trigger	0
Ceriodaphnia dubia	
Test	Survival
# of tests	3
# exceeding limit	0
# exceeding accelerated monitoring trigger	0
# exceeding TRE trigger	0

Baseline Compliance, Chronic Toxicity: Lompoc Regional WWTP

Ceriodaphnia dubia	
Test	Survival and reproduction
# of tests[1]	1
# exceeding limit	0
# exceeding accelerated monitoring trigger	0
# exceeding TRE trigger	0
Pimephales promelas	
Test	Survival and growth
# of tests	1
# exceeding limit	0
# exceeding accelerated monitoring trigger	0
# exceeding TRE trigger	0
Selenastrum capricornutum	
Test	Growth
# of tests	11
# exceeding limit	11
# exceeding accelerated monitoring trigger	11
# exceeding TRE trigger	11

The discharger is out of compliance for chronic toxicity under the existing permit over the period of the data.

A.9.4 Policy Compliance

The discharger has RP under the Policy because it is a WWTP; the projected chronic toxicity effluent limit is 1 TUc. The following table summarizes WET data from 6/7/06 – 9/13/08 under the Policy.

Potential Policy Compliance, Chronic Toxicity: Lompoc Regional WWTP

Ceriodaphnia dubia	
Test	Survival and reproduction
# of tests	1
# exceedances	0
Pimephales promelas	
Test	Survival and growth
# of tests	1

Potential Policy Compliance, Chronic Toxicity: Lompoc Regional WWTP

# exceedances	0
Selenastrum capricornutum	
Test	Growth
# of tests	11
# exceedances	10

Based on the analysis of effluent data under the Policy, *Selenastrum capricornutum* is the most sensitive species and would be used to assess compliance with the projected effluent limit. Almost all of the test results exceed the projected effluent limit based on 100% effluent sample.

A.9.5 Potential Incremental Impact Summary

Given the number of exceedances under the Policy, the facility would likely need to conduct accelerated monitoring and a TRE. However, because all of the *Selenastrum capricornutum* WET results exceed both the accelerated monitoring and TRE triggers, the discharger would likely need to conduct accelerated monitoring and a TRE under the baseline as well. Thus, incremental controls costs are likely zero.

There will be no acute monitoring under the Policy, as shown in the table below. Chronic monitoring will be monthly, but with single-concentration tests. In addition, incremental cost savings associated with initial RP monitoring (chronic three species testing) would likely be minimal because the permit already requires at least three multiple dilution tests per species (the policy requires four single concentration tests per species).

Routine Monitoring: Lompoc Regional WWTP

Component	Baseline	Policy	Incremental
Acute			
Frequency	12/yr	NA	NA
# Species	1	NA	NA
Test type	Single concentration	NA	NA
Unit cost	$308 (*Pimephales promelas*)	NA	NA
Annual cost	$3,691	NA	-$3,691
Chronic			
Frequency	4/yr for most sensitive species; 2 additional species for 1st quarter of permit	12/yr	NA
# Species	Varies (*Selenastrum capricornutum* most sensitive)	1	NA
Test type	Multiple dilutions	Single concentration	NA
Unit costs	$1,221 (*Ceriodaphnia dubia*) $1,290 (*Pimephales promelas*) $813 (*Selenastrum capricornutum*)	$463 (*Selenastrum capricornutum*)	NA
Annual cost	$3,752	$5,556	$1,804

NA = not applicable.

Thus, total incremental cost savings for the discharger may be $1,887 per year.

A.10 Pactiv Corporation

The following sections document the incremental compliance analysis for the sample facility.

A.10.1 Facility Information

The following exhibit summarizes general information about the facility.

General Information: Pactiv Corporation

Name	Pactiv Corporation Molded Pulp Mill, Tehama County
NPDES No.	CA0004821
Category	Major industrial (pulp and paper)
Flow (mgd)	2.7
Receiving water	Lake Red Bluff, Sacramento River
Existing treatment level	Secondary
Existing treatment train	Primary settling, clarification and aeration

A.10.2 Existing Permit Requirements

The following exhibit summarizes the existing permit requirements related to WET testing for the sample facility.

WET Permit Requirements: Pactiv Corporation

Permit issue date	9/10/2004
Permit expiration date	9/1/2009
Dilution	8:1
Acute monitoring	Twice per month; 1 species (*Oncorhynchus mykiss*)
Acute limits	Survival of aquatic organisms in 96-hour bioassays of undiluted waste shall be no less than 70% for one bioassay, and the median for any three or more consecutive bioassays shall be no less than 90%.
Chronic monitoring	Annually; 3 species (*Pimephales promelas*, *Ceriodaphnia dubia*, and *Selenastrum capricornutum*); 12.5% 6.25% and 3.125% dilutions.
Chronic limits	None
Accelerated monitoring trigger	If a sample at a dilution of 1:8 (effluent to receiving water) exhibits toxicity, the Discharger shall sample during the next available discharge event.
TIE/TRE trigger	If initial and confirmation testing indicates that the discharge causes, has the reasonable potential to cause or contributes to an instream excursion above the water quality objective for toxicity at the edge of the approved mixing zone (8:1 dilution credit), then the Discharger shall initiate a TIE to identify the causes of toxicity. Upon completion of the TIE, the Discharger shall submit a work plan to conduct a TRE, and upon approval conduct the TRE.
Resume regular testing condition	Not specified

A.10.3 Baseline Compliance

The following tables summarize WET data from 8/8/06 – 8/14/07 under the existing permit.

Baseline Compliance, Acute Toxicity: Pactiv Corporation

Species	*Oncorhynchus mykiss*
Test	Survival and reproduction
# of tests	32
# exceeding accelerated monitoring trigger	NA
# exceeding TRE trigger	NA

Baseline Compliance, Chronic Toxicity: Pactiv Corporation

Ceriodaphnia dubia	
Test	Survival and reproduction
# of tests	2
# exceeding accelerated monitoring trigger	0
# exceeding TRE trigger	0
Pimephales promelas	
Test	Survival and growth
# of tests	3
# exceeding accelerated monitoring trigger	1
# exceeding TRE trigger	0
Selenastrum capricornutum	
Test	Growth
# of tests	2
# exceeding accelerated monitoring trigger	0
# exceeding TRE trigger	0

The discharger exceeded the accelerated monitoring trigger for chronic toxicity to *Pimephales promelas* over the period of the data.

A.10.4 Policy Compliance

Regional Water Boards can allow dilution at their discretion. However, assuming that the facility would receive a dilution ratio of 8:1 as in the existing permit, the IWC would represent a 12.5% effluent sample.

The following table summarizes WET data from 8/8/06 – 8/14/07 under the Policy based on comparison of 12.5% effluent sample to a control.

Analysis of Effluent Data under the Policy, Chronic Toxicity: Pactiv Corporation

Ceriodaphnia dubia	
Test	Survival and reproduction
# of tests	2
# of exceedances	0
# with mean effect >10%	0
Pimephales promelas	
Test	Survival and growth

Analysis of Effluent Data under the Policy, Chronic Toxicity: Pactiv Corporation

# of tests	3
# of exceedances	1
# with mean effect >10%	3
Selenastrum capricornutum	
Test	Growth
# of tests	2
# of exceedances	0
# with mean effect >10%	0

Based on the analysis of effluent data under the Policy, the discharger would have RP because there is one exceedance of the criterion for *Pimephales promelas* and all test results for *Pimephales promelas* have a mean effect ratio above 10%.

The projected effluent limit is 1.0 TUc, and compliance with this limit would be based on 12.5% effluent sample. The monitoring data in the table indicate that the facility would exceed the projected chronic limit once. (Note that existing data may not be indicative of results under the TST because the discharger may increase the number of replicates to increase the power of the test.)

A.10.5 Potential Incremental Impact Summary

Under the Policy, the discharger is required to conduct another single-concentration WET test within five business days of the exceedance. If this follow-up test fails, the discharger is in violation of the permit limit and must initiate accelerated monitoring consisting of 6 single-concentration tests over a 12-week period and a TRE. However, under the existing permit, the discharger has also exceeded the accelerated monitoring trigger; the existing permit also requires a follow up test and a TIE/TRE if the follow up test fails. Therefore, based on similar evaluation of existing data under the current permit and the Policy, incremental control costs are likely zero.

There will be no acute monitoring under the Policy, as shown in the table below. Chronic monitoring will be monthly, but with one species (most sensitive) and single-concentration tests. In addition, there is no incremental cost associated with initial RP monitoring (chronic three-species testing) because the permit already requires three-species testing annually.

Routine Monitoring: Pactiv Corporation

Component	Baseline	Policy	Incremental
Acute			
Frequency	24/yr	NA	NA
# Species	1	NA	NA
Test type	Single concentration	NA	NA
Unit cost	$347 (*Oncorhynchus mykiss*)	NA	NA
Annual cost	$8,316	NA	-$8,316
Chronic			
Frequency	1/yr	12/yr	NA
# Species	3	1	NA
Test type	Multiple dilutions	Single concentration	NA

Routine Monitoring: Pactiv Corporation

Component	Baseline	Policy	Incremental
Unit costs	$1,221 (*Ceriodaphnia dubia*) $1,290 (*Pimephales promelas*) $813 (*Selenastrum capricornutum*)	$725 (*Pimephales promelas*)	NA
Annual cost	$3,324	$8,700	$5,376

NA = not applicable.

Thus, total incremental cost savings associated with routine monitoring for the discharger may be $2,940.

A.11 Red Bluff WWTP

The following sections document the incremental compliance analysis for the sample facility.

A.11.1 Facility Information

The following exhibit summarizes general information about the facility.

General Information: Red Bluff WWTP

Name	Red Bluff WWTP
NPDES No.	CA0078891
Category	Major municipal
Flow (mgd)	2.5
Receiving water	Sacramento River
Existing treatment level	Tertiary
Existing treatment train	Treatment consists of screening for removal of large solids, aerated grit removal, primary sedimentation, activated sludge treatment with secondary clarification, filtration, and chlorination/dechlorination. Primary and waste activated sludge are treated by aerobic digestion, storage in solids storage basins, followed by dewatering and drying in sludge drying beds.

A.11.2 Existing Permit Requirements

The following exhibit summarizes the existing permit requirements related to WET testing for the sample facility.

WET Permit Requirements: Red Bluff WWTP

Permit issue date	5/4/2007
Permit expiration date	5/1/2012
Dilution	None (for chronic toxicity)
Acute monitoring	Monthly; 1 species (*Oncorhynchus mykiss*); 100% effluent
Acute limits	Survival of aquatic organisms in 96-hour bioassays of undiluted waste of no less than 70%, minimum for any one bioassay; and 90%, median for any 3 consecutive bioassays.
Chronic monitoring	Annually; 3 species (*Ceriodaphnia dubia*, *Pimephales promelas*, *Selenastrum capricornutum*); dilutions of 100%, 75%, 50%, 25%, and 12.5%
Chronic limits	None
Accelerated monitoring trigger	Average survival in undiluted effluent of 3 consecutive 96-hr bioassay data points <90% or single test <70% survival.
TRE trigger	>10 TUc
Resume regular testing condition	If the results of 4 consecutive accelerated monitoring data points do not exceed the monitoring trigger, the Discharger may cease accelerated monitoring and resume regular chronic toxicity monitoring.

A.11.3 Baseline Compliance

The following tables summarize WET data from 8/8/06 – 8/30/07 under the existing permit.

Baseline Compliance, Acute Toxicity: Red Bluff WWTP

Species	*Oncorhynchus mykiss*
Test	Survival
# of tests	2
# exceeding limit	0
# exceeding accelerated monitoring trigger	0
# exceeding TRE trigger	NA

Baseline Compliance, Chronic Toxicity: Red Bluff WWTP

Ceriodaphnia dubia	
Test	Survival and reproduction
# of tests[1]	2
# exceeding limit	NA
# exceeding accelerated monitoring trigger	0
# exceeding TRE trigger	0
Pimephales promelas	
Test	Survival and growth
# of tests[1]	2
# exceeding limit	NA
# exceeding accelerated monitoring trigger	0
# exceeding TRE trigger	0
Selenastrum capricornutum	
Test	Growth
# of tests	2
# exceeding limit	NA
# exceeding accelerated monitoring trigger	0
# exceeding TRE trigger	0

The discharger is in compliance with the existing permit over the period of the data.

A.11.4 Policy Compliance

The discharger has RP under the Policy because it is a WWTP; the projected chronic toxicity effluent limit is 1 TUc. The following table summarizes WET data from 8/8/06 – 8/30/07 under the Policy.

Effluent Data Analysis under the Policy, Chronic Toxicity: Red Bluff WWTP

Ceriodaphnia dubia	
Test	Survival and reproduction
# of tests[1]	2
# exceedances	0
Pimephales promelas	
Test	Survival and growth
# of tests	2

Effluent Data Analysis under the Policy, Chronic Toxicity: Red Bluff WWTP

# exceedances	0
Selenastrum capricornutum	
Test	Growth
# of tests	2
# exceedances	0

None of the WET results exceed the projected effluent limit based on 100% effluent sample.

A.11.5 Potential Incremental Impact Summary

The evaluation of WET test results is similar under the Policy compared to the existing permit. Thus, incremental costs will likely be zero.

There will be no acute monitoring under the Policy, as shown in the table below. Chronic monitoring will be monthly, but with one species (most sensitive) and single-concentration tests. In addition, there is no incremental cost associated with initial RP monitoring (chronic three-species testing) because the permit already requires such testing annually.

Routine Monitoring: Red Bluff WWTP

Component	Baseline	Policy	Incremental
Acute			
Frequency	12/yr	NA	NA
# Species	1	NA	NA
Test type	Single concentration	NA	NA
Unit cost	$347 (*Oncorhynchus mykiss*)	NA	NA
Annual cost	$4,158	NA	-$4,158
Chronic			
Frequency	1/yr	12/yr	NA
# Species	3	1	NA
Test type	Multiple dilutions	Single concentration	NA
Unit costs	$1,221 (*Ceriodaphnia dubia*) $1,290 (*Pimephales promelas*) $813 (*Selenastrum capricornutum*)	$609 (Uncertain[1])	NA
Annual cost	$3,324	$7,309	$3,985

NA = not applicable.

1. Uncertain which species is most sensitive based on Policy results; cost represents average of freshwater species.

Thus, total incremental cost savings for the discharger may be $173 per year.

A.12 Sacramento Regional WWTP

The following sections document the incremental compliance analysis for the sample facility.

A.12.1 Facility Information

The following exhibit summarizes general information about the facility.

General Information: Sacramento Regional WWTP

Name	Sacramento Regional WWTP
NPDES No.	CA0077682
Category	Major municipal
Flow (mgd)	181
Receiving water	Sacramento River
Existing treatment level	Secondary
Existing treatment train	Treatment operation consists of coarse screening, aerated grit chambers, primary sedimentation, pure oxygen activated sludge, secondary clarification, and disinfection using chlorination/dechlorination systems.

A.12.2 Existing Permit Requirements

The following exhibit summarizes the existing permit requirements related to WET testing for the sample facility.

Permit Requirements: Sacramento Regional WWTP

Permit issue date	8/4/2000
Permit expiration date	8/1/2005
Dilution	None
Acute monitoring	Weekly; 1 species (*Pimephales promelas*)
Acute limits	Survival of aquatic organisms in 96-hour bioassays of undiluted waste of no less than 70%, minimum for any one bioassay; and 90%, median for any 3 consecutive bioassays.
Chronic monitoring	Quarterly; 3 species (*Pimephales promelas*, *Ceriodaphnia dubia*, *Selenastrum capricornutum*); standard 5 dilution series (ranging from 100 to 6.25 percent sample)
Chronic limits	None
Accelerated monitoring trigger	TU >= 8
TRE trigger	Follow-up chronic test within 9 days >= 8 TU
Resume regular testing condition	If the follow up sample demonstrates an NOEC of < 8 TUs, the Discharger shall conduct 2 additional weekly chronic data points from the same sample location on the affected test species to check for persistent toxicity. If there is no further significant toxicity shown on the follow up samples, the accelerated monitoring can be discontinued and event monitoring will resort to the regular schedule.

A.12.3 Baseline Compliance

The following tables summarize WET data from 1/2/06 to 7/21/08 under the existing permit.

Baseline Compliance, Acute Toxicity: Sacramento Regional WWTP

Species	*Pimephales promelas*
Test	Survival
# of tests	134
# exceeding limit	7

Baseline Compliance, Chronic Toxicity: Sacramento Regional WWTP

Ceriodaphnia dubia	
Test	Survival and reproduction
# of tests	10
# exceeding accelerated monitoring trigger	4
# exceeding TRE trigger	3
Pimephales promelas	
Test	Survival and growth
# of tests	10
# exceeding accelerated monitoring trigger	1
# exceeding TRE trigger	0
Selenastrum capricornutum	
Test	Growth
# of tests	12
# exceeding accelerated monitoring trigger	0
# exceeding TRE trigger	0

The discharger exceeded limits and both accelerated monitoring and TRE triggers for acute and chronic toxicity over the period of the data.

A.12.4 Policy Analysis

The discharger has RP under the Policy because it is a WWTP; the projected chronic toxicity effluent limit is 1 TUc. The following table summarizes WET data from 1/2/06 to 7/21/08 under the Policy.

Effluent Data Analysis under the Policy, Chronic Toxicity: Sacramento Regional WWTP

Ceriodaphnia dubia	
Test	Survival and reproduction
# of tests	13
# exceedances	13
Pimephales promelas	
Test	Survival and growth
# of tests	10
# exceedances	6
Selenastrum capricornutum	
Test	Growth
# of tests	12

Effluent Data Analysis under the Policy, Chronic Toxicity: Sacramento Regional WWTP

# exceedances	1

Based on the analysis of effluent data under the Policy, *Ceriodaphnia dubia* is the most sensitive species and would be used to assess compliance with the projected effluent limit. All of the test results exceed the projected effluent limit based on 100% effluent sample.

A.12.5 Potential Incremental Impact Summary

Given the number of exceedances under the Policy, the facility would likely need to conduct accelerated monitoring and a TRE. However, as a result of baseline toxicity, the facility has been conducting a TRE since April 2004 (SRCSD, 2008). Thus, incremental controls costs are likely zero.

There will be no acute monitoring under the Policy, as shown in the table below. Chronic monitoring will be monthly, but with one species (most sensitive) and single-concentration tests. In addition, there is no incremental cost associated with initial RP monitoring (chronic three-species testing) because the permit already requires such testing quarterly.

Routine Monitoring: Sacramento Regional WWTP

Component	Baseline	Policy	Incremental
Acute			
Frequency	52/yr	NA	NA
# Species	1	NA	NA
Test type	Single concentration	NA	NA
Unit cost	$308 (*Pimephales promelas*)	NA	NA
Annual cost	$15,995	NA	-$15,995
Chronic			
Frequency	4/yr	12/yr	NA
# Species	3	1	NA
Test type	Multiple dilutions	Single concentration	NA
Unit costs	$1,221 (*Ceriodaphnia dubia*) $1,290 (*Pimephales promelas*) $813 (*Selenastrum capricornutum*)	$639 (*Ceriodaphnia dubia*)	NA
Annual cost	$13,295	$7,671	-$5,624

NA = not applicable.

Thus, total incremental cost savings for the discharger may be $21,619 per year.

A.13 Shell Oil, Martinez Refinery

The following sections document the incremental compliance analysis for the sample facility.

A.13.1 Facility Information

The following exhibit summarizes general information about the facility.

General Information: Shell Oil, Martinez Refinery

Name	Shell Oil, Martinez Refinery
NPDES No.	CA0005789
Category	Major industrial (petroleum refining)
Flow (mgd)	6.7
Receiving water	Carquinez Strait
Existing treatment level	Tertiary
Existing treatment train	The treatment system consists of 3 oil-water separators, 4 dissolved nitrogen flotation units, a number of equalization and diversion tanks, 2 activated sludge biological treatment systems, a number of ponds, a chemical precipitation unit for the removal of selenium, and a GAC adsorption system for polishing treated wastewater.

A.13.2 Existing Permit Requirements

The following exhibit summarizes the existing permit requirements related to WET testing for the sample facility.

WET Permit Requirements: Shell Oil, Martinez Refinery

Permit issue date	10/11/2006
Permit expiration date	10/31/2011
Dilution	10:1
Acute monitoring	Weekly; 1 species (*Oncorhynchus mykiss*)
Acute limits	The survival of organisms in undiluted effluent 11-sample median value of not less than 90%, and 11-sample 90^{th} percentile value of not less than 70%.
Chronic monitoring	Quarterly; 1 species (*Americamysis bahia*); 100%, 50%, 25%, 10%, and 5%, and 2.5% dilutions; 3-species screening for sensitive species at permit reissuance.
Chronic limits	A single-sample value of <= 10 TUc
Accelerated monitoring trigger	A single-sample value > 10 TUc. Accelerated monitoring shall consist of monthly monitoring.
TRE trigger	If accelerated monitoring data points continue to exceed the evaluation parameter, then the Discharger shall initiate a chronic TRE.
Resume regular testing condition	If data from accelerated monitoring data points are found to be in compliance with the evaluation parameter, then regular monitoring shall be resumed.

A.13.3 Baseline Compliance

The following tables summarize WET data from 5/6/06 to 5/31/08 under the existing permit.

Baseline Compliance, Acute Toxicity: Shell Oil, Martinez Refinery

Species	*Oncorhynchus mykiss*
Test	Survival
# of tests	109
# exceeding limit	0
# exceeding accelerated monitoring trigger	0

Baseline Compliance, Chronic Toxicity: Shell Oil, Martinez Refinery

Species	*Americamysis bahia*
Test	Growth and Survival
# of tests	9
# exceeding limit	0
# exceeding accelerated monitoring trigger	0
# exceeding TRE trigger	0

The discharger is in compliance under the existing permit for the period of data.

A.13.4 Policy Compliance

Regional Water Boards can allow dilution at their discretion. However, assuming that the facility would receive a dilution ratio of 10:1 as in the existing permit, the IWC would represent a 10% effluent sample.

The following table summarizes WET data from 5/6/06 to 5/31/08 under the Policy based on comparison of 10% effluent sample to a control.

Analysis of Effluent Data under the Policy, Chronic Toxicity: Shell Oil, Martinez Refinery

Species	*Americamysis bahia*[1]
Test	Growth and Survival
# of tests	9
# of exceedances	1
# with mean effect >10%	2

1. EPA WET test methods for *Americamysis bahia* and *Holmesimysis costata* are the same; Based on b and α values for *Holmesimysis costata* survival and growth.

The permit indicates that *Americamysis bahia* is the most sensitive species. Based on these data, the discharger would have RP under the Policy because one of the samples fails the WET test and two results have a mean effect greater than 10%.

The projected effluent limit is 1.0 TUc, and compliance with this limit would be based on 10% effluent sample. The monitoring data in the table indicate one exceedance of the projected chronic limit based on existing data. (Note that existing data may not be indicative of results under the TST because the discharger may increase the number of replicates to increase the power of the test.) Under the Policy, the discharger is required to conduct another single-concentration WET test within five business days of the exceedance. If this follow-up test fails, the discharger is in violation of the permit limit and must initiate accelerated monitoring consisting of 6 single-concentration tests over a 12-week period and a TRE. However, with only one exceedance of the projected limit over the period of data, it is uncertain whether the results of the follow-up test would indicate a need for accelerated monitoring and a TRE.

A.13.5 Potential Incremental Impact Summary

If the existing monitoring data (1 exceedance over 2 years) is indicative of greater potential to trigger accelerated monitoring and a TRE under the Policy compared to the existing permit, incremental costs could be $6,729 to $9,729 per year ($1,729 for follow-up and accelerated monitoring plus $5,000 to $8,000 for a TRE).3 However, the discharger may also increase the number of replicates tested under the Policy, and results may differ from the existing data. Thus, whether an incremental cost will be incurred under the Policy is uncertain.

There will be no routine acute monitoring under the Policy, as shown in the table below. Chronic monitoring will be monthly, but with single-concentration tests. In addition, incremental cost savings associated with initial RP monitoring (chronic three species testing) would likely be minimal because the permit already requires at least three multiple dilution tests per species prior to permit reissuance (the policy requires four single concentration tests per species).

Routine Monitoring: Shell Oil, Martinez Refinery

Component	Baseline	Policy	Incremental
Acute			
Frequency	52/yr	NA	NA
# Species	1	NA	NA
Test type	Single concentration	NA	NA
Unit cost	$347 (*Oncorhynchus mykiss*)	NA	NA
Annual cost	$18,018	NA	-$18,018
Chronic			
Frequency	4/yr	12/yr	NA
# Species	1	1	NA
Test type	Multiple dilutions	Single concentration	NA
Unit costs	$1,938 (*Americamysis bahia*)[1]	$1,000 (*Americamysis bahia*[1,2])	NA
Annual cost	$7,750	$12,000	$4,250

NA = not applicable.
1. EPA WET test methods for *Americamysis bahia* and *Holmesimysis costata* are the same; costs represent WET test for *Holmesimysis costata* survival and growth.
2. Assumed most sensitive species per existing permit.

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3 The cost of the follow-up test with *Americamysis bahia/Holmesimysis costata* is $1,000; costs for accelerated monitoring are $7,643 and represent the average of freshwater and marine 3-species tests multiplied by 2 (total of 6 multiple dilution chronic tests are required for 3 species); dividing by the permit term (5 years), annual costs may be $1,729 per year. TRE costs may range from $25,000 to $40,000, or $5,000 to $8,000 over the life of the permit (5 years).

Total incremental cost savings associated with routine monitoring for the discharger may be $13,768. Incremental costs associated with follow-up monitoring, accelerated monitoring, and a TRE, converted to an annual basis over a 5-year permit term ($6,729 to $9,729 per year), could reduce potential cost savings to $4,039 to $7,039 per year. Due to uncertainty associated with the need for accelerated monitoring and a TRE based on the results of the follow-up monitoring, annual cost savings could range from $12,768 (for routine and follow-up monitoring) to $4,039 (for routing and follow-up monitoring, accelerated monitoring, and a TRE).

A.14 USS-POSCO Industries

The following sections document the incremental compliance analysis for the sample facility.

A.14.1 Facility Information

The following exhibit summarizes general information about the facility.

General Information: USS-POSCO Industries

Name	USS-POSCO Industries
NPDES No.	CA0005002
Category	Major industrial (metals)
Flow (mgd)	20
Receiving water	Suisun Bay
Existing treatment level	Secondary
Existing treatment train	Oil separation, flocculation, clarification, and final pH adjustment

A.14.2 Existing Permit Requirements

The following exhibit summarizes the existing permit requirements related to WET testing for the sample facility.

WET Permit Requirements: USS-POSCO Industries

Permit issue date	5/10/2006
Permit expiration date	6/30/2011
Dilution	5:1
Acute monitoring	Biweekly; 1 species (*Oncorhynchus mykiss*)
Acute limits	The survival of organisms in undiluted effluent shall be an 11-sample median value of not less than 90 percent survival, and an 11-sample 90 percentile value of not less than 70 percent survival.
Chronic monitoring	Quarterly; 1 species (*Haliotis rufescens*); multiple concentrations; screening for most sensitive species at permit reissuance
Chronic limits	A three-sample median value of equal to or less than 5 TUc; and a single-sample maximum value of equal to or less than 10 TUc.
Accelerated monitoring trigger	Single-test value greater than 10 TUc OR single-sample value > 5 TUc AND 1 or both of previous 2 data points > 5 TUc. TUc is 100/NOEL. Accelerated monitoring is monthly.
TRE trigger	If accelerated monitoring data points continue to exceed chronic toxicity limitation(s) (i.e., any 2 consecutive accelerated monitoring data points > 5 TU_c), then the Discharger shall initiate a chronic toxicity reduction evaluation.
Resume regular testing condition	If data from accelerated monitoring data points are found to be in compliance with the chronic toxicity effluent limitations, then regular monitoring shall be resumed.

A.14.3 Baseline Compliance

The following tables summarize WET data from 3/1/06 to 5/28/08 under the existing permit.

Baseline Compliance, Acute Toxicity: USS-POSCO Industries

Species	*Oncorhynchus mykiss*
Test	Survival
# of tests	58
# exceeding limit	5

Baseline Compliance, Chronic Toxicity: USS-POSCO Industries

Species	*Haliotis rufescens*
Test	Shell development
# of tests	8
# exceeding limit	1
# exceeding accelerated monitoring trigger	1
# exceeding TRE trigger	0

The discharger has exceeded acute and chronic limits over the period of data.

A.14.4 Policy Compliance

Regional Water Boards can allow dilution at their discretion. However, assuming that the facility would receive a dilution ratio of 5:1 as in the existing permit, the IWC would represent a 20% effluent sample.

The following table summarizes WET data from 3/1/06 to 5/28/08 under the Policy. The analysis is based on comparison of 25% effluent sample to a control because the facility did not conduct tests at 20% effluent.

Analysis of Effluent Data under the Policy, Chronic Toxicity: USS-POSCO Industries

Species	*Haliotis rufescens*
Test	Shell development
Projected effluent limit or monitoring trigger	10 TUc
# of tests	8
# of exceedances	1
# with mean effect >10%	2

Based on the 25% effluent sample the discharger would have RP because there is one exceedance of the criterion and 2 test results have mean effects greater than 10%. However, an analysis of the effluent based on a 10% effluent sample, indicates that the discharger would not have RP. Thus, it is uncertain based on the available data whether the discharger would have RP under the Policy

A.14.5 Potential Incremental Impact Summary

Available effluent data indicate that the discharger is exceeding the baseline acute and chronic permit requirements. Due to data limitations, it is uncertain whether the discharger would have RP or exceed projected effluent limits under the Policy. However, because the discharger is not in compliance under the baseline, it is unlikely that there would be incremental control costs under the Policy.

There will be no routine acute monitoring under the Policy, as shown in the table below. Chronic monitoring will be monthly if there is RP. In addition, incremental cost savings associated with initial RP monitoring (chronic three species testing) would likely be minimal because the permit already requires at least three multiple dilution tests per species for permit renewal (the policy requires four single concentration tests per species).

Routine Monitoring: USS-POSCO Industries

Component	Baseline	Policy	Incremental
Acute			
Frequency	26/yr	NA	NA
# Species	1	NA	NA
Test type	Single concentration	NA	NA
Unit cost	$347 (*Oncorhynchus mykiss*)	NA	NA
Annual cost	$9,009	NA	-$9,009
Chronic			
Frequency	4/yr	12/yr	NA
# Species	1	1	NA
Test type	Multiple dilutions	Single concentration	NA
Unit costs	$1,363 (*Haliotis rufescens*)	$655 (*Haliotis rufescens* [1])	NA
Annual cost	$5,451	$7,860	$2,409

NA = not applicable.
1. Based on *Haliotis rufescens* as most sensitive species under the Policy because the permit indicates that it is the most sensitive species under the baseline.

Total incremental cost savings associated with routine monitoring for the discharger may be $6,600 per year. Thus, depending on the results of the RP analysis using a 20% effluent sample, total annual cost savings could range from $9,009 (no RP) to $6,600 (for routine monitoring under an RP scenario).

A.15 Victor Valley Regional WWTP

The following sections document the incremental compliance analysis for the sample facility.

A.15.1 Facility Information

The following exhibit summarizes general information about the facility.

General Information: Victor Valley Regional WWTP

Name	Victor Valley Regional WWTP
NPDES No.	CA0102822
Category	Major municipal
Flow (mgd)	14
Receiving water	Mojave River
Existing treatment level	Tertiary
Existing treatment train	The treatment system consists of headworks, primary clarifiers, flow equalization, aeration basins, secondary clarifiers, coagulation/flocculation, filtration, and chlorination/dechlorination, and sludge handling.

A.15.2 Existing Permit Requirements

The following exhibit summarizes the existing permit requirements related to WET testing for the sample facility.

WET Permit Requirements: Victor Valley Regional WWTP

Permit issue date	2/14/2008
Permit expiration date	4/4/2013
Dilution	None
Acute monitoring	Quarterly; 1 species (*Pimephales promelas*)
Acute limits	< 90% survival of *Pimephales promelas* in undiluted effluent in 50% of the samples in a calendar year; or < 70% survival of *Pimephales promelas* in undiluted effluent in 10% of the samples in a calendar year.
Chronic monitoring	Annually; 2 species (*Ceriodaphnia dubia, Pimephales promelas*); 100% effluent
Chronic limits	None
Accelerated monitoring trigger	Acute: survival of < 90% in 2 consecutive quarterly samples, increase frequency to once per month. Chronic: statistically significant difference between sample of 100% effluent and a control, increase frequency to once per month.
TRE trigger	If acute or chronic toxicity is detected during accelerated testing, the Discharger shall initiate a TRE within 15 days of receipt of the final acute or chronic toxicity test results in order to reduce the causes of toxicity.

WET Permit Requirements: Victor Valley Regional WWTP

Resume regular testing condition	Acute: When 3 consecutive monthly tests demonstrate a survival rate of >90%, the Discharger may resume acute WET testing at a frequency of once per calendar quarter. Chronic: When 3 consecutive accelerated monthly tests demonstrate no chronic toxicity, which is defined as WET test results not exceeding 1.0 TUc, the Discharger may resume regular chronic WET testing at a frequency of once per calendar year.

A.15.3 Baseline Compliance

The following tables summarize WET data from 1/30/07 – 4/10/08 under the existing permit.

Baseline Compliance, Acute Toxicity: Victor Valley Regional WWTP

Species	*Pimephales promelas*
Test	Survival
# of tests	6
# exceeding limit	0
# exceeding accelerated monitoring trigger	0
# exceeding TRE trigger	0

Baseline Compliance, Chronic Toxicity: Victor Valley Regional WWTP

Ceriodaphnia dubia	
Test	Survival and reproduction
# of tests	2
# exceeding accelerated monitoring trigger	0
# exceeding TRE trigger	0
Pimephales promelas	
Test	Survival and teratogenicity
# of tests	3
# exceeding accelerated monitoring trigger	0
# exceeding TRE trigger	0

The discharger is in compliance with WET requirements in the current permit.

A.15.4 Policy Compliance

The discharger has RP under the Policy because it is a WWTP; the projected chronic toxicity effluent limit is 1 TUc. The following table summarizes WET data from 1/30/07 – 4/10/08 under the Policy.

Effluent Data Analysis under the Policy, Chronic Toxicity: Victor Valley Regional WWTP

Ceriodaphnia dubia	
Test	Survival and reproduction
# of tests	2
# exceedances	0
Pimephales promelas	
Test	Survival and teratogenicity

Effluent Data Analysis under the Policy, Chronic Toxicity: Victor Valley Regional WWTP

# of tests	3
# exceedances[1]	2

1. Based on survival results only.

Under the Policy, the discharger will have to conduct three-species screening to determine the most sensitive species for chronic monitoring. Existing data are only available for *Ceriodaphnia dubia* and *Pimephales promelas*. The discharger would exceed the projected effluent limits for *Pimephales promelas* based on a 100% effluent sample.

Under the Policy the discharge would need to conduct a follow up test to confirm the exceedance. If that sample confirmed the exceedance, accelerated monitoring (6 samples over a 12 week period) and a TRE would be necessary.

A.15.5 Potential Incremental Impact Summary

The evaluation of WET test data under the existing permit indicates compliance. However, under the Policy, the WET test results indicate a need for a follow-up test and, depending on the outcome, accelerated monitoring and a TRE. (Existing data may not be indicative of the results obtained under the Policy as the discharger may increase the number of replicates to increase the power of the test.)

Follow-up monitoring costs could be approximately $609 based on the average test cost for freshwater species. If the follow-up monitoring results in an exceedance, incremental costs associated with accelerated monitoring would be $6,547 based on 6 multiple dilution chronic tests for 3 freshwater species; TRE costs range from $25,000 to $40,000. Thus, total control costs may range from $32,156 to $47,156; dividing over the period of the permit (5 years), annual costs may range from $6,431 to $9,431 per year.

There will be no acute monitoring under the Policy, as shown in the table below. Chronic monitoring will be monthly, but with one species (most sensitive) and single-concentration tests.

Routine Monitoring: Victor Valley Regional WWTP

Component	Baseline	Policy	Incremental
Acute			
Frequency	4/yr	NA	NA
# Species	1	NA	NA
Test type	Single concentration	NA	NA
Unit cost	$308 (*Pimephales promelas*)	NA	NA
Annual cost	$1,230	NA	-$1,230
Chronic			
Frequency	1/yr	12/yr	NA
# Species	2	1	NA
Test type	Single concentration	Single concentration	NA
Unit costs	$639 (*Ceriodaphnia dubia*) $725 (*Pimephales promelas*)	$609 (Uncertain[1])	NA
Annual cost	$1,364	$7,309	$5,945

Routine Monitoring: Victor Valley Regional WWTP

Component	Baseline	Policy	Incremental

NA = not applicable.
1. Sensitive species is uncertain; cost represents average of freshwater species.

Incremental costs associated with routine monitoring would be $4,715 per year. There will also be a cost of initial RP monitoring of approximately $7,078 at the beginning of each permit cycle (based on 4 samples per species and average single-concentration chronic test costs for freshwater vertebrates, invertebrates, and aquatic plants), or $1,416 per year (assuming a 5-year permit cycle). Thus, total incremental costs for compliance with the Policy may range from $12,561 to $15,561 per year (includes RP screening, routine monitoring, follow-up monitoring, accelerated monitoring, and TRE).

Summary of Whole Effluent Toxicity Test Costs

Tests of whole effluent toxicity (WET) measure the cumulative toxic effect of pollutants in a facility's effluent on aquatic organisms (vertebrates, invertebrates, and plants). The test results may indicate the potential for a discharge to cause acute and chronic toxicity in the receiving water. Regional Water Boards require municipal and industrial dischargers to conduct WET testing as part of National Pollutant Discharge Elimination System (NPDES) permits. Permittees may also conduct WET tests as part of toxicity reduction evaluations (TREs) to identify specific toxics components of a discharge or to manage the effectiveness of treatment technologies.

The California Department of Health has accredited 78 laboratories under the Environmental Laboratories Accreditation Program (ELAP) to perform WET tests. These laboratories have demonstrated capability to analyze environmental samples using approved methods (CA DHS, 2007). **Exhibit B-1** summarizes the certified laboratories that were performing WET tests from 2005 to 2007. The exhibits below provide test costs as provided by laboratories in February 2008. Note that costs may have increased since the time of collection, although the magnitude of any increases is uncertain since some laboratories do not increase costs on an annual basis and other laboratories only increase certain test costs (e.g., acute toxicity only).

Exhibit B-1. California Department of Health Certified Laboratories Performing WET Tests

Location	Number of Laboratories				
	Commercial	Municipal	Private/ Company	University	Total
North Coast RB (1)	1	0	0	0	1
San Francisco Bay RB (2)	4	30	7	0	41
Central Coast RB (3)	1	0	0	0	1
Los Angeles RB (4)	2	4	0	0	6
Central Valley RB (5)	3	9	2	1	15
Lahontan RB (6)	0	0	0	0	0
Colorado River RB (7)	1	0	0	0	1
Santa Ana RB (8)	3	1	0	0	4
San Diego RB (9)	2	2	0	0	4
Colorado	1	0	0	0	1
Iowa	0	0	0	1	1
Minnesota	1	0	0	0	1
Oregon	1	0	0	0	1
Tennessee	1	0	0	0	1
Total	21	46	9	2	78

Most of the certified laboratories are located in the western part of California, with 87% located in either Region 2 (San Francisco Bay) or Region 5 (Central Valley). In addition, five laboratories are located in other states (Colorado, Iowa, Minnesota, Oregon, and Tennessee).

Commercial and university laboratories provide analytical testing services to dischargers. Testing costs are based on the test type, number of samples analyzed, and turnaround time. Municipal laboratories collect samples and perform toxicity tests onsite. These laboratories do not typically keep record of per sample testing costs; testing costs are rolled up as part of the municipality's operating budget. Company-owned laboratories are similar to municipal laboratories in that testing costs may be rolled up into the facility's operating budget. Presumably, both municipal and private industrial dischargers perform in-house testing because it is less expensive than contracting the work out to a commercial or university laboratory, or they want to perform the tests themselves. Thus, price information from commercial and university laboratories establishes market costs relevant to the potential impacts of changes in WET test requirements; these prices may overstate costs to dischargers using in-house laboratories.

Exhibit B-2 shows acute and chronic toxicity tests for fresh and marine waters.

Exhibit B-2. Aquatic Toxicity Test Types

Common Name (Species)	EPA Method	Endpoint	Test Type
Freshwater Acute Tests			
Fathead minnow (*Pimephales promelas*)	2000.0	Mortality	Static, renewal, or flow-through
Water flea (*Ceriodaphnia dubia*)	2002.0	Mortality	Static, renewal, or flow-through
Rainbow trout (*Oncorhynchus mykiss*)	2019.0	Mortality	Static, renewal, or flow-through
Brook trout (*Salvelinus fontinalis*)	2019.0	Mortality	Static, renewal, or flow-through
Water flea (*Daphnia magna*)	2021.0	Mortality	Static, renewal, or flow-through
Water flea (*Daphnia pulex*)	2021.0	Mortality	Static, renewal, or flow-through
Freshwater Chronic Tests			
Fathead minnow (*Pimephales promelas*)	1000.0	Larval survival and growth	Renewal
Fathead minnow (*Pimephales promelas*)	1001.0	Combined mortality	Renewal
Water flea (*Ceriodaphnia dubia*)	1002.0	Survival and reproduction	Renewal
Green alga (*Selenastrum capricornutum*)	1003.0	Growth	Static
Marine Acute Tests			
Sheepshead minnow (*Cyprinodon variegates*)	2004.0	Mortality	Static, renewal, or flow-through
Bannerfish shiner (*Cyprinella leedsi*)	2004.0	Mortality	Static, renewal, or flow-through
Inland silverside (*Menidia beryllina*)	2006.0	Mortality	Static, renewal, or flow-through
Silverside (*Menidia menidia*)	2006.0	Mortality	Static, renewal, or flow-through
Silverside (*Menidia peninsulae*)	2006.0	Mortality	Static, renewal, or flow-through
Mysid (*Mysidopsis bahia*)	2007.0	Mortality	Static, renewal, or flow-through

Exhibit B-2. Aquatic Toxicity Test Types

Common Name (Species)	EPA Method	Endpoint	Test Type
Topsmelt (*Atherinops affinis*)	NA	Mortality	Static, renewal, or flow-through
West Coast mysid (*Holmesimysis costata*)	NA	Mortality	Static, renewal, or flow-through
Marine Chronic Tests			
Pacific Oyster (*Crassostrea gigas*) and Mussel (*Mytilus sp.*)	1005.0	Shell development	Renewal
Topsmelt (*Atherinops affinis*)	1006.0	Survival and growth	Renewal
West Coast Mysid (*Holmesimysis costata*)	1007.0	Survival and growth	Renewal
Purple Urchin (*Strongylentrotus purpuratus*)	1008.0	Fertilization	Static
Giant Kelp (*Macrocystis pyrifera*)	1009.0	Germination and germ tube growth	Static
Purple Urchin (*Strongylentrotus purpuratus*)	NA	Embryo development	Static
Red abalone (*Haliotus rufescens*)	NA	Larval development	Static

Sources: U.S. EPA (2002a); U.S. EPA (2002b); U.S. EPA (1995).
Combined mortality = dead and deformed
NA = not applicable.

Freshwater Acute Tests

There are four freshwater acute toxicity test methods for six different species. Freshwater acute toxicity tests measure species mortality over a specified duration, usually 24, 48, or 96 hours. **Exhibit B-3** shows summary statistics for sample costs.

Exhibit B-3. Per Sample Costs for Freshwater Acute Toxicity Tests

Test Type	N	Per Sample Costs		
		Average	Minimum	Maximum
Static				
Single concentration	32	$289	$160	$450
Multiple concentration	35	$518	$240	$1,000
Renewal				
Single concentration	26	$353	$150	$500
Multiple concentration	45	$615	$300	$1,800

N = number of per test costs available from certified commercial and university labs performing WET tests.

As shown in the exhibit, costs for each test type (e.g., single and multiple concentrations) do not vary greatly between static and renewal tests. For example, the minimum static single concentration cost is $160, which is only $10 greater than the minimum renewal single concentration cost; there is only a $50 difference between the maximum single concentration costs for static and renewal tests.

Although the range of costs for each test type appears to be large, there is a relatively small range in which most of the costs fall. For example, **Exhibit B-4** shows the price ranges in which most observations fall.

Exhibit B-4. Frequency of Test Prices, Freshwater Acute Toxicity

Test Type	Price Range	Percent of Test Prices within Range
Static, single concentration	$200 - $400	78%
Static, multiple concentration	$300 - $500	69%
Renewal, single concentration	$300 - $500	88%
Renewal, multiple concentration	$350 - $550	67%

In addition, removing high outlier values from one laboratory reduces the maximum sample cost for static and renewal multiple-concentration tests to $900 and $775, respectively.

Freshwater Chronic Tests

There are four freshwater chronic toxicity test methods for three different species. Freshwater chronic toxicity tests measure a variety of endpoints depending on the species and test method (e.g., larval survival and growth or combined mortality). **Exhibit B-5** shows summary statistics for sample costs.

Exhibit B-5. Per Sample Costs for Freshwater Chronic Toxicity Tests

Test Type	N	Per Sample Costs		
		Average	Minimum	Maximum
Static				
Single concentration	5	$463	$315	$600
Multiple concentration	11	$854	$400	$1,700
Renewal				
Single concentration	14	$653	$450	$1,200
Multiple concentration	29	$1,200	$355	$2,700

N = number of per test costs available from certified commercial and university labs performing WET tests.

As shown in the exhibit, the range of costs for all test types except static single-concentration tests is significant. For the static multiple-concentration tests, there is one outlier laboratory that reports a cost of $1,700 per test; removing this value, costs range from $400 to $1,000 with 70% of the costs ranging from $600 to $900 per test. There are also outliers for the renewal tests. One laboratory reports a cost of $1,200 for renewal single-concentration tests. Removing this value, costs would range from $450 to $900, with 77% of the costs ranging from $450 and $600 per test. One laboratory reports 3 different test costs ranging from $2,400 to $2,700; these costs are approximately 30% greater than the next highest sample cost. Removing these outliers, renewal multiple concentration costs would range from $355 to $1,650 per test, with 70% ranging from around $950 to $1,250 per test. **Exhibit B-6** summarizes these frequencies.

Exhibit B-6. Frequency of Test Prices (without Outliers), Freshwater Chronic Toxicity

Test Type	Price Range[1]	Percent of Test Prices within Range[1]
Static, multiple concentration	$600 - $900	70%
Renewal, single concentration	$450 - $600	77%
Renewal, multiple concentration	$950 - $1,250	70%

1. High outlier prices removed.

Marine Acute Tests

There are five marine acute toxicity test methods for seven different species. Marine acute toxicity tests measure species mortality over a specified duration, usually 24, 48, or 96 hours. **Exhibit B-7** shows summary statistics for sample costs.

Exhibit B-7. Per Sample Costs for Marine Acute Toxicity Tests

Test Type	N	Per Sample Costs		
		Average	Minimum	Maximum
Static				
Single concentration	5	$309	$170	$450
Multiple concentration	18	$574	$340	$750
Renewal				
Single concentration	10	$435	$250	$600
Multiple concentration	29	$881	$500	$1,750

N = number of per test costs available from certified commercial and university labs performing WET tests.

Static single-concentration test costs represent costs from only two laboratories and three test types, and renewal single-concentration test costs represent costs from three laboratories and three test types. Combining the static and renewal single-concentration test costs would result in an average test cost of approximately $400 (or about the midpoint of the range between the separate averages).

All of the static multiple-concentration test costs greater than the average are from one laboratory, which reports the same cost for every test method it offers. The same is true of the renewal multiple concentration costs, except the costs range from $1,575 to $1,750 per test. Thus, the difference in costs may be a function of the laboratory and not test method. **Exhibit B-8** shows the effect of removing these outlier values on average costs.

Exhibit B-8. Comparison of Average Test Prices, Marine Acute Toxicity

Test Type	Average of All Prices	Average with Outliers Removed
Static, multiple concentration	$574	$486
Renewal, multiple concentration	$881	$677

Marine Chronic Tests

There are seven marine chronic toxicity test methods for seven different species. Marine chronic toxicity tests measure a variety of endpoints depending on the species and test method (e.g., fertilization or embryo development). **Exhibit B-9** shows summary statistics for sample costs.

Exhibit B-9. Per Sample Costs for Marine Chronic Toxicity Tests

Test Type	N	Per Sample Costs		
		Average	Minimum	Maximum
Static				
Single concentration	13	$694	$375	$1,050
Multiple concentration	26	$1,275	$400	$2,000
Renewal				
Single concentration	10	$838	$480	$1,600
Multiple concentration	19	$1,526	$940	$3,000

N = number of per test costs available from certified commercial and university labs performing WET tests.

Static single-concentration test costs are variable, and the minimum and maximum renewal single and multiple-concentration test costs differ by more than a factor of three. **Exhibit B-10** shows the frequency of prices ranges for static single and multiple concentration toxicity tests.

Exhibit B-10. Frequency of Test Prices, Marine Chronic Toxicity

Test Type	Price Range	Number of Observations
Static, single concentration	≤$500	4
	>$500 and ≤$750	4
	>$750	5
Static, multiple concentration	≤$800	3
	>$800 and ≤1,200	11
	>$1,200 and ≤$1,600	8
	>$1,600	4
Renewal, single concentration	≤$500	3
	>$500 and ≤$1,000	5
	>$1,000	2
Renewal, multiple concentration	≤$1,000	1
	>$1,000 and ≤$1,500	12
	>$1,500 and ≤$2,000	4
	>$2,000	2

Both renewal single-concentration test costs greater than $1,000 are from the same laboratory and both renewal multiple-concentration test costs greater than $2,000 are from the same laboratory.

Detailed Toxicity Test Cost Data

Exhibits B-11 and B-12 summarize the available cost data for each of the freshwater and marine acute toxicity tests from the certified laboratories. **Exhibits B-13 and B-14** summarize cost data for chronic toxicity tests for vertebrates, invertebrates, and aquatic plants from the certified laboratories.

Exhibit B-11. Freshwater Acute Toxicity Testing Costs

Name	EPA Method	Type	N	Range (2007 Price)	Average (2007 Price)
Fathead minnow (*Pimephales promelas*)	2000.0	SC, static	14	$160 - $425	$268
Fathead minnow (*Pimephales promelas*)	2000.0	SC, static renewal	11	$200 - $500	$358
Fathead minnow (*Pimephales promelas*)	2000.0	MC, static	10	$240 - $750	$449
Fathead minnow (*Pimephales promelas*)	2000.0	MC, static renewal	16	$350 - $1,640	$607
Brook trout (*Salvelinus fontinalis*)	2019.0	SC, static	1	$450	$450
Brook trout (*Salvelinus fontinalis*)	2019.0	MC, static	1	$750	$750
Brook trout (*Salvelinus fontinalis*)	2019.0	MC, static renewal	2	$750 - $1,800	$1,275
Rainbow trout (*Oncorhynchus mykiss*)	2019.0	SC, static	6	$225 - $450	$319
Rainbow trout (*Oncorhynchus mykiss*)	2019.0	SC, static renewal	4	$300 - $750	$475
Rainbow trout (*Oncorhynchus mykiss*)	2019.0	MC, static	5	$350 - $900	$676
Rainbow trout (*Oncorhynchus mykiss*)	2019.0	MC, static renewal	8	$500 - $1,800	$750
Water flea (*Ceriodaphnia dubia*)	2002.0	SC, static	9	$160 - $425	$287
Water flea (*Ceriodaphnia dubia*)	2002.0	SC, static renewal	7	$150 - $400	$329
Water flea (*Ceriodaphnia dubia*)	2002.0	MC, static	11	$240 -$815	$460
Water flea (*Ceriodaphnia dubia*)	2002.0	MC, static renewal	13	$300 - $750	$479
Water flea (*Daphnia magna*)	2021.0	SC, static	5	$250 - $300	$260
Water flea (*Daphnia magna*)	2021.0	SC, static renewal	4	$350	$350
Water flea (*Daphnia magna*)	2021.0	MC, static	7	$300 - $1,000	$493
Water flea (*Daphnia magna*)	2021.0	MC, static renewal	5	$500 - $550	$540
Water flea (*Daphnia pulex*)	2021.0	MC, static	1	$1,000	$1,000
Water flea (*Daphnia pulex*)	2021.0	MC, static renewal	1	$500	$500

MC = multiple concentration
N = number of per test costs available from certified commercial and university labs performing WET tests
SC = single concentration.

Exhibit B-12. Marine Acute Toxicity Testing Costs

Name	EPA Method	Type	N	Range (2007 Price)	Average (2007 Price)
Sheepshead minnow (*Cyprinodon variegatus*)	2004.0	MC, static	4	$500 - $750	$563
Sheepshead minnow (*Cyprinodon variegatus*)	2004.0	MC, static renewal	1	$600 - $1,575	$825
Inland silverside (*Menidia beryllina*)	2006.0	SC, static	2	$170 - $450	$310
Inland silverside (*Menidia beryllina*)	2006.0	SC, renewal	3	$250 - $525	$425
Inland silverside (*Menidia beryllina*)	2006.0	MC, static	3	$340 - $750	$530
Inland silverside (*Menidia beryllina*)	2006.0	MC, static renewal	6	$500 - $1,750	$846
Silverside (*Menidia menidia*)	2006.0	MC, static	1	$750	$750
Silverside (*Menidia menidia*)	2006.0	MC, static renewal	2	$750 - $1,750	$1,250
Silverside (*Menidia peninsulae*)	2006.0	MC, static	1	$750	$750
Silverside (*Menidia peninsulae*)	2006.0	MC, static renewal	2	$750 - $1,750	$1,250
Topsmelt (*Atherinops affinis*)	NA	SC, static	1	$175	$175
Topsmelt (*Atherinops affinis*)	NA	SC, static renewal	3	$250 -$ 525	$425
Topsmelt (*Atherinops affinis*)	NA	MC, static	2	$345 - $550	$448
Topsmelt (*Atherinops affinis*)	NA	MC, static renewal	3	$500 - $775	$675
West Coast mysid (*Holmesimysis costata)*	NA	SC, static	1	$300	$300
West Coast mysid (*Holmesimysis costata)*	NA	SC, static renewal	1	$600	$600
West Coast Mysid (*Holmesimysis costata)*	NA	MC, static	2	$600 - $750	$675
West Coast Mysid (*Holmesimysis costata)*	NA	MC, static renewal	3	$750 - $1,575	$1,058
Mysid (*Mysidopsis bahia*)	2007.0	SC, static	1	$450	$450
Mysid (*Mysidopsis bahia*)	2007.0	SC, static renewal	3	$250 - $500	$400
Mysid (*Mysidopsis bahia*)	2007.0	MC, static	5	$500 - $750	$550
Mysid (*Mysidopsis bahia*)	2007.0	MC, static renewal	8	$500 - $1,575	$769

MC = multiple concentration
N = number of per test costs available from certified commercial and university labs performing WET tests
NA = not applicable
SC = single concentration.

Exhibit B-13. Freshwater Chronic Toxicity Testing Costs

Name	EPA Method	Type	N	Range (2007 Price)	Average (2007 Price)
Vertebrates					
Fathead minnow (*Pimephales promelas*)	1000.0	SC, static renewal	2	$600 - $850	$725

Exhibit B-13. Freshwater Chronic Toxicity Testing Costs

Name	EPA Method	Type	N	Range (2007 Price)	Average (2007 Price)
Fathead minnow (*Pimephales promelas*)	1000.0	MC, static renewal	5	$550 - $2,700	$1,290
Fathead minnow (*Pimephales promelas*)	1001.0	SC, static renewal	5	$450 - $1,200	$644
Fathead minnow (*Pimephales promelas*)	1001.0	MC, static renewal	8	$945 - $1,650	$1,208
Invertebrates					
Water flea (*Ceriodaphnia dubia)*	1002.0	SC, static renewal	7	$450 - $950	$639
Water flea (*Ceriodaphnia dubia)*	1002.0	MC, static renewal	15	$500 - $2,400	$1,221
Aquatic Plants					
Green Alga (*Selenastrum capricornutum*)	1003.0	SC, static	5	$315 - $600	$463
Green Alga (*Selenastrum capricornutum*)	1003.0	MC, static	11	$400 - $1,700	$854
Green Alga (*Selenastrum capricornutum*)	1003.0	MC, static renewal	1	$355	$355

MC = multiple concentration
N = number of per test costs available from certified commercial and university labs performing WET tests
SC = single concentration.

Exhibit B-14. Marine Chronic Toxicity Testing Costs

Name	EPA Method	Type	N	Range (2007 Price)	Average (2007 Price)
Vertebrates					
Topsmelt (*Atherinops affinis*)	1006.0	SC, static renewal	6	$480 - $1,600	$763
Topsmelt (*Atherinops affinis*)	1006.0	MC, static renewal	9	$940 - $3,000	$1,499
Invertebrates					
Mussel (*Mytilus sp.*)	1005.0	SC, static	1	$750	$750
Mussel (*Mytilus sp.*)	1005.0	SC, static renewal	1	$900	$900
Mussel (*Mytilus sp.*)	1005.0	MC, static	1	$1,500	$1,500
Mussel (*Mytilus sp.*)	1005.0	MC, static renewal	3	$1,100 - $1,850	$1,350
Pacific Oyster (*Crassostrea gigas*)	1005.0	SC, static renewal	1	$900	$900
Pacific Oyster (*Crassostrea gigas*)	1005.0	MC, static	1	$1,550	$1,550
Pacific Oyster (*Crassostrea gigas*)	1005.0	MC, static renewal	3	$1,100 - $1,850	$1,350
West Coast Mysid (*Holmesimysis costata)*	1007.0	SC, static renewal	2	$500 - $1,500	$1,000
West Coast Mysid (*Holmesimysis costata)*	1007.0	MC, static renewal	4	$1,250 - $2,800	$1,938
Purple Urchin (*Strongylentrotus purpuratus*)	1008.0	SC, static	4	$375 - $900	$600
Purple Urchin (*Strongylentrotus purpuratus*)	1008.0	MC, static	9	$400 - $1,500	$1,083

Exhibit B-14. Marine Chronic Toxicity Testing Costs

Name	EPA Method	Type	N	Range (2007 Price)	Average (2007 Price)
Purple Urchin (*Strongylentrotus purpuratus*)	NA	SC, static	1	$900	$900
Purple Urchin (*Strongylentrotus purpuratus*)	NA	MC, static	2	$1,100	$1,100
Purple Urchin (*Strongylentrotus purpuratus*)	NA	MC, static renewal	1	$1,500	$1,500
Red Abalone (*Haliotus rufescens*)	NA	SC, static	4	$420 - $900	$655
Red Abalone (*Haliotus rufescens*)	NA	MC, static	7	$840 - $1,950	$1,363
Aquatic Plants					
Giant Kelp (*Macrocystis pyrifera*)	1009.0	SC, static	3	$600 - $1,050	$783
Giant Kelp (*Macrocystis pyrifera*)	1009.0	MC, static	6	$1,000 - $2,000	$1,433

MC = multiple concentration

N = number of per test costs available from certified commercial and university labs performing WET tests

NA = not applicable

SC = single concentration.

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