Policy for Toxicity Assessment and Control

Draft Staff Report and Environmental Checklist

June 2012

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 draft Policy for Toxicity Assessment and Control (Policy) include a consistent statistical approach 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) or conditional waivers.

Toxicity occurs when the effects of pollutants negatively impact beneficial uses; when originating from an effluent, these effects are typically referred to as "whole effluent toxicity" (WET). Toxicity tests estimate the 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 monitoring provides a vital tool to assess the chronic and acute effects of a given discharge. Toxicity tests alert dischargers to the presence of undefined pollutants that may later be determined through a toxicity identification evaluation (TIE). Additionally, toxicity testing can demonstrate the aggregate effects of pollutant mixtures, which cannot be done with current chemical methodologies. The necessity of toxicity monitoring is further underscored in a report compiled by the State Water Board's Surface Water Ambient Monitoring Program or SWAMP. Of the 922 water bodies sampled, 473 (48%) produced at least one sample (water or sediment) that demonstrated toxicity, while 129 of these were classified as "high toxicity sites" based on the average result of the most sensitive test species (State Water Board 2010)

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 for acute toxicity monitoring (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 TIE if needed. 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 Draft Policy

The draft Policy was developed to fulfill Item 4 of State Water Board Resolution No. 2005-0019, and to improve upon existing toxicity regulations established in the Basin Plans and the SIP. Although the SIP establishes minimum chronic toxicity testing requirements, numerous inconsistencies persist among permits, while many dischargers are not required to monitor toxicity at all. The draft Policy seeks to resolve these discrepancies by creating a consistent, yet flexible regulatory framework for monitoring toxicity in discharges to inland surface waters, enclosed bays, and estuaries statewide. Through incorporation of U.S. EPA's new statistical approach, the draft Policy will also improve toxicity data interpretation and improve incentives for high quality laboratory work. Lastly, the numeric objectives and permit limitations proposed in the draft Policy will provide a compliance-driven approach to toxicity regulation that stands to improve efficiency and afford greater protection to aquatic life beneficial uses (see Section IV for an in-depth analysis of the provisions proposed in the draft Policy).

Purpose of the Staff Report

Pursuant to California Code of Regulations, title 23, section 3777, this Staff Report is a component 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 (Cal. Code Regs., tit.14, §15251, subd. (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, Wat. Code, § 13000 et seq.) 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" (Wat. Code §13050, subd. (f)). Regulatory protection of beneficial uses is carried out, in part, through water quality objectives established in each Basin Plan (Wat. Code §13241).

In 1972, Congress enacted the federal Clean Water Act with the goal to "restore and maintain the chemical, physical, and biological integrity of the Nation's waters" (33 U.S.C., §1251(a)). To achieve this goal, the Clean Water Act established the NPDES Permit Program to regulate point source discharges of pollutants to waters of the United States (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 (Wat. Code §13377). 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 (33 U.S.C. § 1311(b)(1)(A)-(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 303, subdivision (c)(2)(B) of the Clean Water Act requires states to adopt water quality criteria for all priority pollutants established in section 307(a). To comply with section 303, subdivision (c)(2)(B), the State Water Board adopted both 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 303, subdivision (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 Clean Water Act, 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 NPDES permits. However, MMPs do not apply to chronic or acute toxicity violations unless an NPDES permit is devoid of pollutant-specific effluent limitations. For applicable violations, 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 appropriate. Water Code section 13385, subdivision (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 an NPDES 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 section 13260 or; violates a toxicity effluent limitation where the permit does 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 amended Enforcement Policy, violations of acute or chronic toxicity requirements, where the discharge may adversely affect fish or wildlife, are 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 (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).

If adopted, the Policy will supersede Section 4 of the SIP, as well as the Basin Plan provisions establishing specific toxicity test methods and data analysis approaches. However, the policy will not supersede the narrative toxicity objectives established in each of the ten Basin Plans

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 toxicity 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.

SECTION III: ENVIRONMENTAL SETTING

For the purposes of water quality management, Water Code section 13200 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.

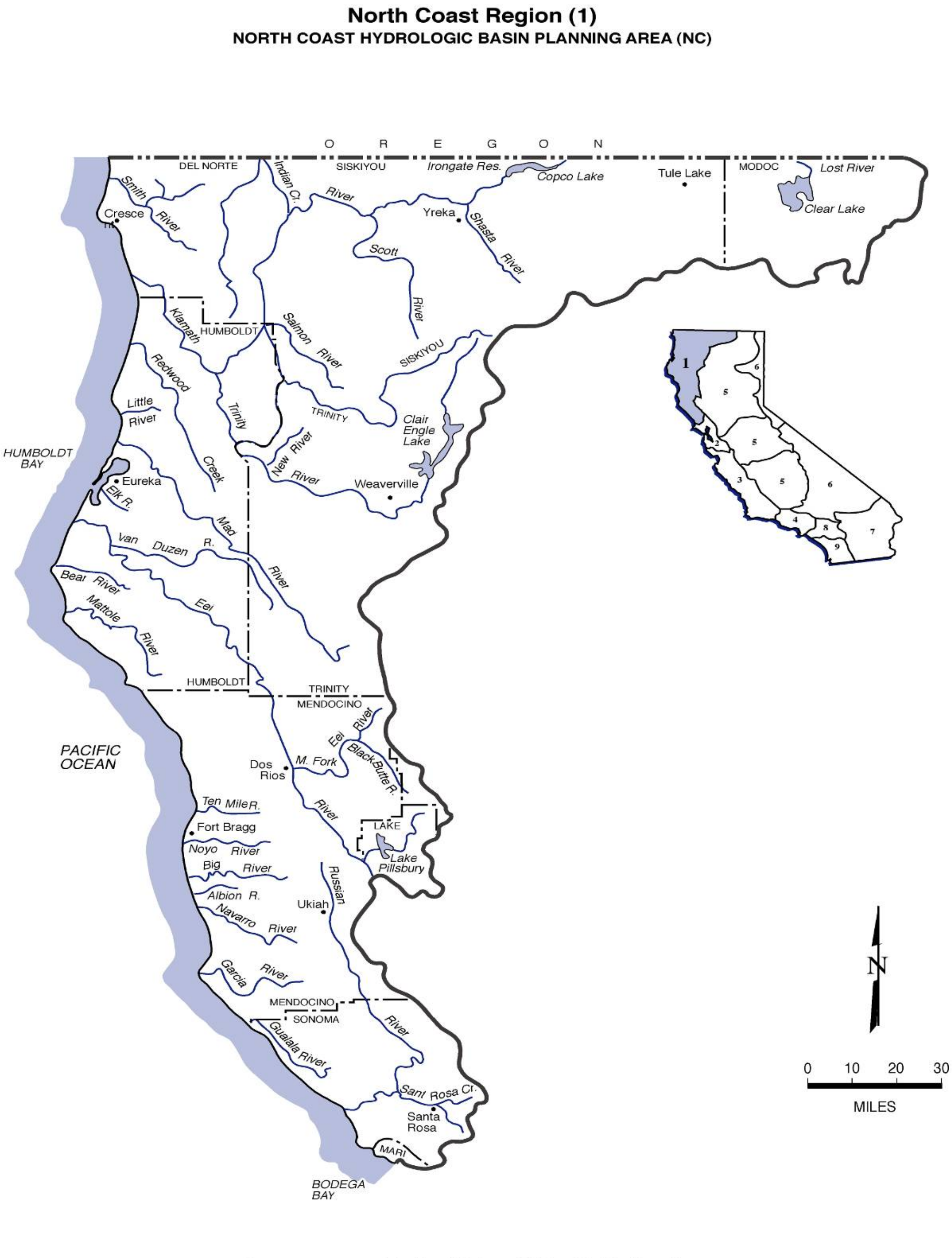


Figure 1: North Coast Region Hydrologic Basin

The 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.

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.

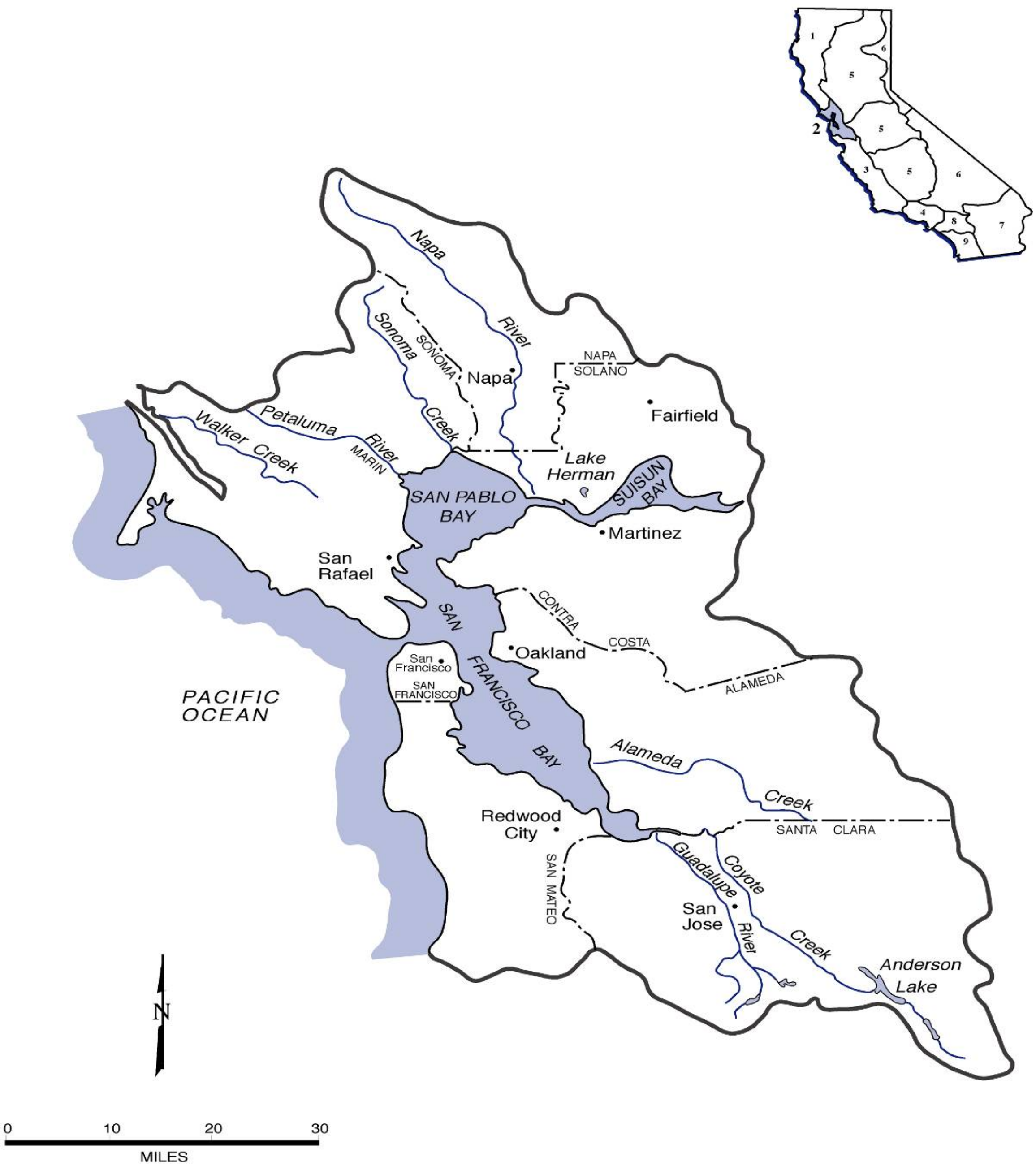
The Region comprises most of the San Francisco Estuary to the mouth of the Sacramento-San Joaquin Delta. The San Francisco Estuary conveys the waters of the Sacramento and San Joaquin Rivers to the Pacific Ocean. Located on the central coast of California, the Bay system functions as the only drainage 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.

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)

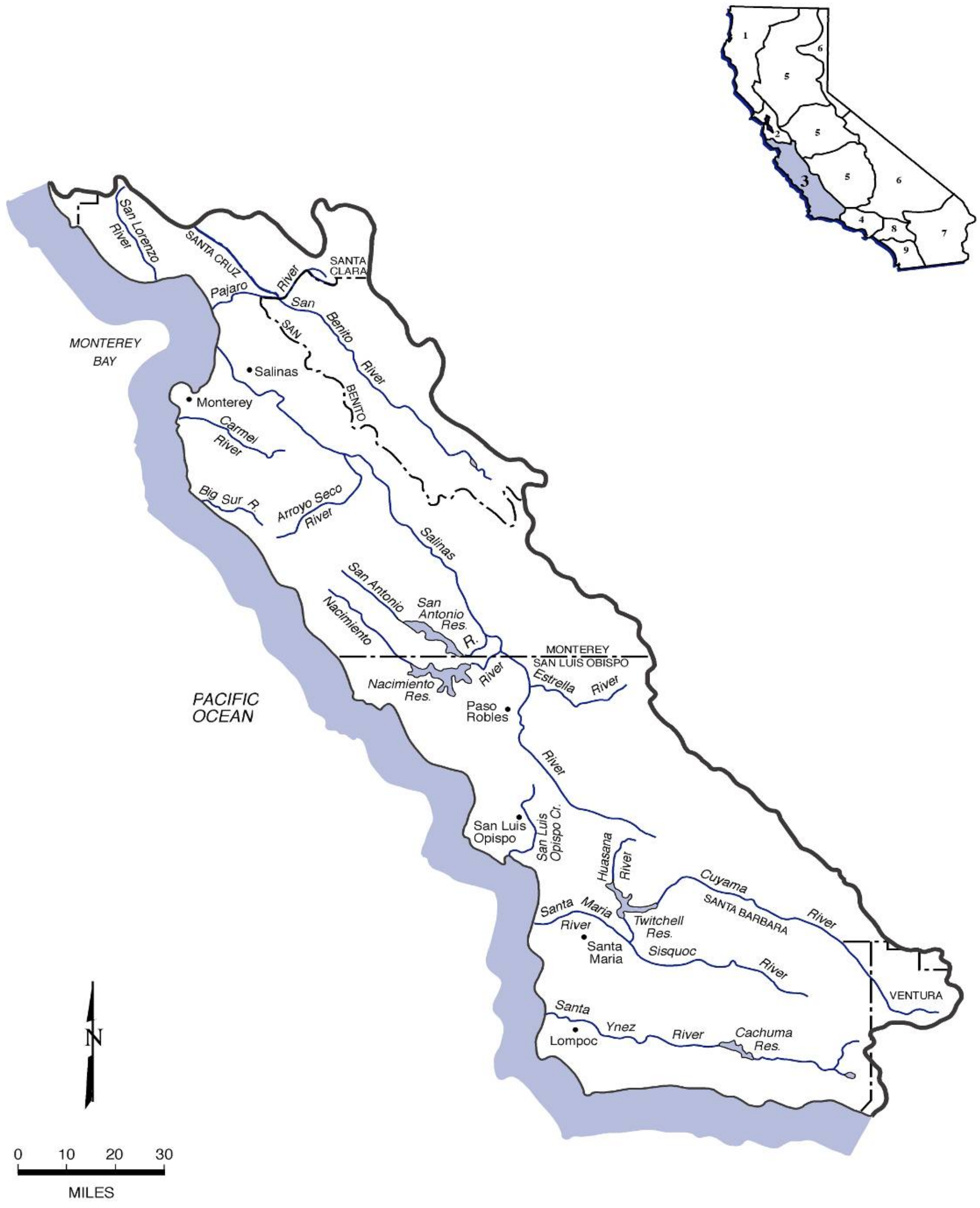
The Central Coast Region comprises all basins (including Carrizo Plain in San Luis Obispo and Kern Counties) draining into the Pacific Ocean from the southern boundary of the Pescadero Creek watershed in San Mateo and Santa Cruz Counties, to the southeastern boundary of the Rincon Creek watershed, located 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.

Central Coast Region (3)
CENTRAL COAST HYDROLOGIC BASIN PLANNING AREA (CC)



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

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.

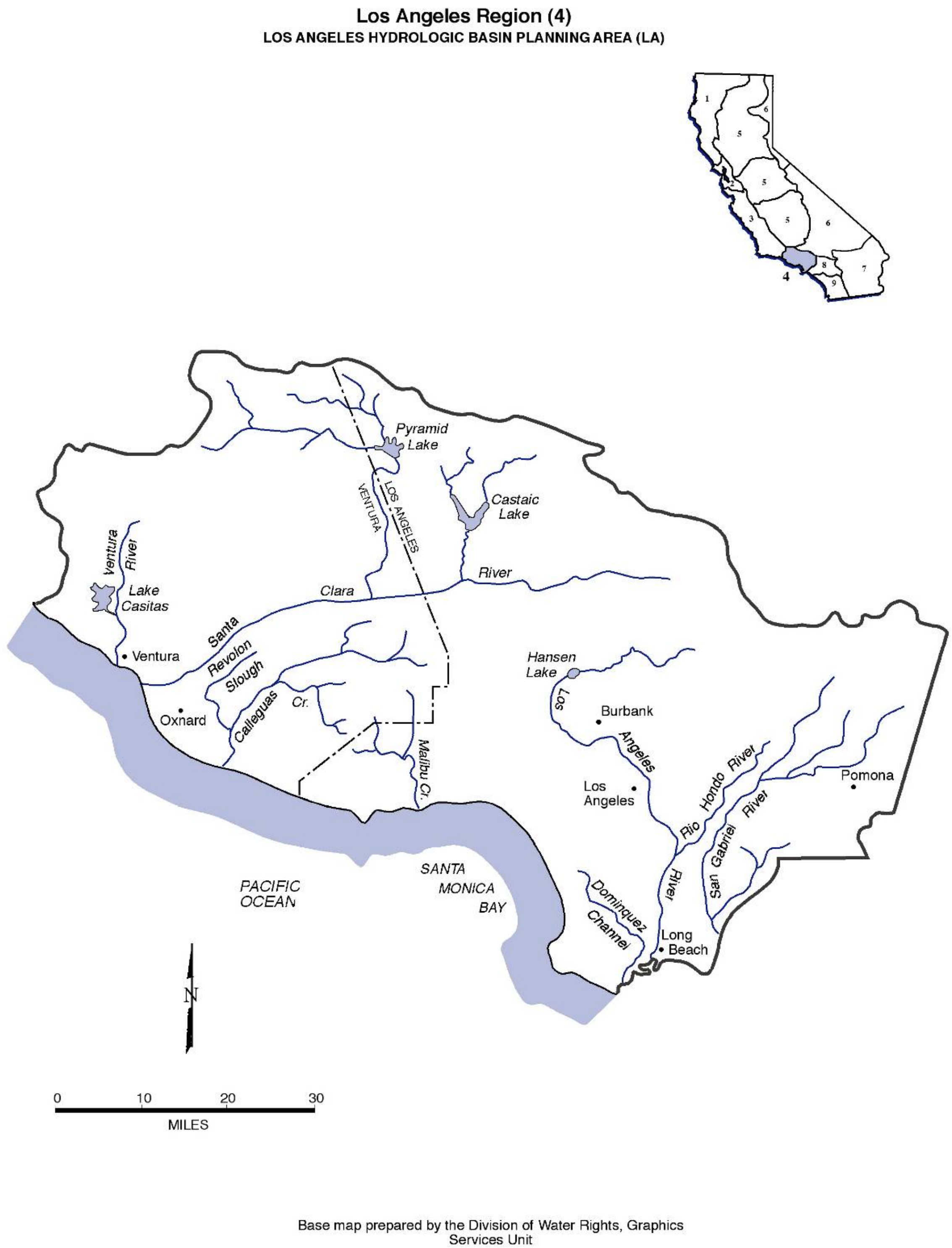


Figure 4: Los Angeles Region Hydrologic Basin

Central Valley Region (Region 5)

The Central Valley Region includes approximately 40 percent 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 percent 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 Water Code, section 12220.

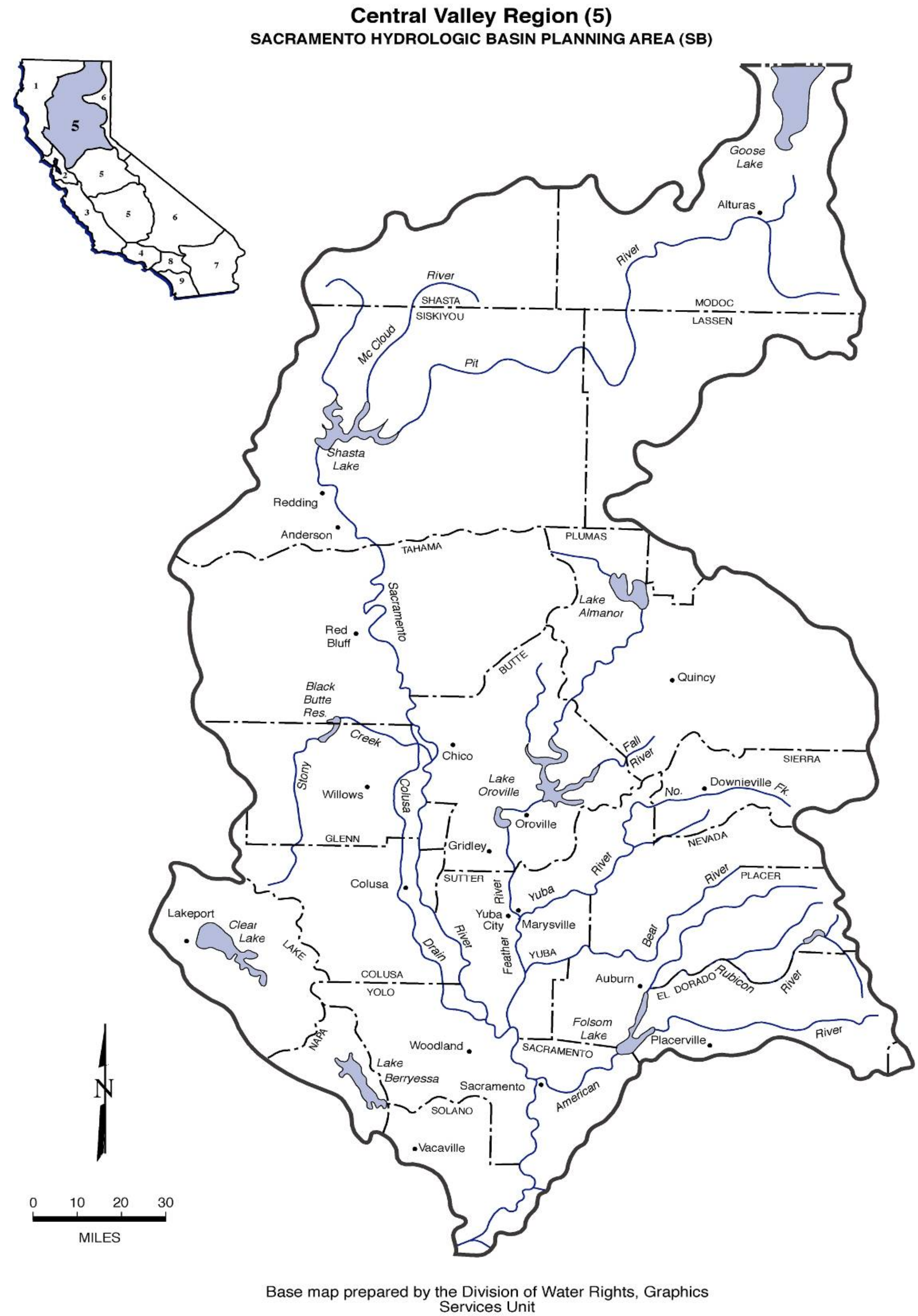
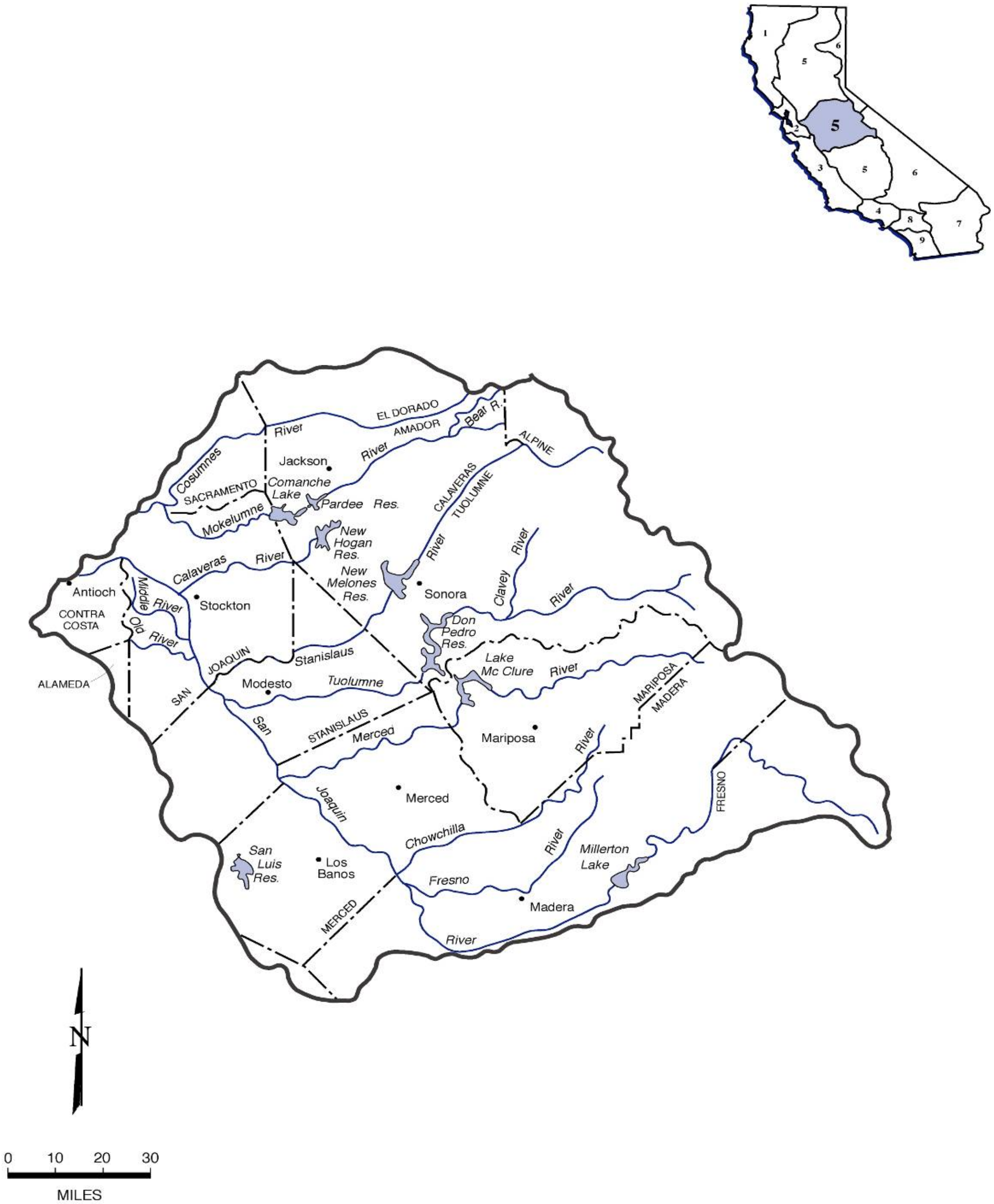


Figure 5: Central Valley Region, Sacramento Hydrologic Basin

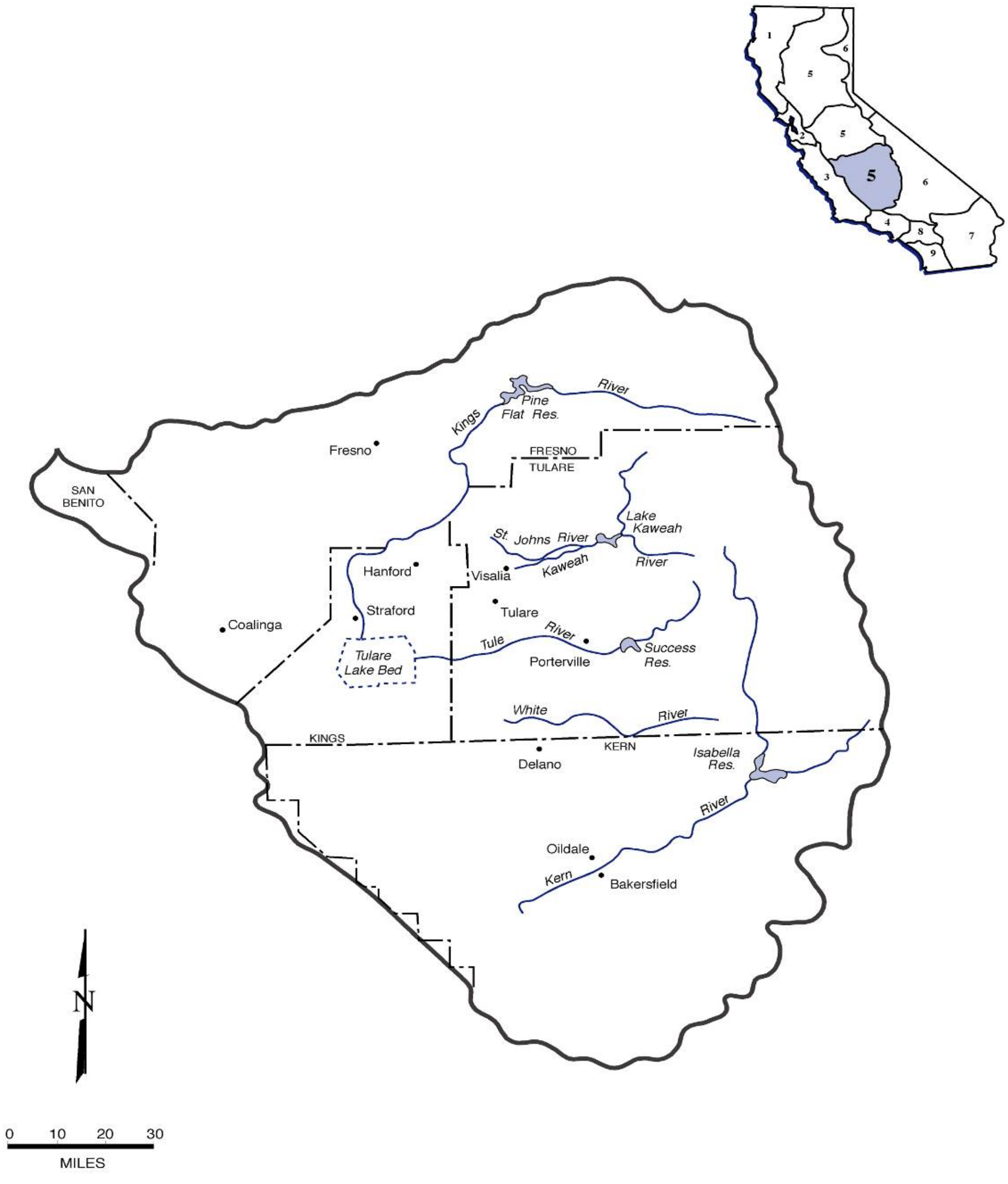
Central Valley Region (5)
SAN JOAQUIN HYDROLOGIC BASIN PLANNING AREA (SJ)



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

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 point (Mount Whitney) and lowest point (Death Valley) 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. Alpine and subalpine 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), including remnants of Native American irrigation systems, Comstock mining era ghost towns (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 recreation (e.g. camping, skiing) and undeveloped recreation (e.g. hiking, fishing) 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 currently being mined at various locations within the Lahontan Region.

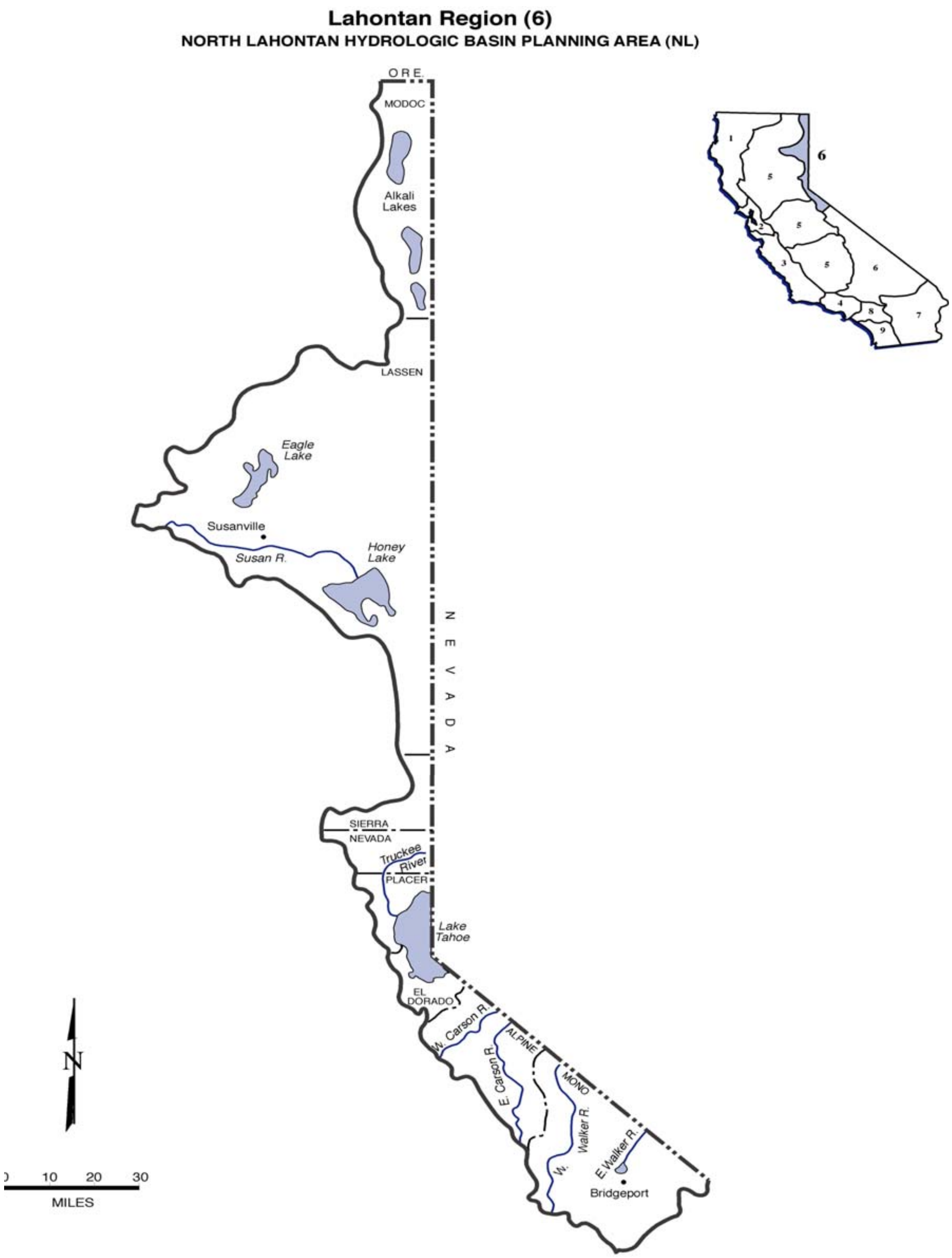


Figure 8: Lahontan Region, North Lahontan Hydrologic Basin

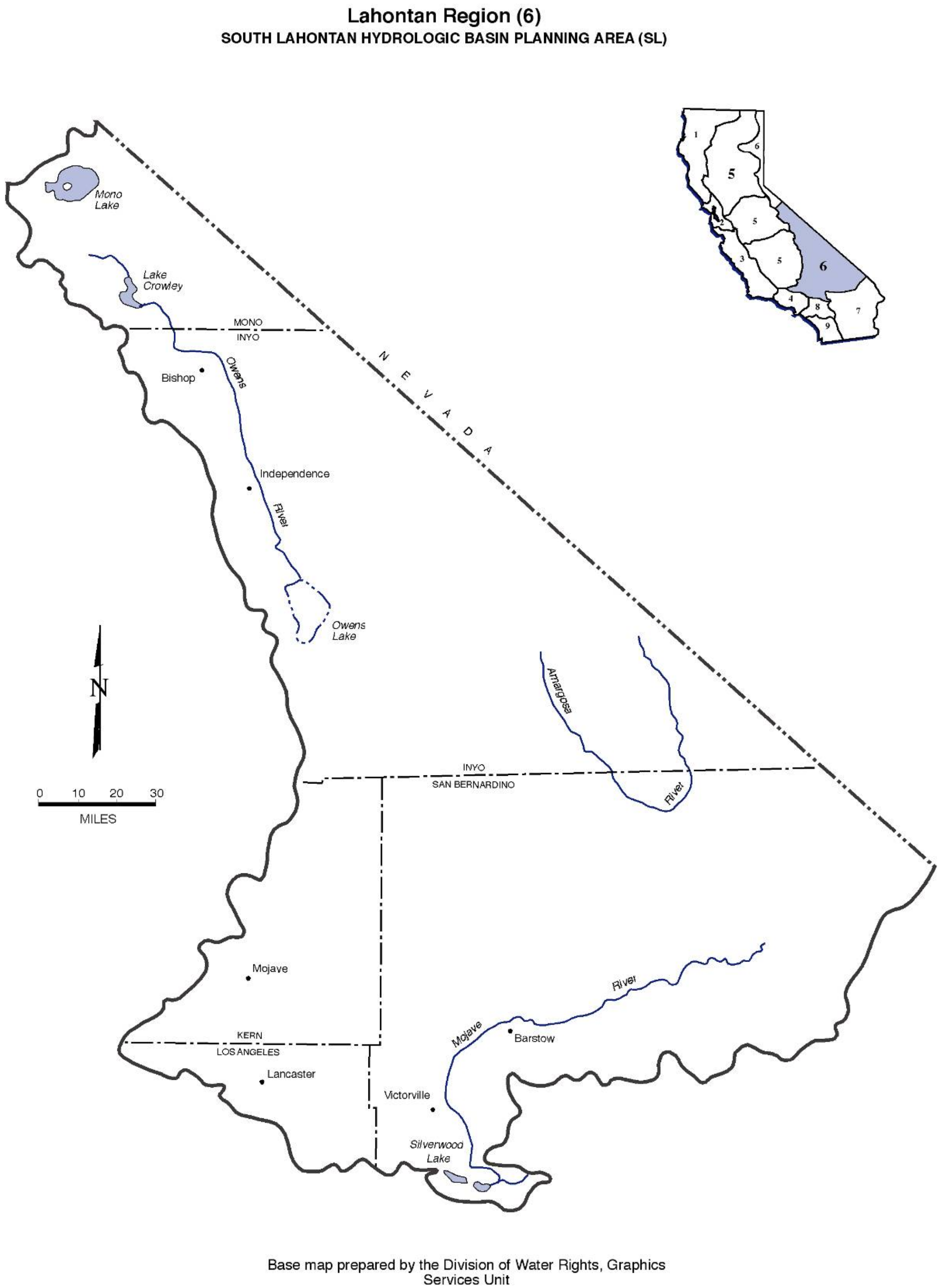


Figure 9: Lahontan Region, South Lahontan Hydrologic Basin

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.

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 to 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.

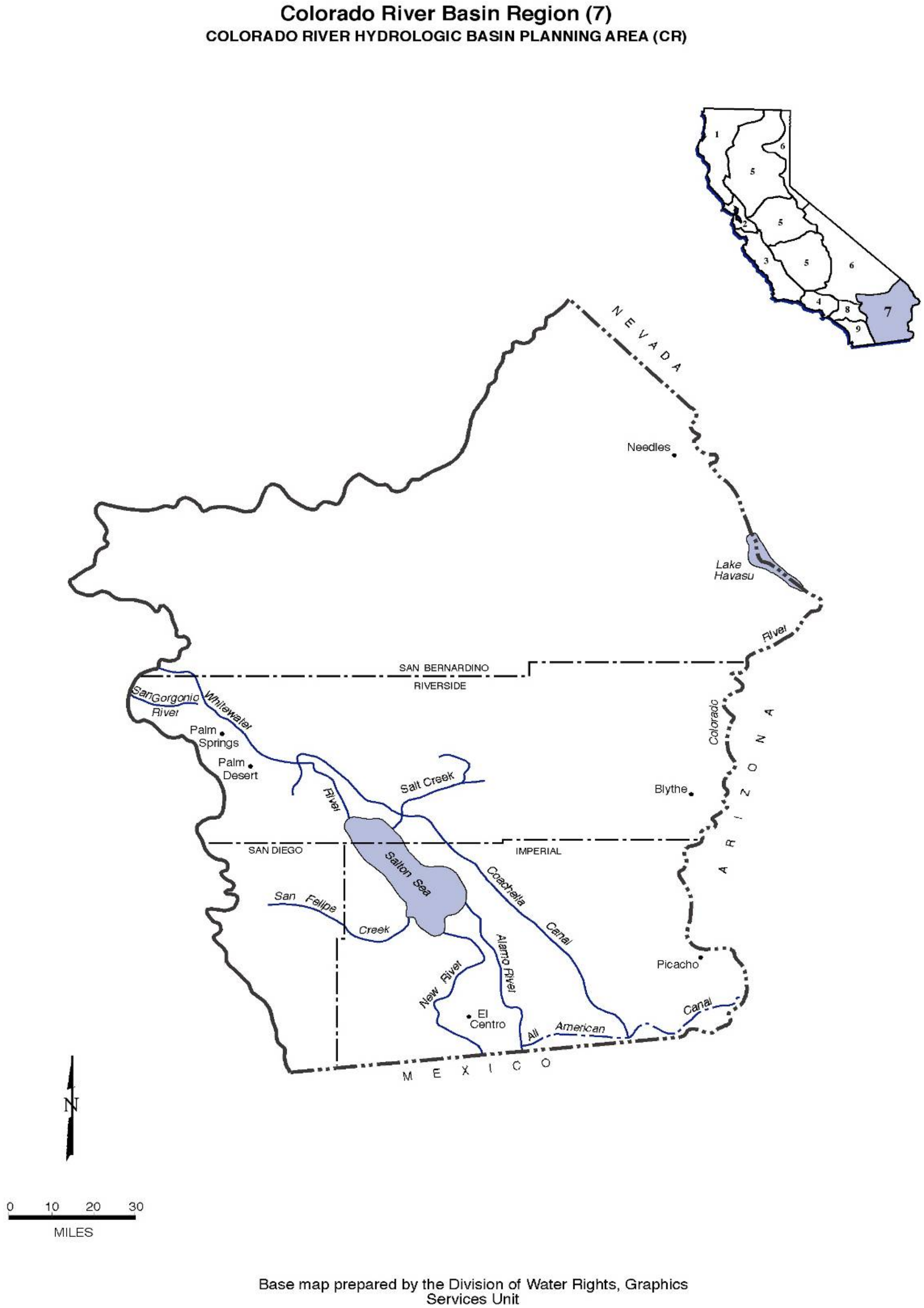
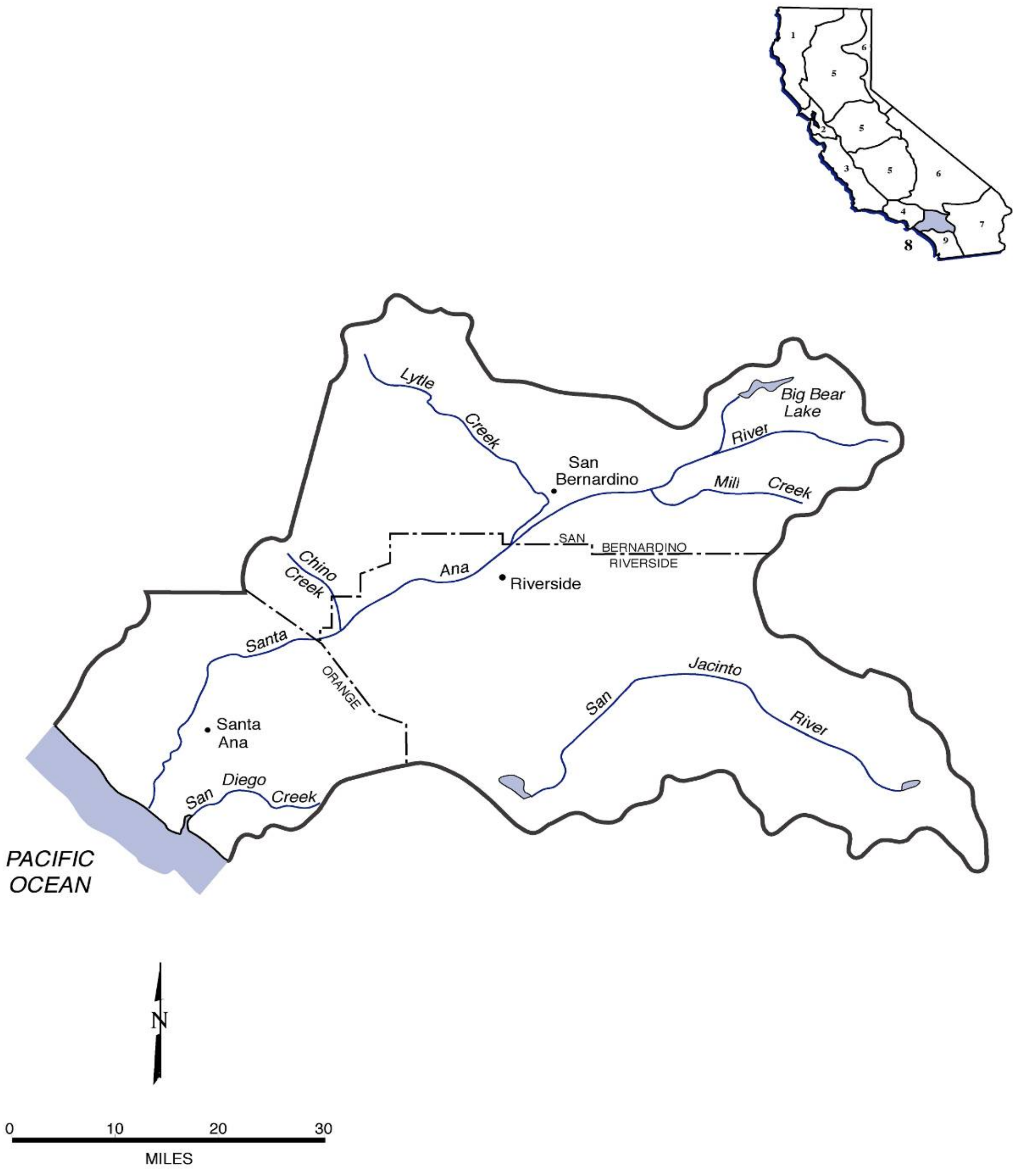


Figure 10: Colorado River Region Hydrologic Basin

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.

Santa Ana Region (8)
SANTA ANA HYDROLOGIC BASIN PLANNING AREA (SA)



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.

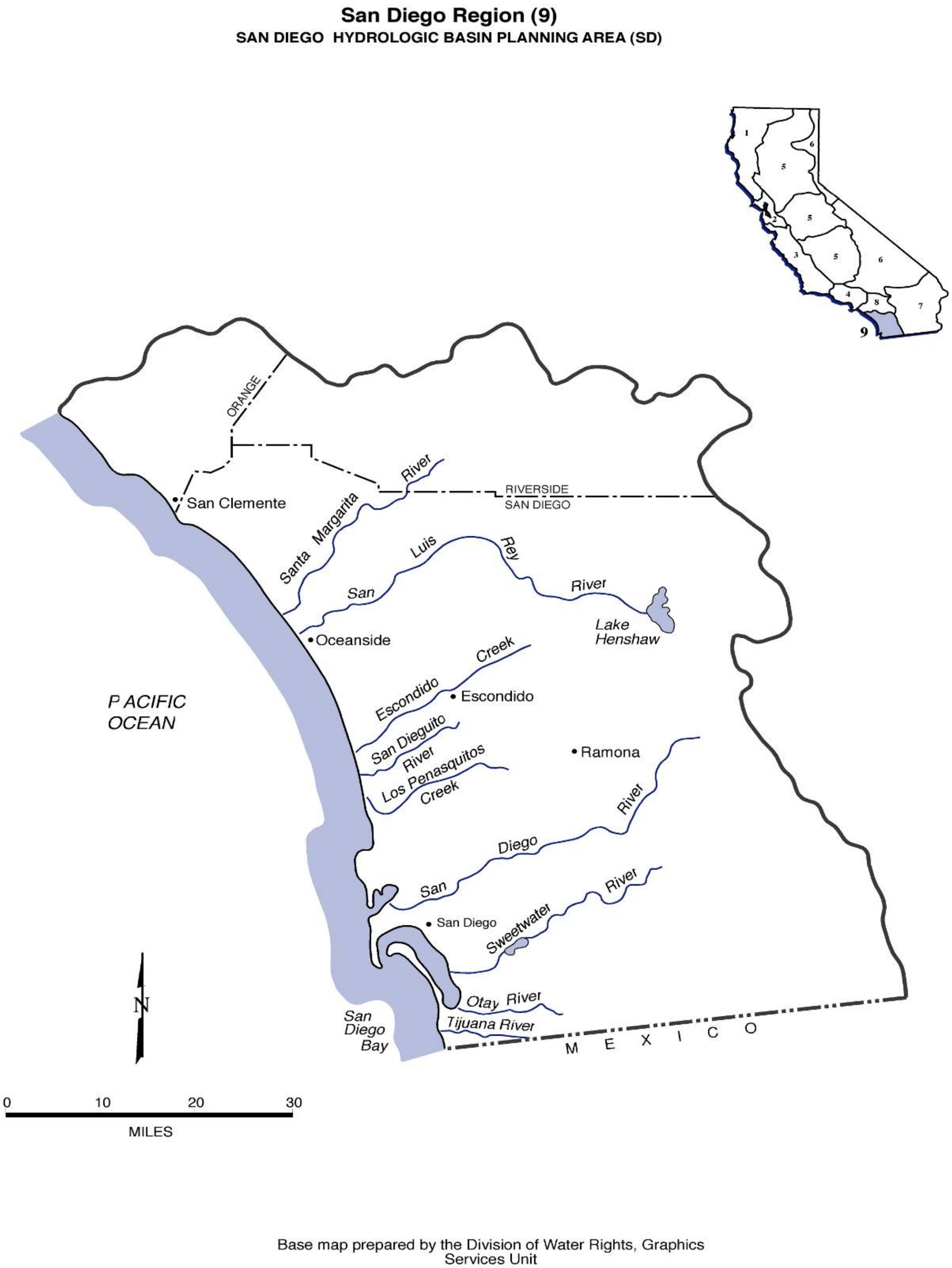


Figure 12: San Diego Region Hydrologic Basin

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 Issue describes and compares the alternatives that State Water Board staff has 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 that 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 organisms, 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 Water 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 individual 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 non-storm water NPDES permits and WDRs 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 volume of discharge (see Issue 2D). The State and Regional Water Boards, however, would be granted the authority to establish supplemental acute toxicity monitoring requirements at their discretion (see Issue 2B).

   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 test analyses. 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) to generate the no observed effect concentration (NOEC), lowest observed effect concentration (LOEC), no observed adverse effect concentration (NOAEC), or a pass/fail result, as well as point estimate techniques (e.g. Probit analysis, Spearman-Karber, Trimmed Spearman-Karber, linear Interpolation, and graphical approaches) to generate the effect concentration (U.S. EPA 1995; U.S. EPA 2002a; U.S. EPA 2002b; U.S EPA 2002c). NOEC and NOAEC 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. Effect concentrations (EC) describe the specific toxicant concentration that causes a given percent reduction in a continuous biological measurement (e.g. biomass) or survival, and are denoted as the inhibition concentration (IC) and lethal concentration (LC), respectively.

Use of the traditional hypothesis method for determining compliance with toxicity provisions has become a topic of frequent discussion as several studies have raised concerns about the limitations of this approach and offered various alternatives to the hypothesis approach (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 the toxicity test methodologies promulgated by U.S. EPA do not establish an acceptable rate of false negative results (Type II or β errors) to control test power. β errors pose a significant threat to water quality as false negatives result in unidentified toxic samples. A false positive (α error) rate of 0.05, 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 in order to document (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, U.S. EPA has developed a new approach for analyzing toxicity test data: 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 compares the organism response in the instream waste concentration to a percentage of the response in the control. This percentage-based effect threshold, denoted as *b*, is set at differing levels for chronic and acute toxicity tests. Chronic toxicity tests are assigned a *b* value of 0.75 so as to establish a percent effect 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. These values, which are also referred to as regulatory management decisions (RMD), provide a clear threshold for declaring an unacceptable level of toxicity in a given sample (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 dischargers with 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 as the alpha rate used in the current approach) to ensure that acceptable organismal responses are deemed non-toxic and a test-specific false negative rate (α), which has not been established thus far, and provides incentives to ensure adequate statistical power.

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 approach 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 traditional hypothesis test method as a statewide provision.** 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, if the toxicity data are proportional (e.g. percent survival, percent fertilization). This calculation is recommended in U.S. EPA toxicity test methodology for proportional data and is commonly used to stabilize the variance, satisfy the normality requirement, and is typically completed with the Shapiro-Wilk test. If the data set does not meet the normality requirements, the non-parametric Wilcoxon 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 (that adjusts the pooled variance for equal variance) is used (U.S. EPA 2002a).

   NOEC and LOEC
   The NOEC endpoint can be derived for multi-concentration chronic toxicity tests. 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 1995; U.S. EPA 2002a; U.S. EPA 2002b; U.S.EPA 2002c). 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, LOEC, 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 non-monotonic 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).

NOAEC
This hypothesis testing approach employs the same statistical procedures as those of the NOEC and LOEC endpoints, but can be utilized for multi-concentration acute toxicity tests.

3. **Adopt a point estimate method as a statewide provision.** 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), Short-term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Marine and Estuarine Organisms (3rd 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 EC refers to the concentration of a sample at which a certain percentage of a given number of test organisms exhibit a negative quantal response (e.g. death or immobilization). The effect level for chronic endpoints is denoted in the acronym (e.g. 25% is represented as EC_{25}). This method is akin to a linear regression, but rather than exhibiting a linear fit, the data are analyzed using a log-normal function, if possible. Due to the complexity of this method, a Probit software program is typically used for data that meet the required assumptions of that model. Spearman-Karber, Trimmed Spearman-Karber, and graphical methods may be used in place of Probit for data sets that do not meet the assumptions of the Probit analysis, however, both Spearman-Karber and Trimmed Spearman-Karber methods also require certain concentration-response assumptions (U.S. EPA 2002b).

LC
The LC 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 meets neither the normality assumption nor contains at least two concentrations with partial mortality cannot be analyzed using Probit analyses. For these data sets, the Spearman-Karber, Trimmed Spearman-Karber, and graphical approaches are employed (Denton et al. 2010).

IC
The IC is used to measure the chronic, non-quantal effects of an effluent, and is computed using tested effluent concentrations at which negative effects are observed. Similar 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 effluent samples is also designated in the acronym.

Point estimate techniques offer benefits over traditional hypothesis testing. The endpoints are not dependent upon pre-determined effluent concentrations, so effect values can be interpolated at any point in the concentration-response dataset depending on the pattern. These values can be used to quantify precision within and between tests, and 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). 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 non-monotonic 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 in nonparametric methods and linear interpolation. 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 approaches are incapable of calculating endpoints below a 50 percent effect level (Grothe et al. 1995; U.S. EPA 2002b). Furthermore, a recent study published in the journal Environmental Toxicology and Chemistry showed that outlier data points increased the false positive rate of Probit analyses by as much as 20 percent (Robert et al. 2009).

4. **Adopt the TST approach as a statewide provision.** The TST was designed to statistically compare a test species response to the instream waste concentration and a control. Data are analyzed using Welch's t-test with quantal data appropriately transformed prior to doing so. This form of t-test is robust to heterogeneous variances and non-normal data. 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." Conversely, 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 *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, reduces laboratory costs for dischargers and concurrently improves 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 (α level using the TST approach) establishes explicit test power and provides motivation to decrease within-test variability, which significantly reduces 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; Diamond et al., 2011). 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.

5. **Adopt two methods as a statewide protocol.** A dual endpoint approach is another option available to the State Water Board. Under this alternative, dischargers would be required to analyze each sample using two different statistical methods, such as traditional hypothesis testing and point estimates. While this comparison-based approach may provide an additional means of substantiating results, reconciling endpoints from differing methods would likely prove challenging for the permitting authority and ultimately unnecessary complexity to the program for analyzing the data and interpretation of the test results.

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 SIP and these narrative objectives provide the basis for regulating toxicity in applicable permits, the requirements 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 uniformly apply these objectives as effluent limits in permits in order to 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 implement their respective Basin Plan objectives. Despite the toxicity provisions established in the SIP, 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 instream 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. Narrative objectives, however, do not provide a clear measurement of compliance and ultimately obligate the permitting authority to prove that a violation occurred before enforcement actions can be taken. This approach represents an oversight-driven model of toxicity control that essentially requires the regulatory agency to manage the dischargers' efforts to reduce and control toxicity. Furthermore, the significant amount of resources that would be required to ensure water quality objectives are met under such a policy would encumber the Regional Water Boards, and ecological protections would continue to be compromised by such 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 percent effect of test species used and expressed as a null hypothesis using the U.S. EPA's 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 instream waste concentration 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 lower effect threshold is warranted for the more severe impacts of acute toxicity. These objectives can be expressed as permit limits in multiple ways (see Issues 2B and 2C).

   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 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 2F). Numeric objectives represent a compliance-driven model of toxicity control that provides clearly defined and consistently applied requirements to determine the protection of aquatic life.

   A discharger with an NPDES permit that relies solely on toxicity limits to control pollution (i.e. contains no pollutant-specific limitations) could potentially receive an MMP of $3,000 after the fourth violation, and each violation thereafter, within any consecutive six-month period (Wat. Code, §13385, subd. (i)). Such permits, however, are a rarity among wastewater dischargers. The application of numeric effluent limits to storm water and non-NPDES dischargers, however, is not currently practicable (see Issues 1D and 1E). Despite these aspects, 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 Dischargers

Present Statewide Policy

Clean Water Act section 402, subdivision (p) and Water Code 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 practicable” using structural and nonstructural mitigation measures known as “management practices.” 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

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.

Alternatives

1. **No action.** If the State Water Board remains silent on this issue, toxicity provisions will continue to be established at the permit level. While this approach does not resolve the regulatory discrepancies that exist amongst the various municipalities, it enables the permitting authorities to individually tailor monitoring requirements to each storm water discharger.

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 would be assigned reasonable potential to exceed the proposed chronic toxicity objective, or be required to conduct a reasonable potential analysis using the TST approach.

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, the option to grant compliance schedules to eligible permit holders would be included. In addition, exceptions may be granted to specific categories of storm water dischargers (see Issue 2G).

A toxicity test resulting in a “fail” would be considered a violation of effluent limitations, requiring implementation of a TRE Work Plan approved by the applicable Water Board. Dischargers would be required to conduct the 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. 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, management practices, and SWMPs constituted “effluent limitations” and were therefore in accordance with the Clean Water Act. 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*); 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 maximum extent practicable standard unless the State or Regional Water Boards specifically required 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 management practice 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 management practices, as well as an enforceable maintenance program. Even with these suggested improvements, however, the panel deemed numeric effluent limits infeasible for MS4 permits, citing management practice 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 management practice 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 MS4s that discharge to inland surface waters, enclosed bays, and estuaries would be subject to minimum toxicity monitoring requirements. As opposed to requiring numeric effluent limitations, the permitting authority would have 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 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 Water Code section 13383 letters requiring the use of the TST approach 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 using the most sensitive test species. Toxicity test results would require TST analyses, and the applicable Water Board would have discretion to apply compliance schedules to assist dischargers in implementing this monitoring program (see Issue 2E).

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 maximum extent practicable 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 under protective of aquatic life beneficial uses as it fails to establish standardized methods of remediation. Permits without management practice design requirements may result in unsatisfactory or inappropriate implementation measures, and the omission of management practice 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 requirements are omitted from permits. Lastly, a monitoring program may prove to be economically burdensome to municipalities that are not currently required to conduct toxicity tests.

4. **Require the use of the TST for toxicity monitoring.** Given the compliance difficulties associated with numeric effluent limitations, and the potential cost of monitoring programs, staff may choose to only require the use of the TST for individual industrial storm water and Phase I and II MS4 dischargers that are required to conduct toxicity testing under a permit. While this option would not establish a statewide monitoring program, use of the TST is expected to improve test precision and toxicity data interpretation which will, in turn, direct the permitting authorities to appropriately address toxic events.

Recommendation:
Adopt Alternative 4.

Issue 1E: Channelized Dischargers

Present Statewide Policy

Nonpoint 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). Chronic and acute toxicity has also been directly linked to pesticide in agricultural runoff (Anderson et al. 2003a; Anderson et al 2003b; Anderson et al. 2006). In order to control polluted runoff and comply with section 1329 of the Clean Water Act, 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 required under Water Code sections 13269 and 13369, and the Policy for Implementation and Enforcement of the Nonpoint Source Pollution Control Program, section 2, subsection C 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 requirements 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 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, conditional prohibitions, and conditional waivers. Such omissions further erode regulatory consistency and are not protective of aquatic life beneficial uses.

2. **Require WDRs, conditional prohibitions, and conditional waivers for channelized dischargers to include numeric limitations for chronic toxicity.** Under this option, the permitting authority would be required to apply the proposed chronic toxicity objective as a numeric limitation to all channelized dischargers. 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, conditional prohibition, 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, and the TST approach 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 Work Plan approved by the applicable Water Board.

   Numeric 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 numeric limits, 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 nonpoint source pollution, the costs to do so may be unduly burdensome on some operations.

3. **Require WDRs, conditional prohibitions, and conditional waivers for channelized dischargers to include chronic toxicity monitoring requirements.** Rather than requiring WDRs and conditional waivers to include numeric 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 Water Code section 13267 letters requiring the use of the TST approach 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, conditional prohibition, 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. 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, conditional prohibition, or conditional waiver cycle. The permitting authority would determine sampling times and locations, as well as the management practices, oversight procedures, and remediation measures to be employed by the discharger. The applicable Water Board would also be provided discretion to apply compliance schedules to assist dischargers implementing this monitoring program (see Issue 2E).

   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 approach will improve data interpretation, while minimum monitoring requirements will facilitate permit consistency. In addition, the Water Boards would retain the authority to establish numeric 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 management practices, oversight procedures, and remediation measures for toxicity may or may not be specified in a WDR, conditional prohibition, or conditional waiver.

4. **Require the use of the use of the TST for toxicity monitoring.** Given the compliance difficulties associated with numeric effluent limitations, and the potential cost of monitoring programs, staff may choose to only require the use of the TST for channelized dischargers that are required to conduct toxicity testing under a WDR, conditional prohibition, or conditional waiver. While this option would not establish a statewide monitoring program, use of the TST would provide a simple, transparent, and consistent approach to toxicity data interpretation across programs.

Recommendation:
Adopt Alternative 4.

ISSUE 2: COMPLIANCE DETERMINATION

The following Alternatives explore the options available to the State Water Board for establishing a uniform approach to toxicity monitoring and enforcement.

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, data is reviewed to determine the observed maximum effluent concentration for a given pollutant (facilities are required to obtain the necessary monitoring data prior to conducting this analysis). If the maximum effluent concentration is greater than or equal to the pollutant objective, then an effluent limit is required. If the maximum effluent concentration 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 procedure, see Section 1.3 of the SIP.

Issue Description

The reasonable potential formula established in the SIP was developed for quantifiable 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. 2010).

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 contribute to an excursion above ocean water quality objectives, in accordance with Code of Federal Regulations, title 40 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 Technical Support Document for Water Quality-based Toxics Control (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 large-scale 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 POTWs 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 approach The TST requires dischargers to conduct a minimum of four, single-concentration toxicity tests, after which the TST approach 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 percent effect of the test organisms (and determines the most sensitive test species) by comparing the mean effect level at the instream waste concentration to a 10 percent mean effect threshold. Regardless of the initial outcome of the toxicity tests, reasonable potential to cause or contribute to acute or chronic toxicity is demonstrated when a test sample exhibits a mean effect above the 10 percent 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 developed.

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 TRE implementation. The adoption of numeric toxicity objectives 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, the 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 for a facility. When applied in conjunction with the CV of a given discharge, the target long-term average 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 long-term average (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, rather than a WLA. An effluent concentration

allowance 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).

Adopting the effluent concentration allowance method would simplify the process of calculating effluent limitations because it requires less data accumulation than that of a WLA and the Policy 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 effluent concentration allowances, the State Water Board may decide to directly translate the proposed objectives as effluent limits. Under this option, the application of the proposed chronic objective would be required under the Policy, while the proposed acute objective would be applied to permits and WDRs at the discretion of the permitting authority. Dischargers would be obligated to meet these objectives at the instream waste concentration through a permit limit that may be expressed in a number of ways (see Issue 2C). By foregoing the use of long-term averages, this alternative enables facilities to maintain their current rate of discharge and provides State Water Board staff with a range of options for permit limit expression.

Recommendation:
Adopt Alternative 4.

Issue 2C: Effluent Limitation Expression

Present Statewide Policy

Although daily maximums and monthly averages are frequently used in permits, a statewide method of expressing effluent limitations for toxicity has not been established.

Issue Description

The direct application of the proposed objectives to permits allots several options for effluent limitation expression. If the method of this expression is not established in the draft Policy, compliance determination may be inconsistent among Regions and permits.

Alternatives

1. **No action.** If the draft Policy does not establish proposed effluent limits for chronic and acute toxicity, the Regional Water Boards will ultimately decide the method of compliance. While this approach would offer permit writers the flexibility to adjust compliance requirements to fit specific dischargers, the resulting inconsistencies could lead to an inequitable distribution of enforcement actions.

2. **Direct Application with established replicates.** Under this option, the chronic and acute null hypotheses, established in the TST approach, would be directly applied as MDELs, so that a sample producing a result of “fail” would demonstrate toxicity. Provisions increasing the minimum number of test replicates beyond what are promulgated in Code of Federal Regulations, title 40, section 136.3 would be established in the Policy for each test method in order to reduce the potential number of tests being declared toxic with a percent effect below the respective unacceptable RMD.

   Direct application of the proposed objectives would afford a sufficient level of protection for aquatic life uses as a single exceedance would trigger accelerated monitoring. In addition, this alternative would likely reduce unwarranted determinations of toxicity that may lead to unnecessary accelerated monitoring schedules, violations, and TREs. However, the TST has been vetted by U.S. EPA’s Whole Effluent Toxicity Test Drive Analysis of the Test of Significant Toxicity (TST) report (U.S. EPA 2011), and external peer reviewers requested by both U.S. EPA (U.S. EPA 2008) and the State Water Board. Therefore, such a provision may prove to be unnecessary.

3. **Adopt RMDs with a tiered accelerated monitoring schedule.** This approach would also express the acute and chronic null hypotheses as MDELs. A discharger that “fails” a TST analysis, yet does not exceed the RMDs would be required to implement the first tier of a two-tiered accelerated monitoring schedule. This initial tier would obligate the discharger to conduct two additional toxicity tests within the same calendar month. Should either of these tests “fail,” the discharger would then be required to implement the second tier of the accelerated monitoring schedule and conduct four, five-concentration tests over a period of eight weeks (see Issue 2F). Dischargers would also be obligated to initiate these second tier requirements whenever the chronic or acute RMDs are exceeded.

   Functionally similar to Alternative 4, his approach would help mitigate the potential for within-test variability to influence the outcome of the TST. However, the inclusion of an AMEL, discussed in alternative 4, would be more consistent with the permitting requirements established in Code of Federal Regulations, title 40, part 122.45.

4. **Establish statewide MDELs and AMELs for toxicity.** Rather than relying solely upon a single ”pass” or “fail” result, State Water Board staff may choose to express the proposed limitations as both MDELs and AMELs. This alternative would establish the percent effect of the acute and chronic RMDs as MDELs that, if exceeded, would trigger an accelerated monitoring schedule. Because the MDEL would be based on a percent effect, a TST analysis that results in a “fail” below the RMD-based percent effect would not exceed the MDEL, but would obligate the discharger to conduct two additional tests within the calendar month. Should the average percent effect exceed the RMD, the discharger would be in exceedance of the AMEL.

   While this option would temper the limited instances that the TST results in a “fail” below an RMD-based percent effect, an AMEL is ultimately impracticable for this statistical approach. The primary output of the TST is a statistical determination of “pass” or “fail;” non-numeric values that cannot be averaged. The percent effects that accompany this determination are secondary outputs that ignore the statistical aspects of the TST approach. Furthermore, an AMEL may confound compliance determinations as an exceedance of the monthly average would mathematically necessitate an exceedance of the MDEL (i.e. an average percent effect of 0.30 would essentially exceed both the MDEL and AMEL). Conversely, scenarios may arise where a percent effect from one of the additional tests exceeds the MDEL, but the resulting average complies with the AMEL.

5. **Establish statewide MDELs and median monthly effluent limitations for toxicity.** Alternately, State Water Board staff may propose the pairing of MDELs with median monthly effluent limitations (MMELs) to regulate acute and chronic toxicity. Similar to Alternative 4, dischargers would be required to conduct two additional toxicity tests, within the same calendar month, to determine compliance with this monthly limitation. However, the MMEL would be exceeded when the median result (i.e. two out of three) is a “fail.” Compliance with an MMEL would be required whenever a TST analysis results in a “fail” below the MDELs, which would be established as twice the RMD-based percent effect for acute and chronic toxicity (0.40 and 0.50 respectively).

   This option affords several benefits over the other alternatives for Issue 2C. This regulatory combination provides a means of mitigating the effects of test sensitivity and variability, while establishing unique values for these limitations prevents the potential for redundancy found in Alternative 4. Furthermore, the inclusion of the proposed MMEL will retain the statistical rigor of the TST approach.

Recommendation:
Adopt Alternative 5.

Issue 2D: 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 among 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 can individually tailor monitoring schedules based upon their in-depth knowledge of the water bodies located within their jurisdiction, requirements will continue to vary among dischargers. As a result, an unequal distribution of costs associated with toxicity monitoring will persist. 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 (or POTWs with a dry weather design capacity of 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 would be required for discharges lasting more than two days, but only during each period 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 (a calendar quarter would be counted whenever the discharge period lasts seven or more days during a calendar month). 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 the reduced volume of discharge from these facilities pose less of a threat to aquatic biota than their larger counterparts.

   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 many 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. 2010). 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 2E: 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 (Compliance Schedule Policy 2008), 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 the proposed Policy. Therefore, it is necessary to determine the means by which the Water Boards will or will not 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 would retain the ability to require immediate compliance with this, or any other policy. The various means by which the Water Boards can establish compliance schedules, however, have the propensity to create discrepancies among dischargers and may postpone compliance with 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 contain toxicity monitoring provisions during the effective date of the Policy would not be eligible to receive a compliance schedule. This approach would expedite the implementation process for dischargers, thereby strengthening the protections afforded to aquatic biota at a faster pace.

3. **Prohibit compliance schedules for the Policy.** The State Water Board may decide to prohibit compliance schedules for the Policy altogether. This alternative may burden dischargers that have never conducted toxicity monitoring before as immediate compliance could prove difficult to achieve. 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.

Issue 2F: 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 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 exceedances 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 would impose uniform requirements for NPDES wastewater dischargers and point source discharges subject to WDRs. Dischargers that exceed their applicable effluent limitations would be in violation and required to implement an accelerated monitoring schedule included in the NPDES permit or WDR. At a minimum, an accelerated monitoring schedule would consist of four 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 and a control (multi-concentration test) with the test species used for routine monitoring. However, dischargers would only be required to report compliance with the IWC as determined with the TST approach. Should the IWC result in a "fail" with a percent effect at or above 0.25 for chronic toxicity tests or 0.20 for acute, the discharger would then be required to initiate a TRE in accordance with a Work Plan approved by the applicable Water Board[1]. Although these provisions may reduce the compliance options currently available to Water Board staff and dischargers, the consistency achieved through this alternative would further strengthen the proposed Policy's goal of regulatory uniformity. 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 and limits.

Recommendation:
Adopt Alternative 2.

Issue 2G: 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 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

1 The language addressing TRE Work Plan requirements has been removed from the Policy and, consequently, this Staff Report.

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 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.** In accordance with the SIP, all wastewater dischargers subject to the Policy would be eligible to file for a categorical or case-by-case exception to the proposed provisions. 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.

2. **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, and the effluent must not significantly impact water quality. In essence, this approach would preserve the guidelines the Water Boards currently use to exempt low threat dischargers from Basin Plan requirements. 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 1 and 2.

Issue 2H: Small Communities

Present Statewide Policy

Small communities, as recognized in State Water Board Resolution No. 2004-0038, are towns and rural areas that have a population of 20,000 or fewer, and a median household income (MHI) that is less than 80 percent of the statewide annual MHI. Communities with a population of 20,000 persons or less, and an MHI above 80 percent of the statewide median may also be considered disadvantaged on a case-by-case basis by the applicable Water Board, provided that a minimum of four percent of their MHI is paid toward wastewater infrastructure. Communities fitting this definition are eligible for the Small Community Wastewater Grant program and are given special consideration when enforcement actions are necessary. Additionally, Water Code section13385, subdivision (k) grants the Regional Water Boards the ability to waive MMPs for POTWs serving small communities and require these facilities, instead, to spend an equivalent amount on a compliance project designed to correct the problem from which the violation stems. Under the Water Code, however, eligible communities have a different set of qualifying factors than those of Resolution No. 2004-038. To be considered a “small community,” under Water Code section13385, subdivision (k), a POTW must be serving a population of 10,000 or less, or serving a community located in one or more rural counties. In addition, 20 percent of the community’s population must live below the poverty level, or the community must have an unemployment rate of 10 percent or more.

Issue Description

While the provisions proposed in the draft Policy will not impose a significant economic burden upon most of California’s dischargers, some small community-based POTWs may be disproportionately affected. As such, it is appropriate to consider a provision to mitigate possible financial impacts for these communities. (Note: each of the following alternatives is based upon the small community definition set forth in State Water Board Resolution No. 2004-0038, as it is the more inclusive of the two definitions.)

Alternatives

1. **No action.** Small POTWs would be required to conduct monitoring according to the requirements proposed in the draft Policy if no action is taken on this matter. The current grant program, while helpful for start-up costs, does not offer long-term financial assistance for permit requirements. In addition, the usefulness of Water Code section13385 is limited, given that MMPs can only be applied to dischargers operating under permits absent of effluent limitations for specific pollutants (Wat. Code, §13385, subd. (i)).

2. **Grant discretionary authority to the permitting authority.** Under this alternative, the applicable Water Board would develop their own criteria for determining which communities would qualify for exemption from the provisions of the draft Policy. While such determinations would ultimately be based upon the “small community” definition established in State Water Board Resolution No. 2004-0038, the permitting authority would retain the ability to grant and exclude communities that may or may not meet all of the requirements. This approach would offer a high degree of flexibility to both the Water Boards and the permittees at the cost of further uniformity and equitable permitting practices.

3. **Modify discharger classification.** Rather than assigning the responsibility of developing exemption guidelines to the permitting authority, staff may choose to alter the discharger classification provisions proposed in the Policy that require monthly monitoring for facilities that discharge one million gallons a day or more, and quarterly monitoring for facilities that discharge less. In so doing, new monitoring schedules would be developed for these expanded classifications that would afford provisional exemptions or a significant reduction in the quantity of toxicity tests to small POTWs. Although this alternative would address small communities and promote consistency throughout the state, it may not be inclusive enough to support most of the small, disadvantaged communities in California.

4. **Exempt small communities.** Another option available to the State Water Board is to simply exempt small communities from the draft Policy altogether unless the applicable Water Board finds them to have an impact on receiving water quality. While some toxic discharges may go unreported, a blanket exemption would eliminate any financial hardship that may arise from compliance costs, while still allowing the Regional Water Boards to address high priority discharges regardless of community type.

Recommendation:
Adopt Alternative 4.

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 U.S. EPA's Antidegradation Policy, which requires the full protection of all existing beneficial uses (40 C.F.R. § 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, 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 (Stevenson et al. 2009). Furthermore, toxicity has been observed in each of the nine Regions from 2001 to 2009 (State Water Board 2010). 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, subdivision (g) of the CEQA guidelines (Cal. Code Regs., tit. 14, § 15000 et seq.), 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 these CEQA guidelines, 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 Water Code, section13241, 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 as written. The potential economic impacts of the Policy are not expected to extend beyond the dischargers subject to the proposed provisions (see Appendix H for a detailed analysis of these impacts). In addition, small communities will be exempt from the Policy unless the permitting authority determines otherwise. 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 little, if any effect on greenhouse gas emissions, and will have no effect on existing greenhouse gas regulations. An increase in vehicle omissions may occur as the toxicity monitoring requirements established in the Policy could require some dischargers to transport samples to laboratories on a more frequent basis. An increase in omissions may also result from the construction of facility upgrades that might be necessary to achieve compliance. However, the variability of facility monitoring schedules, laboratory locations, and the modifications required for compliance make further examination purely speculative. In addition, 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.

APPENDICES

APPENDIX A: Environmental Checklist

(State Water Board CEQA Regulations, Cal. Code Regs., tit 23, § 3720 et seq.)

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
   Environmental Scientist
   (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

	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
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
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:				
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

	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
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
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

	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
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
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

	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
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

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

	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
d) Have sufficient water supplies available to serve the project from existing entitlements and resources, or are new or expanded entitlements needed?	❒	❒	❒	X
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
It is unlikely that the Policy will adversely affect air quality. An increase in vehicle omissions may occur as the toxicity monitoring requirements established in the Policy may require some dischargers to transport samples to laboratories on a more frequent basis. An increase in omissions may also result from the construction of facility upgrades that might be necessary to achieve compliance. However, the variability of facility monitoring schedules, laboratory locations, and the modifications required for compliance make further examination purely speculative.

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.

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

AMEL	average monthly effluent limitation
AML	average monthly limitation
CEQA	California Environmental Quality Act
CFR	Code of Federal Regulations
CV	coefficient of variation
EC	effect concentration
IC	inhibition concentration
IWC	instream waste concentration
LC	lethal concentration
LOEC	lowest observed effect concentration
MDEL	maximum daily effluent limitation
MDL	maximum daily limitation
MHI	median household income
MMEL	median monthly effluent limitation
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
RMD	regulatory management decision
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.

Channelized discharger
Dischargers subject to waste discharge requirements (WDR), conditional waivers, or conditional prohibitions where the discharge is directed through a channel, including the Irrigated Lands Regulatory Program, into surface waters 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.

Instream waste concentration (IWC)
Also referred to as the receiving water concentration, the instream 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 tested concentration of an effluent or receiving water sample that causes observable, adverse effect on the test organisms

Management practice
Any program, process, siting criteria, operating method, measure or device which controls, prevents, removes, or reduces nonpoint source pollution.

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.

Median monthly effluent limitation (MMEL)
The highest allowable median of “daily discharges” over a calendar month, calculated as the middle value of all “daily dischargers” measured during a calendar month.

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.

Nonpoint 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 (RMD)
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) (e.g. survival, growth, and reproduction) used in a toxicity test method. The responses from the control and the IWC are quantified using statistical approaches to determine if toxicity is present.

Small Community
A town or rural area that has a population of 20,000 or fewer, and a median household income (MHI) that is less than 80 percent of the statewide annual MHI. Communities with a population of 20,000 persons or less, and an MHI above 80 percent of the statewide median may also be considered disadvantaged on a case-by-case basis by the applicable Water Board, provided that four percent or more of their MHI is paid toward wastewater infrastructure.

Test of Significant Toxicity (TST)
A statistical approach used to analyze toxicity test data. The TST incorporates a restated null hypothesis, Welch's t-test, and biological effect thresholds for chronic and acute 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 percent of the organisms to die in an acute toxicity test (TUa = $100/LC_{50}$). 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) = 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) 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.

			EFFLUENT CONCENTRATION (µg/L)				
	Replicate	**Control**	**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.

		EFFLUENT CONCENTRATION (µg/L)				
Replicate	**Control**	**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 $n_1 + n_2 ..... + n_P$
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:

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

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).

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

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,

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

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:

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

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

$SSW = SST - SSB$ Within sum of squares

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

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).

a) For 0 < RP < 1

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

For replicate A (100% effluent) = 0.40

Angle (rad) = 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) sine^{-1} $\sqrt{1/(4*10)}$ = 0.159 rad

c) For RP = 1

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

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.

$$v = \frac{\left(\frac{S_t^2}{n_t} + \frac{b^2 S_c^2}{n_c}\right)^2}{\frac{\left(\frac{S_t^2}{n_t}\right)^2}{n_t - 1} + \frac{\left(\frac{b^2 S_c^2}{n_c}\right)^2}{n_c - 1}} = \frac{\left(\frac{10.68}{10} + \frac{(0.75)^2(8.93)}{10}\right)^2}{\frac{\left(\frac{10.68}{10}\right)^2}{10-1} + \frac{\left(\frac{(0.75)^2(8.93)}{10}\right)^2}{10-1}} = 15$$

4. 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 = 0.86 (obtained from Table E-1 in U.S. EPA 2010).

5. 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.

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

4) 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).

5) 0.82 < 0.87 = 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 $X = (C_e + D_mC_s) / (D_m + 1)$; 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 < MDL is a tie. An adjusted DNQ value having C_o < 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 part 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 instream 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 instream waste concentration (IWC) and control test concentrations. If the TST indicates that the instream waste concentration 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:

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

The regulatory management decision threshold for non-toxicity is 10% effect at the instream waste concentration. 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 instream waste concentration demonstrates reasonable potential to cause toxicity.

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

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 instream waste concentration 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 instream waste concentration): 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 (in TUc) = WLAa (in TUa) × ACR

Step 2:

$$LTA_{a,c} = WLA_{a,c} \times e^{[0.5\sigma^2 - z\sigma]}$$

Where

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

$$LTA_c = WLA_c \times e^{[0.5\sigma_4^2 - z\sigma_4]}$$

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 = C + D (C – B) when C ≥ B, and
Effluent Concentration Allowance = 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 effluent concentration allowance 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 previously contracted with Scientific Applications International Corporation (SAIC) to complete the economic analysis required by Water Code, section 13241. The following report, prepared by Abt Associates, is a revised version of the December 2009 analysis that was included in the draft Staff Report released in October 2010.

Economic Considerations of Proposed Whole Effluent Toxicity Control Policy for California

June 2012

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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

1 Introduction

This report updates the 2008 analysis by Science Applications International Corporation (SAIC) on 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 minimum requirements for implementation (the Policy).

1.1 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 supersede 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.

1.2 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 report provides analysis of 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.

1.3 Organization of Report

The 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.
- **Appendix A**: Facility Analyses**:** provides information on individual sample facilities and the detailed compliance analyses.

2 Current Regulatory Framework

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.

2.1 Existing Toxicity Provisions

Exhibit 2-1 shows the toxicity provision in existing Regional Water Board Basin Plans.

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.
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.

Exhibit 2-1. Existing Regional Water Board Toxicity Provisions	
Regional Water Board	**Basin Plan Toxicity Provisions**
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 Standard 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.

In addition, the provisions in the SIP supplement Basin Plan requirements; they do not supersede existing Regional Water Board toxicity requirements.

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 then 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.

2.2 Affected Dischargers

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

2.2.1 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 465 individually permitted facilities (not including storm water) that discharge to inland surface waters, enclosed bays, and estuaries in California (U.S. EPA, 2012). Of these facilities, approximately 60% are minor discharges. Data in EPA's integrated compliance information system (ICIS-NPDES) database indicate that most major dischargers have effluent limits and/or monitoring requirements for acute and chronic toxicity in their NPDES permits; data on limits and effluent data in ICIS-NPDES for minor dischargers is limited. 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	148	70
Chemicals and Allied Products	1	3
Metals Manufacturing and Finishers	1	1
Petroleum Refineries	9	11

Exhibit 2-2. Summary of Potentially Affected Facilities		
Discharger Category	Number of Dischargers[1]	
	Major Dischargers	Minor Dischargers
Pulp and Paper	1	12
Other Industrial	27	181
Total	187	278
1. Source: U.S. EPA (2012).		

2.2.2 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 management practices and 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 22 area-wide medium and large MS4 permitted discharges in California that discharge, at least in part, to inland waters, enclosed bays, or estuaries (SWRCB, 2012). 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*.

Exhibit 2-3. Toxicity Requirements in Large and Medium MS4 Permits[1]		
Region	**Name (NPDES #)**	**Requirements**
2	San Francisco Bay Regional (CAS612008)	U.S. EPA three species toxicity tests: *Selenastrum* growth and *Ceriodaphnia* and *Pimephales* with lethal and sublethal endpoints; also *Hyalella azteca* with lethal endpoint twice per year (1 dry season and 1 storm event). If toxicity results < 50% of control results, repeat sample. If 2nd sample yields < 50% of control results, initiate a TRE.
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.
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 (CA083313)	Toxicity monitoring twice per year with one event during dry season and one event during a storm event at a minimum of two sites. If toxicity results < 50% of control results, repeat sample. If 2nd sample yields < 50% of control results, conduct a TRE.
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.

Exhibit 2-3. Toxicity Requirements in Large and Medium MS4 Permits[1]		
Region	**Name (NPDES #)**	**Requirements**
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.
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)	Narrative toxicity provision. 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. If possible, test species shall include a vertebrate, an invertebrate, and an aquatic plant. After an initial screening period, monitoring may be reduced to the most sensitive species. Dilution and control waters should be obtained from an unaffected area of the receiving waters.
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.

Exhibit 2-3. Toxicity Requirements in Large and Medium MS4 Permits[1]		
Region	**Name (NPDES #)**	**Requirements**
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.
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. Accessed May 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, 206 of the over 211 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[1] 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.

2.3 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.

[1] An active treatment system is a treatment system that employs chemical coagulation, chemical flocculation, or electro-coagulation in order to reduce turbidity caused by fine suspended sediment

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 waiver requires 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, 2012).

The Los Angeles Regional Water Board's conditional waiver requires dischargers to determine the most sensitive species for toxicity monitoring and use the results to trigger further investigations into the cause of toxicity. Dischargers must implement a TIE when there is more than 50% mortality in any test. 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, 2010).

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 toxicant(s).

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 Water Board is developing a program to include irrigated lands in the North Coast Region and address discharges of waste to waters of the State. The State Water Board expect the Program to address, at a minimum, waste discharges from lands uses such as irrigated row crops, vineyards, orchards, and irrigated pasture. This effort is intended to augment, but not supersede, existing Regional Water Board programs addressing discharges from irrigated lands, such as the TMDL programs.

San Francisco Bay Water Board staff is developing a conditional waiver for vineyard properties in the Napa and Sonoma watersheds to require that effective management practices be implemented to control human-caused discharges of pollutants from vineyard facilities. The vineyard waiver would cover existing vineyards, vineyard replants, as well as new vineyard development. The Regional Water Board also adopted a conditional waiver for grazing operations in the Napa River and Sonoma Creek watersheds on September 14, 2011. The goals of the waiver are to reduce the discharge of sediment and pathogens to the Napa River and Sonoma Creek, and to protect stream and riparian areas. This program is a key element to implementing TMDLs for these two watersheds.

The Colorado Regional Water Board has a conditional prohibition for agriculture in its Basin Plan as part of TMDL implementation, and the Lahontan Regional Water Board does not have waivers for agricultural discharges.

3 Description of Proposed Policy

This section describes the toxicity Policy which supersedes the numeric toxicity objectives and implementation provisions for toxicity in the Basin Plans and the SIP. The Policy does not supersede the narrative toxicity objectives established in the Basin Plans.

3.1 Objectives

The Policy establishes toxicity objectives applicable to all inland surface waters, enclosed bays, and estuaries to protect freshwater and saltwater aquatic life.

3.1.1 Chronic Toxicity

The chronic toxicity objective is expressed as a null hypothesis and a regulatory management decision (RMD) of 0.75 for chronic toxicity methods, where the following null hypothesis is used:

$$H_o\text{: Mean response (IWC)} \leq 0.75 \cdot \text{mean response (control)}$$

Attainment of the water quality objective is demonstrated by rejecting this null hypothesis in accordance with the TST statistical approach.

3.1.2 Acute Toxicity

The acute toxicity objective is expressed as a null hypothesis and an RMD of 0.80 for acute toxicity methods, where the following null hypothesis is used:

$$\text{Ho: Mean response (IWC)} \leq 0.80 \bullet \text{mean response (control)}$$

Attainment of the water quality objective is demonstrated by rejecting this null hypothesis in accordance with the TST statistical approach.

3.2 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.

3.2.1 Reasonable Potential

The Policy requires all dischargers to conduct a minimum of four WET tests 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 may also be required by the applicable Water Board; these tests must, at a minimum, include one vertebrate and one invertebrate. WET test results must be analyzed using the Test of Significant Toxicity (TST; U.S. EPA, 2010), 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 (i.e., greater than 1 mgd) wastewater treatment plants (WWTPs) have reasonable potential (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 is greater than 10%, the discharger has RP and will receive a numeric permit limit for chronic or acute WET and a requirement for routine effluent monitoring for WET. If the WET test result is a "pass" and the mean effect is 10% or less, a numeric effluent limit is not required. The mean effect is calculated as the difference between the mean control response and the mean response at the IWC divided by the mean control response.

3.2.2 Effluent Limits

The Policy requires that Regional Water Boards apply the objectives for chronic WET directly in permits as numeric limits expressed as a maximum daily effluent limitation (MDEL), and a median monthly effluent limitation (MMEL) for dischargers with RP. The Water Board also may, at its discretion, include a numeric limit for acute toxicity, also to be expressed as an MDEL and an MMEL. MDEL is an effluent limit based on the outcome of the TST statistical test and the percent effect. The MDEL is exceeded when a toxicity test, using the TST, results in a fail, and the percent effect is greater than or equal to 50% for chronic toxicity tests or 40% for acute toxicity tests. MMEL is an effluent limit based on the median TST statistical results of three independent toxicity tests taken within the same calendar month. The MMEL is exceeded when the median TST result (i.e. two out of three) is "Fail."

3.2.3 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.

3.2.4 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 test consisting of the IWC and a control. Continuous dischargers categorized as major facilities, must conduct one short-term, chronic 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 only during periods of discharge. Acute toxicity monitoring intervals are set at the discretion of the applicable Water Board. Water Boards also may, at their discretion, require periodic monitoring for chronic or acute toxicity of NPDES wastewater and point source WDR dischargers even in the absence of RP.

Rates of discharge are calculated based on daily rates for a representative period of time prior to permit reissuance or reopening. New POTW permits will use dry weather design capacity as a flow rate value, and existing sources will use the highest expected rate of discharge. Calculation of non-continuous dischargers' rates of discharge will not include any days where discharge does not occur.

3.2.5 Compliance

A chronic toxicity test result indicating a "fail" with a percent effect at or above 0.50 is an exceedance of the chronic MDEL. An acute toxicity test result indicating a fail with a percent effect at or above 0.40 is an exceedance of the acute MDEL. Upon exceedance of an MDEL, dischargers may implement corrective action if the source of toxicity is known (e.g. operational upset) and confirm the corrective action with an additional toxicity test, conducted within the same calendar month. The verification test must result in a "pass". If this toxicity test fails at any percent effect, the discharger will proceed to accelerated monitoring.

If a toxicity test results in a "fail," but the percent effect is below the MDEL, dischargers shall conduct two additional toxicity tests within the same calendar month in order to determine compliance with the MMEL. If either of these two additional tests results in a "fail," the median monthly result is "fail" and the discharger will be in exceedance of the MMEL.

At a minimum, an accelerated monitoring schedule must consist of four multiple-concentration WET tests, conducted at approximately two-week intervals, over an eight-week period. The test species used for accelerated monitoring must be the most sensitive species used during routine toxicity monitoring.

If a test "fails" during accelerated monitoring with a percent effect at or above 0.25 for chronic tests or 0.20 for acute tests, the discharger is obligated to conduct a TRE in order to characterize and control the toxic constituents in the discharge The discharger must conduct a TRE in accordance with a TRE Work Plan developed pursuant to the requirements of the applicable Water Board.

3.2.6 Compliance Schedules

The applicable Water Board has the discretion to grant a compliance schedule to NPDES wastewater and point source WDR dischargers in order to achieve the objectives. Compliance schedules must be consistent with the State Water Board's Policy for Compliance Schedules in National Pollutant Discharge Elimination System Permits, with the exception that the duration of the compliance schedule may not exceed two years from the date of permit issuance, reissuance, or reopening to address toxicity requirements after the effective date of the Policy. The discretion to grant compliance schedules, however, will expire ten years after the effective date of the Policy. In addition, dischargers operating under existing NPDES wastewater permits or point source WDRs containing toxicity monitoring requirements are not eligible to receive a compliance schedule.

3.2.7 Exemptions

The Policy exempts small communities and insignificant dischargers from the effluent limits, routine monitoring, and compliance provisions of the Policy unless the applicable Water Board finds them to have an impact on receiving water quality.[2] Small communities are communities with populations of 20,000 or less, and a median household income (MHI) below 80% of the statewide MHI. Communities with an MHI above 80% can also be considered by their Water Board if they pay at least four percent of their MHI towards wastewater infrastructure. Insignificant dischargers have an insignificant impact on receiving water quality and must discharge less than one mgd on a non-continuous basis.

The Policy also allows the Water Boards, after compliance with CEQA, to grant short-term or seasonal exceptions from meeting the toxicity objectives if determined to be necessary to implement control measures either:

- For resources or pest management (e.g. vector or weed control, pest eradication, or fishery management) conducted by public entities or mutual water companies to fulfill statutory requirements, including, but not limited to, those in the California Fish and Game, Food and Agriculture, Health and Safety, and Harbors and Navigation codes; or
- Regarding drinking water conducted to fulfill statutory requirements under the federal Safe Drinking Water Act or the California Health and Safety Code. Such categorical exceptions may also be granted for draining water supply reservoirs, canals, and pipelines for maintenance, for draining municipal storm water conveyances for cleaning or maintenance, or for draining water treatment facilities for cleaning or maintenance.

In addition, where site-specific conditions in individual water bodies or watersheds differ sufficiently from statewide conditions and those differences cannot be addressed through other provisions of this Policy, the State Water Board may, in compliance with CEQA, subsequent to a public hearing, and with the concurrence of the U.S. EPA, grant an exception to meeting the toxicity objectives or any other provision of the Policy where the State Water Board determines:

- The exception will not compromise protection of enclosed bay, estuarine, and inland surface waters for beneficial uses; and
- The public interest will be served.

3.2.8 Storm Water

Under the Policy, all MS4s and individual industrial storm water dischargers subject to existing toxicity monitoring requirements will be required to analyze toxicity data using the TST approach and to report results as a “pass” or “fail.” In addition, the policy recommends, but does not require, the implementation of chronic toxicity monitoring programs for MS4 and individual industrial storm water dischargers not currently required to do so. The recommended program

[2] However, nothing in the Policy precludes the applicable Water Board from requiring periodic toxicity testing for small communities.

consists of four single-concentration toxicity tests conducted each year , based on two storm events and two non-storm event flows (if the latter exist). Remediation is recommended if these dischargers “fail” a test.

3.2.9 Channelized Dischargers

Under the Policy, channelized dischargers subject to existing toxicity monitoring requirements under a conditional waiver or nonpoint source WDR will be required to analyze toxicity data using the TST approach and to report results as a “pass” or “fail.” In addition, the policy recommends, but does not require, the implementation of chronic toxicity monitoring programs for these channelized dischargers not currently required to do so. The recommended program consists of four single-concentration toxicity tests conducted each quarter. Remediation is recommended if these dischargers “fail” a test.

4 Method for Evaluating Compliance and Costs

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

4.1 Municipal and Industrial Wastewater

The method for evaluating potential impacts of the Policy for municipal and industrial wastewater dischargers is based on a sample of facilities and involves determining RP, evaluating compliance with revised effluent limits based on analyzing existing data using the TST, determining the necessary compliance mechanisms, and estimating the cost of those mechanisms.

4.1.1 Identifying Potentially Affected Facilities

There are a total of 465 (218 municipal WWTP and 247 industrials) individually-permitted NPDES dischargers that discharge wastewaters to inland surface waters, enclosed bays, and estuaries in California. However, some of these dischargers are exempt from routine monitoring, sensitive species testing, and effluent limit requirements in the Policy. For example, small communities, defined as having populations less than 20,000 and MHI less than 80% of the state average MHI or wastewater infrastructure costs exceeding four percent of MHI, are exempt from the Policy (although permit writers may require periodic monitoring for toxicity). Abt Associates excluded small communities from this analysis as unlikely to incur incremental costs associated with the Policy.

To identify small communities, Abt Associates first assumed that any municipal WWTP with a flow (as reported in EPA's PCS database in August 2008) greater than three mgd is likely serving more than 20,000 people based on a maximum of 150 gallons of water per day per person (typical water consumption is 75 to 130 gallons per person per day; Metcalf and Eddy, 2003). Abt Associates then used facility names to match Census population and MHI data to identify small communities. To err on the side of overestimating potential costs associated with the Policy, Abt Associates assumed that any community with less than 20,000 people and MHI greater than 80% of the state average MHI would not be small even though wastewater infrastructure costs could exceed four percent of the MHI for some of these municipalities. Thus, Abt Associates identified 53 municipal WWTPs (21 majors and 32 minors) likely to be classified as small communities and exempt from the Policy.

4.1.2 Selecting a Sample

Most of the dischargers potentially affected by the Policy currently have WET provisions in their permits. 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.[3]

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

- Facility type (municipal/industrial)
- Flow (for process controls)
- Industrial processes
- Dilution allowances.

The CWA requires municipal dischargers to have secondary treatment or an equivalent, and most major WWTPs 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.

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 ICIS-NPDES 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 Abt Associates evaluated the potential impact of the Policy on major facilities using the sample SAIC selected for analysis of the draft Policy. For major municipal dischargers, SAIC 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.[4] For remaining municipal facilities, SAIC selected a representative sample based on flow (five facilities).

To reflect the importance of industrial type for major industrial discharges, SAIC selected a stratified random sample using five industrial categories: chemicals products, metals manufacturers and finishers, petroleum refineries, pulp and paper mills, and other industries.

[3] 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 chronic or chronic and acute tests.

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

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	127	7
Chemicals and Allied Products	1	1
Metals Manufacturing and Finishers	1	1
Petroleum Refineries	9	2
Pulp and Paper	1	1
Other Industrial	27	2
Total	166	14
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
CA0053911	LA County Sanitation District, San Jose Creek WRP (East and West)	Municipal	100
Municipal Wastewater			
CA0105392	San Bernardino WWTP	Municipal	28
CA0102822	Victor Valley Regional WWTP	Municipal	14
CA0079049	Davis WWTP	Municipal	7.5
CA0048127	Lompoc Regional WWTP	Municipal	5
CA0059501	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.			

4.1.3 Evaluating Compliance with Existing Requirements

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

Current permit requirements range from narrative or 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.

Evaluation of existing permit requirements is necessary to determine the incremental impacts of the Policy. Baseline compliance actions would need to be undertaken even in the absence of the Policy. Thus, only those actions above and beyond baseline activities are attributable to the Policy.

4.1.4 Determining Reasonable Potential under the Policy

Under the Policy, all major WWTPs have RP to cause or contribute to instream toxicity. For major industrial facilities, Abt Associates estimated RP based on data from 2006 through 2008 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. Under the Policy, mean effects greater than 10% indicate potential to contribute to instream toxicity and thus, RP.

4.1.5 Evaluating Compliance under the Policy

For all WWTPs and industrial facilities in the sample with RP, Abt Associates evaluated potential compliance with chronic effluent limits under the Policy based on three years of existing data (2006 through 2008) analyzed using the TST. For those facilities that may receive dilution, Abt Associates evaluated compliance based on the percent of effluent that corresponds to the dilution ratio. For example, for 10:1 dilution, compliance is based on comparing the 10 percent effluent sample to the control using the TST approach. In cases of data not reflecting the exact IWC, Abt Associates evaluated the effluent percentages closest to the actual IWC and estimated a range of compliance scenarios if necessary.

Under the Policy, any chronic test evaluated using the TST approach that results in a “fail” with a percent effect greater than 50% is an exceedance of the chronic MDEL. Assessing compliance with the chronic MMEL is only necessary when tests result in a “fail” with a percent effect less than 50%.

4.1.6 Estimating Potential Compliance Mechanisms

The potential for incremental actions under the Policy reflects a comparison of compliance with current permit requirements compared to the Policy. Under the Policy, there may be incremental differences in monitoring frequencies and test types (e.g., chronic or acute; single-concentration or multiple-concentration tests) that could result in additional costs or cost savings. For example, under the Policy, only chronic monitoring is required; permit writers have the discretion to include acute monitoring if they deem such testing necessary.

However, current NPDES permit regulations indicate that effluent limits should be based on the more stringent of acute or chronic long term averages. With toxicity, long term averages based on chronic toxicity tests are the more stringent in most cases. In addition, the Policy requires permit writers to justify in the permit why both acute and chronic toxicity limits would be necessary which would result in the permit being subject to petition and review by the State Board. Thus, for this analysis Abt Associates assumed that dischargers will only receive chronic toxicity monitoring requirements.

In addition to changes in monitoring requirement, incremental differences in test evaluation may result from use of the TST compared to the statistical evaluations currently in use. For the sample facilities, Abt Associates compared the current (baseline) and Policy results to identify potential changes in compliance status.

To identify compliance actions under the Policy, Abt Associates first identified all samples that could exceed the chronic MDEL (i.e., "fail" with percent effect at or above 50%) or result in the need to assess compliance with the MMEL (i.e., "fail" with percent effect below 50%). Then, depending on data availability, Abt Associates evaluated whether verification monitoring (to determine compliance with the MDEL)_or additional monthly monitoring (to determine compliance with the MMEL) indicated a need for accelerated monitoring. Because accelerated monitoring results are not typically available for the sample facilities, Abt Associates conservatively (i.e., erring on the side of higher costs) assumed that accelerated monitoring results would indicate the need for a TRE. Abt Associates then compared the compliance actions under the Policy with those that would be required under the existing permit; only those actions that would not also be needed for compliance with existing permit requirements are attributable to the Policy.

Abt Associates also estimated the potential for the sample facilities to add replicates if necessary to an analysis. The TST is designed to declare a chronic test toxic (i.e., a "fail") when the percent effect at the IWC is ≥25% compared to the control and non-toxic (i.e., a "pass") a sample when the mean percent effect at the IWC is ≤10% compared to the control. At effects between these boundaries (10% and 25% effect for chronic tests), TST is designed to "pass" most tests if within-test variability is at or below the national average for the method. One way to lower within-test variability is for laboratories to test additional replicates. However, the few cases of the TST indicating toxicity at effects less than the toxic RMD but above the non-toxic RMD were due to high variability between replicates in the controls and/or IWC treatments (State Water Board, 2011). Addition of a minimal number of replicates to these tests usually resulted in the sample being declared non-toxic using the TST procedure. Thus, Abt Associates assumed that incremental costs associated with the addition of replicates would be minimal.

Monitoring Costs

Incremental monitoring costs could result from routine, verification/follow-up, or accelerated monitoring. The California Department of Health Services (DHS) has accredited 75 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, 2012). The accredited laboratories include both commercial and university testing facilities.

Unit costs vary with species and test type (e.g., acute or chronic, single-concentration or multiple dilutions). In addition, laboratories may offer discounts related to the number of tests or longer turnaround times, or charge additional fees related to delivery charges, shorter turnaround times, or the type of control water (laboratory water versus ambient water).

Some municipal and industrial dischargers with DHS-accredited laboratories collect samples and perform toxicity tests onsite. These dischargers may not keep record of per sample testing costs; rather, 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 4-3 shows acute and chronic toxicity test species and methods for fresh and marine waters.

Exhibit 4-3. 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
Water flea (*Ceriodaphnia dubia*)	1002.0	Survival and reproduction	Renewal
Green alga (*Selenastrum capricornutum*)	1003.0	Growth	Static
Marine Acute Tests			
Sheepshead minnow (*Cyprinodon variegatus*)	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

Exhibit 4-3. Aquatic Toxicity Test Types			
Common Name (Species)	**EPA Method**	**Endpoint**	**Test Type**
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
Topsmelt (*Atherinops affinis*)	NA	Mortality	Static, renewal, or flow-through
West Coast mysid (*Holmesimysis costata*)	NA	Mortality	Static, renewal
Marine Chronic Tests			
Pacific Oyster (*Crassostrea gigas*) and Mussel (*Mytilus sp.*)	1005.0	Larval development	Renewal
Topsmelt (*Atherinops affinis*)	1006.0	Survival and growth	Renewal
West Coast Mysid (*Holmesimysis costata*)	1007.0	Survival and growth	Renewal
Purple Urchin (*Strongylocentrotus purpuratus*)	1008.0	Fertilization	Static
Giant Kelp (*Macrocystis pyrifera*)	1009.0	Germination and germ tube growth	Static
Purple Urchin (*Strongylocentrotus purpuratus*)	NA	Embryo development	Static
Red abalone (*Haliotis rufescens*)	NA	Larval development	Static
Sources: U.S. EPA (2002a); U.S. EPA (2002b); U.S. EPA (2002c); U.S. EPA (1995). NA = not applicable.			

Abt Associates collected toxicity test price information from a number of the California DHS-accredited laboratories, as summarized in **Exhibit 4-4**

Exhibit 4-4: Summary of WET Test Costs

Test Method and Species	Multiple-Concentration			Single-Concentration		
	N	Range (2012 $)	Average (2012 $)	N	Range (2012 $)	Average (2012 $)
Acute						
EPA Method 2000.0 - *Cyprinodon variegatus*	2	$370 - $410	$390	4	$260 - $420	$330
EPA Method 2000.0 - *Oncorhynchus mykiss*	2	$370 - $410	$390	4	$260 - $420	$330
EPA Method 2000.0 - *Pimephales promelas*	11	$225 - $800	$527	19	$180 - $600	$352
EPA Method 2002.0 - *Ceriodaphnia dubia*	9	$275 - $800	$590	12	$180 - $600	$372
EPA Method 2004.0 - *Cyprinodon variegatus*	3	$500 - $750	$667	1	$300	$300
EPA Method 2006.0 - *Menidia beryllina*	6	$390 - $850	$686	4	$195 - $638	$421
EPA Method 2006.0 - *Menidia menidia*	2	$750	$750	0	ND	ND
EPA Method 2006.0 - *Menidia peninsulae*	2	$750	$750	0	ND	ND
EPA Method 2007.0 - *Mysidopsis bahia*	5	$500 - $775	$675	3	$300 - $500	$383
EPA Method 2019.0 - *Oncorhynchus mykiss*	5	$400 - $959	$712	11	$260 - $450	$387
EPA Method 2019.0 - *Salvelinus fontinalis*	2	$750	$750		ND	ND
EPA Method 2021.0 - *Daphnia magna*	2	$450 - $750	$600	8	$250 - $563	$402
EPA Method 2021.0 - *Daphnia pulex*	1	$900	$900	1	$675	$675
N/A - *Atherinops affinis*	4	$395 - $850	$655	4	$200 - $638	$422
N/A - *Holmesimysis costata*	2	$750	$750		ND	ND
Chronic						
EPA Method 1000.0 - *Pimephales promelas*	2	$1,200 - $1,250	$1,225	1	$600	$600
EPA Method 1002.0 - *Ceriodaphnia dubia*	7	$1,071 - $1,450	$1,237	5	$450 - $1,088	$674
EPA Method 1003.0 - *Selenastrum capricornutum*	6	$700 - $1,250	$920	4	$350 - $938	$547
EPA Method 1005.0 - *Crassostrea gigas or Mytilus sp.*	3	$1,400 - $2,200	$1,817	2	$1,050 - $1,300	$1,175
EPA Method 1006.0 - *Atherinops affinis*	6	$1,070 - $1,450	$1,237	5	$550 - $1,088	$698
EPA Method 1007.0 - *Holmesimysis costata*	2	$1,250 - $1,850	$1,550	1	$500	$500
EPA Method 1008.0 - *Strongylocentrotus purpuratus*	4	$855 - $1,500	$1,078	3	$430 - $825	$562
EPA Method 1009.0 - *Macrocystis pyrifera*	4	$1,200 - $1,850	$1,438	3	$600 - $1,125	$808
N/A - *Haliotis rufescens*	5	$960 - $2,000	$1,502	4	$480 - $1,200	$845
N/A - *Strongylocentrotus purpuratus*	3	$1,400 - $2,200	$1,700	3	$430 - $1,300	$927

ND = not cost data available
N/A = no method number specified
N = number of per test costs available from certified commercial and university labs performing WET tests

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

Exhibit 4-5. Average Costs for Three-Species Chronic WET Tests		
Test Type	**Single-Concentration**	**Multiple-Concentration**
Freshwater 3-species[1]	$1,542	$3,344
Marine 3-species[2]	$2,322	$4,227

1. Based on the sum of average costs of *Ceriodaphnia dubia*, *Pimephales promelas*, and *Selenastrum capricornutum*
2. Based on the sum of average costs of *Atherinops affinis, Macrocystis pyrifera*, and the combined average of *Crassostrea gigas or Mytilus sp,, Haliotis rufescens, Holmesimysis costata, and Strongylocentrotus purpuratus.*

Toxicity Reduction Evaluation Unit Costs

If accelerated monitoring indicates a fail at or above the toxic RMD of 0.20 for acute or 0.25 for chronic then the Policy requires dischargers to 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 (2012) indicates that a Phase I TIE would cost $5,000 to $7,000; however, costs for Phase II and III TIEs are site-specific. GEI Consultant indicates that Phase I TIE costs vary, but are approximately an additional $100 to $250 per test, depending on effluent manipulations required, data review needs, etc. (GEI Consultants, 2012).

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. For this analysis, Abt Associates used a TRE cost of $40,000 to be conservative (i.e., err on the side of higher costs).

Process Controls

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. If 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 4-6 provides examples of the types of control actions that may be necessary for different discharger categories. Note that unit costs for these actions are not readily available, and Abt Associates could not develop unit costs for these specific actions due to a lack of site-specific data for each facility and activity.

Exhibit 4-6. 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.

4.1.7 Estimating Potential Incremental Statewide Costs

To estimate total statewide costs, Abt Associates calculated average per facility costs for each discharger category by dividing total compliance costs for the sample facilities by the number of sample facilities in each discharger category. Abt Associates then multiplied average per facility costs by the total number of facilities in the applicable category. Note that because WET monitoring costs are not likely to vary based on flow, Abt Associates did not extrapolate the estimated incremental costs for the sample facilities to all facilities based on a cost per mgd of flow. In comparison, costs for compliance technologies to reduce WET would likely be related to flow. However, Abt Associates did not estimate process control costs for the sample facilities.

4.2 Storm Water Discharges

Under the Policy, the only change to permit requirements for MS4 permittees and individual industrial storm water dischargers with existing toxicity monitoring requirements is that toxicity data must be analyzed using the TST approach. There are no toxicity monitoring data from storm water dischargers from which to determine the change in compliance actions for storm water dischargers under the Policy and thus, the incremental controls that may be needed under the Policy. However, the State Water Board (2011) evaluated storm water samples collected during dry weather, storm events, and irrigation seasons in agricultural areas and found that using the TST approach is not expected to result in a change in the number of enforcement actions compared to use of the current toxicity methods.

While enforcement actions may not change under the Policy, monitoring requirements could increase for certain dischargers. For example, for those storm water dischargers without existing toxicity monitoring requirements, the Policy recommends they implement a chronic monitoring program. For Phase I MS4s, only three of the 21 permittees do not currently have toxicity monitoring provisions. Assuming permit writers would require yearly chronic toxicity monitoring consisting of four single-concentration tests for the Phase I MS4s without existing monitoring provisions, incremental annual costs could be approximately $2,900 per year per permittee, or $8,700 per year total for all three permittees. **Exhibit 4-7** summarizes these potential incremental costs.

Exhibit 4-7: Potential Incremental Phase I MS4 Monitoring Costs

Name (NPDES #)	Existing Toxicity Monitoring Requirements	Annual Incremental Cost[1]
Santa Rosa and County of Sonoma (CA0025038)	Yes	$0
San Francisco Bay Regional (CAS612008)	Yes	$0
Salinas (CA0049981)	Yes	$0
Long Beach (CAS004003)	Yes	$0
County of Los Angeles (CAS004001)	Yes	$0
Ventura County (CAS004002)	Yes	$0
Bakersfield-Kern County (CA00883399)	No	$2,900
Contra Costa Clean Water (CA0083313)	Yes	$0
Fresno (CA0083500)	No	$2,900
Modesto (CAS083526)	Yes	$0
Port of Stockton (CAS084077)	Yes	$0

Exhibit 4-7: Potential Incremental Phase I MS4 Monitoring Costs		
Name (NPDES #)	**Existing Toxicity Monitoring Requirements**	**Annual Incremental Cost[1]**
Sacramento (CAS082597)	Yes	$0
Stockton and San Joaquin County (CAS083470)	Yes	$0
South Lake Tahoe, El Dorado and Placer County (CAG616001)	Yes	$0
Riverside County (CAS617002)	No	$2,900
Orange County (CAS618030)	Yes	$0
Riverside County (CAS618033)	Yes	$0
San Bernardino County (CAS618036)	Yes	$0
Orange County (CAS108740)	Yes	$0
Riverside County (CAS108766)	Yes	$0
San Diego (CAS108758)	Yes	$0
Total		$8,700
1. Represents average of chronic toxicity test prices ($717) multiplied by 4 samples per year for those permittees without existing toxicity monitoring requirements.		

Phase II MS4s are covered under a statewide general permit that contains specific water quality monitoring requirements based on the impairment status or sensitivity of the receiving waters. Thus, Abt Associates assumed that specific monitoring requirements would not likely change under the Policy.

In addition, costs associated with incremental changes to monitoring requirements for individual industrial storm water dischargers are already captured in the industrial costs described above.

4.3 Channelized Dischargers

Under the Policy, the only change to permit requirements for channelized dischargers regulated exclusively under the Porter-Cologne Water Quality Control Act required to monitor for toxicity under existing requirements is that toxicity data must be analyzed using the TST approach. However, the State Water Board (2011) evaluated storm water samples collected during dry weather, storm events, and irrigation seasons in agricultural areas and found that using the TST approach is not expected to result in a change in the number of enforcement actions compared to use of the current toxicity methods. Thus, potential incremental costs associated with the Policy are most likely to be related to a change in toxicity monitoring requirements.

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 toxicity results analyzed using the TST method would remain unchanged, incremental compliance costs could be minimal in these regions.

The North Coast, San Francisco, 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 Lahontan Regional Water Board does not currently have conditional waivers for agricultural lands. However, because all of the Regional Boards are required to implement an agriculture discharge program, the Policy will apply to this region in the future. Whether those waivers would have included toxicity monitoring in the absence of the Policy or whether permit writers will revise waivers to include monitoring provisions is uncertain.

5 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.

5.1 Municipal and Industrial Wastewater

Exhibit 5-1 summarizes the potential incremental costs to the sample facilities of complying with the Policy. Negative values represent cost savings associated with reduced WET testing requirements, and reduced accelerated monitoring and TRE activities associated with the change in statistical method, under the Policy. Reduced monitoring costs are typically attributable to removing acute WET testing requirements. Reduced TRE costs may result if effluent data analyzed under existing methods trigger permit requirements to implement a TRE and no such requirements are triggered under the Policy using the TST method.

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

Name	Monitoring[1]	Compliance Actions[2]	Total
Municipal Wastewater			
Sacramento Regional County Sanitation District WWTP	-$52,600	$0	-$52,600
Los Angeles County Sanitation District, San Jose Creek WRP (East and West)	-$3,900	-$15,000	-$18,900
Camrosa Water District WWTP	$0	$0	$0
Colton/San Bernardino RIX	-$6,400	-$14,400 to $400	-$20,800 to -$6,000
Davis WWTP	-$23,200	-$14,200 to $400	-$37,400 to -$22,800
Lompoc Regional WWTP	-$3,400	$0	-$3,400
Victor Valley Regional WWTP	$5,800	$400 to $15,200	$6,200 to $21,000
Industrials			
Aerojet	$4,800	ND	$4,800
Chevron, Richmond Refinery	-$25,900	$0	-$25,900
Pactiv Corporation, Molded Pulp Mill	-$5,500	$0	-$5,500
Dow Chemical Company	-$7,300	$0	-$7,300
DWR, Warne Power Plant	-$2,000 to $12,600	$0	-$2,000 to $12,600
Shell Oil, Martinez Refinery	-$20,300	$300 to $15,700	-$20,000 to -$4,600
USS POSCO Industries	-$6,800	-$1,500 to $13,900	-$8,300 to $7,100

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 potential incremental statewide costs associated with the Policy.

Exhibit 5-2 shows the calculation of incremental 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[2]	-$71,500	2	NA	2	-$71,500
Municipal Wastewater	-$53,800 to -$9,600	5	-$10,800 to -$1,900	125	-$1,350,000 to -$237,500
Chemicals and Allied Products	-$7,300	1	-$7,300	1	-$7,300
Metals Manufacturing and Finishers	-$7,400 to $7,900	1	-$7,400 to $7,900	1	-$7,400 to $7,900
Petroleum Refineries	-$45,900 to -$30,500	2	-$23,000 to -$15,300	9	-$207,000 to -$137,700
Pulp and Paper	-$5,500	1	-$5,500	1	-$5,500
Other Industrial	$2,800 to $17,400	2	$1,400 to $8,700	27	$37,800 to $234,900
Total	NA	14	NA	166	-$1,610,900 to -$216,700

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.
2. Represents 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.

5.2 Storm Water Dischargers

Incremental compliance costs to storm water discharges associated with additional enforcement actions due to a change in test analysis methods under the Policy are unlikely based on the State Water Board (2011) comparison of toxicity results for storm water data using the TST method and current toxicity methods. However, there could be incremental costs to storm water dischargers that do not currently have toxicity monitoring requirements if permit writers implement a recommended monitoring program under the Policy of approximately $8,700 per year.

5.3 Channelized Dischargers

Incremental costs to discharges from channelized dischargers associated with additional enforcement actions due to a change in test analysis methods under the Policy are unlikely based on the State Water Board (2011) comparison of toxicity results for storm water runoff from agriculture areas using the TST method and current toxicity methods. In addition, it is uncertain whether monitoring requirements would change under the Policy.

5.4 Limitations and Uncertainties

There are a number of uncertainties associated with the analysis of potential compliance and costs under the Policy due to data limitations. **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 Estimated Costs**	**Comments**
Treatment costs not estimated.	–	If a TRE is necessary, dischargers could incur some costs for reducing effluent toxicity. However, without information on the pollutants causing the toxicity, the magnitude of those costs cannot be estimated.
Compliance with Policy and thus estimated costs based on WET tests from 2006 through 2008.	?	Dischargers may test different species (due to rescreening and changes in acceptable test species) under the Policy, which could change compliance results. Effluent quality may have changed over time.
Incremental costs associated with a change in monitoring requirements are not estimated for channelized discharges.	?	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 if permit writers choose to include the recommended monitoring programs in permits; however, such costs could be offset by potential cost savings from other dischargers.
'?' = uncertain '-' = estimated costs may be understated		

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Appendix A: Facility Analyses

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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.

Abt Associates assumed that permit writers would not require routine 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 Costs: 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	$352 (*Pimephales promelas*)	NA	NA
Annual cost	$700	NA	-$700
Chronic			
Frequency	1/yr	12/yr	NA
# Species	3	1	NA
Test type	Single concentration	Single concentration	NA
Unit costs	$674 (*Ceriodaphnia dubia*) $600 (*Pimephales promelas*) $547 (*Selenastrum capricornutum*)	$607 (Uncertain[1])	NA
Annual cost	$1,800	$7,300	$5,500
Total			
Annual cost	$2,500	$7,300	$4,800

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 $4,800 per year.

Potential Total Annual Incremental Compliance Costs: Aerojet-General Corporation

Routine Monitoring	3-Species Sensitivity Monitoring	Permit Limit Compliance	Total Annual
$4,800	$0	$0	$4,800

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 Work Plan 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	9/1/2011
Permit expiration date	8/31/2016
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 (*Ceriodaphnia dubia*); 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	Submit TRE work plan based on required generic Work Plan within 30 days of exceeding an accelerated monitoring trigger
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. The 2011 permit revised chronic monitoring requirements to specify tests based on *Ceriodaphnia dubia* instead of *Macrocystis pyrifera*, however, due to a lack of more recent effluent data Abt Associates evaluated compliance with baseline permit requirements based on *Macrocystis pyrifera* data.

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	8
# exceeding limit	0
# exceeding accelerated monitoring trigger	0
Exceeding TRE trigger? (Y/N)	N

The discharger is in compliance with existing permit limits and requirements.

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	8
# of fails	0
# with mean effect >10%	0
"fail" = statistically significant using the TST method	

Based on existing chronic monitoring data, the discharger would not have RP under the Policy because there are no "fail" results and all of the test mean effects 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.

Abt Associates assumed that permit writers would not require routine acute monitoring under the Policy, as shown in the table below, and no routine monitoring is needed 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 Costs: 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	$387 (*Oncorhynchus mykiss*)	NA	NA
Annual cost	$20,100	NA	-$20,100
Chronic			
Frequency	4/yr	NA	NA
# Species	1	NA	NA
Test type	Multiple dilutions	NA	NA
Unit costs	$1,438 (*Macrocystis pyrifera*)	NA	NA
Annual cost	$5,800	NA	-$5,800
Total			
Annual cost	$25,900	$0	-$25,900
NA = not applicable.			

Thus, total incremental cost savings for the discharger may be approximately $25,900 per year.

Potential Total Annual Incremental Compliance Costs: Chevron, Richmond Refinery

Routine Monitoring	3-Species Sensitivity Monitoring	Permit Limit Compliance	Total Annual
-$25,900	$0	$0	-$25,900

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.

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 TRE trigger? (Y/N)	Y

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 major WWTP. 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
# of potential exceedances of MDEL	1
Failure of MDEL verification test	No
# of potential exceedances of MMEL	2*
"fail" = statistically significant using the TST method *Uncertain because there were no additional tests in the same calendar month to determine compliance.	

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*. In addition, the existing data indicate that there is one exceedance of the MDEL, however the verification test indicates that accelerated monitoring would not be necessary for the exceedance because the test passed. If a toxicity test result is a "fail," but the percent effect is below the MDEL, dischargers must conduct two additional toxicity tests within the same calendar month in order to determine compliance with the MMEL. If either of these two additional tests results in a "fail," the median monthly result is "fail" and the discharger will be in exceedance of the MMEL. Because the data to assess compliance with the MMEL are not available, Abt Associates estimated potential compliance based on both potential outcomes: 1) monitoring indicates exceedance of the MMEL and 2) monitoring indicates compliance with the MMEL.

A.4.5 Potential Incremental Impact Summary

Under the scenario in which additional monitoring indicates that the facility is exceeding the MMEL, the compliance actions under the Policy would be similar to those required under the existing permit. That is, the facility would need to conduct accelerated monitoring and a TRE. Thus, incremental costs would only reflect the additional monitoring associated with determining compliance with the MMEL, or approximately $400 per year.

Under the scenario in which additional monitoring indicates that the facility is in compliance with the MMEL, there could be a cost savings under the Policy because there would no longer be a requirement to conduct accelerated monitoring and a TRE. Potential cost savings could be approximately $14,400 per year.

Potential Incremental Permit Limit Compliance Costs: Colton/San Bernardino Regional Tertiary Treatment Facility

Scenario	Potential to Exceed MDEL	Verification Test Costs	Total Incremental Costs			Incremental Annual Costs[2]
			MMEL Monitoring[1]	Accelerated Monitoring	TRE	
Comply with MMEL	No	$0	$1,200	-$4,500	-$40,000	-$14,400
Exceed MMEL	No	$0	$1,200	$0	$0	$400

1. Represents unit cost of $607 per test (average of 3 freshwater species tests) multiplied by 2 follow-up tests for MMEL monitoring trigger.
2. Total incremental costs divided by period of which data were evaluated (three years).

In addition, routine monitoring requirements would change under the Policy in that chronic monitoring will be monthly with one species (most sensitive), but with a single-concentration test.

Routine Monitoring Costs: 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
Unit costs	$1,237 (*Ceriodaphnia dubia*)	$607 (Uncertain[1])	NA
Annual cost	$14,800	$7,300	-$7,600

NA = not applicable.
1. Sensitive species is uncertain because facility only has monitoring data for a single species; cost represents average of three freshwater species.

Incremental cost savings associated with routine monitoring would be approximately $7,600 per year.

There will also be an incremental cost associated with initial RP monitoring (chronic three-species testing) of approximately $6,200 (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 $1,200 per year (assuming a 5-year permit cycle).

Thus, total incremental cost savings may range from approximately $20,800 to $6,000 per year.

Potential Total Annual Incremental Compliance Costs: Colton/San Bernardino Regional Tertiary Treatment Facility

Routine Monitoring	3-Species Sensitivity Monitoring	Permit Limit Compliance	Total Annual
-$7,600	$1,200	-$14,400 to $400	-$20,800 to -$6,000

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)
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 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? (Y/N)	N

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? (Y/N)	N

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? (Y/N)	Y
Pimephales promelas	
Test	Survival and growth
# of tests	7
# exceeding accelerated monitoring trigger	1
Exceeding TRE trigger? (Y/N)	Y
Selenastrum capricornutum	
Test	Growth
# of tests	7
# exceeding accelerated monitoring trigger	1
Exceeding TRE trigger? (Y/N)	Y

Baseline Compliance, Chronic Toxicity: Davis WWTP Outfall 002

Ceriodaphnia dubia	
Test	Survival and reproduction
# of tests	2
# exceeding accelerated monitoring trigger	1
Exceeding TRE trigger? (Y/N)	Y
Pimephales promelas	
Test	Survival and growth
# of tests	2
# exceeding accelerated monitoring trigger	0
Exceeding TRE trigger? (Y/N)	N

Baseline Compliance, Chronic Toxicity: Davis WWTP Outfall 002

Selenastrum capricornutum	
Test	Growth
# of tests	1
# exceeding accelerated monitoring trigger	1
Exceeding TRE trigger? (Y/N)	Y

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 major WWTP. 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
# of potential exceedances of MDEL	0
# of potential exceedances of MMEL	0
Pimephales promelas	
Test	Survival and growth
# of tests	7
# of potential exceedances of MDEL	0
# of potential exceedances of MMEL	0
Selenastrum capricornutum	
Test	Growth
# of tests	7
# of potential exceedances of MDEL	0
# of potential exceedances of MMEL	1*
"fail" = statistically significant using the TST method *Uncertain because there were no additional tests in the same calendar month to determine compliance.	

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

Ceriodaphnia dubia	
Test	Survival and reproduction
# of tests	2
# of potential exceedances of MDEL	0
# of potential exceedances of MMEL	0
Pimephales promelas	
Test	Survival and growth
# of tests	2
# of potential exceedances of MDEL	0
# of potential exceedances of MMEL	0

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

Selenastrum capricornutum	
Test	Growth
# of tests	1
# of potential exceedances of MDEL	0
# of potential exceedances of MMEL	1*
*Uncertain because there were no additional tests in the same calendar month to determine compliance.	

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 may be exceedances of the chronic MMEL for both outfalls because there is one "fail" result for each with a percent effect less than 50%. Under the Policy additional monitoring to assess compliance with the MMEL (two additional samples in the same calendar month) would be needed. Because the data to assess compliance with the MMEL are not available, Abt Associates estimated potential compliance based on both potential outcomes: 1) monitoring indicates exceedance of the MMEL and 2) monitoring indicates compliance with the MMEL.

A.5.5 Potential Incremental Impact Summary

Under the scenario in which additional monitoring indicates that the facility is exceeding the MMEL, the compliance actions under the Policy would be similar to those required under the existing permit. That is, the facility would need to conduct accelerated monitoring and a TRE. Thus, incremental costs would only reflect the additional monitoring associated with determining compliance with the MMEL, or approximately $400 per year.

Under the scenario in which additional monitoring indicates that the facility is in compliance with the MMEL, there could be a cost savings under the Policy because there would no longer be a requirement to conduct accelerated monitoring and a TRE. Potential cost savings could be approximately $14,200 per year.

Potential Incremental Permit Limit Compliance Costs: Davis WWTP

Scenario	Exceed MDEL	Verification Test Costs	Total Incremental Costs			Incremental Annual Costs[2]
			MMEL Monitoring[1]	Accelerated Monitoring	TRE	
Comply with MMEL	No	$0	$1,100	-$3,700	-$40,000	-$14,200
Exceed MMEL	No	$0	$1,100	$0	$0	$400

1. Represents unit cost of $547 per test (for *Selenastrum capricornutum*) multiplied by 2 follow-up tests for exceedances of MMEL monitoring triggers at each outfall.
2. Total incremental costs divided by period of which data were evaluated (three years).

In addition, routine monitoring requirements would change under the Policy in that Abt Associates assumed that permit writers would not require routine 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: 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	$387 (*Oncorhynchus mykiss*)	NA	NA
Annual cost	$9,300	NA	-$9,300
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	$1,237 (*Ceriodaphnia dubia*) $1,225 (*Pimephales promelas*) $920 (*Selenastrum capricornutum*)	$547 (*Selenastrum capricornutum* [1])	NA
Annual cost	$27,100	$13,100	-$14,000
Total			
Annual cost	$36,400	$13,100	-$23,200

NA = not applicable.
Note: Detail may not add to total due to independent rounding.
1. Based on *Selenastrum capricornutum* as most sensitive species for both outfalls.

Incremental cost savings associated with routine monitoring would be approximately $23,200 per year.

There is no incremental cost associated with initial RP monitoring (chronic three-species testing) because the permit already requires such testing quarterly.

Thus, total incremental cost savings for the discharger may range from approximately $37,400 to $22,800 per year.

Potential Total Annual Incremental Compliance Costs: Davis WWTP

Routine Monitoring	3-Species Sensitivity Monitoring	Permit Limit Compliance	Total Annual
-$23,200	$0	-$14,200 to $400	-$37,400 to -$22,800

A.6 Dow Chemical Company, Pittsburg 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, Pittsburg 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, Pittsburg 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 TRE/TIE
Resume regular testing condition	Return to routine monitoring after appropriate elements of TRE Work Plan 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 acute and chronic monitoring data for the facility from 7/25/06 to 4/21/08.

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

Thalassiosira pseudonana	
Test	Growth
# of tests[1]	7
# exceeding accelerated monitoring trigger	0
Exceeding TRE trigger? (Y/N)	N
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

Permit writers 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, Pittsburg Plant

Thalassiosira pseudonana	
Test	Growth
# of tests[1]	7
# fails[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*. “fail” = statistically significant using the TST method	

The discharger would not have RP under the Policy because there are no “fail” results 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 costs associated with permit limits 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 Costs: Dow Chemical, Pittsburg Plant

Component	Baseline	Policy	Incremental
Acute			
Frequency	4/yr	NA	NA
# Species	1	NA	NA
Test type	Single concentration	NA	NA
Unit cost	$370 (most sensitive[1])	NA	NA
Annual cost	$1,500	NA	-$1,500
Chronic			
Frequency	4/yr	NA	NA
# Species	1	NA	NA
Test type	Multiple dilutions	NA	NA
Unit costs	$1,438 (*Thalassiosira pseudonana*)[2]	NA	NA
Annual cost	$5,800	NA	-$5,800
Total			
Annual cost	$7,300	NA	-$7,300

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 approximately $7,300 per year.

Potential Total Annual Incremental Compliance Costs: Dow Chemical, Pittsburg Plant

Routine Monitoring	3-Species Sensitivity Monitoring	Permit Limit Compliance	Total Annual
-$7,300	$0	$0	-$7,300

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	7/3/2010
Permit expiration date	6/10/2015
Dilution	None
Acute monitoring	Annually; 1 species (*Pimephales promelas* for fresh water, *Atherinops affinis* for brackish water; *Menidia beryllina* optional if salinity 1 to 32 ppt); 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%, average for any three consecutive bioassays.
Chronic monitoring	Annually; vertebrate, invertebrate, plant initial test for 3 consecutive months; most sensitive species thereafter.
Chronic limits	>1.0 TUc
Accelerated monitoring trigger	Average survival in undiluted effluent of 3 consecutive 96-hr bioassay data points < 90% OR single test less than 70% survival (acute); Monthly median toxicity exceeds 1.0 TUc (chronic).
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. For chronic toxicity, if any three of the initial test plus the six follow-up tests exceeds 1 TUc, Discharger must begin a TRE.
Resume regular testing condition	If the additional data points indicate compliance with acute toxicity limitation, the Discharger may resume regular testing. Executive Officer may end accelerated schedule once TRE/TIE initiated if no longer needed.

A.7.3 Baseline Compliance

The following table summarizes acute WET data from 2/22/07 – 4/23/08. Chronic monitoring requirements and limits were added to the 2010 permit. Thus, due to a lack of more recent effluent data, Abt Associates could not evaluate compliance with baseline chronic toxicity requirements.

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

Species	*Pimephales promelas*
Test	Survival
# of tests	14
# exceeding limit[2]	1
# exceeding accelerated monitoring trigger	1
Exceeding TRE trigger? (Y/N)[3]	N
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 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 effluent limits under the Policy.

A.7.5 Potential Incremental Impact Summary

Because there are no chronic data from which to assess compliance, Abt Associates assumed that the compliance actions under the Policy would be the same as those under the baseline (i.e., accelerated monitoring).

Abt Associates assumed that permit writers would not require routine acute monitoring under the Policy. 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	$352 (*Pimephales promelas*)	NA	NA
Annual cost	$700	NA	-$700
Chronic			
Frequency	1/yr at 2 outfalls	12/yr at 2 outfalls	NA
# Species	1 (after determining most sensitive)	1	NA
Test type	Single concentration	Single concentration	NA
Unit costs	$607 (average of 3 species)	$607 (Uncertain[1])	NA
Annual cost	$1,200	$14,600	$13,300
Total			
Annual cost	$1,900	$14,600	$12,600
NA = not applicable. Note: detail may not add to total due to independent rounding. 1. The most sensitive species is uncertain; costs represent average across freshwater species.			

Incremental routine monitoring costs may be approximately $12,600 per year if the discharger has RP or a cost savings of $2,000 per year if the discharger does not have RP.

There is also no cost of initial RP monitoring because the permit already requires single-concentration chronic test costs for freshwater vertebrates, invertebrates, and aquatic plants for Outfalls 001 and 002 at the beginning of each permit cycle.

Thus, total incremental costs may range from a cost savings of approximately $2,000 per year if there is no RP to approximately $12,600 per year under a scenario of RP.

Potential Total Annual Incremental Compliance Costs: DWR, Warne Power Plant

Routine Monitoring	3-Species Sensitivity Monitoring	Permit Limit Compliance	Total Annual
-$2,000 to $12,600	$0	$0	-$2,000 to $12,600

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 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	7/24/2009
Permit expiration date	5/10/2014
Dilution	None
Acute monitoring	Annually; 1 species (*Pimephales promelas* for fresh water discharges, *Atherinops affinis* for brackish discharges, and *Menidia beryllina* for brackish waters with salinity of 1 to 32 ppt)
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 (acute) or monthly median chronic toxicity greater than 1.0 TUc.
TRE trigger	Any two of the six accelerated tests are less than 90% survival (acute, TIE); Any three out of the initial test and the six additional tests results exceed 1.0 TUc (chronic, TRE)
Resume regular testing condition	If the additional data points indicate compliance with acute toxicity limitation, the Discharger may resume regular testing.

A.8.3 Baseline Compliance

The following tables summarize WET data from 5/11/06 – 6/5/08 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 TRE trigger? (Y/N)	N

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? (Y/N)	N

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 TRE trigger? (Y/N)	N
Pimephales promelas	
Test	Survival and growth
# of tests	27
# exceeding limit	1
# exceeding accelerated monitoring trigger	1
Exceeding TRE trigger? (Y/N)	N
Selenastrum capricornutum	
Test	Growth
# of tests	2
# exceeding limit	0
# exceeding accelerated monitoring trigger	0
Exceeding TRE trigger? (Y/N)	N

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? (Y/N)	N
Pimephales promelas	
Test	Survival and growth
# of tests	32
# exceeding limit	4
# exceeding accelerated monitoring trigger	4
Exceeding TRE trigger? (Y/N)	Y
Selenastrum capricornutum	
Test	Growth
# of tests	3
# exceeding limit	0
# exceeding accelerated monitoring trigger	0
Exceeding TRE trigger? (Y/N)	N

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 major WWTP. 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
# of potential exceedances of MDEL	0
# of potential exceedances of MMEL	0
Pimephales promelas	
Test	Survival and growth
# of tests	27
# of potential exceedances of MDEL	0
# of potential exceedances of MMEL	0
Selenastrum capricornutum	
Test	Growth
# of tests	2
# of potential exceedances of MDEL	0
# of potential exceedances of MMEL	0
“fail” = statistically significant using the TST method	

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

Ceriodaphnia dubia	
Test	Survival and reproduction
# of tests	4
# of potential exceedances of MDEL	1
Failure of verification test for MDEL	No
# of potential exceedances of MMEL	0
Pimephales promelas	
Test	Survival and growth
# of tests	32
# of potential exceedances of MDEL	0
# of potential exceedances of MMEL	0
Selenastrum capricornutum	
Test	Growth
# of tests	3
# of potential exceedances of MDEL	0
# of potential exceedances of MMEL	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 Policy. The available data indicate that the discharger would not be in exceedance of either the MDEL or MMEL based on 100% effluent samples for the East and West plants.

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, the discharger would likely be in compliance with projected effluent limits. Thus, there could be incremental cost savings under the Policy of approximately $15,000 per year (-$4,900 for accelerated monitoring + -$40,000 for TRE ÷ 3 year period of data).

Potential Incremental Permit Limit Compliance Costs: LACSD San Jose Creek WRP

Scenario	Exceed MDEL	Verification Test Costs	Total Incremental Costs			Incremental Annual Costs[2]
			MMEL Monitoring[1]	Accelerated Monitoring	TRE	
Comply with Limits	No	$0	$0	-$4,900	-$40,000	-$15,000
1. Represents unit cost of $1,237 per test (for *Ceriodaphnia dubia*) multiplied by 4 tests. 2. Total incremental costs divided by period of which data were evaluated (three years).						

Abt Associates assumed that permit writers would not require routine 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	$352 (*Pimephales promelas*)	NA	NA
Annual cost	$1,100	NA	-$1,100
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	$674 (*Ceriodaphnia dubia*) $600 (*Pimephales promelas*) $547 (*Selenastrum capricornutum*)	$674 (*Ceriodaphnia dubia*)	NA
Annual cost	$27,100	$24,200	-$2,800
Total			
Annual cost	$28,200	$24,200	-$3,900
NA = not applicable.			

Incremental cost savings associated with routine monitoring would be approximately $3,900 per year.

Thus, total incremental cost savings may be approximately $18,900 per year.

Potential Total Annual Incremental Compliance Costs: LACSD San Jose Creek WRP

Routine Monitoring	3-Species Sensitivity Monitoring	Permit Limit Compliance	Total Annual
-$3,900	$0	-$15,000	-$18,900

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	1/13/2012
Permit expiration date	1/13/2017
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 (acute) or chronic toxicity in effluent > 1.0 TUc
TRE/TIE trigger	If 2 of three accelerated toxicity tests are failed, perform TIE
Resume regular testing condition	If accelerated monitoring indicates that toxicity triggers are not exceeded, return to regular monitoring.

A.9.3 Baseline Compliance

The following tables summarize WET data from 6/7/06 – 9/13/08.

Baseline Compliance, Acute Toxicity: Lompoc Regional WWTP

Pimephales promelas	
Test	Survival
# of tests	24
# exceeding limit	1
# exceeding accelerated monitoring trigger	1
Exceeding TRE trigger? (Y/N)	N
Ceriodaphnia dubia	
Test	Survival
# of tests	3
# exceeding limit	0
# exceeding accelerated monitoring trigger	0
Exceeding TRE trigger? (Y/N)	N

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? (Y/N)	N
Pimephales promelas	
Test	Survival and growth
# of tests	1
# exceeding limit	0
# exceeding accelerated monitoring trigger	0
Exceeding TRE trigger? (Y/N)	N
Selenastrum capricornutum	
Test	Growth
# of tests	11
# exceeding limit	11
# exceeding accelerated monitoring trigger	11
Exceeding TRE trigger? (Y/N)	Y

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 major WWTP. 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
# of potential exceedances of MDEL	0
# of potential exceedances of MMEL	0
Pimephales promelas	
Test	Survival and growth
# of tests	1
# of potential exceedances of MDEL	0
# of potential exceedances of MMEL	0
Selenastrum capricornutum	
Test	Growth
# of tests	11
# of potential exceedances of MDEL	5
Failure of verification tests	Not available
# of potential exceedances of MMEL	5*
"fail" = statistically significant using the TST method *Uncertain because there were no additional tests in the same calendar month to determine compliance.	

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. The data indicate that the discharger is exceeding both the chronic MDEL and MMEL based on 100% effluent sample.

A.9.5 Potential Incremental Impact Summary

Given exceedances of both the MDEL and MMEL under the Policy, the facility would likely need accelerated monitoring and a TRE. However, given the *Selenastrum capricornutum* results, the discharger would likely need to conduct accelerated monitoring and a TRE under the baseline as well. Thus, incremental controls costs are likely zero.

Abt Associates assumed that permit writers would not require routine acute monitoring under the Policy. 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	$352 (*Pimephales promelas*)	NA	NA
Annual cost	$4,200	NA	-$4,200
Chronic			
Frequency	4/yr for most sensitive species; 2 additional species for 1st quarter	12/yr	NA
# Species	Varies (*Selenastrum capricornutum* most sensitive)	1	NA
Test type	Multiple dilutions	Single concentration	NA
Unit costs	$1,237 (*Ceriodaphnia dubia*) $1,225 (*Pimephales promelas*) $920 (*Selenastrum capricornutum*)	$547 (*Selenastrum capricornutum*)	NA
Annual cost	$4,200	$6,600	$2,400
Total			
Annual cost	$8,400	$6,600	-$1,800
NA = not applicable.			

Thus, total incremental cost savings for the discharger may be $1,800 per year.

Potential Total Annual Incremental Compliance Costs: Lompoc Regional WWTP

Routine Monitoring	3-Species Sensitivity Monitoring	Permit Limit Compliance	Total Annual
-$1,800	$0	$0	-$1,800

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	6/10/2011
Permit expiration date	6/1/2016
Dilution	None
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 exhibits toxicity of > 1 TUc, the Discharger shall perform four chronic toxicity tests in a six week period using species that exhibited toxicity.
TIE/TRE trigger	If a pattern of toxicity is demonstrated, specifically if any of the four chronic toxicity tests subsequent to the initial failure demonstrates toxicity, a TRE is required. Executive Officer may also require a TRE if other evidence indicates toxicity occurs >20% of the time. A TIE may be required if appropriate.
Resume regular testing condition	If source of toxicity is readily identified, four consecutive accelerated tests that do not exceed the monitoring trigger will be considered sufficient to assume regular monitoring

A.10.3 Baseline Compliance

The following tables summarize WET data from 8/8/06 – 8/14/07.

Baseline Compliance, Acute Toxicity: Pactiv Corporation

Species	*Oncorhynchus mykiss*
Test	Survival and reproduction
# of tests	32
# exceeding limits	0

Baseline Compliance, Chronic Toxicity: Pactiv Corporation

Ceriodaphnia dubia	
Test	Survival and reproduction
# of tests	2
# exceeding accelerated monitoring trigger	2
Exceeding TRE trigger? (Y/N)	No data to evaluate
Pimephales promelas	
Test	Survival and growth
# of tests	3
# exceeding accelerated monitoring trigger	3
Exceeding TRE trigger? (Y/N)	No data to evaluate
Selenastrum capricornutum	
Test	Growth
# of tests	2
# exceeding accelerated monitoring trigger	2
Exceeding TRE trigger? (Y/N)	No data to evaluate

The discharger exceeded the accelerated monitoring trigger for chronic toxicity for all species over the period of the data. In addition, although there are no accelerated monitoring data from which to determine whether a TRE would be needed under the existing permit, given that all observations exceed the chronic monitoring trigger, it is likely that a TRE would be needed under baseline requirements.

A.10.4 Policy Compliance

The previous permit (2006) allowed an 8:1 dilution ration, which represents and IWC of 12.5% effluent. However, the 2011 permit does not allow for dilution, resulting in an IWC representing a 100% effluent sample. Due to a lack of more recent data, Abt Associates evaluated compliance with the Policy based on the highest percent effluent data available, 50%.

The following table summarizes WET data from 8/8/06 – 8/14/07 under the Policy based on comparison of 50% 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 fails	0
# with mean effect >10%	0
Pimephales promelas	
Test	Survival and growth
# of tests	3
# of fails	1
# with mean effect >10%	2
# of potential exceedances of MDEL	0
# of potential exceedances of MMEL	1*
Selenastrum capricornutum	
Test	Growth
# of tests	2
# of fails	0
# with mean effect >10%	0
"fail" = statistically significant using the TST method *Uncertain because there were no additional tests in the same calendar month to determine compliance.	

Based on the analysis of effluent data under the Policy, the discharger would have RP because two of the test results for *Pimephales promelas* have a mean effect above 10%.

The single "fail" result with percent effect below 50% would trigger monitoring to assess compliance with the MMEL. However, the data to assess compliance with the MMEL are not available. Given that the analysis reflects a dilution ratio of 2:1 (50% effluent samples) and the facility does not currently receive dilution in its existing permit, Abt Associates estimated potential compliance based on the assumption that accelerated monitoring indicates exceedance of the MMEL.

A.10.5 Potential Incremental Impact Summary

Under the scenario in which additional monitoring indicates that the facility is exceeding the MMEL, compliance actions under the baseline are likely the same as those under the Policy (i.e., accelerated monitoring and a TRE). Thus, incremental costs would be zero.

In addition, routing monitoring requirements would change in that Abt Associates assumed that permit writers would not require routine 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: Pactiv Corporation

Component	Baseline	Policy	Incremental
Acute			
Frequency	24/yr	NA	NA
# Species	1	NA	NA
Test type	Single concentration	NA	NA
Unit cost	$387 (*Oncorhynchus mykiss*)	NA	NA
Annual cost	$9,300	NA	-$9,300
Chronic			
Frequency	1/yr	12/yr	NA
# Species	3	1	NA
Test type	Multiple dilutions	Single concentration	NA
Unit costs	$1,237 (*Ceriodaphnia dubia*) $1,225 (*Pimephales promelas*) $920 (*Selenastrum capricornutum*)	$600 (*Pimephales promelas*)	NA
Annual cost	$3,400	$7,200	$3,800
Total			
Annual cost	$12,700	$7,200	-$5,500
NA = not applicable.			

Total incremental cost savings associated with routine monitoring for the discharger may be approximately $5,500.

There is also no incremental cost associated with initial RP monitoring (chronic three-species testing) because the permit already requires three-species testing annually.

Thus, total incremental cost savings may be approximately $5,500 per year.

Potential Total Annual Incremental Compliance Costs: Pactiv Corporation

Routine Monitoring	3-Species Sensitivity Monitoring	Permit Limit Compliance	Total Annual
-$5,500	$0	$0	-$5,500

A.11 Sacramento Regional 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: 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.11.2 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	12/1/2010
Permit expiration date	12/1/2015
Dilution	None
Acute monitoring	Weekly; 1 species (*Oncorhynchus mykiss, as of July 1, 2011*)
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	Monthly; 3 species (*Pimephales promelas*, *Ceriodaphnia dubia*, *Selenastrum capricornutum*); standard 5 dilution series (ranging from 100 to 6.25% sample)
Chronic limits	None
Accelerated monitoring trigger	TUc >= 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 tests 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.11.3 Baseline Compliance

The following tables summarize WET data from 1/2/06 to 7/21/08. Note that the 2010 permit changed the acute species from *Pimephales promelas* to *Oncorhynchus mykiss* as of July 2011. Thus, due to a lack of more recent effluent data, the analysis below is based on *Pimephales promelas* for acute toxicity.

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? (Y/N)	Y
Pimephales promelas	
Test	Survival and growth
# of tests	10
# exceeding accelerated monitoring trigger	1
Exceeding TRE trigger? (Y/N)	N
Selenastrum capricornutum	
Test	Growth
# of tests	12
# exceeding accelerated monitoring trigger	0
Exceeding TRE trigger? (Y/N)	N

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

A.11.4 Policy Analysis

The discharger has RP under the Policy because it is a major WWTP. 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
# of potential exceedances of MDEL	13
Failure of verification tests	Yes
Pimephales promelas	
Test	Survival and growth
# of tests	10
# of potential exceedances of MDEL	2
Failure of verification tests	Not available
# of potential exceedances of MMEL	4*
Selenastrum capricornutum	
Test	Growth
# of tests	12
# of potential exceedances of MDEL	0
# of potential exceedances of MMEL	1*
"fail" = statistically significant using the TST method *Uncertain because there were no additional tests in the same calendar month to determine compliance.	

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 chronic MDEL based on 100% effluent sample.

A.11.5 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.

However, Abt Associates assumed that permit writers would not require routine 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	$387 (*Oncorhynchus mykiss*)	NA	NA
Annual cost	$20,100	NA	-$20,100
Chronic			
Frequency	12/yr	12/yr	NA
# Species	3	1	NA
Test type	Multiple dilutions	Single concentration	NA
Unit costs	$1,237 (*Ceriodaphnia dubia*) $1,225 (*Pimephales promelas*) $920 (*Selenastrum capricornutum*)	$674 (*Ceriodaphnia dubia*)	NA
Annual cost	$40,600	$8,100	-$32,500
Total			
Annual cost	$60,700	$8,100	-$52,600
NA = not applicable. Note, details may not add to total due to independent rounding.			

Thus, total incremental cost savings for the discharger may be $52,600 per year.

Potential Total Annual Incremental Compliance Costs: Sacramento Regional WWTP

Routine Monitoring	3-Species Sensitivity Monitoring	Permit Limit Compliance	Total Annual
-$52,600	$0	$0	-$52,600

A.12 Shell Oil, Martinez Refinery

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: 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.12.2 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 90th 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.12.3 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? (Y/N)	N

The discharger is in compliance under the existing permit for the period of data.

A.12.4 Policy Compliance

Permit writers 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
Test	Growth and Survival
# of tests	9
# of fails	1
# with mean effect >10%	2
# of potential exceedances of MDEL	0
# of potential exceedances of MMEL	1*
"fail" = statistically significant using the TST method *Uncertain because there were no additional tests in the same calendar month to determine compliance	

The permit indicates that *Americamysis bahia* is the most sensitive species. Based on these data, the discharger would have RP under the Policy because two samples have a mean effect greater than 10%.

Compliance with the projected chronic limits is based on 10% effluent sample. The monitoring data in the table indicate that the one "fail" result with percent effect below 50% would result in the need for additional monitoring to assess compliance with the MMEL. Because the data to assess compliance with the MMEL are not available, Abt Associates estimated potential compliance based on both potential outcomes: 1) monitoring indicates exceedance of the MMEL and 2) monitoring indicates compliance with the MMEL.

A.12.5 Potential Incremental Impact Summary

Under the scenario in which additional monitoring indicates that the facility is exceeding the MMEL under the Policy, the discharger could incur incremental costs associated with accelerated monitoring and a TRE (the discharger is in compliance with baseline limits). Thus, incremental costs could be approximately $15,700 per year (as shown in the table below).

Under the scenario in which additional monitoring indicates that the facility is in compliance with the MMEL, incremental costs reflect the cost of additional monitoring of $300 per year.

Potential Incremental Permit Limit Compliance Costs: Shell Oil, Martinez Refinery

Scenario	Exceed MDEL	Verification Test Costs	Total Incremental Costs			Incremental Annual Costs[2]
			MMEL Monitoring[1]	Accelerated Monitoring	TRE	
Comply with MMEL	No	$0	$1,000	$0	$0	$300
Exceed MMEL	No	$0	$1,000	$6,200	$40,000	$15,700

1. Represents unit cost of $500 per test (*Holmesimysis costata*) for follow-up tests.
2. Total incremental costs divided by period of data evaluated (three years).

In addition, routine monitoring requirements would change under the Policy in that Abt Associates assumed that permit writers would not require routine acute monitoring, as shown in the table below. Chronic monitoring will be monthly, but with single-concentration tests.

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	$387 (*Oncorhynchus mykiss*)	NA	NA
Annual cost	$20,100	NA	-$20,100
Chronic			
Frequency	4/yr	12/yr	NA
# Species	1	1	NA
Test type	Multiple dilutions	Single concentration	NA
Unit costs	$1,550 (*Americamysis bahia*)[1]	$500 (*Americamysis bahia*[1,2])	NA
Annual cost	$6,200	$6,000	-$200
Total			
Annual cost	$26,300	$6,000	-$20,300

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.

Total incremental cost savings associated with routine monitoring for the discharger may be $20,300.

Also, 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).

Thus, total incremental cost savings may range from approximately $4,600 to $20,000 per year.

Potential Total Annual Incremental Compliance Costs: Shell Oil, Martinez Refinery

Routine Monitoring	3-Species Sensitivity Monitoring	Permit Limit Compliance	Total Annual
-$20,300	$0	$300 to $15,700	-$20,000 to -$4,600

A.13 USS-POSCO Industries

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: 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.13.2 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	9/1/2011
Permit expiration date	8/31/2016
Dilution	4:1
Acute monitoring	Biweekly; 1 species (*Oncorhynchus mykiss*); 96 hour continuous flow-through bioassay using dechlorinated effluent
Acute limits	The survival of organisms in undiluted effluent shall be an 11-sample median value of not less than 90% survival, and an 11-sample 90 percentile value of not less than 70% 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 8 TUc or three-sample median of 4 TUc. Accelerated monitoring is monthly.
TRE trigger	If accelerated monitoring data points continue to exceed chronic toxicity limitation(s) then the discharger shall initiate a chronic toxicity reduction evaluation and continue accelerated monitoring.
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.13.3 Baseline Compliance

The following tables summarize WET data from 3/1/06 to 5/28/08.

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	Larval development
# of tests	8
# exceeding limit	2
# exceeding accelerated monitoring trigger	2
Exceeding TRE trigger? (Y/N)	N

The discharger has exceeded acute and chronic limits over the period of data.

A.13.4 Policy Compliance

Permit writers can allow dilution at their discretion. However, assuming that the facility would receive a dilution ratio of 4:1 as in the existing permit, the IWC would represent a 25% 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.

Analysis of Effluent Data under the Policy, Chronic Toxicity: USS-POSCO Industries

Species	*Haliotis rufescens*
Test	Larval development
# of tests	8
# of fails	1
# with mean effect >10%	2
# of potential exceedances of MDEL	0
# of potential exceedances of MMEL	1*
"fail" = statistically significant using the TST method *Uncertain because there are no additional tests in the same calendar month to determine compliance	

Based on the 25% effluent sample the discharger would have RP because 2 test results have mean effects greater than 10%. The single "fail" result with a percent effect below 50% would trigger monitoring to assess compliance with the MMEL. Because the data to assess compliance with the MMEL are not available, Abt Associates estimated potential compliance based on both potential outcomes: 1) monitoring indicates exceedance of the MMEL and 2) monitoring indicates compliance with the MMEL.

A.13.5 Potential Incremental Impact Summary

Under the scenario in which additional monitoring indicates that the facility is exceeding the MMEL, the facility may need to conduct accelerated monitoring and a TRE; under baseline requirements the facility only exceeded the accelerated monitoring trigger (and not the TRE trigger). Thus, incremental costs would reflect the additional monitoring associated with determining compliance with the MMEL and the potential for a TRE, or approximately $13,900 per year.

Under the scenario in which additional monitoring indicates that the facility is in compliance with the MMEL, there could be a cost savings under the Policy because there would no longer be a requirement to conduct accelerated monitoring. Potential cost savings could be approximately $1,400 per year.

Potential Incremental Permit Limit Compliance Costs: USS-POSCO Industries

Scenario	Exceed MDEL	Verification Test Costs	Total Incremental Costs			Incremental Annual Costs[2]
			MMEL Monitoring[1]	Accelerated Monitoring	TRE	
Comply with MMEL	No	$0	$1,700	-$6,000	$0	-$1,400
Exceed MMEL	No	$0	$1,700	$0	$40,000	$13,900

1. Represents unit cost of $845 per test (*Haliotis rufescens*) multiplied by 2 follow-up tests for the exceedance of the MMEL monitoring trigger.
2. Total incremental costs divided by period of which data were evaluated (3 years).

In addition, routing monitoring requirements would change in that Abt Associates assumed that permit writers would not require routine acute monitoring under the Policy, as shown in the table below. Chronic monitoring will be monthly if there is RP.

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	$387 (*Oncorhynchus mykiss*)	NA	NA
Annual cost	$10,100	NA	-$10,100
Chronic			
Frequency	4/yr	12/yr	NA
# Species	1	1	NA
Test type	Multiple dilutions	Single concentration	NA
Unit costs	$1,502 (*Haliotis rufescens*)	$845 (*Haliotis rufescens* [1])	NA
Annual cost	$6,000	$10,100	$4,100
Total			
Annual cost	$16,100	$10,100	-$6,000

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 $6,000 per year.

Also, 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).

Thus, total incremental cost savings may range from a cost savings of approximately $7,400 to a cost of approximately $7,900 per year.

Potential Total Annual Incremental Compliance Costs: USS-POSCO Industries

Routine Monitoring	3-Species Sensitivity Monitoring	Permit Limit Compliance	Total Annual
-$6,000	$0	-$1,400 to $13,900	-$7,400 to $7,900

A.14 Victor Valley Regional WWTP

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: 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.14.2 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.
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.14.3 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? (Y/N)	N

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? (Y/N)	N
Pimephales promelas	
Test	Survival and growth
# of tests	3
# exceeding accelerated monitoring trigger	0
Exceeding TRE trigger? (Y/N)	N

The discharger is in compliance with WET requirements in the current permit.

A.14.4 Policy Compliance

The discharger has RP under the Policy because it is a major WWTP. 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
# of potential exceedances of MDEL	0
Pimephales promelas	
Test	Survival and growth
# of tests	3
# of potential exceedances of MDEL[1]	0
# of potential exceedances of MMEL	2*
1. Based on survival results only. *Uncertain because there were no additional tests in the same calendar month to determine compliance	

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*.

Two "fail" results with percent effects below 50% for *Pimephales promelas* would trigger monitoring to assess compliance with the MMEL. Because the data to assess compliance with the MMEL are not available, Abt Associates estimated potential compliance based on both potential outcomes: 1) monitoring indicates exceedance of the MMEL and 2) monitoring indicates compliance with the MMEL.

A.14.5 Potential Incremental Impact Summary

Under the scenario in which confirmatory monitoring indicates that the facility is exceeding the MMEL, the facility would likely incur incremental costs under the Policy for additional monitoring associated with determining compliance with the MMEL and to conduct accelerated monitoring and a TRE. Thus, incremental costs would be approximately $15,200 per year.

Under the scenario in which additional monitoring indicates that the facility is in compliance with the MMEL, there would only be incremental costs associated with additional monitoring to determine compliance with the MMEL of approximately $400 per year.

Potential Incremental Permit Limit Compliance Costs: Victor Valley Regional WWTP

Scenario	Exceed MDEL	Verification Test Costs	Total Incremental Costs			Incremental Annual Costs[2]
			MMEL Monitoring[1]	Accelerated Monitoring	TRE	
Comply with MMEL	No	$0	$1,200	$0	$0	$400
Exceed MMEL	No	$0	$1,200	$4,500	$40,000	$15,200

1. Represents unit cost of $607 per test (average of 3 freshwater species tests) for follow-up tests for 2 exceedances of MMEL monitoring triggers.
2. Total incremental costs divided by the period of the data evaluated (3 years).

In addition, routine monitoring requirements would change under the Policy in that Abt Associates assumed that permit writers would not require 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	$352 (*Pimephales promelas*)	NA	NA
Annual cost	$1,400	NA	-$1,400
Chronic			
Frequency	1/yr	12/yr	NA
# Species	2	1	NA
Test type	Single concentration	Single concentration	NA
Unit costs	$674 (*Ceriodaphnia dubia*) $600 (*Pimephales promelas*)	$607 (Uncertain[1])	NA
Annual cost	$1,300	$7,300	$6,000
Total			
Annual cost	$2,700	$7,300	$4,600

NA = not applicable.
1. Sensitive species is uncertain; cost represents average of all freshwater species.
Note detail may not add to totals due to independent rounding.

Incremental costs associated with routine monitoring would be $4,600 per year.

There will also be a cost of initial RP monitoring of approximately $6,200 at the beginning of each permit cycle (based on four samples per species and average single-concentration chronic test costs for freshwater vertebrates, invertebrates, and aquatic plants), or $1,200 per year (assuming a five-year permit cycle).

Thus, total incremental costs for compliance with the Policy may range from $6,200 to $21,000 per year.

Potential Total Annual Incremental Compliance Costs: Victor Valley Regional WWTP

Routine Monitoring	3-Species Sensitivity Monitoring	Permit Limit Compliance	Total Annual
$4,600	$1,200	$400 to $15,200	$6,200 to $21,000