REVISED STAFF REPORT

PROPOSED AMENDMENTS TO THE WATER QUALITY CONTROL PLAN – LOS ANGELES REGION – TO INCORPORATE SITE-SPECIFIC AMMONIA OBJECTIVES FOR SELECT INLAND SURFACE WATERS IN THE SAN GABRIEL RIVER, LOS ANGELES RIVER AND SANTA CLARA RIVER WATERSHEDS

May 30, 2007

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I. Introduction

This staff report discusses the scientific basis for proposed Basin Plan amendments to establish site-specific water quality objectives for ammonia for various reaches and tributaries of the Los Angeles River, Santa Clara River and San Gabriel River.

Ammonia is a pollutant routinely found in the wastewater effluent of Publicly Owned Treatment Works (POTWs), landfill leachate, and runoff from agricultural fields where commercial fertilizers and animal manure are applied. Because ammonia is toxic to aquatic life, the United States Environmental Protection Agency (US EPA) Office of Water has determined that control of ammonia discharges to surface waters of the United States is necessary to protect aquatic life uses in surface waters of the United States.

When developing its 1985 water quality criteria for ammonia, the US EPA reviewed data regarding the relationship of ammonia toxicity to various physicochemical properties of the test water, especially temperature and pH. The US EPA concluded in the 1985 document that ammonia toxicity can depend on the ionic composition of the exposure water, but the effects were not clear and consistent enough to include other variables in the criterion. In 1999, the US EPA published an update to its 1985 ambient water quality criteria for ammonia titled "1999 Update of Ambient Water Quality Criteria for Ammonia" (hereafter referred to as 1999 update). The US EPA reiterated, "there is still insufficient understanding and information to account for these effects in the criterion and they will have to be addressed using water-effect ratios or other site-specific approaches" (US EPA 1999).

Studies cited in the 1999 update indicate that ammonia toxicity may be reduced in waterbodies with high hardness and elevated concentrations of certain ions. The hardness and ionic concentrations of many waterbodies in the Los Angeles Region are much higher than concentrations found in the laboratory water used in the national studies that were the basis for the national ammonia criteria.

The purpose of this proposed Basin Plan amendment is to take into account ionic composition in local receiving waters to develop site-specific 30-day average objectives for a subset of inland surface waters in three watersheds in the Los Angeles Region. These site-specific objectives are derived using US EPA's "Guidelines for Deriving Numerical National Water Quality Criteria for the Protection of Aquatic Organisms and Their Uses," "1999 Update of Ambient Water Quality Criteria for Ammonia," and "Interim Guidance on Determination and Use of Water-Effect Ratios for Metals" (US EPA 1985, 1999, 1994).

The Los Angeles Regional Water Quality Control Board (Regional Board) is the California state agency responsible for setting and enforcing water quality standards for surface waters in Los Angeles and Ventura counties. Water quality standards in California consist of designated beneficial uses, narrative and numeric water quality objectives (equivalent to the federal term "criteria") for protection of designated uses, and an anti-degradation policy. Water quality standards and control measures for surface and ground waters of the Los Angeles Region are set forth in the "Water Quality Control Plan for the Los Angeles Region" (Basin Plan), available online at www.waterboards.ca.gov/losangeles.

The Regional Board must formally adopt Basin Plan amendments to incorporate new water quality standards or revise existing standards. These standards then must be approved by the California State Water Resources Control Board (State Board), the California Office of Administrative Law (OAL), and the US EPA [for surface water standards only]. Opportunities for public participation in the Basin Plan amendment process occur at the Regional and State Board levels. The water quality standards not specifically proposed for change in this amendment will continue to apply to all waterbodies affected by these amendments.

Table 1 describes the affected waterbodies and Figures 1 through 3 illustrate the locations of these waterbodies. Detailed documentation of the environmental setting of the three watersheds affected by the amendment, including information on Total Maximum Daily Loads (TMDL), wastewater treatment facilities and the specific reaches affected by the amendment is available on the Regional Board's website at:

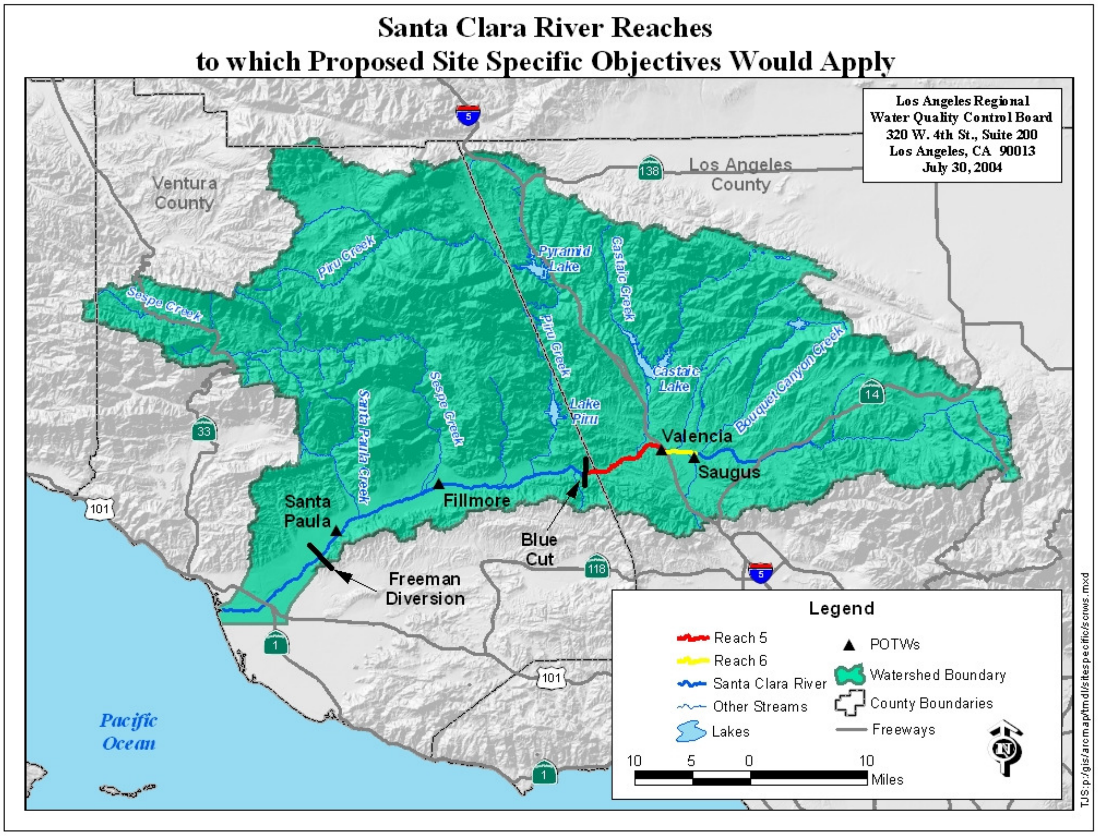
- http://www.waterboards.ca.gov/losangeles/html/programs/regional_program/ws_santaclara.html,
- http://www.waterboards.ca.gov/losangeles/html/programs/regional_program/ws_losangeles.html, and
- http://www.waterboards.ca.gov/losangeles/html/programs/regional_program/ws_sangabriel.html.

The revised site-specific objectives will be implemented through the Regional Board's existing permitting and enforcement authority, and in particular, through TMDLs and NPDES permits for POTWs discharging to these waterbodies.

Table 1
Description of Affected Waterbodies

Reach Name	Reach Length (in miles)	Upstream and Downstream Points
Los Angeles River Reach 5	5.42	Sepulveda Basin
Los Angeles River Reach 4	9.60	Sepulveda Dam to Riverside Drive
Los Angeles River Reach 3	9.27	Riverside Drive to Figueroa Street
Burbank Western Channel	2.11	to confluence with LA River
San Jose Creek	15.76	to confluence with San Gabriel River
San Gabriel River Reach 2 and 3	9.59	Confluence of San Jose Creek to Firestone Boulevard
San Gabriel River Reach 1	8.70	Firestone Boulevard to the Estuary
Coyote Creek	1.06	to confluence with San Gabriel River
Rio Hondo above Whittier Narrows Dam	11.69	Upstream of Whittier Narrows Dam
Santa Clara River Reach 6	2.79	Bouquet Canyon Road Bridge to West Pier Highway 99
Santa Clara River Reach 5	8.29	West Pier Highway 99 to Blue Cut gauging station

Figure 1



Santa Clara River Reaches
to which Proposed Site Specific Objectives Would Apply
Los Angeles Regional
Water Quality Control Board
320 W. 4th St., Suite 200
Los Angeles, CA 90013
July 30, 2004
Ventura County
Los Angeles County
Piru Creek
Sespe Creek
Pyramid Lake
Castaic Creek
Castaic Lake
Bouquet Canyon Creek
Lake Piru
Santa Paula Creek
Valencia
Saugus
Fillmore
Santa Paula
Blue Cut
Freeman Diversion
Pacific Ocean
Legend
Reach 5
Reach 6
Santa Clara River
Other Streams
Lakes
POTWs
Watershed Boundary
County Boundaries
Freeways
10 5 0 10
Miles
TJS:p:/gis/aromap/tmdl/sitespecific/scrws.mxd

Figure 2

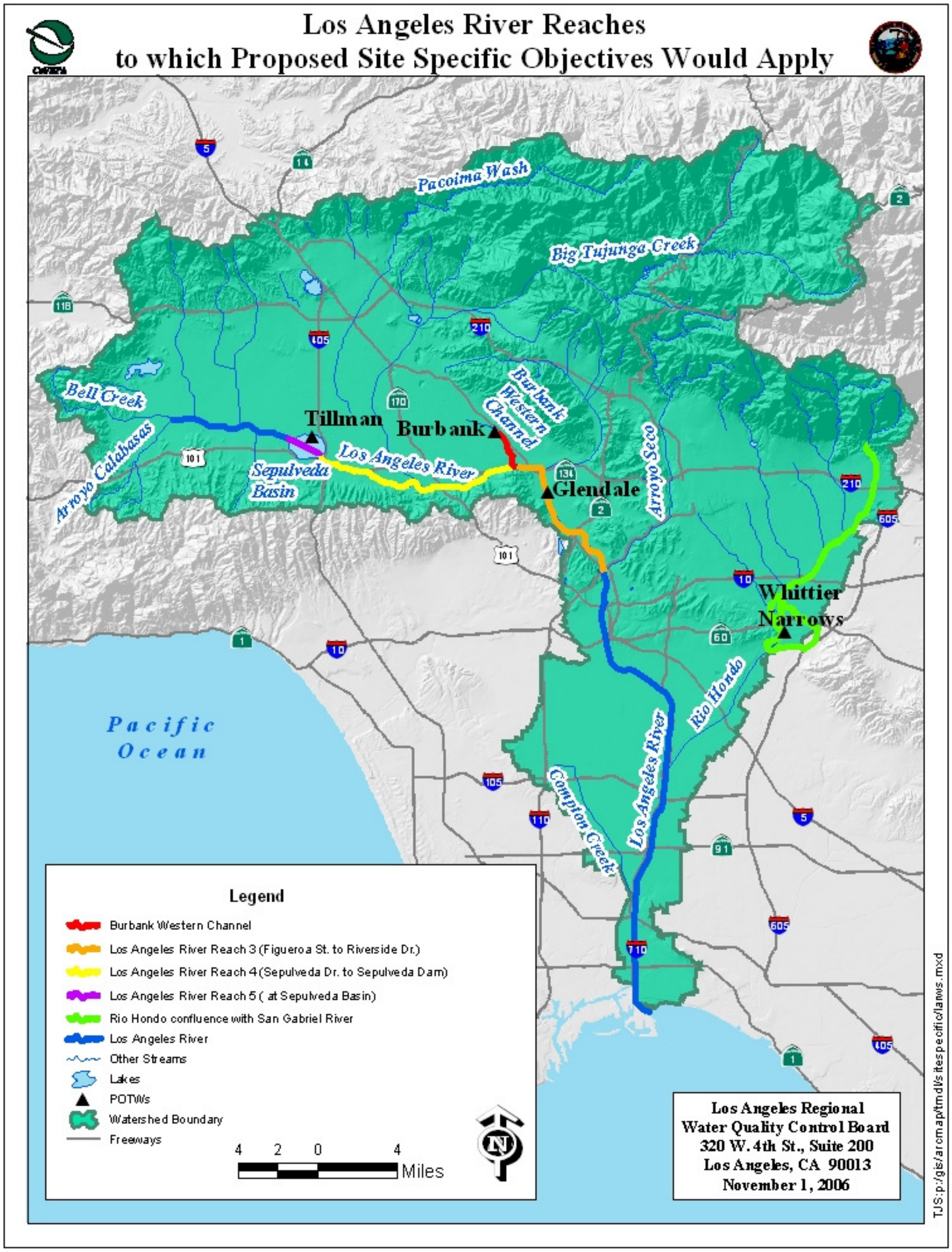
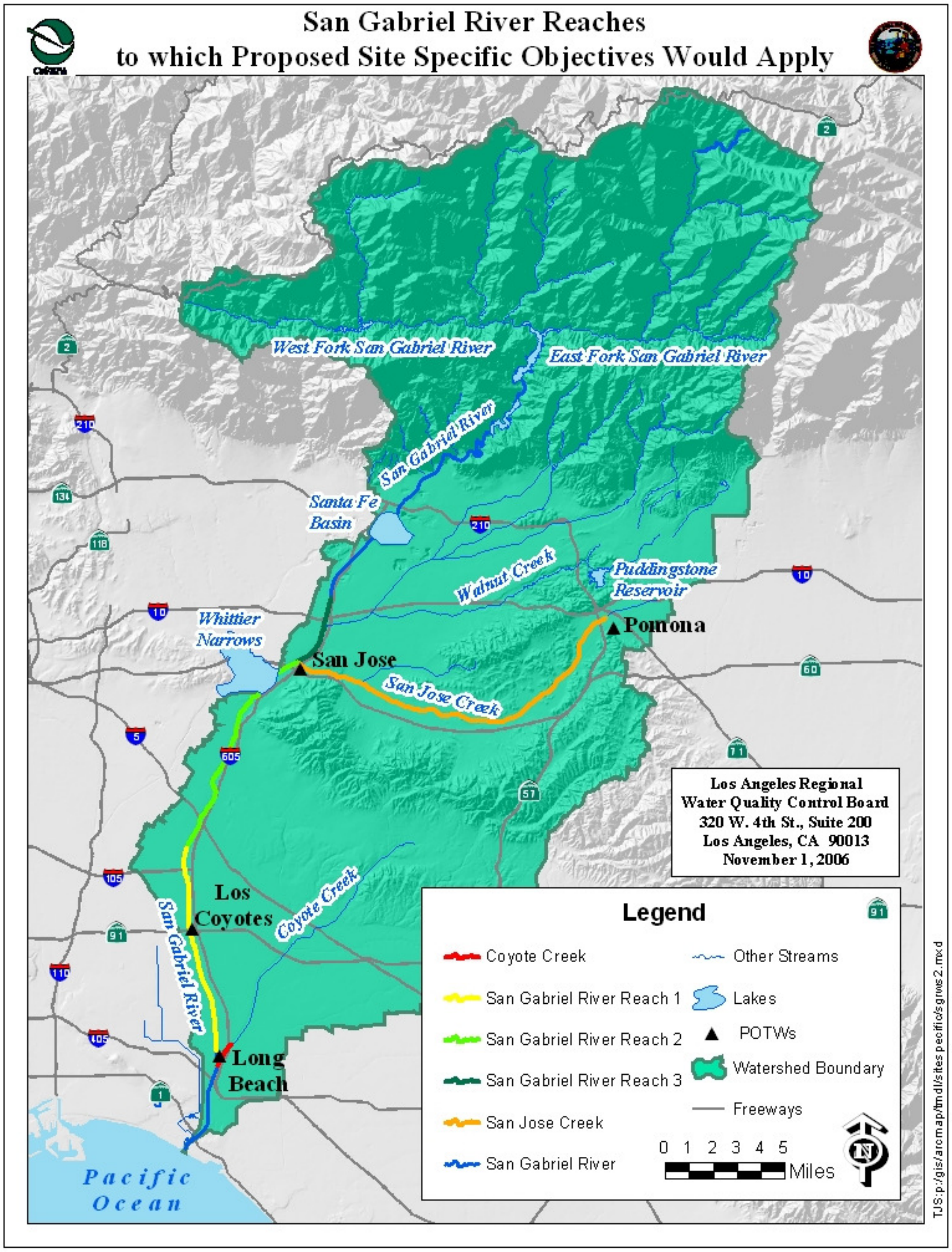

Los Angeles River Reaches
to which Proposed Site Specific Objectives Would Apply
Pacoima Wash
Big Tujunga Creek
Bell Creek
Arroyo Calabasas
Tillman
Sepulveda Basin
Los Angeles River
Burbank
Burbank Western Channel
Glendale
Arroyo Seco
Whittier Narrows
Rio Hondo
Compton Creek
Los Angeles River
Pacific Ocean
Legend
Burbank Western Channel
Los Angeles River Reach 3 (Figueroa St. to Riverside Dr.)
Los Angeles River Reach 4 (Sepulveda Dr. to Sepulveda Dam)
Los Angeles River Reach 5 (at Sepulveda Basin)
Rio Hondo confluence with San Gabriel River
Los Angeles River
Other Streams
Lakes
POTWs
Watershed Boundary
Freeways
4 2 0 4
Miles
Los Angeles Regional
Water Quality Control Board
320 W. 4th St., Suite 200
Los Angeles, CA 90013
November 1, 2006
TJS:p:/gis/arcmap/tmdl/sitespecific/lanws.mxd

Figure 3



San Gabriel River Reaches
to which Proposed Site Specific Objectives Would Apply
West Fork San Gabriel River
East Fork San Gabriel River
San Gabriel River
Santa Fe Basin
Walnut Creek
Puddingstone Reservoir
Whittier Narrows
San Jose
Pomona
San Jose Creek
Los Coyotes
Coyote Creek
San Gabriel River
Long Beach
Pacific Ocean
Los Angeles Regional
Water Quality Control Board
320 W. 4th St., Suite 200
Los Angeles, CA 90013
November 1, 2006
Legend
Coyote Creek
San Gabriel River Reach 1
San Gabriel River Reach 2
San Gabriel River Reach 3
San Jose Creek
San Gabriel River
Other Streams
Lakes
POTWs
Watershed Boundary
Freeways
0 1 2 3 4 5
Miles
TJS:p:/gis/aromap/tmdl/sitespecific/sgrws2.mxd

A. History of Proposed Amendment

In 2001, the Regional Board identified updating the ammonia objectives for inland surface waters in the Los Angeles Region as the second highest priority during its Triennial Review of Basin Planning Priorities (Regional Board Resolution 01-011, adopted on May 31, 2001). Staff began discussing the proposed amendment with the US EPA and the State Board in 2001.

On April 25, 2002, the Regional Board adopted a Basin Plan Amendment updating the freshwater ambient objectives for ammonia based on US EPA's currently recommended Clean Water Act (CWA) section 304(a) criteria contained in the 1999 Update (US EPA 1999). The State Board approved the amendment on April 30, 2003; OAL approved the amendment on June 5, 2003; and the US EPA approved the revised ammonia objectives on June 19, 2003. The updated objectives include formulas for computing allowable one-hour average and 30-day average concentrations of total ammonia based on ambient water temperature and pH conditions as well as the presence (or absence) of salmonids and early life stages of fish (ELS). They also include tables of allowable concentrations under representative temperature and pH conditions taken from the 1999 Update.

On December 1, 2005, the Regional Board revised the Basin Plan Amendment that updated the freshwater ambient objectives for ammonia described above. The revision to the previous amendment was made at the direction of the Regional Board and specifically addressed the ELS implementation provisions. In the 2002 amendment, the Regional Board elected to use the Region's "Spawning, Reproduction and/or Early Development" (SPWN) beneficial use as a proxy for the presence of ELS. Stakeholders raised concerns that the Region's SPWN designations did not accurately reflect the entire universe of waterbodies in the region where fish spawning, reproduction and early development are occurring. To address these concerns, the Regional Board directed staff to convene a technical advisory committee to evaluate the approach recommended by staff and identify alternative approaches that could be implemented.

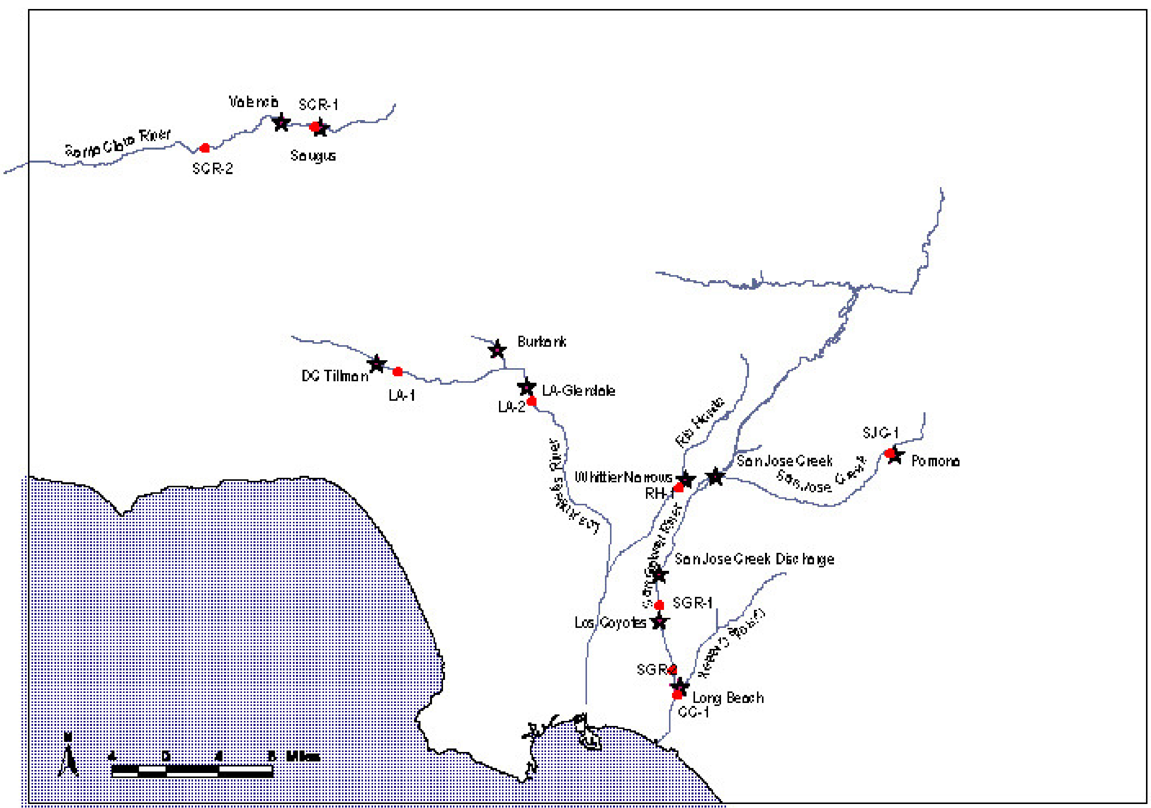
The revised ELS implementation provisions employ a narrowly tailored approach by using two criteria to classify waterbodies in the region as "ELS Present" for the sole purpose of implementing the freshwater 30-day average ammonia objective. The two criteria are (1) the presence of fish species that reproduce in significant numbers at temperatures below 15 degrees C and (2) physical conditions that *do not* preclude fish reproduction. The 15-degree C threshold is used because, under the regional 30-day average objective, at temperatures below 15 degrees C ELS are the most chronically sensitive organism to ammonia toxicity. At temperatures above 15 degrees C, invertebrates are the most chronically sensitive organism and, therefore, it is irrelevant whether ELS are present or not. The State Board approved the 2005 amendment on July 19, 2006 (Resolution 2006-0053) and OAL approved the amendment on August 31, 2006. US EPA approved the amendment on February 16, 2007.

Prior to updating the ammonia objectives, the Basin Plan contained ammonia objectives based on EPA's 1985 recommended criteria (US EPA 1985). At the time of adoption, the Regional Board recognized that significant upgrades to treatment facilities at POTWs might be needed to achieve the new objectives. As a result, the Regional Board included in the Basin Plan a compliance schedule of up to eight years (i.e. until June 13, 2002) to achieve the ammonia objectives or to develop site-specific objectives (SSOs) for ammonia.

In August 2001, the County Sanitation Districts of Los Angeles County (CSDLAC) and Cities of Los Angeles and Burbank (collectively, agencies) began discussing with Regional Board staff a proposal to develop ammonia SSOs using the US EPA's water effect ratio (WER) methodology (US EPA 1994). The purpose of the study was to calculate WERs for several waterbody segments and use these WERs to adjust the 30-day average objective. *Adjustments to the one-hour average objective (i.e. acute objective) were not proposed* *as a part of this study. Furthermore, no adjustments were proposed to the saltwater ammonia objectives for inland brackish or saline waters or the ammonia objectives for ocean waters.* A work plan for the study was prepared by Larry Walker Associates under contract to the agencies and is included in its entirety as Appendix 1.

The agencies focused their efforts in three watersheds -- the Los Angeles River, Santa Clara River and San Gabriel River. Within these three watersheds, study sites were located downstream of each agency's POTWs. The rationale for focusing on waterbodies to which major POTWs discharge was that the agencies wanted to ensure that the ammonia objectives that would be the basis for TMDLs and, ultimately, effluent limits in permits were as precise as possible as these agencies planned for facility upgrades and adjustments to treatment processes (i.e. Nitrification/Denitrification [N/DN]) to meet TMDL and permit requirements. See Figure 4 for the locations of the major POTWs and study sites. (Stars represent POTW locations; dots represent sampling locations for the SSO Study.) This proposed amendment is a direct result of this study.

Figure 4
Locations of Study Sites



B. Summary of Proposed Action

The existing Basin Plan establishes regional water quality objectives for ammonia in inland surface waters that are based on US EPA's 1999 Update. The Basin Plan also contains implementation provisions for these objectives, which include a discussion of the use of Water Effect Ratios to derive site-specific objectives for ammonia where appropriate.

Regional Board staff proposes an amendment to the Basin Plan to incorporate site-specific ammonia objectives for select inland surface waters. The proposed amendment would change the current 30-day average (i.e. chronic) objective in Chapter 3 of the Basin Plan for the subset of inland surface waters listed in Table 1 and shown in Figures 1 through 3. The proposed amendment would not change the current one-hour average (i.e. acute) objective. The goal of this amendment is to take into account site-specific conditions that have been shown to reduce the toxicity of ammonia to aquatic life and aquatic invertebrates in particular. The proposed changes are based on toxicity tests using the amphipod crustacean *Hyalella azteca*, the most chronically sensitive test species used in the development of the national ammonia criteria, and the US EPA's "Guidelines for Deriving Numerical National Water Quality Criteria for the Protection of Aquatic Organisms and Their Uses," "Interim Guidance on Determination and Use of Water-Effect Ratios for Metals" and the 1999 Update (US EPA 1985, 1994, 1999). Additionally, the proposed amendment would add site-specific implementation provisions for protection of ELS, which would supersede those adopted by the Regional Board in December 2005 for the affected waterbodies listed in Table 1as provided for under subparagraph 3 of "Implementation Provisions for the Application of Ammonia Objectives to Inland Surface Waters in the Los Angeles Region."

II. Purpose of Basin Plan Amendment

The criteria contained in US EPA's 1999 Update constitute the agency's current recommended federal CWA section 304(a) criteria for ammonia, which States, Territories, and authorized Tribes may use as guidance in adopting water quality standards. Water quality standards developed from the section 304(a) criteria are designed to protect the beneficial uses identified for a particular waterbody. Water quality standards form the basis for setting numeric targets and load allocations in Total Maximum Daily Loads (TMDLs) and for establishing enforceable water quality-based effluent limitations (WQBELs) in discharge permits.

Section 304(a)(1) of the CWA (33 U.S.C. 1314(a)(1)) directs US EPA to publish and periodically update ambient water quality criteria. These criteria are to reflect the latest scientific knowledge on the identifiable effects of the pollutants on public health and welfare, aquatic life, and recreation. These criteria serve as guidance to States, Territories and authorized Tribes in adopting water quality standards under section 303(c) of the CWA that protect aquatic life from acute and chronic effects of ammonia. State and Tribal decision-makers retain the discretion to adopt water quality standards on a case-by-case basis that differ from this guidance when appropriate and where supported by local data. The proposed SSOs for ammonia would take into account differences that affect the toxicity of ammonia between the local water chemistry and that of the test water used in the development of the national criteria. The proposed SSOs would provide the same level of protection for aquatic life in the affected waterbodies as the national 30-day average criterion is intended to, but would be more easily attainable much of the time. The amendments will facilitate development and implementation of TMDLs as well as ongoing Regional Board oversight of discharges from POTWs to these waterbodies.

A. Rationale for Developing Site-Specific Ammonia Objectives

Ambient water quality criteria are set at the national level by the US EPA to be protective of conditions throughout the United States. Because of the variety of waterbodies and differing conditions throughout the country, the criteria developed on the national level might be over- or under-protective for some waterbodies. Beyond the headwaters, many of the waterbodies in the Los Angeles Region receive significant inputs of effluent from POTWs, particularly during the prevailing dry weather conditions in Southern California. Characteristics of these waterbodies, such as high hardness and ionic composition, vary from conditions in other waterbodies where there is significant flow from sources other than POTW discharges. The objective of this amendment is to adopt site-specific 30-day average (i.e. chronic) objectives for ammonia in select waterbodies that will provide the same level of protection for aquatic life in these waterbodies that is intended by be as protective as the nationally derived 30-day average criterion (also known as the CCC), but not over-protective of the aquatic life in these waterbodies. Site-specific one-hour average (i.e. acute) objectives (also known as CMCs) are not being proposed as a part of this amendment.

In 1999, the US EPA issued an update to the 1985 Ambient Water Quality Criteria for Ammonia. In both of the criteria documents, the US EPA acknowledged that ammonia toxicity may be dependent on the ionic composition of the exposure water, but the effects and understanding of these effects were insufficient to allow inclusion of them in the national criteria derivation. In the 1999 Update, US EPA states that these effects will "have to be addressed using water-effect ratios or other site-specific approaches" (US EPA 1999). Studies cited in the 1999 Update include several studies done to investigate the impacts of the ionic composition of the exposure water on the toxicity of ammonia to a number of species, including Atlantic salmon, lake trout, rainbow trout, *Ceriodaphnia dubia* and *Hyalella azteca*. The results of these studies indicate that the toxicity of ammonia may be reduced in waterbodies similar to those found in Southern California with high hardness and elevated concentrations of certain ions (calcium, sodium and potassium). Because many of the waterbodies in the Los Angeles Region are dominated by effluent, the hardness and ionic concentrations in these waterbodies are much higher than the concentrations found in the test water used in the studies that were the basis for the ammonia criteria. For this reason, there is a potential to develop WERs for ammonia in these waterbodies.

In the recent past, and in subsequent years, the Regional Board will consider several TMDLs for nutrients, including ammonia. Adoption of this Basin Plan amendment will revise the Region's 30-day average ammonia water quality objective for select waterbodies based on local conditions. By adopting the most precise objectives based on local conditions, the Regional Board will facilitate and strengthen future TMDL development and implementation and permit issuance in these waterbodies.

III. Sources of Information and Data

The technical report prepared by Larry Walker Associates, Inc. contains the scientific background and basis for the proposed Basin Plan amendment. In addition, Regional Board staff reviewed additional scientific literature and water quality criteria documents relevant to the proposed amendments. Regional Board staff did not perform or contract for any water quality sampling or other field or laboratory studies as part of this project. The final consultants' report on recommended site-specific ammonia objectives (Larry Walker Associates, 2003) is included as Appendix 2 to this staff report, and other reference documents are cited as appropriate. Most of the ambient water quality data were collected under the dischargers' self-monitoring programs associated with their NPDES permits or as part of this study. These data meet the Regional Board's quality assurance/quality control requirements.

IV. Technical and Stakeholder Input

The "Ammonia Water Effects Ratio and Site-Specific Objective Workplan for Los Angeles County Waterbodies" was developed during 2001-02 by Larry Walker Associates. The work plan was reviewed by the Regional Board, US EPA Region IX staff, and a Technical Advisory Committee (TAC) comprised of Charles Delos, US EPA Headquarters, Gary Chapman, private consultant, and ~~David Hansen~~Steve Bay, Southern California Coastal Water Research Project (SCCWRP). Charles Delos and Gary Chapman were authors, along with several others, of US EPA's 1994 Interim Guidance. Charles Delos co-authored the 1999 Update. This approach to review is consistent with US EPA's WER guidance (US EPA, 1994), which recommends that a multi-disciplinary "design team" with site-specific knowledge be used.

The work plan for this study called for a technical advisory committee consisting of three to four experts in the fields of standards development, WER development, toxicology, and water quality to review of the work plan and subsequent deliverables for this study, written by LWA.

Additionally, the work plan for the study called for a stakeholder coordinating committee comprised of representatives of organizations that would be affected by, or had general interest in, the study and its outcome. The stakeholder coordinating committee met several times during the course of the study.

Health and Safety Code Section 57004 mandates external scientific peer review to determine whether the scientific portions of proposed rule are based upon sound scientific knowledge, methods, and practices. In accordance with this statute, the chief of the Toxicology and Peer Review Section of the Division of Water Quality, State Water Resources Control Board identified Dr. Inge Werner, Assistant Research Scientist – Aquatic Toxicology, Department of Anatomy, Physiology and Cell Biology, School of Veterinary Medicine, University of California, Davis as the external peer reviewer for the proposed amendment to adopt site-specific objectives for ammonia in a subset of waterbodies within the San Gabriel, Los Angeles and Santa Clara River watersheds. Regional Board staff sent a formal request for review to Dr. Inge Werner along with the scientific documents and supporting documents for her review. On September 8, 2004, Dr. Werner emailed her comments. Dr. Werner stated that, "it is clear to the reader that based on previous work and recommendations of the US EPA, the WER approach and the "Guidelines for Deriving Numerical Water Quality Criteria for Protection of Aquatic Organisms and their Uses" are the appropriate approaches for determining site-specific numerical objectives for ammonia in the Southern California water bodies under discussion." She further stated that, "[t]he number of performed tests is appropriate and the relatively low variability between sites on the same water body confirms that results are scientifically acceptable." Finally, she states that, "[t]he approaches [to calculating the final WERs and SSOs] are scientifically sound since they follow the US EPA guidance documents and are sufficiently conservative in nature, where deviations from the guidance document occur." Regional Board staff considered and responded to ~~these~~ Dr. Werner's comments, and made revisions as appropriate.

"Regional projects" must conduct a CEQA scoping meeting (section 21083.9 of Public Resources Code). CEQA Scoping meetings are designed to identify the "scope and content" of the environmental documents, including the range of actions, alternatives, mitigation measures, and significant effects to be analyzed (CCR § 15083). Notice of a CEQA scoping meeting for the project was sent to interested persons and agencies. The meeting was held on May 3, 2006. Comments received at this meeting were considered and addressed in the substitute documents for this proposed action.

V. Site-Specific Objectives for Ammonia

The 1994 Basin Plan included ammonia objectives based on US EPA's recommended 304(a) criteria, published in 1985 and revised in a 1992 memorandum. The Regional Board gave dischargers up to eight years following the adoption of the Basin Plan (i.e. until June 13, 2002) by the Regional Board to "(i) make the necessary adjustments/improvements to meet these [ammonia] objectives or (ii) to conduct studies leading to an approved site-specific objective for ammonia". (See Basin Plan, 1994, p. 3-3) In August 2001, the agencies began discussing with the Regional Board a proposal to develop SSOs in the Los Angeles, San Gabriel and Santa Clara River watersheds. Larry Walker Associates, the consultant retained by the agencies, completed a final work plan for the SSO study in May 2002 based on input from a technical advisory committee (TAC) and the Regional Board. The work plan provided an overview of the WER methodology and proposals for ambient water sampling and toxicity tests. Plans for SSO development were further refined from 2002-2003 through discussions with the TAC, Regional Board staff, and US EPA Region IX staff. Larry Walker Associates and its subcontractors carried out field sampling and laboratory analysis from January 2002 to February 2003. Larry Walker Associates prepared a final report, including final WERs and recommendations for SSOs, in September 2003 based on input from the TAC, a stakeholder Coordinating Committee and Regional Board staff.

The following is a summary of the technical basis for the proposed SSOs. Appendix 2 contains the final consultant's report in its entirety, which provides more technical details, Quality Assurance/Quality Control procedures, and calculations. For the most part, the methods follow the US EPA's direction for the development of SSOs using WERs (1994a, 1994b), guidelines for deriving numeric criteria for protection of aquatic life (1985), and procedures for calculating acute and chronic ammonia toxicity criteria from the 1999 Update.

A. SSOs and the WER Approach[1]

The US EPA's recommended national aquatic life criteria for ammonia and other constituents are based upon available toxicity data for species with reproducing wild populations in North America. The criteria are derived from a required minimum dataset of Genus Mean Acute Values (GMAVs) calculated from all acceptable data for species within a given genus. Species values (Species Mean Acute Value or SMAV) are the geometric mean of all acceptable data for each species.

Most national aquatic criteria consist of an acute value (the Criteria Maximum Concentration or CMC) and a chronic value (the Criterion Continuous Concentration or CCC). Both the CMC and the CCC have three parts, an average concentration magnitude, an averaging duration, and a return period. The magnitude is expressed as a chemical concentration and is calculated from the toxicity dataset for each chemical. The duration and return periods are default periods established by the US EPA. Duration is the period over which the concentration is averaged. For most toxic chemicals, the duration is usually one hour for the CMC and four days for the CCC. However, a 30-day averaging period is currently used for the US EPA's ammonia criteria. The current "return period" (i.e., allowable frequency of exceedance) for all US EPA aquatic life criteria is one allowable exceedance every three years on the average based on US EPA's "Guidelines for Deriving Numerical National Water Quality Criteria for Protection of Aquatic Life and their Uses" (US EPA 1985). US EPA is currently drafting new guidance, "Modeling Framework Applied to Establishing an Allowable Frequency of Exceeding Aquatic Life Criteria", which may update the allowable

[1] Most of the following information is condensed from California State Water Resources Control Board, 2003. Available on-line at www.waterboards.ca.gov by clicking on "Division of Water Quality" on the left-hand side of screen and then scrolling to the bullet item on "Site-specific Objectives" guidance.

frequency of exceedances of the ammonia criteria to five percent of the time (US EPA, December 2005, in draft).

The national aquatic life criteria developed from laboratory tests are intended to be protective of aquatic organisms in all surface waters, because they are based on data for many species and because tests are generally conducted in high quality waters. However, the US EPA recognizes that chemicals may be either more or less toxic under site-specific conditions in ambient water than in laboratory tests. There are several US EPA-accepted procedures for establishing site-specific objectives based on ambient conditions. The WER procedure is the most commonly used.

A water effect ratio, or WER, is the ratio of the toxicity of a chemical in site water to that chemical's toxicity in laboratory test water.

$$\text{WER} = \frac{\text{Site Water Ammonia } LC_{50}}{\text{Lab Water Ammonia } LC_{50}}$$

The procedure involves conducting a minimum of three sets of side-by-side toxicity tests using both laboratory and site water. The "effect level" of the test determined in the site water is divided by the "effect level" for the laboratory water to derive the WER. (The "effect level" used in the SSO study was the LC_{50}, the concentration of ammonia lethal to 50 percent of the test organisms.) Typically, the WER is then multiplied by an existing water quality objective to give the SSO. If the chemical is less toxic in the site water than in laboratory water, the multiplier is greater than one and results in a higher objective. If the chemical is more toxic in the site water, the multiplier is less than one and results in a lower objective.

B. Test organism: Hyalella azteca

Hyalella azteca are amphipod crustaceans and are small-bodied, measuring about 5.5 millimeters long. They average about 15 broods of young over a five-month period. They are omnivorous scavengers, "most frequently found feeding under plant mats and rocks in shallow pools" (AMEC, 2003). *H. azteca* was the most chronically sensitive test species used in the development of the national ammonia criteria and, thus, drives the 30-day average regional objective in most cases.[2]

The US EPA (1994) WER guidance recommends use of at least two different species, preferably a fish and an invertebrate, in toxicity tests for development of SSOs using the WER procedure. While two species, a fish and an invertebrate, were used in the toxicity testing for the study, the proposed SSOs were ultimately developed using only the results from the *H. azteca* toxicity tests.

Fathead minnow (*Pimephales promelas*) was used as the secondary species, but based on the recommendation of the TAC, fathead results were not used in the final calculation of the WERs or SSOs. The primary reason for this was because as the results of the study were gathered, it became clear that fathead minnow demonstrated a WER near 1.0 in all cases, which was significantly lower than the results for *H. azteca*. Because the fathead minnow is a less sensitive species than *H. azteca,* a lower WER was expected during the testing. Based on the differences in sensitivities between the two species (*H. azteca* is

[2] This is because the equation for the 30-day average objective is set up such that the lower of the invertebrate (i.e. ~~Hyalella~~ *H. azteca*) Genus Mean Chronic Value (GMCV) of 1.45 multiplied by the temperature function or fish GMCV of 2.85 is used to calculate the objective. This ensures that both invertebrates and fish species, including early life stages of fish, are adequately protected.

$$\text{30-day Average Concentration} = \left(\frac{0.0577}{1+10^{7.688-pH}}+\frac{2.487}{1+10^{pH-7.688}}\right)*MIN\left(2.85, 1.45*10^{0.028*(25-T)}\right)$$

two times more sensitive to ammonia than fathead based on the 1999 Update), the WERs found for fathead confirm the results of the *H. azteca* testing because they are approximately half of the WERs found for *H. azteca.* However, since the fathead minnow was less sensitive than *H. azteca* (i.e. ammonia toxicity was observed at a significantly higher concentration, above the range of the probable SSO values), the question was raised whether the fathead minnow WER value should be given equal weight in the final WER calculation. Consequently, the TAC recommended that an alternative approach should be used for calculating ammonia SSOs in this particular study. It was decided that to develop a SSO for ammonia, the WER calculated from the *H. azteca* data would be used to adjust the invertebrate data used to calculate the ammonia objective whereas the fish data used in the objective equation calculation would not be adjusted. After the adjustments for the invertebrate data, the objective would be recalculated to determine the SSO. For example, in the equation for the 30-day average objective (CCC) below for one of the sites, the final function requires that the lower of either the 1) fish GMCV (2.85) or 2) adjusted invertebrate GMCV (2.03) be used in the calculation of the final objective to ensure protection of both fish and invertebrate species.

$$CCC = \left(\frac{0.0676}{1 + 10^{7.688 - pH}} + \frac{2.912}{1 + 10^{pH - 7.688}} \right) * 0.92 * MIN(2.85, 2.03 * 10^{0.028*(25-T)})$$

Using this alternative approach, given the observed differences between fish and invertebrates in local site water, guarantees the protection of both in local waterbodies based on the results of the WER testing.

C. Summary of Technical Elements of SSO Development

The following is a technical summary of the WER and SSO development from Larry Walker Associates (2003). Methods and QA/QC procedures are described in this report, which includes a copy of the study work plan (Larry Walker Associates, 2003). See Appendices 1 and 2 for more details.

1. Sampling locations were located downstream of ten wastewater treatment plants (POTWs) on seven waterbodies. Sampling was conducted between January 2002 and February 2003. At all but one station, four samples were collected for the primary test species, *H. azteca*. At each location, one of the four samples was collected during wet weather, while the other samples were collected during dry weather. The dry weather samples were collected during both the summer dry season and winter dry periods. One sample was collected at each location for the secondary species, *Pimephales promelas* or fathead minnow. The primary test for *H. azteca* was an acute, 4-day test. A 21-day chronic test for *H. azteca* was also conducted at five of the ten locations to ensure the acute test results were protective of chronic conditions. Prior to this study, in October 2000, ten acute *H. azteca* initial samples were collected on the Los Angeles River and San Gabriel River to assess the possibility for developing a WER on these waterbodies. Where the sampling locations were co-located in the two studies, the results of this initial study were also used in the development of the WER.

2. The results of laboratory and site water tests were adjusted to the same pH using procedures in the 1999 Update.

3. The QA/QC analysis demonstrated that, except for 10 rejected site water sample results, the majority of the tests collected were acceptable for the analysis, the results of the acute *H. azteca* laboratory water results compared well with other laboratory studies, and in general the samples were collected during typical conditions. Because more than the required number samples, as outlined in the 1994 Interim Guidance, were collected at each location, the rejected results do not prevent the development of WERs and SSOs for the waterbodies in the study.

4. The calculation of the final WERs for the study is based on the process outlined in the WER guidance document and summarized in the work plan for this study. For each location, the process involves calculating WERs for each of the dry weather events by dividing the site water LC_{50} by the adjusted lab water LC_{50} and then taking the adjusted geometric mean of those dry weather WERs. For each location, that result is then compared to the WER calculated for the wet weather event (hWER) to determine the final WER (fWER) for the location.

5. The WER guidance procedure places a large emphasis on the wet weather sample and the results obtained during wet weather. During the calculation of the wet weather hWERs, it became clear that the determination of the hWER was significantly impacted by the assumptions used in calculating the hWER, especially the flow conditions. Because the flow conditions are highly variable in Southern California, the use of a hWER based on a flow condition that could change dramatically over a very short period of time is difficult to justify. For all but one location, the hWER calculations result in wet weather hWERs that are significantly higher than the adjusted geometric mean of the dry weather WER. The one exception is Site LA2 in the Los Angeles River where the hWER drives the fWER using the calculation conditions chosen. However, because the choice of calculation conditions causes such variability in the hWER, under other wet weather conditions, the hWER may not be the lowest value. Over the course of the storm at Site LA2, the hWER was estimated to range from 1.0 to 409 based on the changing flow conditions in the river. Additionally, the chronic objective is the only objective being adjusted by the fWER. The chronic objective is based on a 30-day averaging period. Wet weather events in Southern California occur over a matter of hours to days, but generally do not last for weeks at a time. Therefore, the application of a hWER based on a short-term condition to a 30-day chronic objective is not appropriate. Therefore, the adjusted geometric mean of the dry weather WERs was used as the fWER for all of the sites.

6. The final WERs are presented below.

Table 2
Final WERs (fWERs) by Waterbody & Site

Waterbody Reach(es)	Site	fWER
Los Angeles River Reach 4 and 5	LA1	1.966
Los Angeles River Reach 3	LA2	1.967
Burbank Western Channel	BW1	1.400
San Gabriel River Reaches 2 and 3	SGR1	1.637
San Gabriel River Reach 1	SGR2	2.303
Coyote Creek	CC1	2.038
San Jose Creek	SJC1	1.395
Rio Hondo above Whittier Narrows Dam	RH1	2.094
Santa Clara River Reach 6	SCR1	2.233
Santa Clara River Reach 5	SCR2	2.206

7. The final step in the process is the calculation of a site-specific objective (SSO) for the sites based on the fWERs. The traditional approach to calculating a SSO is to multiply the fWER and the existing objective to obtain the SSO. Because of the alternative approach taken under this study (i.e. only invertebrate data are adjusted within the chronic criteria equation), the method for calculating the SSO is more complicated. The approach taken included recalculating the criteria using the 1999 Update and the *Guidelines for Deriving Numerical National Water Quality Criteria for the Protection of Aquatic Organisms and Their Uses* (Guidelines) (US EPA, 1985). In this section, a basic summary of the calculation process based on these two documents is presented.

The process outlined in the Guidelines for calculating objectives is driven, in most cases, by the toxicity results for the four lowest tested genera. The regional chronic (30-day average) objective is driven by invertebrate test results in most cases and 30-day average SSOs are being proposed based on the study results. The calculation process described here is for the chronic criterion calculations. In the 1999 Update, chronic tests on 10 genera and the associated genus mean chronic values (GMCVs) are used to calculate the chronic criterion. Of these species, four are invertebrates and five are fish genera. The first step in the SSO calculation process was to multiply the fWERs by the four invertebrate GMCVs in the criterion.[3] The fish GMCVs were not multiplied by the fWER, since the fWERs for fathead minnow were close to 1.0 indicating that the chronic toxicity did not differ significantly from that observed in the national dataset.[4] The next step was to recalculate the Final Chronic Value (FCV)[5] using the steps presented in the Guidelines as follows.

1. Order the invertebrate data (multiplied by the fWER) and the fish data from lowest to highest.
2. Assign ranks (R) from 1 to 10 to the ordered data.
3. Calculate the cumulative probability (P) for each data point as R/(N+1).
4. Select the four data points that have cumulative probabilities closest to 0.05.
5. Using those values, calculate the FCV using the following equations:

$$S^2 = \frac{\sum((\ln GMCV)^2) - ((\sum(\ln GMCV)^2/4)}{\sum(P) - ((\sum(\sqrt{P}))^2/4)}$$

$$L = \frac{(\sum(\ln GMCV) - S(\sum(\sqrt{P}))}{4}$$

$$A = S(\sqrt{0.05}) + L$$

$$FCV = e^A$$

The design of the calculation process listed above is to determine a criterion value that will protect 95% of aquatic species.

To calculate the FCV, all of the toxicity results were normalized to a pH of 8.0 and temperature of 25°C. Therefore, the FCV calculated from this dataset is determined at this pH and temperature. In the 1999 criteria calculations, this dataset results in a FCV that is lower than the lowest GMCV (*H. azteca*) by about 15% (i.e., the FCV is 85.4% of the *H. azteca* GMCV). The criteria were then determined to be the chronic pH relationship multiplied by 85.4% of the lower of (1) the appropriate fish GMCV (different depending on whether or not early life stages of fish are present) and (2) the temperature adjusted *H. azteca* GMCV.

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[3] In the development of the 1999 Update, the US EPA examined all invertebrate data and determined that the response of invertebrates to ammonia was different than the response of fish and that the invertebrate species responded in a similar manner to each other. The criteria document developed relationships that consider invertebrates as a group and used those relationships to develop the criteria. The SSO uses this premise to adjust the criteria. Additionally, the Interim WER guidance is based on the premise that WER testing on sensitive species is representative of other species that could be tested and can be used to adjust the results of the criteria analysis.

[4] Fish species are chronically less sensitive to ammonia. The Interim WER guidance predicts that less sensitive species will have lower WERs. The results of the testing are consistent with this prediction. Additionally, the 1999 Update determined that fish and invertebrates respond differently to ammonia in that invertebrate toxicity is dependent on both pH and temperature and fish toxicity is only dependent on pH.

[5] The FCV is the value used to determine the criteria that is estimated to be protective of 95% of all species that could be impacted by ammonia.

The net effect of this calculation procedure in most cases is that for waterbodies without early life stages of fish present, the site-specific objective basically becomes the national criterion multiplied by the fWER. However, when early life stages of fish are present, the objective is dependent on the fish data and will not always be the national criterion multiplied by the fWER. The calculations for the various stations are included in the technical report (specifically Appendix 4 of the report), which is included as Appendix 2 to this report. An example calculation is presented in Table 3 below for Site SGR1 in the San Gabriel River.

Multiply the invertebrate data by the fWER of 1.64 for SGR1 and rank the results from lowest to highest.

Table 3
Site-specific Objective Calculation for Site SGR1 in the San Gabriel River

Genus/Species	GMCV	Rank	Cumulative Probability (P)	GMCV*fWER (1.64) for invertebrates	New Rank	New P
Hyalella azteca	1.45	1	0.09	2.37	1	0.09
Musculium spec.	2.26	2	0.18	3.70	4	0.36
Lepomis	2.85	3	0.27	2.85	2	0.18
Pimephales promelas	3.09	4	0.36	3.09	3	0.27
Micropterus	4.56	5	0.45	4.56	5	0.45
Catostomus	4.79	6	0.55	4.79	6	0.55
Ictalurus	8.84	7	0.64	8.84	7	0.64
Daphnia magna	12.3	8	0.73	20.1	8	0.73
Ceriodaphnia dubia	16.1	9	0.82	26.4	9	0.82

VI. Site-specific Implementation Provisions for Protection of ELS

For the 30-day average objective, the 1999 US EPA guidance includes a choice between two equations, depending on whether or not early life stages of fish (ELS) are present. Based on the national criterion, at temperatures above 15°C, invertebrate species are the most sensitive chronic test species. At temperatures below 15°C, the chronic toxicity criterion depends on the presence or absence of fish early life stages.

A. Background

As described earlier, on December 1, 2005, the Regional Board revised the Basin Plan Amendment that updated the freshwater ambient objectives for ammonia and specifically addressed the ELS implementation provisions. The revised implementation provisions for ELS provide a narrowly tailored approach to protect ELS by identifying those waterbodies in the region that meet two criteria as “ELS Present” for the sole purpose of implementing the freshwater 30-day average ammonia objective. The two criteria are (1) the presence of fish species that reproduce in significant numbers at temperatures below 15 degrees C and (2) physical conditions that *do not* preclude fish reproduction. The 15-degree C threshold is used because at temperatures below 15 degrees C ELS are the most chronically sensitive organism to ammonia toxicity. At temperatures above 15 degrees C, invertebrates are the most chronically sensitive organism and, therefore, it is irrelevant whether ELS are present or not. Four waterbody reaches covered by this study have physical conditions that preclude fish reproduction and are therefore proposed as ELS absent year round. These are Burbank Western Wash, Coyote Creek, Los Angeles River Reach 4 and San Gabriel River Reach 1.

While the invertebrate GMCVs control the value of the national [30-day average] criterion at most temperatures (i.e. temperatures >15 degrees C), based on the final WERs used to adjust the *H. azteca* GMCV in the criterion equation, the fish ELS GMCV becomes the controlling value (i.e. Lepomis spec. at 2.85) up to higher temperatures in local waters at most sites as a result of the decreased sensitivity of invertebrate species to ammonia toxicity in local waters. In other words, instead of an intersection of the ELS present and ELS absent criterion at 15 degrees C, the intersection does not occur until approximately 20 C for San Jose Creek (SJC1); between 20 and 25 C for Reaches 2 and 3 of the San Gabriel River (SGR2); 25 C for sites on the Los Angeles River (LA1 and LA2); and between 25 and 30 C for sites on the Santa Clara River and Rio Hondo (SCR1 and 2 and RH1).

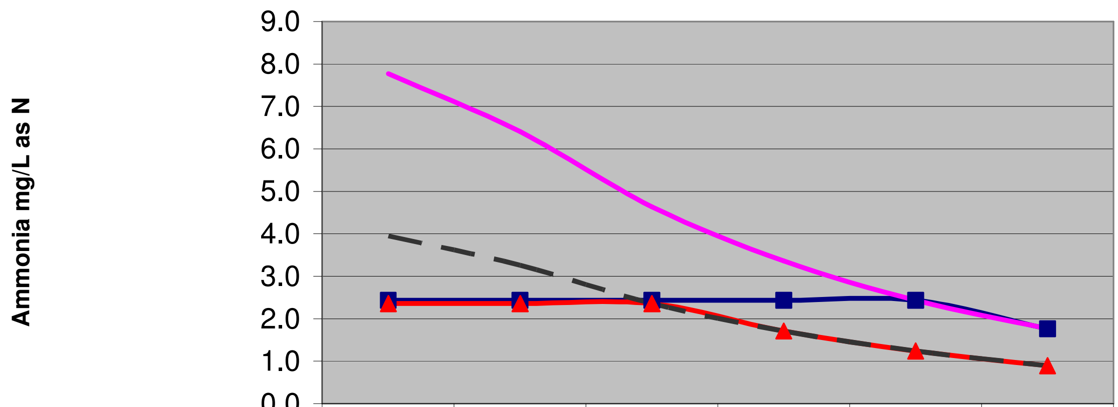
Since the approach used in this study was to only adjust the invertebrate data, this means that where ELS are present the WER does not result in as great of an increase in the 30-day average criterion at these temperatures, since the fish ELS control the criterion up to higher temperatures. (In other words, the point at which *H. azteca* becomes more sensitive than ELS occurs at a higher temperature with the WER.) Figure 5 illustrates this effect by plotting for one site the existing Basin Plan objective with ELS present and absent in comparison with the proposed SSO with ELS present and absent. Table 4 (included at end of report) shows the difference in the resultant SSO under the ELS present versus ELS absent condition. The yellow highlighting shows the temperatures above which the criterion is the same for ELS present and ELS absent conditions.

Table 4

[See end of report]

Figure 5

Comparison of ELS Effect on SSO at LA1 (pH=8)



	5	10	15	20	25	30
SSO w/ ELS	2.4	2.4	2.4	2.4	2.4	1.8
SSO w/o ELS	7.8	6.4	4.6	3.4	2.4	1.8
99 Crit w/ ELS	2.4	2.4	2.4	1.7	1.2	0.9
99 Crit w/o ELS	4.0	3.3	2.4	1.7	1.2	0.9

Temperature (C)

B. Proposed Site-specific Implementation Provisions for ELS

Staff proposes the following approach to protect ELS in waters subject to the proposed SSOs. For SSO waters, staff has identified all current and historical fish species that have used the affected waterbodies for reproduction and early development since 1975. For these species, staff reviewed existing literature to determine the reproductive periods (by month or season) for each species. Using this information, staff proposes to apply the ELS present criterion to each waterbody based on the earliest month during which reproduction begins until the latest month of reproduction and early development *unless* staff conclude that physical conditions and, specifically, hydromodifications of the waterbody preclude the presence of early life stages of fish in significant numbers. During the remainder of the year, the ELS absent condition shall apply.

This approach is consistent with US EPA's recommendations contained in the Federal Register "Water Quality Criteria; Notice of Availability; 1999 Update of Ambient Water Quality Criteria for Ammonia; Notice"

(FR Vol. 64, No. 245, Dec. 22, 1999). In the Federal Register notice, EPA states, "the best way for a State or Tribe to implement its ELS-absent provision is to establish in its water quality standards a fall and a spring date based on historical spawning and early life stage data" (p. 71978). Table 5 identifies the SSO waters for which physical conditions do not preclude the presence of early life stages of fish in significant numbers, fish species identified for these waters, and corresponding reproductive periods that will be used to define the ELS present period. The remaining SSO waters are considered ELS absent during all periods because physical conditions preclude the presence of early life stages of fish in significant numbers.

Table 5
Current and Historical Fish Species and Corresponding ELS Present Period for SSO Waters

Reach Name	Upstream and Downstream Points	Fish Species	Proposed ELS Present Period
Los Angeles River Reach 5	Sepulveda Basin	carp (*Cyprinus carpio*) tilapia (*Oreochromis mossambicus*) catfish (likely bullhead (*Ictalurus* sp.)) arroyo chub (*Gila orcutti*)	April through September
Los Angeles River Reach 3	Riverside Drive to Figueroa Street	fathead minnow (*Pimephales promelas)* goldfish (*Carassius auratus*) mosquitofish (*Gambusia affinis*) tilapia (*Oreochromis mossambicus*)	April through September
San Jose Creek	Pomona WRP to confluence with San Gabriel River	mosquitofish (*Gambusia affinis*) carp (*Cyprinus carpio*)	April through September
San Gabriel River Reaches 2 and 3	Confluence of San Jose Creek to Firestone Boulevard	carp (*Cyprinus carpio*) green sunfish (L*epomis cyanellus*) bluegill (*Lepomis macrochirus*) catfish (likely bullhead (*Ictalurus* sp.))	April through September
Rio Hondo	Upstream of Whittier Narrows Dam	catfish (likely bullhead (*Ictalurus* sp.)) carp (*Cyprinus carpio*) green sunfish (*Lepomis cyanellus*) mosquitofish (*Gambusia affinis*) tilapia (*Oreochromis mossambicus*)	April through September
Santa Clara River Reach 6	Bouquet Canyon Road Bridge to West Pier Highway 99	goldfish (*Carassius auratus*) carp (*Cyprinus carpio*) mosquitofish (*Gambusia affinis*)	February through September

Current and Historical Fish Species and Corresponding ELS Present Period for SSO Waters

Reach Name	Upstream and Downstream Points	Fish Species	Proposed ELS Present Period
		arroyo chub (*Gila orcutti*) unarmored threespine stickleback (*Gasterosteus aculeatus williamsoni*) Santa Ana sucker (*Catostomus santaanae*)	
Santa Clara River Reach 5	West Pier Highway 99 to Blue Cut gauging station	goldfish (*Carassius auratus*) carp (*Cyprinus carpio*) mosquitofish (*Gambusia affinis*) arroyo chub (*Gila orcutti*) unarmored threespine stickleback (*Gasterosteus aculeatus williamsoni*) Santa Ana sucker (*Catostomus santaanae*)	February through September

C. Protection of Ecologically and Commercially Sensitive Species

The WER methodology generally involves calculating preliminary SSOs and then comparing them with Final Chronic Values (FCVs) for any ecologically or commercially sensitive species present in the waterbody. For the waterbodies in this study, three species were identified that fit into this category: unarmored three-spine stickleback, Santa Ana sucker, and steelhead trout. However, given the approach taken in which only the invertebrate data is adjusted in the objective equation, these fish species should still be fully protected from ammonia toxicity. See also the final consultants' report in Appendix 2 and, specifically, the discussion on "Protection of Rare, Endangered, Threatened or Locally Important Species."

The Regional Board may reconsider the fish species or ELS present period(s) for these waterbodies if valid evidence is presented to indicate a reassessment would be appropriate. The Regional Board may also reconsider the fish GMCV used in the calculation of the 30-day average objective if special studies are undertaken to determine the fish species present in the waterbody and the ammonia sensitivities of those species (instead of relying upon the default sensitivity of bluegill used in the 1999 Update). Any such study must follow appropriate US EPA guidance.

VII. Proposed Site-specific Objectives

The proposed SSOs include equations for determining the allowable 30-day average concentration of total ammonia for each affected waterbody reach. The allowable concentration is a function of temperature, pH and the presence/absence of ELS. The SSOs have a "return period" allowance of no more than one exceedance in a three year period, in conformance with the US EPA's general direction for national aquatic life criteria. Changes will also be made in Chapter 3 to reference the applicability of the SSOs instead of the regionwide objectives for the affected waterbodies. The adopted SSOs and ELS present periods specified in this amendment will supersede the ELS periods for each waterbody adopted in December 2005.

Table 6
Proposed Site-Specific 30-day Average Objectives for Ammonia by Site

Los Angeles River, Reach 5 (Sepulveda Basin)	**ELS Present (from April 1 – September 30)** $CCC = \left(\frac{0.0676}{1+10^{7.688-pH}} + \frac{2.912}{1+10^{pH-7.688}}\right) * 0.854 * MIN(2.85, 2.85 * 10^{0.028*(25-T)})$ **ELS Absent (from October 1 – March 31)** $CCC = \left(\frac{0.0676}{1+10^{7.688-pH}} + \frac{2.912}{1+10^{pH-7.688}}\right) * 0.854 * 2.85 * 10^{0.028*(25-Max(T,7))}$
Los Angeles River, Reach 4 (Sepulveda Dam to Riverside Drive)	**ELS Absent (year round)** $CCC = \left(\frac{0.0676}{1+10^{7.688-pH}} + \frac{2.912}{1+10^{pH-7.688}}\right) * 0.854 * 2.85 * 10^{0.028*(25-Max(T,7))}$
Los Angeles River, Reach 3 (Riverside Drive to Figueroa Street)	**ELS Present (from April 1 – September 30)** $CCC = \left(\frac{0.0676}{1+10^{7.688-pH}} + \frac{2.912}{1+10^{pH-7.688}}\right) * 0.854 * MIN(2.85, 2.85 * 10^{0.028*(25-T)})$ **ELS Absent (from October 1 – March 31)** $CCC = \left(\frac{0.0676}{1+10^{7.688-pH}} + \frac{2.912}{1+10^{pH-7.688}}\right) * 0.854 * 2.85 * 10^{0.028*(25-Max(T,7))}$
Burbank Western Wash (Burbank Water Reclamation Plant to confluence with LA River)	**ELS Absent (year round)** $CCC = \left(\frac{0.0676}{1+10^{7.688-pH}} + \frac{2.912}{1+10^{pH-7.688}}\right) * 0.92 * 2.03 * 10^{0.028*(25-Max(T,7))}$
San Gabriel River, Reaches 2 and 3 (Confluence with San Jose Creek to Firestone Blvd.) (including all San Jose Creek WRP discharges)	**ELS Present (from April 1 – September 30)** $CCC = \left(\frac{0.0676}{1+10^{7.688-pH}} + \frac{2.912}{1+10^{pH-7.688}}\right) * 0.89 * MIN(2.85, 2.37 * 10^{0.028*(25-T)})$ **ELS Absent (from October 1 – March 31)** $CCC = \left(\frac{0.0676}{1+10^{7.688-pH}} + \frac{2.912}{1+10^{pH-7.688}}\right) * 0.89 * 2.37 * 10^{0.028*(25-Max(T,7))}$
San Gabriel River, Reach 1 (Firestone Blvd. to Willow St. or start of estuary)	**ELS Absent (year round)** $CCC = \left(\frac{0.0676}{1+10^{7.688-pH}} + \frac{2.912}{1+10^{pH-7.688}}\right) * 0.854 * 3.34 * 10^{0.028*(25-Max(T,7))}$

Santa Clara River, Reach 6 (Bouquet Canyon Rd. Bridge to West Pier Hwy 99)	**ELS Present (from February 1 – September 30)** $CCC = \left(\frac{0.0676}{1 + 10^{7.688 - pH}} + \frac{2.912}{1 + 10^{pH - 7.688}} \right) * 0.854 * MIN(2.85, 3.24 * 10^{0.028*(25-T)})$ **ELS Absent (from October 1 – January 31)** $CCC = \left(\frac{0.0676}{1 + 10^{7.688 - pH}} + \frac{2.912}{1 + 10^{pH - 7.688}} \right) * 0.854 * 3.24 * 10^{0.028*(25-Max(T,7))}$
Santa Clara River, Reach 5 (West Pier Hwy 99 to Blue Cut gauging station)	**ELS Present (from February 1 – September 30)** $CCC = \left(\frac{0.0676}{1 + 10^{7.688 - pH}} + \frac{2.912}{1 + 10^{pH - 7.688}} \right) * 0.854 * MIN(2.85, 3.20 * 10^{0.028*(25-T)})$ **ELS Absent (from October 1 – January 31)** $CCC = \left(\frac{0.0676}{1 + 10^{7.688 - pH}} + \frac{2.912}{1 + 10^{pH - 7.688}} \right) * 0.854 * 3.20 * 10^{0.028*(25-Max(T,7))}$
San Jose Creek (Pomona WRP to confluence with San Gabriel River)	**ELS Present (from April 1 – September 30)** $CCC = \left(\frac{0.0676}{1 + 10^{7.688 - pH}} + \frac{2.912}{1 + 10^{pH - 7.688}} \right) * 0.92 * MIN(2.85, 2.02 * 10^{0.028*(25-T)})$ **ELS Absent (from October 1 – March 31)** $CCC = \left(\frac{0.0676}{1 + 10^{7.688 - pH}} + \frac{2.912}{1 + 10^{pH - 7.688}} \right) * 0.92 * 2.02 * 10^{0.028*(25-Max(T,7))}$
Rio Hondo (Upstream of Whittier Narrows Dam)	**ELS Present (from April 1 – September 30)** $CCC = \left(\frac{0.0676}{1 + 10^{7.688 - pH}} + \frac{2.912}{1 + 10^{pH - 7.688}} \right) * 0.854 * MIN(2.85, 3.04 * 10^{0.028*(25-T)})$ **ELS Absent (from October 1 – March 31)** $CCC = \left(\frac{0.0676}{1 + 10^{7.688 - pH}} + \frac{2.912}{1 + 10^{pH - 7.688}} \right) * 0.854 * 3.04 * 10^{0.028*(25-Max(T,7))}$
Coyote Creek (Long Beach WRP to confluence with San Gabriel River)	**ELS Absent (year round)** $CCC = \left(\frac{0.0676}{1 + 10^{7.688 - pH}} + \frac{2.912}{1 + 10^{pH - 7.688}} \right) * 0.854 * 2.96 * 10^{0.028*(25-Max(T,7))}$

In addition, the highest four-day average within the 30-day period shall not exceed 2.5 times the 30-day average objective shown in Table 6.

VIII. Comparison of Proposed Objectives and Current Basin Plan Objectives

A. Assessment of Proposed SSOs

The ammonia concentrations allowed under the proposed SSOs would be higher (less stringent) in some cases than those allowed for similar temperature and pH conditions under the current water quality objectives. However, the toxicity tests show that these higher levels will protect aquatic organisms against toxicity in the affected waters at the same level as the nationally derived criteria.

"Typical" ammonia concentrations in the target waterbodies are presented in Table 7. Since the ammonia measurements were collected in the WER study, eight of the 10 POTWs of interest have added nitrification and denitrification capabilities (N/DN)[6] to their facilities and thus have experienced substantial reductions in effluent concentrations of ammonia.[7] Thus, the concentration of ammonia in the local receiving waterbodies has consequently been reduced. Table 7 shows the average receiving water ammonia measured during the WER Study and in pre- and post-N/DN time periods at the receiving water monitoring locations downstream of the POTWs.

[6] Nitrification is the biological oxidation of ammonia with oxygen into nitrite followed by the oxidation of these nitrites into nitrates. Denitrification is the process of reducing nitrate and nitrite, highly oxidized forms of nitrogen available for consumption by a many groups of organisms, into gaseous nitrogen, which is far less accessible to life forms but makes up the bulk of our atmosphere. Nitrification plays an important role in the removal of nitrogen from municipal wastewater. The conventional removal is nitrification, followed by denitrification.

[7] The facilities that have converted to N/DN include all seven of the County Sanitation Districts' POTWs (Pomona, San Jose Creek, Whittier Narrows, Long Beach, Los Coyotes, Saugus and Valencia) and the Burbank POTW. The two facilities that have not converted to N/DN are the two City of LA POTWs – LA Glendale and D.C. Tillman.

Table 7

Typical receiving water ammonia concentrations in mg/L as N

Waterbody	WER Study	Average pre-N/DN Concentration	Average post-N/DN Concentrations	
			Average	Range
San Jose Creek	7.5	5.0	0.8	0.1-1.9
Santa Clara River (1)	10.1	9.7	0.7	0.1-2.6
Santa Clara River (2)	6.7	4.1	0.5	0.1-2.9
San Gabriel River (1)	4.4	4.6	0.3	0.1-1.8
San Gabriel River (2)	4.2	5.6	0.3	0.1-3.1
Coyote Creek	2.4	5.0	0.9	0.1-2.5*
Rio Hondo	0.7	5.6	0.5	0.1-2.2
Los Angeles River (2) [A]	7.8	6.5	NA	NA
Los Angeles River (1) [A]	11.5	8.8	NA	NA
Burbank Western Channel [B]	14.2	16.0	0.3	0.2-0.4

Notes: Data for the WER Study are taken from Table 8 of "Ammonia Water Effects Ratios and Site-Specific Objectives for Los Angeles County Waterbodies-Final Results" (Larry Walker Associates 2003). Average pre-N/DN ~~Typical~~ conditions are based on data from POTW receiving water monitoring locations closest to the WER study locations. ~~For the most part, the averages and ranges are based on data from 1996 to 2000. The range is equal to the mean plus or minus two standard deviations.~~Average post-N/DN conditions are taken from the same receiving water stations after N/DN has been implemented at the upstream POTWs. For Burbank Western Wash, the post-N/DN measurements are from 2006, the rest of the data represent conditions in 2004-2006.

*The reported maximum is the highest monthly average for this POTW.

[A] In 2006, the POTWs operated by the City of Los Angeles had not begun operations with N/DN.

[B] Receiving water ammonia concentrations are expected to be slightly higher in the future. The Burbank POTW is currently adding facilities to add back some ammonia into the wastewater (after N/DN) in an effort to minimize formation of trihalomethanes during the disinfection process.

Based on average pre-N/DN conditions in Table 7 and allowable ammonia concentrations in Table 8 (below), there are three sites at which the SSOs for ELS absent periods would allow levels of ammonia higher than historically measured concentrations under some pH and temperature conditions. There are only two sites at which the historically measured ammonia was below the ELS present objective for the SSO. However, these sites would still be subject to state and federal anti-degradation requirements.

Compliance with the SSOs will require reductions from the historical ammonia concentrations listed in Table 7 at 8 out of 10 sites during ELS present periods and 7 out of 10 sites during ELS absent periods (under average conditions). However, it is important to note that the POTWs will be operating in N/DN for the foreseeable future; thus, it is appropriate to compare the post-N/DN concentrations to the allowable ammonia levels under the different SSOs. (It is important to note, however, that since the measurements in Table 7 were collected, 8 of the 10 POTWs have added nitrification and denitrification capabilities to their facilities and thus have experienced substantial reductions in effluent concentrations of ammonia.)

Table 8
Comparison of Allowable Total Ammonia Concentrations under Different Scenarios
Concentrations are mg/L as N

Waterbody	Site	Average pH	ELS Absent Period		ELS Present Period	
			SSO	Basin Plan Regional Objective	SSO	Basin Plan Regional Objective
Los Angeles River Reaches 4 and 5	**LA1**	8.0	3.36	1.71	2.43	1.71
Los Angeles River Reach 4	**LA1**	8.0	3.36	1.71	N/A	N/A
Los Angeles River Reach 3	**LA2**	7.6	5.49	2.79	3.98	2.79
Burbank Western Channel	**BW1**	8.0	2.58	1.71	N/A	N/A
San Gabriel River Reaches 2 and 3	**SGR1**	7.5	5.22	3.06	4.55	3.06
San Gabriel River Reach 1	**SGR2**	8.3	2.47	1.07	N/A	N/A
San Jose Creek	**SJC1**	7.4	4.99	3.32	4.99	3.32
Rio Hondo	**RH1**	7.5	6.43	3.06	N/A	N/A
Coyote Creek	**CC1**	7.7	5.13	2.51	N/A	N/A
Santa Clara River Reach 6	**SCR1**	7.3	7.97	3.57	5.08	3.57
Santa Clara River Reach 5	**SCR2**	7.8	4.93	2.23	3.18	2.23

Notes: Allowable total ammonia concentrations are based on average historical pH for each site (taken from Table 8 in Appendix 2) and a typical temperature of 20 degrees Celsius. The average temperature in all waterbodies in the Los Angeles Region is 19.14 degrees Celsius (based on data used in the 2002 303(d) List submittal), with a standard deviation of 4.11 degrees Celsius. This means that 68% of all temperature data falls between 15.03 and 23.25 degrees Celsius and 95% of all data falls between 10.92 and 27.35 degrees Celsius. N/A indicates that the objective is not applicable to the reach.

The proposed site-specific objectives are equal to or higher (less stringent) than the current 30-day average objective contained in the Basin Plan. The greatest differences between the present and proposed site-specific objectives occur at low temperatures where ELS are absent. The magnitude of the difference decreases as temperature increases, holding pH constant. See Table 9 for the range of difference between the current objective and the proposed objectives under the ELS absent condition. On average, the proposed site-specific objectives under the ELS absent condition are 1.5 to 2.3 times greater than the current 30-day average objectives. See Table 10 for the range of difference between the current objective and the proposed objectives under the ELS present condition. On average, the proposed site-specific objectives under the ELS present condition are 1.35 to 1.54 times greater than the current 30-day average objectives. The difference is smaller under the ELS present condition because at lower temperatures early life stages of fish are more sensitive than invertebrates to ammonia toxicity.[8] As a result, the 30-day average objective at lower temperatures is controlled by the Genus Mean Chronic Value of the most sensitive fish species. As discussed earlier, findings of the Ammonia Water Effect Ratio study, on which the proposed site-specific objectives are based, indicated that the final WERs for fathead minnow were close to one. Therefore, the TAC for the study recommended only adjusting the invertebrate GMCVs in the objective equation.

Table 9

Range of Differences between the Current 30-day Average Objective and the Proposed Site-specific 30-day Average Objectives (ELS absent condition)

Site	Maximum Difference at Average pH (mg N/L)	Minimum Difference at Average pH (mg N/L)	Average Difference at Average pH (mg N/L)
LA1	3.14	0.87	1.78
LA2	5.14	1.41	2.91
BW1	1.65	0.46	0.94
SGR1	4.11	1.13	2.32
SGR2	2.66	0.73	1.50
SCR1	8.39	2.31	4.75
SCR2	5.14	1.42	2.91
SJC1	3.18	0.88	1.80
RH1	6.40	1.76	3.62
CC1	4.98	1.37	2.82

Note: Average pH values for each site were taken from Table 8 of “Ammonia Water Effects Ratios and Site-Specific Objectives for Los Angeles County Waterbodies – Final Results” (September 2003). Temperature range evaluated is 10 to 30° Celsius.

[8] The equation for the 30-day average objective is set up such that the lower of the invertebrate or fish GMCV is used to calculate the objective. This ensures that both invertebrates and fish species, including early life stages of fish, are adequately protected.

Table 10

Range of Differences between the Current 30-day Average Objective and the Proposed Site-specific 30-day Average Objectives (ELS present condition)

Site	Maximum Difference at Average pH (mg N/L)	Minimum Difference at Average pH (mg N/L)	Average Difference at Average pH (mg N/L)
LA1	1.19	0.00	0.60
LA2	1.96	0.00	0.97
BW1	N/A	N/A	N/A
SGR1	N/A	N/A	N/A
SGR2	0.84	0.00	0.42
SCR1	2.80	0.00	1.36
SCR2	1.72	0.00	0.85
SJC1	1.67	0.37	0.98
RH1	2.28	0.00	1.13
CC1	N/A	N/A	N/A

Note: Average pH values for each site were taken from Table 8 of "Ammonia Water Effects Ratios and Site-Specific Objectives for Los Angeles County Waterbodies – Final Results" (September 2003). Temperature range evaluated is 10 to 30° Celsius. N/A indicates that the site has physical characteristics in the form of hydromodifications that preclude the presence of early life stages of fish.

B. Need for Proposed SSOs

As mentioned earlier, 8 of the 10 POTWs that are affected by the SSO have been modified to operate in N/DN. All eight plants (all seven of the CSDLAC tertiary plants and the Burbank POTW) converted to N/DN in 2003. The N/DN at all of these plants is generally capable of removing all or almost all of the ammonia before it is discharged from the POTWs into waterbodies. However, to ensure adequate disinfection of the effluent, a small measured amount of ammonia must be added near the end of the treatment process to form chloramines. The use of chloramines provides for effective disinfection while minimizing the formation of trihalomethanes (a toxic pollutant). Thus, seven plants currently add ammonia back into their water after N/DN removes it and the eighth plant is currently in the process of adding this capability.

Disinfecting treated wastewater with chlorine has become very complicated in terms of complying with more restrictive discharge requirements for not only ammonia but also for other disinfection by-products. In general, POTW operators attempt to remove all the ammonia in the secondary treated wastewater during N/DN and then add a small measured amount back in just prior to the disinfection process. The amount of ammonia added back to the secondary effluent averages approximately 1.5 mg/L.

Further complicating the process are diurnal variations in influent flows to the wastewater treatment plants and ammonia concentrations, natural variability in the biological N/DN treatment process, and variations in influent organic loadings. For example, the flows in wastewater treatment plants fluctuate with weather conditions, time of day, and day of the week. Also, the influent ammonia concentrations will vary depending on time of day, with peak influent ammonia concentrations occurring around early to mid-morning. Lastly, since the N/DN process is a biological process, it too is subject to performance variability as a result of climatic conditions that can result in a less robust biological process during cold weather events. Individually, each of these variations in influent conditions and biological process performance, along with the disinfection process issues described earlier, may result in only minor or insignificant increases in treated effluent ammonia concentrations. However, in combination, all these factors result in typical concentrations of ammonia in the final treated effluent between 1-2 mg/L, with occasional increases that can approach 3 mg/L. Thus, there are times that the final treated effluent ammonia concentrations, from the best performing and optimally operated wastewater treatment facilities, can be in the 2-3 mg/L range.

Additionally, ammonia effluent limits are based on downstream receiving water pH and temperature conditions as opposed to treated effluent temperature and pH conditions. Once ammonia is discharged into the receiving water, it begins oxidizing to nitrite and nitrate in the waterbodies. The average ammonia levels measured in the immediate downstream receiving water stations are often less than 1 mg/L (see Table 7). However, depending on the water body, the pH of the receiving water can be elevated as a result of physical characteristics of the channel. For example, while the pH of the POTW effluent may only be 7.3 (a typical value), the pH in the downstream receiving water may exceed a pH of 8.0. At a typical regional temperature of 20° Celsius and a pH of 7.3, the allowable ammonia is 3.6 mg/L under the current applicable Basin Plan objectives for ammonia. However, at a receiving water pH of 8.0, the allowable ammonia decreases to 1.71 mg/L. Again, the level of the ammonia discharged from the POTW can on occasion be between 2 and 3 mg/L due to operational variations; thus, the SSOs provide needed relief to the POTWs to enable them to meet ammonia permit limits.

IX. Implementation of Ammonia Objectives

A. Compliance with Proposed Objectives

The California Water Code (Section 13360) prohibits Regional Boards from specifying the means of compliance with their orders. However, the California Environmental Quality Act (Public Resources Code Section 21159) requires Regional Boards, when adopting requirements for the installation of new pollution control equipment or new performance standards for pollution control, to analyze reasonable means of compliance with the new regulations, including general consideration of environmental impacts, alternatives, and mitigation measures. The following is a summary of potential means of compliance with the performance standards that would be established by the proposed Basin Plan amendments. Notably, each of these means of compliance is already expected in the absence of this amendment, to comply with previously adopted water quality objectives and TMDLs. Use of such compliance mechanisms therefore, is considered part of baseline or current conditions.

The POTWs discharging to these waterbodies are expected to be the primary parties involved in compliance with the revised objectives. If approved, the ammonia SSOs would be reflected in revised effluent and receiving water limitations for the affected POTWs and waterbody reaches. Eight of the affected POTWs have added nitrification/denitrification (N/DN) capability. The remaining two POTWs (DC Tillman and LA-Glendale) are in the process of adding N/DN capability and, in both cases, the facility upgrades will be completed in 2007. The need for N/DN was prompted by the requirements of the 1994 Basin Plan ammonia objectives. As mentioned earlier, a plant that uses N/DN and chloramination can reliably ~~is capable of eliminating~~ reduce ammonia to ~~approximately 1.0 - 2.0~~below 3.0 mg/L (total ammonia as N)~~/L~~. While the SSOs will allow for slightly increased concentrations of ammonia in some local waterbodies, the POTWs that currently do not operate in N/DN will still need to upgrade their facilities and the other POTWs that are operating with N/DN will continue to operate in~~to~~ N/DN. Because the SSOs are refined objectives that are higher than the objectives in the Basin Plan, this amendment should not cause any expenditures to upgrade facilities beyond N/DN. Therefore, the economic cost of this amendment should not be significant.

B. Compliance Point for SSOs

The compliance points for the proposed SSO(s) would be the discharge points for the POTWs, since there are currently no approved mixing zones in inland surface waters of the Los Angeles Region. Compliance with receiving water limits is measured at the nearest existing downstream receiving water monitoring stations for the POTWs listed in Table 11.[9] Compliance with receiving water limits will be based on the pH and temperature of the site where the sample was collected. Monitoring of effluent quality will show whether the SSOs are being met above the nearest receiving water station. Each objective will apply to the entire reach as described in Table 1.

Table 11
POTW Characteristics and Associated Sampling Locations

Name	Agency	Main Receiving Water	Design / Permitted Flow (mgd)	Typical Dry Weather Upstream Flow (mgd)	Sampling Location ID	Description
DC Tillman	City of Los Angeles	Los Angeles River Reaches 4 and 5	80	NA	LA-1, LA-R8	Downstream of DC Tillman at Van Nuys Blvd. and Coldwater Canyon
LA-Glendale	City of Los Angeles	Los Angeles River Reach 3	20	51	LA-2, LA-R7	Downstream of LA Glendale at Los Feliz
Burbank WWTP	City of Burbank	Burbank Western Wash/Los Angeles River	9	NA	BW-1	Downstream of Burbank at Riverside Dr.
Saugus	CSDLAC	Santa Clara River Reach 6	6.5	0	SCR-1	Downstream of Saugus- 25 feet downstream of discharge
Valencia	CSDLAC	Santa Clara River Reach 5	~~12.6~~21.6	5.4	SCR-2	Downstream of Valencia, 1.6 miles upstream of Chiquita Canyon Road.
Whittier Narrows	CSDLAC	Rio Hondo Above Whittier Narrows Dam/San Gabriel River	15	NA	RH-1	Downstream of Whittier Narrows WRP 150 feet upstream of the Whittier Narrows Dam
Los Coyotes	CSDLAC	San Gabriel River Reach 1	37.5	0	SGR-2, SGR-R9W	Downstream of Los Coyotes at Willow
Long Beach	CSDLAC	Coyote Creek	25	10.3	CC-1	Downstream of Long Beach at foot bridge 200 yards downstream of discharge
San Jose Creek	CSDLAC	San Gabriel River Reaches 2 and 3/San Jose Creek	100	0	SGR-1, SGR-R4	Downstream of San Jose Creek WRP at Alondra
Pomona	CSDLAC	San Jose Creek	15	0	SJC-1	Downstream of Pomona WRP at San Jose St.

Ammonia ~~toxicity~~ concentrations will ~~is expected to~~ be lower downstream of these receiving water stations because of reduced concentrations due to natural processes such as volatilization, uptake by plants, conversion of ammonia to nitrate by microorganisms, etc.

C. Compliance Schedule for SSOs

The Basin Plan authorizes the use of compliance schedules in NPDES permits for effluent limits and receiving water limits to achieve new, revised or newly interpreted water quality standards, where justified.

[9] These receiving water stations are specified in the individual NPDES permits for each POTW and may not coincide with the listed "Sampling Location ID".

However, the proposed objectives are generally less stringent than, or equal to, the current objectives, therefore, a compliance schedule for the revised objectives is not being proposed.

X. Water Code Section 13241 Considerations

Section 13241 of the California Water Code lists factors that must be considered by Regional Boards when adopting or modifying water quality objectives. The following discussion summarizes information applicable to each of the subsections of Section 13241 in connection with the proposed site-specific water quality objectives for ammonia.

Past, present and probable future beneficial uses. See the relevant watershed sections in the Region's Watershed Management Initiative Chapter as well as available State of the Watershed reports for a description of beneficial uses. The reports are available on the Board's website at: http://www.waterboards.ca.gov/losangeles/html/programs/regional_programs.html#Watershed

Additionally, Chapter 2 of the Basin Plan, which identifies designated beneficial uses for waterbodies in the Los Angeles Region, is hereby incorporated by reference to address this factor.

Environmental characteristics of the hydrographic unit under consideration, including the quality of water available thereto. See the relevant watershed sections in the Region's Watershed Management Initiative Chapter as well as available State of the Watershed reports for information on the environmental setting of the affected waters and on water quality in relation to specific beneficial uses.

Additionally, Chapters 1 through 3 of the Basin Plan are hereby incorporated by reference to address this factor.

Water quality conditions that could reasonably be achieved through the coordinated control of all factors which affect water quality in the area. The environmental setting of the Los Angeles River watershed, San Gabriel River watershed, and Santa Clara River watershed and environmental factors affecting water quality and beneficial uses in these watersheds are discussed in the Region's Watershed Management Initiative Chapter as well as available State of the Watershed reports.

Staff uses existing water quality standards contained in Chapters 2 and 3 of the Basin Plan as the baseline or benchmark for water quality conditions that could reasonable be achieved through the coordinated control of all factors that affect water quality in the affected waters. The "Beneficial Uses" and "Water Quality Objectives" chapters (Chapters 2 and 3) of the Basin Plan are incorporated by reference to address this factor.

The SSOs developed by Larry Walker Associates are designed to protect the most sensitive aquatic organism in these waterbodies against ammonia toxicity. As previously stated, the SSOs can be attained using N/DN, which is already in place or under development at the affected POTWs. The SSOs represent "worst case" conditions at the nearest receiving water stations downstream of the POTW outfalls, and actual ammonia concentrations elsewhere in the waterbodies can be expected to be lower than the SSOs due to natural processes.

Available information on the quality of stormwater in the region and its cumulative impacts with wastewater discharges on the water quality of these waterbodies is limited. However, overall improvements in stormwater quality may be expected to occur over time with ongoing implementation of the Region's Municipal Storm Water NPDES Permits and TMDLs.

Economic considerations. The POTWs discharging to these waterbodies are expected to be the primary parties involved in compliance with the revised objectives. Eight of the affected POTWs have added N/DN capability. The remaining two POTWs (DC Tillman and LA-Glendale) are in the process of adding N/DN capability and, in both cases, the facility upgrades will be completed in 2007. The need for N/DN was prompted by the requirements of the 1994 Basin Plan ammonia objectives. N/DN is capable of eliminating ammonia to approximately 1.0 - 2.0 mg total ammonia as N/L. While the SSOs will allow for slightly increased concentrations of ammonia in some local waterbodies, the POTWs will still need to upgrade their facilities to N/DN. Because the SSOs are refined objectives that are higher than the objectives in the Basin Plan, this amendment should not cause any expenditures to upgrade facilities beyond N/DN. Therefore, the additional economic cost of this amendment will be negligible.

Need for developing housing within the region. Ammonia SSO adoption is not expected to affect the development of housing in the Los Angeles Region, since the objectives are less stringent in general than those that they replace.

Need to develop and use recycled water. The difference in the allowable ammonia concentrations between waterbodies with or without an SSO is not significant enough to impact the development or use of recycled water because both objectives require concentrations of ammonia that are acceptable for recycled water use.

XI. Analysis of Alternatives

1. No action; continue to apply existing region wide objectives.

While this is a simpler approach and easier to implement, it will result in an objective that is more stringent than the threshold necessary to protect aquatic life in these waterbodies, particularly during periods when fish ELS are absent. The US EPA acknowledged in the 1999 Update that WERs for ammonia might be substantially different from 1 if there is an interaction with other pollutants or if there is a substantial difference in ionic composition in conjunction with a difference in pH or hardness. Therefore, EPA gave States and Tribes the option of determining and using WERs to derive site-specific objectives for ammonia (US EPA 1999, Appendix 9). Development of WERs is a widely accepted, standard procedure for modifying national water quality criteria to be more appropriate to local conditions.

2. Adopt Reach-Specific Objectives for Select Reaches in the Los Angeles River, Burbank Western Channel, Santa Clara River, San Gabriel River, Rio Hondo, San Jose Creek and Coyote Creek (as defined in Table 1) with modifications arising as a logical outgrowth of the proposed amendment.

While this is the most complex to implement, it is also the most precise given the observed differences in water chemistry and the final WERs (fWERs)for each site. Though the variability in fWERs between sites was not large, the results of an analysis of variance (ANOVA) demonstrated that the fWERs for two of the sites (BW1 and SGR2) were statistically different from the other study sites (Larry Walker Associates 2003). In addition, Table 8 in Appendix 2 shows differences in water chemistry between sites, suggesting that each reach has unique characteristics that may affect ammonia toxicity. Finally, because samples were only collected immediately downstream of POTWs, we do not know whether it would be appropriate to apply the fWERs and, ultimately, SSOs derived for these reaches to other reaches that may have different characteristics.

3. Apply one SSO to all waterbodies in study.

While this also would be a simpler approach, due to the observed variability in fWERs and water chemistry between sites, this approach would result in an objective that was over- or under-protective depending on the waterbody and the fWER and SSO that were selected. Furthermore, given the targeted sampling downstream of POTWs, it would not be appropriate to indiscriminately apply the findings to other reaches and tributaries without further sampling and toxicity testing.

4. Apply SSO on watershed basis.
This would be a preferred approach if the results within each watershed were deemed to be statistically similar and if the sampling and toxicity testing was representative of all reaches and tributaries within the watershed. However, as discussed above, sampling was targeted exclusively to reaches downstream of POTWs and cannot be assumed to be representative of all water quality conditions in the watershed.

XII. Recommended Alternative

Regional Board staff recommends that the Board adopt the proposed amendments consistent with Alternative 2 above and consider future revisions to TMDLs, waste discharge requirements and discharger self monitoring programs of those POTWs affected by the proposed amendment to address both the changes in water quality standards and the monitoring needs described below.

XIII. Conclusions and Recommendations

The information and data summarized in this staff report support the recommended Basin Plan amendments. However, notwithstanding staff recommendations, regulatory actions to achieve applicable site-specific objectives must ensure that downstream standards will also be achieved. Because of the important existing beneficial uses of these waterbodies and the downstream coastal ecosystems to which they flow, continued monitoring is essential. The Regional Board should consider (1) amending the monitoring and reporting programs of NPDES permittees and other dischargers subject to the SSOs to ensure that adequate data are collected to ensure that beneficial uses are fully protected and downstream standards are achieved and (2) working with dischargers and other stakeholders to encourage additional scientific research on the affected waterbodies. If additional monitoring indicates toxicity or a change in the waterbody, including either its chemical characteristics or the aquatic species present, the Regional Board should reconsider the SSOs.

XIV. References

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XV. Glossary

Ammonia	NH_3, un-ionized ammonia, more toxic than ammonium (NH_4^+)
Ammonium	NH_4^+, ionized ammonia, less toxic than ammonia (NH_3)
CCC	Criteria continuous concentration (30-day average concentration for ammonia)
CMC	Criteria maximum concentration (one-hour average concentration)
ELS	Early Life Stages
LOEC	Lowest observed effect level
NOEC	No observed effect level
Salmonids	Salmonids include chinook salmon, coho salmon, steelhead trout and coastal cutthroat trout
LC_{50}	Concentration of pollutant [e.g. ammonia] that results in death of 50% of test organisms