



Central Valley Regional
Water Quality Control Board

AMENDMENTS

TO

THE WATER QUALITY CONTROL PLAN
FOR THE SACRAMENTO RIVER AND
SAN JOAQUIN RIVER BASINS

FOR

pH AND TURBIDITY

FINAL STAFF REPORT

October 2007



CALIFORNIA ENVIRONMENTAL PROTECTION AGENCY



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DISCLAIMER

This publication is a report by staff of the California Regional Water Quality Control Board, Central Valley Region. This report contains the technical evaluations supporting a staff recommendation to amend the Water Quality Control Plan for the Sacramento and San Joaquin River Basin. The Regional Board adopted an amendment to the Basin Plan based on staff recommendations in Resolution No. R5-2007-0136. Mention of specific products does not represent endorsement of those products by the Regional Board.

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TABLE OF CONTENTS

	<u>Page</u>
EXECUTIVE SUMMARY	I
1 INTRODUCTION.....	1-1
1.1 Purpose	1-1
1.2 Scope of Revisions to the Basin Plan	1-1
1.3 Background.....	1-2
1.3.1 Regulatory Authority and Mandates for Basin Plan Amendments	1-2
1.3.2 Basin Plan for the Sacramento and San Joaquin River Basins	1-2
1.3.3 Need for the Proposed Revisions to the Basin Plan	1-3
1.3.3.1 Regulatory and Economic Need	1-4
1.3.3.2 Scientific Justification for pH and Turbidity Water Quality Objectives	1-6
1.3.3.2.1 pH	1-6
1.3.3.2.2 Turbidity	1-7
1.3.3.3 Compliance with Antidegradation Policies	1-7
2 SUMMARY OF PROPOSED AMENDMENTS TO THE BASIN PLAN.....	2-1
2.1 Introduction (Basin Plan Chapter 1)	2-1
2.2 Existing and Potential Beneficial Uses (Basin Plan Chapter II).....	2-1
2.3 Water Quality Objectives (Basin Plan Chapter III)	2-1
2.3.1 Intent of Proposed pH Amendment.....	2-1
2.3.2 Intent of Proposed Turbidity Amendment.....	2-1
2.4 Implementation (Basin Plan Chapter IV)	2-2
2.5 Surveillance and Monitoring (Basin Plan Chapter V).....	2-2
3 BENEFICIAL USES.....	3-1
3.1 Federal and State Regulatory Overview	3-1
3.2 Water Bodies Within the Sacramento River and San Joaquin River Basins and their Designated Beneficial Uses.....	3-2
4 WATER QUALITY OBJECTIVES.....	4-1
4.1 pH Objective.....	4-2
4.1.1 Current pH Objective in the Basin Plan.....	4-2
4.1.2 Alternatives Considered.....	4-2
4.1.2.1 Alternative 1 – No Action	4-3

4.1.2.2	Alternative 2 – Adopt USEPA National Ambient Criteria.....	4-3
4.1.2.3	Alternative 3 – Develop a Basin-Specific pH Objective.....	4-3
4.1.3	Recommended Alternative.....	4-3
4.1.4	Proposed pH Objective.....	4-4
4.1.5	Basis for and Evaluation of the Proposed Basin-Specific pH Objective.....	4-4
4.1.5.1	Beneficial Use Considerations.....	4-4
4.1.5.1.1	Uses Unaffected, or Minimally Affected, by pH.....	4-4
4.1.5.1.2	Effects on Municipal and Industrial Uses.....	4-5
4.1.5.1.3	Effects on Agricultural Uses (AGR).....	4-6
4.1.5.1.4	Effects on Groundwater and Surface Water Replenishment.....	4-7
4.1.5.1.5	Effects on Recreation.....	4-7
4.1.5.1.6	Effects on Aquatic Organisms and Associated Uses.....	4-8
4.1.5.1.7	Effects on Aquatic and Wildlife Habitat.....	4-11
4.1.5.2	Hydrographic Unit Environmental Characteristics Considerations.....	4-11
4.1.5.3	Water Quality Conditions That Could Be Reasonably Achieved.....	4-11
4.1.5.4	Economic Considerations.....	4-11
4.1.5.5	Need for Housing.....	4-11
4.1.5.6	Need to Develop and Use Recycled Water.....	4-11
4.2	Turbidity Objective.....	4-12
4.2.1	Current Basin Plan Turbidity Objective.....	4-12
4.2.2	Alternatives Considered.....	4-12
4.2.2.1	Alternative 1 – No Action.....	4-12
4.2.2.2	Alternative 2 – Adopt USEPA National Criteria.....	4-13
4.2.2.3	Alternative 3 – Develop a Basin-Specific Turbidity Objective.....	4-13
4.2.3	Recommended Alternative.....	4-13
4.2.4	Proposed Turbidity Objective.....	4-13
4.2.5	Basis for and Evaluation of the Basin-Specific Turbidity Objective.....	4-14
4.2.5.1	Beneficial Use Considerations.....	4-14
4.2.5.1.1	Uses Unaffected, or Minimally Affected, by Turbidity.....	4-15
4.2.5.1.2	Effects on Municipal and Industrial Uses.....	4-15
4.2.5.1.3	Effects on Agricultural Uses (AGR).....	4-16
4.2.5.1.4	Effects on Groundwater and Surface Water Replenishment.....	4-16
4.2.5.1.5	Effects on Contact Recreation.....	4-17
4.2.5.1.6	Effects on Aquatic Organisms and Associated Uses.....	4-18
4.2.5.1.7	Effects on Wildlife Habitat and Habitats of Special Significance.....	4-20
4.2.5.2	Hydrographic Unit Environmental Characteristics Considerations.....	4-21
4.2.5.3	Water Quality Conditions that could be Reasonably Achieved.....	4-21
4.2.5.4	Economic Considerations.....	4-21
4.2.5.5	Need for Housing.....	4-21
4.2.5.6	Need to Develop and Use Recycled Water.....	4-21
5	ANTIDEGRADATION ANALYSIS.....	5-1
5.1	Federal Antidegradation Policy.....	5-1
5.2	State Antidegradation Policy.....	5-1

5.3	Antidegradation Analysis of the Proposed Amendments to the pH and Turbidity Objectives	5-2
5.3.1	pH Objective	5-2
5.3.2	Turbidity Objective	5-3
6	PROGRAMS FOR IMPLEMENTATION OF PROPOSED BASIN PLAN AMENDMENTS.....	6-1
6.1	Actions Necessary to Achieve the Proposed Water Quality Objectives.....	6-1
6.1.1	pH.....	6-1
6.1.2	Turbidity	6-1
6.2	Time Schedule for Compliance	6-1
6.3	Monitoring and Surveillance Program.....	6-2
7	ENDANGERED SPECIES ACT CONSIDERATIONS.....	7-1
7.1	Overview and Background	7-1
7.2	NMFS ESA Considerations	7-1
7.3	USFWS ESA Considerations	7-2
8	ENVIRONMENTAL IMPACTS REVIEW.....	8-1
8.1	Introduction.....	8-1
8.2	Proposed Project.....	8-1
8.3	Environmental Checklist.....	8-2
8.4	Thresholds of significance	8-15
8.5	Environmental Impacts of the Proposed Project.....	8-16
8.5.1	Aesthetics	8-16
8.5.2	Agricultural Resources.....	8-16
8.5.3	Air Quality	8-17
8.5.4	Biological Resources	8-17
8.5.4.1	pH	8-17
8.5.4.2	Turbidity	8-18
8.5.5	Cultural Resources	8-18
8.5.6	Geology and Soils.....	8-19
8.5.7	Hazards and Hazardous Materials.....	8-19
8.5.8	Hydrology and Water Quality	8-19
8.5.9	Land Use and Planning.....	8-20
8.5.10	Mineral Resources	8-20
8.5.11	Noise.....	8-20

8.5.12	Population and Housing.....	8-20
8.5.13	Public Services	8-20
8.5.14	Recreation	8-21
8.5.14.1	pH	8-21
8.5.14.2	Turbidity	8-21
8.5.15	Transportation/Traffic.....	8-22
8.5.16	Utilities and Service Systems.....	8-23
8.6	Cumulative Impact Analysis for the Proposed Project	8-23
8.7	Alternatives Considered	8-23
8.8	Recommended Alternative	8-25
8.9	No Effect Finding.....	8-25
9	LITERATURE CITED.....	9-1

APPENDICES

- APPENDIX A: RECOMMENDED FORMAT FOR COMMENT LETTERS
- APPENDIX B: LIST OF BENEFICIAL USE DEFINITIONS FROM THE BASIN
PLAN

ACRONYMS AND ABBREVIATIONS

Basin Plan	Water Quality Control Plan for the Sacramento River and San Joaquin River Basins, Fourth Edition
BMPs	Best Management Practices
CDFG	California Department of Fish and Game
CEQA	California Environmental Quality Act
CFR	Code of Federal Regulations
CTR	California Toxics Rule
CWA	Clean Water Act
Delta	Sacramento-San Joaquin Delta
EDW	Effluent Dominated Water Body
EIFAC	European Inland Fisheries Advisory Committee
ESA	Endangered Species Act
FR	Federal Register
JTU	Jackson Turbidity Units
mg/l	Milligrams Per Liter
mgd	Million Gallons Per Day
NAS	National Academy of Sciences
NMFS	National Marine Fisheries Service
NPDES	National Pollutant Discharge Elimination System
NTAC	National Technical Advisory Committee
NTU	Nephelometric Turbidity Units
OAL	Office of Administrative Law
O&M	operations and maintenance
POTWs	Publicly Owned Treatment Works
Regional Water Board	Regional Water Quality Control Board, Central Valley Region
State Water Board	State Water Resources Control Board
TDS	Total Dissolved Solids
TSS	Total Suspended Solids
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
WWTP	Wastewater Treatment Plant

AMENDMENTS TO THE WATER QUALITY CONTROL PLAN FOR THE SACRAMENTO RIVER AND SAN JOAQUIN RIVER BASINS

FOR pH AND TURBIDITY

STAFF REPORT

EXECUTIVE SUMMARY

The Regional Water Board has identified water quality regulation problems for discharges to streams under low flow conditions. Some municipal wastewater treatment plants have difficulty complying consistently with receiving water limitations based on the current pH and turbidity objectives. The current pH and turbidity objectives are more stringent than current science recommends to protect beneficial uses and more stringent than current Federal criteria.

To resolve these regulatory difficulties, the Regional Water Board proposes to amend the Basin Plan's existing pH and turbidity water quality objectives. The proposed amendments to the pH and turbidity objectives are consistent with current science, founded on Federal criteria, and consistent with Federal and State antidegradation policies.

The proposed pH amendment involves deletion of language from the Basin Plan regarding pH change and averaging periods. The language that is proposed to remain, states that the pH of waters in the basins of the Sacramento and San Joaquin Rivers must be maintained between 6.5 and 8.5.

The current turbidity objective includes four bulleted sections. The proposed amendment involves modification of the first bulleted item regarding natural turbidity between 0 and 5 NTUs. What is now one bulleted item will be split into two bulleted items. The new first bullet will address turbidity less than 1 NTU and will allow turbidity to increase up to 2 NTUs. The new second bullet will address turbidity between 1 and 5 NTUs and will continue to require that turbidity not increase more than 1 NTU. The remaining three bulleted items regarding turbidity at greater than 5 NTUs will remain unchanged.

Analysis of the proposed amendments in conformance with CEQA guidelines is included.

1 INTRODUCTION

This Staff Report is the primary planning documentation required by the California Water Code for adoption of Basin Plan amendments by the Regional Water Quality Control Board, Central Valley Region (Regional Water Board).

1.1 PURPOSE

The purpose of this Staff Report is to define and provide support for the proposed amendments to the Basin Plan's current water quality objectives for pH and turbidity. **Section 1** (Introduction) provides historical and regulatory background for the basin plan amendment process. **Section 2** (Summary of Proposed Amendments to the Basin Plan) presents the proposed modifications to the current water quality objectives for pH and turbidity, as they would actually appear in the Basin Plan. **Section 3** (Beneficial Uses) discusses the regulatory role of beneficial use designations. **Section 4-1** (Water Quality Objectives) discusses the approach used to develop the proposed modifications to the current pH and turbidity objectives, the rationale for the proposed modifications, and evaluates the level to which the amended objectives would protect each beneficial use. **Section 5** (Antidegradation Analysis) evaluates the proposed objectives with respect to the federal and State antidegradation policies. **Section 6** (Programs for Implementation of the Proposed Basin Plan Amendments) discusses the need for and rationale behind the program for implementation and the time schedule for compliance. **Section 7** (Endangered Species Act Considerations) summarizes the results of the technical coordination conducted with National Marine Fisheries Service (NMFS) and United States Fish and Wildlife Service (USFWS) regarding the proposed amendments. **Section 8** (Environmental Impacts Review) provides the analyses of potential environmental impacts associated with adoption and implementation of the proposed amendments. **Section 9** contains references for the literature cited in this report. **Appendix A** provides recommended formats for comment letters. **Appendix B** provides the list of beneficial use definitions from the Basin Plan.

1.2 SCOPE OF REVISIONS TO THE BASIN PLAN

The proposed amendments to the Basin Plan's current water quality objectives for pH and turbidity will be applicable throughout the basins of the Sacramento and San Joaquin Rivers as defined in the Basin Plan, except where otherwise noted for specified water bodies. The proposed amendments to the pH objective will affect all water bodies to which the current pH objective is applicable. The proposed amendments to the turbidity objective will only affect creeks and streams with turbidities at or below 1 NTU.

The amendments are consistent with the Regional Water Board's basin planning priorities, protect beneficial uses, and resolve regulatory issues.

Potential alternatives to the amendments are discussed in detail in Sections 4 and 8 (Environmental Impact Review) of this Staff Report.

1.3 BACKGROUND

1.3.1 Regulatory Authority and Mandates for Basin Plan Amendments

The State Water Resources Control Board (State Water Board) and the nine Regional Water Quality Control Boards (regional water boards) are the principal state agencies with primary responsibility for coordination and control of water quality. (California Water Code (CWC) 13000). Each regional water board is required to adopt a water quality control plan, or basin plan, which provides the basis for regulatory actions to protect water quality. (CWC 13240 et seq.). Basin plans consist of beneficial uses of water, water quality objectives to protect the uses, and a program to implement the objectives. (CWC 13050(j)). Basin plans, once adopted, must be periodically reviewed and may be revised. (CWC 13240).

Under the federal Clean Water Act, 33 U S C. section 1251 et seq., (CWA) the states are required to adopt water quality standards for surface waters. (CWA 303(c)). Water quality standards consist of 1) designated uses; 2) water quality criteria necessary to protect designated beneficial uses; and 3) an antidegradation policy. (CWA 303(c)(2) (A) and (d)(4)(B); 40 C.F.R. 131.6). In California, water quality standards are found in the basin plans and statewide water quality control plans adopted by the State Water Board. State water quality objectives are synonymous with criteria under CWA section 303(c). Under the CWA, the states must review water quality standards at least triennially.

Regional water boards adopt and amend basin plans through a structured process involving peer review, public participation and environmental review. Regional water boards must comply with the California Environmental Quality Act (CEQA) (Public Resources Code (PRC) §21000 et seq.) when amending their basin plans. The Secretary of Resources has certified the basin planning process as exempt from the CEQA requirement to prepare an environmental impact report or other appropriate environmental document. (PRC 21080.5; Cal. Code Regs., tit. 14, §15251(g)). Instead, State Water Board regulations on its exempt regulatory programs require the regional water boards to prepare a written report and an accompanying CEQA Environmental Checklist and Determination with respect to Significant Environmental Impacts (CEQA Checklist). (Cal. Code Regs., tit. 23, §3775 et seq.).

Basin plan amendments are not effective until they are approved by the State Water Board and the regulatory provisions are approved by the State Office of Administrative Law (OAL). The United States Environmental Protection Agency (USEPA) also must review and approve amendments that add or modify water quality standards for waters of the United States.

1.3.2 Basin Plan for the Sacramento and San Joaquin River Basins

The Regional Water Board first adopted the Water Quality Control Plan for the Sacramento River and San Joaquin River Basins in 1975. In 1989 and 1994, the Regional

Water Board adopted major updates resulting in subsequent editions. The current edition (Fourth Edition) incorporates all new amendments approved since 1994.

1.3.3 Need for the Proposed Revisions to the Basin Plan

Beginning with Section 13370 of the Water Code, and as authorized by the CWA, the Regional Water Boards have the authority to regulate discharges of wastewater to surface waters under the National Pollutant Discharge Elimination System (NPDES) Program. The Regional Water Boards issue NPDES Permits that regulate the discharges by including effluent and receiving water limitations. Failure of the dischargers to comply with the limitations may result in the imposition of enforcement orders or fines.

In its most recent (2005) triennial review of the Basin Plan, the Regional Water Board identified the need to resolve water quality regulation problems common to low flow water bodies that become effluent dominated water bodies (EDWs) after receiving discharges. Municipal wastewater treatment plants that discharge to low flow streams have difficulty complying consistently with the Basin Plan's current pH and turbidity water quality objectives. Even tertiary treatment plants that use more stringent treatment methods have difficulty achieving consistent compliance.

The Basin Plan's current general pH and turbidity water quality objectives are as follows:

pH

"The pH shall not be depressed below 6.5 nor raised above 8.5. Changes in normal ambient pH levels shall not exceed 0.5 in fresh waters with designated COLD or WARM beneficial uses. In determining compliance with the water quality objective for pH, appropriate averaging periods may be applied provided that beneficial uses will be fully protected."

Turbidity

"Waters shall be free of changes in turbidity that cause nuisance or adversely affect beneficial uses. Increases in turbidity attributable to controllable water quality factors shall not exceed the following limits:

- *Where natural turbidity is between 0 and 5 Nephelometric Turbidity Units (NTUs), increases shall not exceed 1 NTU.*
- *Where natural turbidity is between 5 and 50 NTUs, increases shall not exceed 20 percent.*
- *Where natural turbidity is between 50 and 100 NTUs, increases shall not exceed 10 NTUs.*
- *Where natural turbidity is greater than 100 NTUs, increases shall not exceed 10 percent.*

In determining compliance with the above limits, appropriate averaging periods may be applied provided that beneficial uses will be fully protected."

Dischargers to low flow water bodies have difficulty complying with the following portions of the current pH and turbidity objectives:

PH

“Changes in normal ambient pH levels shall not exceed 0.5 in fresh waters with designated COLD or WARM beneficial uses. In determining compliance with the water quality objective for pH, appropriate averaging periods may be applied provided that beneficial uses will be fully protected.”

Turbidity

“Where natural turbidity is between 0 and 5 Nephelometric Turbidity Units (NTUs), increases shall not exceed 1 NTU.”

These portions of the pH and turbidity water quality objectives are not supported by current science regarding the effects of pH and low-level turbidity on beneficial uses (RBI, 2004; RBI, 2006), nor are they consistent with current USEPA criteria for pH and turbidity in ambient waters.

In 2002, the Regional Water Board adopted a site-specific water quality objective for pH in Deer Creek, Sacramento and El Dorado counties, that is the same as the modified pH objective proposed herein, based on the same scientific evidence presented in this Staff Report. Consequently, part of this Basin Plan amendment will be to delete the site-specific water quality objective for pH in Deer Creek because it will be covered by this pH amendment, which will apply basin-wide.

The objective of the proposed Basin Plan amendments is to improve the pH and low-level turbidity objectives and to resolve common regulatory problems involving POTWs and the pH and low-level turbidity objectives. The proposed amendments to both the pH and turbidity objectives are consistent with the current science pertaining to these parameters, will comply with federal and state antidegradation policies, and will continue to protect existing and potential beneficial uses.

To facilitate the environmental impact review in Section 8 of this Staff Report, the “Proposed Project” is defined as the implementation of amendments to the Basin Plan’s current pH and 0 - 5 NTU turbidity water quality objectives. Regulatory, economic, and scientific justifications are also provided for the Proposed Project.

1.3.3.1 Regulatory and Economic Need

Dischargers to high flow waterways do not have permit compliance problems associated with the current pH objective, because of dilution that occurs, or with the 0-5 turbidity objective because of dilution and because the turbidity of high flow waterways is more often above 5 NTUs. Therefore, the following discussions of the regulatory problems involving the water quality objectives for pH and the 0-5 NTU turbidity objective pertain primarily to low flow water bodies.

pH

Creeks and streams, particularly under low flow conditions, may be subject to substantial, natural diurnal fluctuations in pH, often greater than 0.5 pH units (Hynes 1970; Wetzel 1983; Boyd 1990). The pH fluctuations are caused primarily by the photosynthesis process in aquatic macrophytes and algae, which occurs during daylight hours.

The component of the pH objective that has caused regulatory issues, is the requirement stating: *“Changes in normal ambient pH levels shall not exceed 0.5 in fresh waters with designated COLD or WARM beneficial uses.”* Compliance with this portion of the pH objective may, in some cases, be achieved if appropriate averaging periods are applied, as provided in the current pH objective: *“In determining compliance with the water quality objective for pH, appropriate averaging periods may be applied provided that beneficial uses will be fully protected.”* Where averaging periods for pH compliance have been included in NPDES permits, compliance has been achieved in many cases. However, such averaging periods have not resolved compliance issues in all cases (e.g., Deer Creek), and the necessary information on effluent and stream conditions has not been available to develop appropriate averaging periods for pH in all NPDES permits. For dischargers without averaging periods, the result has been occasional violations of NPDES permit limitations for pH and, in some cases, enforcement, fines, and third-party lawsuits.

It would be inappropriate, from a regulatory perspective, to expend resources in an effort to resolve POTW pH compliance issues via developing averaging periods in NPDES permits. Dischargers would need to expend time and personnel resources to gather sufficient information to develop appropriate averaging periods and Regional Water Board staff and California Department of Fish and Game staff would need to expend resources to review and approve averaging periods for each site. These expenditures are unnecessary to protect beneficial uses as described in Section 1.3.3.2 and 4.1.5.1.

Turbidity

When water body flow is low and turbidity is less than 1 NTU, dischargers have difficulty complying with the portion of the Basin Plan’s current turbidity objective that states *“Where natural turbidity is between 0 and 5 Nephelometric Turbidity Units (NTUs), increases shall not exceed 1 NTU.”*

Compliance with this portion of the turbidity objective may not be achieved at all wastewater treatment facilities that achieve a tertiary level of treatment with filtration, even if averaging periods are applied as allowed in the current turbidity objective. During non-precipitation periods of the year, low flow waterways often have ambient background turbidities below 0.5 NTU. Even state-of-the-art tertiary treatment facilities cannot always assure that downstream turbidity, under such conditions, will not be increased by more than 1 NTU (i.e., maintain downstream turbidities <1.5 NTUs). For dischargers to low flow streams, the result has been occasional violations of the NPDES permit limitations for turbidity and, in some cases, enforcement, fines, and third-party lawsuits.

Filtration is the mechanism that reduces turbidity by removing suspended matter from the wastewater. It should be noted that treatment plants that achieve less than tertiary levels of treatment (e.g. secondary treatment plants) do not have the filtration capability of tertiary plants. Therefore, the averaging periods that would help tertiary plants achieve compliance may not help secondary plants.

However, as noted above for pH, expenditure of resources to develop averaging periods would be inappropriate because they are unnecessary to protect beneficial uses.

1.3.3.2 Scientific Justification for pH and Turbidity Water Quality Objectives

1.3.3.2.1 pH

The Basin Plan's current pH objective that states in part "*Changes in normal ambient pH levels shall not exceed 0.5 in fresh waters with designated COLD or WARM beneficial uses. In determining compliance with the water quality objective for pH, appropriate averaging periods may be applied provided that beneficial uses will be fully protected.*" This portion of the pH objective is overly stringent when compared to current science regarding the effects of pH on freshwater aquatic life and other beneficial uses (see Section 4.1.5.1). In addition, the current pH objective is inconsistent with current USEPA recommended pH criteria for regulating pH (Section 4.1.2.2) in ambient freshwaters.

Among the beneficial uses defined in the Basin Plan, aquatic life beneficial uses are most sensitive to pH levels and are the only beneficial uses potentially affected by changes in pH within the range of 6.5 to 8.5. The study of the pH requirements of aquatic life dates back to the 1930s (e.g., Ellis 1937). Since that time, hundreds of studies have been conducted and used as the technical basis for recommending ambient pH criteria for the protection of aquatic life. The National Technical Advisory Committee (NTAC) to the Secretary of the Interior (NTAC 1968) published the first pH criteria in 1968. Subsequent pH criteria for the protection of aquatic life were published by the National Academy of Sciences (NAS), National Academy of Engineering Committee on Water Quality Criteria in 1972 (NAS 1972), and by USEPA in 1976, 1986, and 1999 (USEPA 1976, 1986, 1999a). Since 1976, USEPA's pH criterion for the protection of freshwater aquatic life continues to be, maintenance of water body pH between 6.5 and 9.0. None of the pH criteria recommended by the USEPA or other experts incorporates a limit of 0.5 for change of pH within the range of 6.5 - 8.5. Therefore, maintaining a pH between 6.5 and 8.5 will protect aquatic life beneficial uses, and a limit of 0.5 for pH changes within this range is unnecessary. The averaging period provision was used to assist dischargers to achieve compliance with the 0.5 pH change limit. By deleting the pH change requirement, the regulatory issues will also be resolved so the provision for averaging periods should also be deleted.

1.3.3.2 Turbidity

The portion of the Basin Plan's current turbidity objective that is the focus of this amendment is the portion that states: "Where natural turbidity is between 0 and 5 Nephelometric Turbidity Units (NTUs), increases shall not exceed 1 NTU." More specifically, this amendment focuses on situations where ambient background turbidity is below 1 NTU. Among the beneficial uses defined in the Basin Plan, the aquatic life and recreational uses are the most sensitive in this turbidity range. The turbidity of treated water that is distributed for consumption would not be affected at the low turbidities affected by the proposed amendments. Therefore, these Basin Plan turbidity objectives are based on protecting the aquatic life and recreational beneficial uses. The ambient water quality criteria documents cited above (NTAC 1968, NAS 1972, USEPA 1976, 1986, 1999a) and a review of the past and current scientific literature (RBI 2006) indicate that freshwater aquatic life does not require that changes in turbidity be limited to 1 NTU when natural turbidity is 0 - 5 NTUs, as required in the current Basin Plan. Moreover, at low turbidities the visual, aesthetic quality of water bodies differs negligibly (RBI 2006b), and to protect recreational uses, change in turbidity need not be limited to 1 NTU. Thus, this portion of the turbidity objective, specifically when ambient background turbidity is below 1 NTU, is overly stringent when compared to current science regarding the effects of turbidity on freshwater aquatic life and other beneficial uses (see Section 4.2.5.1; RBI 2006).

1.3.3.3 **Compliance with Antidegradation Policies**

The federal antidegradation policy, 40 CFR 131.12(a), states that existing water quality shall be maintained and protected, requires that existing in-stream water uses and the level of water quality necessary to protect the existing uses should be maintained, and where the quality of the water exceeds the levels to protect beneficial uses, allows lower water quality if necessary to accommodate important economic or social development in the area in which the waters are located, as long as water quality is still adequate to fully protect existing uses.

The antidegradation provisions of State Water Board Resolution No. 68-16 state that whenever existing quality of water is better than the quality necessary to protect beneficial uses, such quality shall be maintained until it has been demonstrated that any change will be consistent with maximum benefit to the people of the state, will not unreasonably affect present and anticipated beneficial use of such water and will not result in water quality less than that prescribed in the policies.

pH

The proposed amendment to the Basin Plan's current pH water quality objective will reflect current scientifically supported pH requirements for the protection of aquatic life and other beneficial uses. The proposed amendment will be more consistent with the current USEPA recommended criteria and will be fully protective of aquatic life and the other beneficial uses listed in the Basin Plan. Changes in pH when pH is maintained within the range of 6.5 to 8.5 are neither beneficial nor adverse and, therefore, are not considered to be degradation in water quality. Attempting to restrict pH changes to 0.5

pH units would incur substantial costs without demonstrable benefits to beneficial uses. Thus, any changes in pH that would occur under the amended pH objective would not only be protective of beneficial uses, but also would be consistent with maximum benefit to people of the state. Therefore the proposed amendment will not violate antidegradation policies.

Turbidity

The proposed amendment to the Basin Plan's current turbidity water quality objective will reflect current scientifically supported turbidity requirements for the protection of aquatic life and other beneficial uses and, therefore, will be fully protective of aquatic life and the other beneficial uses listed in the Basin Plan. Changes in turbidity allowed by the proposed amendment, when ambient turbidity is below 1 NTU, would not adversely affect beneficial uses and would maintain water quality at a level higher than necessary to protect beneficial uses. Restricting low-level turbidity changes further would require costly upgrades to numerous POTWs, which would not provide any additional protection of beneficial uses. Thus, any changes in turbidity that would occur under the amended turbidity objective would not only be protective of beneficial uses, but also would be consistent with maximum benefit to people of the state. Therefore, the proposed amendment will not violate antidegradation policies.

2 SUMMARY OF PROPOSED AMENDMENTS TO THE BASIN PLAN

This section presents the amended language as it is proposed to appear in the Basin Plan. Specifically, the amendments proposed in this Staff Report consist of modifications to the current water quality objectives for pH and turbidity.

2.1 INTRODUCTION (BASIN PLAN CHAPTER 1)

No modifications to Chapter I (Introduction) of the Basin Plan are proposed.

2.2 EXISTING AND POTENTIAL BENEFICIAL USES (BASIN PLAN CHAPTER II)

No modifications to Chapter II (Existing and Potential Beneficial Uses) of the Basin Plan are proposed.

2.3 WATER QUALITY OBJECTIVES (BASIN PLAN CHAPTER III)

This section presents the proposed modifications to the current water quality objectives for pH and turbidity. The specific proposed deletions to Section III, page 6 (pH) and page 9 (turbidity) are shown in ~~strikeout~~. The new language proposed for Section III, page 9 (turbidity) is **highlighted**. A detailed discussion of the rationale and technical information in support of the proposed modifications to the objectives is provided in Section 4 and the appendices.

2.3.1 Intent of Proposed pH Amendment

The proposed amendment to the pH objective is intended to: 1) maintain the pH range of the existing objective, which will continue to prevent controllable factors from causing water body pH to be depressed below 6.5 or be raised above 8.5, unless otherwise specified in the Basin Plan; 2) eliminate restrictions on changes in pH when resultant pH is between 6.5 and 8.5; and 3) remove the pH averaging period.

2.3.2 Intent of Proposed Turbidity Amendment

The proposed amendments are intended to modify the portion of the first bullet of the existing turbidity objective when the natural turbidity is less than 1 NTU. The proposed amendment does not affect the Basin Plan's existing turbidity objective when natural turbidity is between 1 and 5 NTUs. The remaining three bulleted portions of the existing turbidity objective where natural turbidity exceeds 5 NTUs will be unaffected by the proposed amendment (turbidity between 5 and 50 NTUs, turbidity between 50 and 100 NTUs; and turbidity greater than 100 NTUs).

The text in the following pages represents specific pages of the Basin Plan, with the proposed amendments indicated in ~~strikeout~~ and **highlight**.

2.4 IMPLEMENTATION (BASIN PLAN CHAPTER IV)

No modifications to Chapter IV (Implementation) of the Basin Plan are proposed.

2.5 SURVEILLANCE AND MONITORING (BASIN PLAN CHAPTER V)

No modifications to Chapter V (Surveillance and Monitoring) of the Basin Plan are proposed.

NOTE THAT ONLY THOSE PORTIONS OF THE BASIN PLAN WITH CHANGES ARE PROVIDED. ROWS OF ASTERISKS (* * * * *) INDICATE WHERE SECTIONS OF TEXT HAVE NOT BEEN INCLUDED.

III. WATER QUALITY OBJECTIVES

The Porter-Cologne Water Quality Control Act defines water quality objectives as "...the limits or levels of water quality constituents or characteristics which are established for the reasonable protection of beneficial uses of water or the prevention of nuisance within a specific area" [Water Code Section 13050(h)]. It also requires the Regional Water Board to establish water quality objectives, while acknowledging that it is possible for water quality to be changed to some degree without unreasonably affecting beneficial uses. In establishing water quality objectives, the Regional Water Board must consider, among other things, the following factors:

- Past, present, and probable future beneficial uses;
- 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;
- The need to develop and use recycled water. (Water Code Section 13241)

The Federal Clean Water Act requires a state to submit for approval of the Administrator of the U.S. Environmental Protection Agency (*USEPA*) all new or revised water quality standards which are established for surface and ocean waters. As noted earlier, California water quality standards consist of both beneficial uses (identified in Chapter II) and the water quality objectives based on those uses.

There are **seven important points** that apply to water quality objectives.

The **first point** is that water quality objectives can be revised through the basin plan amendment process. Objectives may apply region-wide or be specific to individual water bodies or parts of water bodies. Site-specific objectives may be developed whenever the Regional Water Board believes they are

appropriate. As indicated previously, federal regulations call for each state to review its water quality standards at least every three years. These Triennial Reviews provide one opportunity to evaluate changing water quality objectives, because they begin with an identification of potential and actual water quality problems, i.e., beneficial use impairments. Since impairments may be associated with water quality objectives being exceeded, the Regional Water Board uses the results of the Triennial Review to implement actions to assess, remedy, monitor, or otherwise address the impairments, as appropriate, in order to achieve objectives and protect beneficial uses. If a problem is found to occur because, for example, a water quality objective is too weak to protect beneficial uses, the Basin Plan should be amended to make the objective more stringent. (Better enforcement of the water quality objectives or adoption of certain policies or redirection of staff and resources may also be proper responses to water quality problems. See the Implementation chapter for further discussion.)

Changes to the objectives can also occur because of new scientific information on the effects of specific constituents. A major source of information is the USEPA which develops data on the effects of chemical and other constituent concentrations on particular aquatic species and human health. Other information sources for data on protection of beneficial uses include the National Academy of Science which has published data on bioaccumulation and the Federal Food and Drug Administration which has issued criteria for unacceptable levels of chemicals in fish and shellfish used for human consumption. The Regional Water Board may make use of those and other state or federal agency information sources in assessing the need for new water quality objectives.

The **second point** is that achievement of the objectives depends on applying them to controllable water quality factors. *Controllable water quality factors* are those actions, conditions, or circumstances resulting from human activities that may influence the quality of the waters of the State, that are subject to the authority of the State Water Board or the Regional Water Board, and that may be reasonably controlled. Controllable factors are not allowed to cause further degradation of water quality in instances where uncontrollable factors have

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pH

The pH shall not be depressed below 6.5 nor raised above 8.5. ~~Changes in normal ambient pH levels shall not exceed 0.5 in fresh waters with designated COLD or WARM beneficial uses. In determining compliance with the water quality objective for pH, appropriate averaging periods may be applied provided that beneficial uses will be fully protected.~~

The following site-specific objectives replace the general pH objective, above, in its entirety for the listed water bodies.

For Goose Lake (2), pH shall be less than 9.5 and greater than 7.5 at all times. ~~For Deer Creek, source to Cosumnes River, pH shall not be depressed below 6.5 nor raised above 8.5~~

* * * * *

* * * * *

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 become available; and source control of toxic substances will be encouraged.

Turbidity

Waters shall be free of changes in turbidity that cause nuisance or adversely affect beneficial uses. Increases in turbidity attributable to controllable water quality factors shall not exceed the following limits:

- ~~Where natural turbidity is between 0 and 5 Nephelometric Turbidity Units (NTUs), increases shall not exceed 1 NTU.~~
- Where natural turbidity is less than 1 Nephelometric Turbidity Unit (NTU), controllable factors shall not cause downstream turbidity to exceed 2 NTUs.
- Where natural turbidity is between 1 and 5 NTUs, increases shall not exceed 1 NTU.
- Where natural turbidity is between 5 and 50 NTUs, increases shall not exceed 20 percent.
- Where natural turbidity is between 50 and 100 NTUs, increases shall not exceed 10 NTUs.
- Where natural turbidity is greater than 100 NTUs, increases shall not exceed 10 percent.

In determining compliance with the above limits, appropriate averaging periods may be applied provided that beneficial uses will be fully protected.

Exceptions to the above limits will be considered when a dredging operation can cause an increase in turbidity. In those cases, an allowable zone of dilution within which turbidity in excess of the limits may be tolerated will be defined for the operation and prescribed in a discharge permit.

For Folsom Lake (50) and American River (Folsom Dam to Sacramento River) (51), except for periods of storm runoff, the turbidity shall be less than or equal 10 NTUs. To the extent of any conflict with the general turbidity objective, the more stringent applies.

For Delta waters, the general objectives for turbidity apply subject to the following: except for periods of storm runoff, the turbidity of Delta waters shall not exceed 50 NTUs in the waters of the Central Delta and 150 NTUs in other Delta waters. Exceptions to the Delta specific objectives will be considered when a dredging operation can cause an increase in turbidity. In this case, an allowable zone of dilution within which turbidity in excess of limits can be tolerated will be defined for the operation and prescribed in a discharge permit.

For Deer Creek, source to Cosumnes River:

- When the dilution ratio for discharges is less than 20:1 and where natural turbidity is less than 1 Nephelometric Turbidity Unit (NTU), discharges shall not cause the receiving water daily average turbidity to exceed 2 NTUs or daily maximum turbidity to exceed 5 NTUs. Where natural turbidity is between 1 and 5 NTUs, dischargers shall not cause receiving water daily average turbidity to increase more than 1 NTU or daily maximum turbidity to exceed 5 NTUs
- Where discharge dilution ratio is 20:1 or greater, or where natural turbidity is greater than 5 NTUs, the general turbidity objectives shall apply.

* * * * *

3 BENEFICIAL USES

This section provides a brief overview of federal and State regulations pertaining to beneficial use designation as part of establishing water quality standards.

3.1 FEDERAL AND STATE REGULATORY OVERVIEW

Section 303 of the CWA requires that states protect beneficial uses of waters of the United States within their jurisdictional boundaries. USEPA regulations further require that states adopt water quality criteria (referred to as “water quality objectives” in California) that protect the designated “beneficial uses” of water bodies. The designated beneficial uses, the water quality criteria to protect those uses, and an antidegradation policy constitute water quality standards.

To paraphrase USEPA’s “Water Quality Standards Handbook” (USEPA 1994, p. 2-1), a water quality standard defines the water quality goals for a water body that protect the designated beneficial use or uses. States adopt water quality standards to protect public health or welfare, enhance the quality of water, and serve the purposes of the CWA. As defined in Sections 101(a)(2) and 303(c) of the CWA, “Serve the purposes of the CWA” means that water quality standards should:

- Provide, wherever attainable, water quality for the protection and propagation of fish, shellfish, and wildlife, and recreation in and on the water (“fishable/swimmable”); and
- Consider the use and value of State waters for public water supplies, propagation of fish and wildlife, recreation, agriculture, and industrial purposes, and navigation.

In designating beneficial uses for a water body, states are required to consider, at a minimum, those uses listed in Sections 101(a)(2) and 303(c) of the CWA. However, states are allowed to develop subcategories of uses, within the CWA’s general categories, to “... *refine and clarify specific use classes.*” For example, subcategories of aquatic life uses may be on the basis of attainable habitat (e.g., coldwater versus warmwater habitat) (USEPA 1994, p. 2-5). The USEPA (1994, p. 2-6) also notes: “*In some areas of the country, uses are practical only for limited seasons. U.S. EPA recognizes seasonal uses.... States may specify the seasonal uses and criteria protective of that use as well as the time frame for the ...season, so long as the criteria do not prevent the attainment of any more restrictive use attainable in other seasons.*”

The CWA requires states to protect “existing uses” that are defined as those beneficial uses actually attained in the water body on or after 28 November 1975 (40 CFR 131.3(e)).

Beneficial use designation is discussed here prior to the discussion on water quality objectives because water quality objectives are dependent upon the beneficial use designation. Uses that may be protected include, but are not limited to, domestic, municipal, agricultural and industrial supply; power generation; recreation; aesthetic enjoyment;

navigation; and preservation of fish, wildlife, and other aquatic resources or preserves (California Water Code Section 13050(f)).

3.2 WATER BODIES WITHIN THE SACRAMENTO RIVER AND SAN JOAQUIN RIVER BASINS AND THEIR DESIGNATED BENEFICIAL USES

The Basin Plan contains the beneficial uses (Appendix B), water quality objectives and antidegradation policy that make up the water quality standards for the water bodies in the Sacramento River and San Joaquin River Basins.

4 WATER QUALITY OBJECTIVES

The Porter-Cologne Water Quality Control Act defines water quality objectives as “...*the limits or levels of water quality constituents or characteristics which are established for the reasonable protection of beneficial uses of water or the prevention of nuisance within a specific area*” (Water Code Section 13050(h)). The Act also requires the Regional Water Board to establish water quality objectives, while acknowledging that it is possible for water quality to be changed to some degree without unreasonably affecting beneficial uses (Water Code Section 13241).

The proposed Basin Plan amendments are modifications to the water quality objectives for pH and turbidity. Development or modification of water quality objectives requires, at a minimum, consideration of the following six elements (Water Code Section 13241):

- 1) Past, present, and probable future beneficial uses;
- 2) Environmental characteristics of the hydrographic unit under consideration, including the quality of water;
- 3) Water quality conditions that could reasonably be achieved through the coordinated control of all factors that affect water quality in the area;
- 4) Economic considerations;
- 5) The need for developing housing within the region;
- 6) The need to develop and use recycled water.

In addition, on pages III-1 and III-2, the Basin Plan specifies the following seven “important points” that apply to water quality objectives:

- 1) Water quality objectives can be revised through the basin plan amendment process.
- 2) Achievement of the objectives depends on applying them to controllable water quality factors. *Controllable water quality factors* are those actions, conditions, or circumstances resulting from human activities that may influence the quality of the waters of the State, that are subject to the authority of the State Water Board or the Regional Water Board, and that may be reasonably controlled.
- 3) Objectives are to be achieved primarily through the adoption of waste discharge requirements (including permits) and cleanup and abatement orders.
- 4) The Regional Water Board recognizes that immediate compliance with water quality objectives adopted by the Regional Water Board or the State Water Board, or with water quality criteria adopted by the USEPA, may not be feasible in all circumstances.

- 5) In cases where water quality objectives are formulated to preserve historic conditions, there may be insufficient data to determine completely the temporal and hydrologic variability representative of historic water quality. The Regional Water Board determines the reasonableness of achieving the objectives through regulation of the controllable factors in the areas of concern.
- 6) The State Water Board adopts policies and plans for water quality control that can specify water quality objectives or affect their implementation.
- 7) Water quality objectives may be in numerical or narrative form.

The Basin Plan's current objectives for pH and turbidity are provided below, in Section 4.1.1 and Section 4.2.1, respectively. Following subsections address/discuss: 1) the alternative approaches for developing a proposed modification to the current pH and turbidity objectives; 2) the approach selected and used to develop the proposed amendments for both parameters; 3) the proposed changes to the current objectives, which constitute the amendments; and 4) the basis for and evaluation of the proposed objectives in terms of their ability to provide reasonable protection of beneficial uses. The latter "basis and evaluation" discussions of the proposed amendments are provided in a manner that specifically addresses the six Water Code elements listed above.

4.1 PH OBJECTIVE

4.1.1 Current pH Objective in the Basin Plan

The Basin Plan's current general pH objective is as follows:

"The pH shall not be depressed below 6.5 nor raised above 8.5. Changes in normal ambient pH levels shall not exceed 0.5 in fresh waters with designated COLD or WARM beneficial uses. In determining compliance with the water quality objective for pH, appropriate averaging periods may be applied provided that beneficial uses will be fully protected."

4.1.2 Alternatives Considered

To improve the scientific basis for and compliance with the pH water quality objective, and provide consistency with existing Federal criteria, three alternatives were considered: 1) no action; 2) adoption of the USEPA national ambient criteria for pH; and 3) adoption of a basin-specific pH objective. The criteria used for assessing the three alternatives and for selecting the recommended alternative included:

- 1) Consistency with State and Federal water quality laws, policies (including anti-degradation policies), and water quality criteria;
- 2) Protection of all designated beneficial uses;

- 3) Consistency with current science regarding the water quality that is necessary to reasonably protect beneficial uses;
- 4) Is not overly restrictive; and
- 5) Applicability to water bodies of the Basin.

4.1.2.1 Alternative 1 – No Action

Under this alternative, the Basin Plan’s current water quality objective for pH would remain unchanged and, therefore, would continue to be applicable to water bodies in the Basin.

4.1.2.2 Alternative 2 – Adopt USEPA National Ambient Criteria

Under this alternative, the USEPA’s current national ambient criteria for pH in fresh waters would be adopted as the pH water quality objective in the Basin Plan. The current national criteria for pH are as follows (USEPA 1986, 1999a):

“Criteria:

Range

<i>5-9</i>	<i>Domestic water supplies (welfare)</i>
<i>6.5-9.0</i>	<i>Freshwater aquatic life</i>
<i>6.5-8.5</i>	<i>Marine aquatic life (but not more than 0.2 units outside of normally occurring range)”</i>

4.1.2.3 Alternative 3 – Develop a Basin-Specific pH Objective

Under this alternative, a basin-specific pH objective, would be developed that would apply to all waters of the Basin. Its development would reflect current scientifically supported pH requirements and criteria for the protection of all beneficial uses (particularly freshwater aquatic life) and specific chemical, physical, and biological characteristics of the water bodies of the Basin.

4.1.3 Recommended Alternative

Alternative 3 is the recommended alternative because it is:

- 1) Consistent with State and Federal water quality laws, water quality criteria, and policies, including antidegradation policies;
- 2) Protective of beneficial uses;
- 3) Consistent with current science and will improve the scientific basis upon which the water quality objective is based; and
- 4) Not overly restrictive and, thereby addresses regulatory compliance issues.

Adoption of Alternative 1 (No Action) would not satisfy the alternative selection criteria because it would maintain the 0.5-unit-change component of the current pH objective that is unnecessarily restrictive in a manner that creates the very regulatory compliance issues in need of resolution. The feasibility of implementing the No Action alternative is

addressed in Section 8.7. Alternative 2 (USEPA National Criteria) also would not satisfy the alternative selection criteria because it is less restrictive than the current objective and the objective developed under Alternative 3 and it provides a lower level of protection to sensitive aquatic organisms, specifically for salmonids (McKee and Wolf 1963, NAS 1972, Witschi and Ziebel 1979, and Modin, pers. comm., 1998), which are a common and important groups of species within the waterways of the basins.

4.1.4 Proposed pH Objective

The following pH objective is proposed:

~~“The pH shall not be depressed below 6.5 nor raised above 8.5. Changes in normal ambient pH levels shall not exceed 0.5 in fresh waters with designated COLD or WARM beneficial uses. In determining compliance with the water quality objective for pH, appropriate averaging periods may be applied provided that beneficial uses will be fully protected.”~~

The proposed amendment to the pH objective is to delete the restriction on change and its associated averaging period. The aspect of the current pH objective that defines the acceptable range within which pH will be maintained will remain unchanged under the proposed amendment.

4.1.5 Basis for and Evaluation of the Proposed Basin-Specific pH Objective

4.1.5.1 Beneficial Use Considerations

Before amendments to the Basin Plan’s existing pH objective can be developed, or evaluated for their protectiveness, the effect of pH on each beneficial use must be determined. To address this issue, the beneficial uses defined in the Basin Plan (see Appendix B) have been grouped into more general groups based on the effect pH has on specific uses of water. Because it is the “0.5 pH change” component of the current objective that the Regional Water Board proposes to remove, emphasis is placed on the effects of the change of pH when the resultant pH remains between 6.5 and 8.5. For those beneficial uses that are most affected by pH (e.g., aquatic life uses), a general discussion of the effects that may result from pH levels outside the pH range of 6.5 to 8.5, is also included to provide context.

4.1.5.1.1 Uses Unaffected, or Minimally Affected, by pH

- Navigation (NAV)
- Hydropower Generation (POW)

Water pH levels between 6.5 and 8.5 have no effect on the beneficial uses listed in this category. Extreme pH levels in water bodies could affect, either directly or indirectly, almost all beneficial uses. For example, extremely acidic waters (e.g., pH of 1 to 4) could corrode turbines and thus be less suitable for power production at hydropower facilities than water with a less corrosive pH. However, the proposed amendment to the

pH objective would require that the effects of controllable factors on receiving water pH be limited to the range of 6.5 to 8.5 pH units. Therefore, adoption and implementation of the proposed amendment would have no impact on the beneficial uses of navigation and hydropower generation.

4.1.5.1.2 Effects on Municipal and Industrial Uses

- Municipal and Domestic Supply (MUN)
- Industrial Service Supply (IND)
- Industrial Process Supply (PRO)

In its April 1968 report to the Federal Water Pollution Control Administration, under the public water supplies section, the NTAC stated the following (NTAC 1968):

“Most unpolluted waters have pH values within the range recommended as a permissible criterion [6.0-8.5; see Table II-1, p. 20]. Any pH value within this range is acceptable for public water supply.”

In 1972, the National Academy of Sciences-National Academy of Engineering Committee on Water Quality Criteria submitted its report *Water Quality Criteria, 1972* to the USEPA (NAS 1972). The NAS report relied significantly on work published in its predecessor document (NTAC 1968), often referred to as the “Green Book.” USEPA later published the 1972 NAS report as its “Blue Book.” The 1972 NAS report included a complete reexamination of pH effects, and a critical review of all available data. Regarding public water supplies, NAS (1972) stated the following:

“Because the defined treatment process can cope with natural waters within the pH range of 5.0 to 9.0 but becomes less economical as this range is extended, it is recommended that the pH of public water supply sources be within 5.0 to 9.0.”

In both its 1976 “Red Book” and 1986 “Gold Book” water quality criteria documents, the USEPA recommended that the pH of domestic water supplies be maintained between 5 and 9 pH units (USEPA 1976, 1986). The 5 - 9 pH range also was recommended by USEPA for protection of domestic supplies in its most recent criteria update (USEPA 1999a).

Regarding industrial uses, neither the NTAC (1968) report nor the NAS (1972) report made specific, quantitative recommendations for a range of raw surface water pH that was acceptable for industrial service supply or industrial process supply. Rather, the reports listed the range of pH in water supplies that “have been used” by various industries. The range of pH varied widely throughout the reported industrial uses. Water quality requirements for specific industries were specified “at the point of use” and not for the raw surface water or groundwater supply. Neither NTAC nor NAS (NTAC 1968, NAS 1972) specified a range of pH that was required for industrial service or process supply.

Based on its review of the NAS (1972) report, the USEPA stated the following in its 1976 and 1986 criteria documents (USEPA 1976, 1986):

“In general, process waters used varied from pH 3.0 to 11.7, while cooling waters used varied from 5.0 to 8.9. Desirable pH values are undoubtedly closer to neutral to avoid corrosion and other deleterious chemical reactions. Waters with pH values outside these ranges are considered unusable for industrial purposes.”

The proposed pH amendment would remove the component of the current objective that limits changes in normal ambient pH to 0.5 units, and would retain the component that limits the pH range of ambient fresh waters to 6.5-8.5 pH units. Based on the national criteria recommendations, implementation of the proposed amendment would have no effects on the beneficial uses of Municipal and Domestic Supply (MUN), Industrial Service Supply (IND), and Industrial Process Supply (PRO).

4.1.5.1.3 Effects on Agricultural Uses (AGR)

NTAC (1968), Table IV-1, p. 116, titled *Key Water Quality Criteria for Farmstead Uses*, contains a pH recommendation of 6.0 to 8.5. This report stated that: *“acidity or alkalinity in irrigation water is seldom directly detrimental to crop growth. Normally, water with pH values of 4.5 to 9.0 should not present any insurmountable problems, but a range of 5.5 to 8.5 would be more desirable.”*

The 1972 water quality criteria document (NAS 1972) stated:

“Because most of the effects of acidity and alkalinity in irrigation waters on soils and plant growth are indirect, no specific pH values can be recommended. However, water with pH values in the range of 4.5 to 9.0 should be usable provided that care is taken to detect the development of harmful indirect effects.”

This 1972 criteria document further stated:

“For general farmstead uses of water, including drinking, other household uses, and handling of produce and milk, it is recommended that water of the quality designated by the federal Drinking Water Standards be used. Raw water supplies not meeting these requirements should be treated to yield a finished product of quality comparable to drinking water. In general, raw waters should be free from impurities that are offensive to sight, smell, and taste.”

In its 1976 and 1986 criteria documents, the USEPA stated: *“The pH of water applied for irrigation purposes is not normally a critical parameter. Compared with the large buffering capacity of the soil matrix, the pH of applied water is rapidly changed to approximately that of the soil”* (USEPA 1976, 1986). These documents also recommended the pH range of 4.5 to 9.0 as being acceptable for irrigation uses.

Based on the national criteria recommendations, implementation of the proposed amendment would have no effect on Agricultural Uses (AGR).

4.1.5.1.4 Effects on Groundwater and Surface Water Replenishment

- Groundwater Recharge (GWR)
- Freshwater Replenishment (FRSH)

None of the water quality criteria documents reviewed specifically recommended pH ranges or limitations for the beneficial uses of groundwater recharge or freshwater replenishment. However, based on pH recommendations for other beneficial uses of water, particularly for irrigation, maintenance of the surface water pH between 6.5 and 8.5 would have no effect on the beneficial use of Groundwater Recharge (GWR) or Freshwater Replenishment (FRSH).

4.1.5.1.5 Effects on Recreation

- Water Contact Recreation (REC-1)
- Non-contact Water Recreation (REC-2)

Under its primary contact recreation recommendations, the NTAC (1968) report stated the following:

"In primary contact recreation waters, the pH should be within the range of 6.5-8.3, except when due to natural causes and in no case shall be less than 5.0 nor more than 9.0. When the pH is less than 6.5 or more than 8.3, discharge of substances which further increases unfavorable total acidity or alkalinity should be limited."

The NTAC report further recommended a single set of criteria for fresh, estuarine, and marine waters. No separate recommendations were made for contact recreation in these distinct types of surface waters.

Under its aesthetics recommendations, the NTAC stated that all surface waters should contribute to the support of life forms of aesthetic value. In addition, species available for harvest by recreational users should be fit for human consumption. These recommendations were made in recognition of the significance aesthetic value of fishes, waterfowl, and other water-dependent species (NTAC 1968).

Regarding contact recreation (REC-1), the 1972 water quality criteria document (NAS 1972) stated:

"For most bathing and swimming waters, eye irritation is minimized and recreational enjoyment enhanced by maintaining the pH within the range of 6.5 and 8.3 except for those waters with low buffer capacity where a range of pH between 5.0 and 9.0 may be tolerated."

REC-2 activities do not involve significant body contact with the water, but rather are associated with the aesthetic beauty of aquatic environments and the viewing of wildlife.

Therefore, pH levels that meet the requirements of aesthetic enjoyment, aquatic organisms and habitat, and wildlife, would also meet the requirements of REC-2 use.

Neither USEPA's 1976 Red Book, nor its 1986 Gold Book, water quality criteria documents provide pH recommendations for recreational uses of water.

Adoption of the proposed amendment would have no effect on the beneficial use of Water Contact Recreation (REC-1) or Non-contact Water Recreation (REC-2).

4.1.5.1.6 Effects on Aquatic Organisms and Associated Uses

- Commercial and Sport Fishing (COMM)
- Aquaculture (AQUA)
- Warm Freshwater Habitat (WARM)
- Cold Freshwater Habitat (COLD)
- Rare, Threatened, or Endangered Species (RARE)
- Migration of Aquatic Organisms (MIGR)
- Spawning, Reproduction, and/or Early Development (SPWN)
- Shellfish Harvesting (SHELL)

Of the beneficial uses specified in the Basin Plan, aquatic life uses are, in general, the uses most sensitive to and most affected by pH levels of water. Protection of the beneficial uses listed above involves, either directly or indirectly, maintenance of healthy populations of aquatic organisms. The effects of pH on aquatic life will be discussed as a means of addressing pH effects on each of the individual uses listed in this category.

There is an extensive body of scientific literature addressing pH effects on aquatic life. A summary of known effects of pH on aquatic life is provided in *pH Requirements of Freshwater Aquatic Life* (RBI, 2004). A brief overview of past national pH recommendations/criteria for the protection of aquatic life and pH requirements of freshwater aquatic life, is provided below.

McKee and Wolf (1963) stated that, of United States waters that supported "good fish communities," only about 5% had a pH less than 6.7; 50% had a pH less than 7.6; and 95% of the waters had a pH less than 8.3. Values of pH above 8.5 are often associated with high rates of photosynthetic activity and/or underlying limestone geology. Conversely, regions with soft water have low alkalinity and low pH (e.g., 5.5 - 6.5 pH).

The freshwater organisms subsection of NTAC's 1968 document, Section III – Fish, Other Aquatic Life, and Wildlife (NTAC 1968) stated the following:

"No highly dissociated materials should be added in quantities sufficient to lower the pH below 6.0 or to raise the pH above 9.0."

Its successor criteria document, NAS (1972), recommended the following for pH:

“Suggested maximum and minimum levels of protection for aquatic life are given in the following recommendations. A single range of values could not apply to all kinds of fish, nor could it cover the different degrees of graded effects. The selection of the level of protection¹ is a socioeconomic decision, not a biological one.

Nearly Maximum Level of Protection

- *pH not less than 6.5 nor more than 8.5. No change greater than 0.5 units above the estimated natural seasonal maximum, nor below the estimated natural seasonal minimum.*

High Level of Protection

- *pH not less than 6.0 nor more than 9.0. No change greater than 0.5 units outside the estimated natural seasonal maximum and minimum.*

Moderate level of Protection

- *pH not less than 6.0 nor more than 9.0. No change greater than 1.0 units outside the estimated natural seasonal maximum and minimum.*

Low Level of Protection

- *pH not less than 5.5 nor more than 9.5. No change greater than 1.5 units outside the estimated natural seasonal maximum and minimum.*

Additional Requirements for All Levels of Protection

- *If a natural pH is outside the stated range of pH for a given level of protection, no further change is desirable.*
- *The extreme range of pH fluctuation in any location should not be greater than 2.0 units. If natural fluctuation exceeds this, pH should not be altered.*
- *The natural daily and seasonal patterns of pH variation should be maintained, although the absolute values may be altered within the limits specified.*
- *The total alkalinity of water is not to be decreased more than 25 percent below the natural level.”*

In its 1976, 1986, and 1999 documents on water quality criteria, the USEPA published pH criteria for freshwater aquatic life without any restriction on pH changes within the criteria range (USEPA 1976, 1986, 1999a):

¹ Nearly Maximum: For virtually unimpaired productivity and unchanged quality of a fishery.
High: Not likely to cause appreciable change in the ecosystem or material reduction of fish production. Some impairment is risked, but appreciable damage is not to be expected at these levels.
Moderate: Fisheries should persist, usually with no serious impairment, but with some decrease in production.
Low: Should permit the persistence of sizable populations of tolerant species. Much reduced production or elimination of sensitive fish is likely.

Range

6.5 - 9.0 *Freshwater aquatic life*

Scientific studies reported in literature provide further support that aquatic organisms can tolerate both diurnal and rapid change in pH within this range. An overview of the effects of pH changes (based on both magnitude of change and resultant pH levels following the change) is provided below. Additional information regarding the pH requirements of freshwater aquatic life is provided in RBI (2004).

Tolerance to Diurnal and Rapid pH Changes

The pH of lakes and streams often changes during the day in response to photosynthetic activity. In ponds having poorly buffered (low alkalinity) waters, the pH may fall to approximately 7 in the early morning and increase to 9 or more in the afternoon. Good fish production usually can be maintained despite these daily fluctuations (Boyd 1990). In most lakes and ponds, diurnal fluctuations are generally less than 2 pH units during the summer, when photosynthetic activity peaks, with diurnal fluctuations in streams typically less (0.5 – 1.5 pH units). Unless diurnal fluctuations result in ambient pH falling below 6 or being elevated above 9, they generally have no adverse impact on aquatic life.

Fish species studied in the literature (RBI, 2004) tolerated rapid pH changes of 1.3 to 3.5 pH units when these changes occurred within the physiologically tolerated pH range. When the pH changed to a value that approached the species' normal upper tolerance level (pH 9.0) or exceeded their upper tolerance limit (pH 9.5 and 10.0), mortality occurred (Witschi and Ziebell 1979). Personal communications with California Department of Fish and Game (CDFG) fish pathologists confirmed the tolerance limits of fish species. Neither acute mortality nor chronic sublethal effects would occur in fish subjected to rapid pH changes within the range of 6.5 to 8.5 (Modin 1998).

Scientific literature, supported by pH criteria for the protection of aquatic life, provides evidence that, when pH is maintained within the range of 6.5 to 8.5, rapid changes in pH would not cause adverse impacts to freshwater aquatic life. No national quantitative pH criterion for the protection of freshwater aquatic life has ever recommended that rapid pH changes be limited within the acceptable pH range of 6.5 to 8.5. Similarly, the USEPA's current pH criterion for the protection of freshwater aquatic life (USEPA 1986, 1999a) simply defines an acceptable ambient pH range of 6.5 to 9.0. It does not quantitatively limit the magnitude of rapid change that freshwater organisms can be exposed to within this range. Therefore, it does not appear necessary to regulate rapid pH changes to protect beneficial uses as long as the resultant ambient pH is maintained within the acceptable range of 6.5 to 8.5.

The proposed pH amendment is strongly supported by current science regarding the pH requirements of freshwater aquatic life and is consistent with, and more restrictive than,

USEPA's current national recommended criteria for the protection of freshwater aquatic life.

4.1.5.1.7 Effects on Aquatic and Wildlife Habitat

- Estuarine Habitat (EST)
- Wildlife Habitat (WILD)
- Preservation of Biological Habitats of Special Significance (BIOL)

Under its fish, other aquatic life, and wildlife section, wildlife subsection, the NTAC (1968) stated (reiterated in NAS (1972)) the following:

“Aquatic plants of greatest value as food for waterfowl thrive best in waters with a summer pH range of 7.0 to 9.2.”

NTAC (1968) further stated that the pH water quality requirements for fish and aquatic organisms are generally acceptable for wildlife.

Implementation of the proposed pH amendment would have no effect on the beneficial uses of Estuarine Habitat (EST), Wildlife Habitat (WILD), and Preservation of Biological Habitats of Special Significance (BIOL).

4.1.5.2 Hydrographic Unit Environmental Characteristics Considerations

Adoption of the proposed amendment to the pH objective would not affect the hydrology of any water body, relative to existing conditions.

4.1.5.3 Water Quality Conditions That Could Be Reasonably Achieved

Current water quality conditions would continue to be achieved with the proposed amendment to the pH objective in place. The proposed objective is simply to remove the portion of the objective that limits the allowable pH changes to 0.5 units. The allowable pH range of 6.5 - 8.5 will not change. Controllable discharges that affect water quality (e.g., municipal discharges of treated wastewater) would not be permitted to cause a water body's pH to be outside the range of 6.5-8.5.

4.1.5.4 Economic Considerations

The current objective already requires that the pH be maintained within the range of 6.5 to 8.5. The proposed amendment to delete the requirement to limit pH changes and the provision allowing averaging periods is less restrictive. Therefore, no adverse economic effects are expected due to adoption of the proposed amendment to the pH objective.

4.1.5.5 Need for Housing

If adopted, the proposed amendment to the pH objective would have no impact on the need for, or ability to develop, housing in the Basin.

4.1.5.6 Need to Develop and Use Recycled Water

If adopted, the proposed amendment to the pH objective would have no adverse impact on the need for, or ability to develop and use, recycled water in the Basin.

4.2 TURBIDITY OBJECTIVE

4.2.1 Current Basin Plan Turbidity Objective

The Basin Plan's current general turbidity objective is as follows:

“Waters shall be free of changes in turbidity that cause nuisance or adversely affect beneficial uses. Increases in turbidity attributable to controllable water quality factors shall not exceed the following limits:

- *Where natural turbidity is between 0 and 5 Nephelometric Turbidity Units (NTUs), increases shall not exceed 1 NTU.*
- *Where natural turbidity is between 5 and 50 NTUs, increases shall not exceed 20 percent.*
- *Where natural turbidity is between 50 and 100 NTUs, increases shall not exceed 10 NTUs.*
- *Where natural turbidity is greater than 100 NTUs, increases shall not exceed 10 percent.*

To determine compliance with the above limits, appropriate averaging periods may be applied provided that beneficial uses will be fully protected.”

4.2.2 Alternatives Considered

To improve compliance with the turbidity water quality objective when the natural turbidity is between 0 and 5 NTUs, and provide consistency with existing Federal criteria, three alternatives were considered: 1) no action; 2) adoption of the USEPA national ambient criteria for turbidity; and 3) adoption of a basin-specific turbidity objective. The criteria used for assessing the three alternatives and selecting the recommended alternative included:

- 1) Consistency with State and Federal water quality laws, criteria, and policies, including antidegradation policies;
- 2) Protection of all designated beneficial uses;
- 3) Consistency with current science regarding the water quality that is necessary to reasonably protect beneficial uses;
- 4) Is not overly restrictive; and
- 5) Applicability to water bodies of the Basin.

4.2.2.1 Alternative 1 – No Action

Under this alternative, the Basin Plan's current water quality objective for turbidity would remain unchanged and would continue to apply to water bodies in the Basin.

4.2.2.2 Alternative 2 – Adopt USEPA National Criteria

USEPA does not have a national recommended criterion for turbidity per se. Rather, its recommended criterion is for settleable and suspended solids. Under this alternative, the USEPA's current national ambient criteria for settleable and suspended solids in fresh waters would be adopted as a surrogate water quality objective for turbidity in the Basin Plan. The current national criteria for solids (suspended and settleable) is as follows (USEPA 1986, 1999a):

“Criteria:

Freshwater fish and other aquatic life:

Settleable and suspended solids should not reduce the depth of the compensation point for photosynthetic activity by more than 10 percent from the seasonally established norm for aquatic life.”

4.2.2.3 Alternative 3 – Develop a Basin-Specific Turbidity Objective

Under this alternative, a basin-specific turbidity objective would be developed that would apply to all waters of the Basin. Its development would reflect scientifically supported turbidity criteria for the protection of all beneficial uses (particularly freshwater aquatic life and recreation) and specific chemical, physical, and biological characteristics of the water bodies of the Basin.

4.2.3 Recommended Alternative

Regional Water Board staff recommends Alternative 3 because it is:

- 1) Consistent with State and Federal water quality laws, water quality criteria, and policies, including antidegradation policies;
- 2) Protective of beneficial uses;
- 3) Consistent with existing scientifically supported criteria;
- 4) Not overly restrictive and, thereby addresses regulatory compliance issues; and
- 5) Applicable to water bodies of the Basin.

Adoption of Alternative 1 (No Action) would not resolve the regulatory problems associated with turbidity in streams during low flow periods. To adopt Alternative 2 (USEPA National Criteria), it would be necessary to determine the seasonal norm for the compensation point for photosynthetic activity in each applicable water body and thus there would be no definitive turbidity criterion for the basins. Moreover, it may be difficult or infeasible to determine seasonal norms for the compensation point for photosynthetic activity in some low flow streams.

4.2.4 Proposed Turbidity Objective

Following is the proposed turbidity objective:

“Waters shall be free of changes in turbidity that cause nuisance or adversely affect beneficial uses. Increases in turbidity attributable to controllable water quality factors shall not exceed the following limits:

- *Where natural turbidity is less than 1 Nephelometric Turbidity Unit (NTU), controllable factors shall not cause downstream water turbidity to exceed 2 NTUs.*
- *Where natural turbidity is between 1 and 5 NTUs, increases shall not exceed 1 NTU.*
- *Where natural turbidity is between 5 and 50 NTUs, increases shall not exceed 20 percent.*
- *Where natural turbidity is between 50 and 100 NTUs, increases shall not exceed 10 NTUs.*
- *Where natural turbidity is greater than 100 NTUs, increases shall not exceed 10 percent.*

To determine compliance with the above limits, appropriate averaging periods may be applied provided that beneficial uses will be fully protected.”

As shown above, the proposed amendments affect only the portion of the water quality objective related to turbidities between 0 to 5 NTUs, and more specifically, that portion of the objective related to turbidity less than 1 NTU. The other components of the current Basin Plan turbidity objective that apply when natural ambient turbidity is above 1 NTUs are unaffected by this proposed amendment and, therefore, their applicability will not change.

4.2.5 Basis for and Evaluation of the Basin-Specific Turbidity Objective

4.2.5.1 Beneficial Use Considerations

Before modifications to the Basin Plan’s existing turbidity objective can be developed, the effect of turbidity on each beneficial use must be determined. To address this issue, the beneficial uses defined in the Basin Plan have been grouped into general categories based on the affects that ambient turbidity has on specific uses of water.

Suspended solids and turbidity are often discussed together in the scientific literature and sometimes used rather synonymously because suspended solids cause turbidity. However, the degree of turbidity is not equal to the concentration or quantity of suspended solids. Rather, turbidity is an expression of only one effect of suspended solids upon the character of water (i.e., the ability of light to penetrate through the water column). Because the size and nature of suspended solids affect the transmission of light, different turbidities can be measured for waters having the same level of TSS, (McKee and Wolf 1963). In wastewater treatment plant effluent, the average concentration of TSS, in mg/l, is approximately twice (sometimes more, sometimes less) the average level of turbidity, expressed as NTU. The level of suspended solids is a primary factor

in determining the level of turbidity, and much of the scientific literature is based on the effects of suspended solids rather than turbidity. The discussions below characterize the affects of turbidity and/or suspended solids on the beneficial uses defined in the Basin Plan. Emphasis is placed on the effects of ambient turbidity in the range of 0 to 1 NTUs, which is under consideration for amendment. Discussion of the effects of turbidity levels outside this range is included to provide context.

4.2.5.1.1 Uses Unaffected, or Minimally Affected, by Turbidity

- Navigation (NAV)
- Hydropower Generation (POW)

Ambient turbidity levels below 1 NTU have no effect on the Navigation and Hydropower Generation beneficial uses.

4.2.5.1.2 Effects on Municipal and Industrial Uses

- Municipal and Domestic Supply (MUN)
- Industrial Service Supply (IND)
- Industrial Process Supply (PRO)

NTAC (1968), Section II (Public Water Supplies) stated:

“Turbidity in water must be readily removable by coagulation, sedimentation, and filtration; must not be present in quantities (either by weight or volume) that will overload the water treatment plant facilities; and must not cause unreasonable treatment costs. In addition, turbidity in water must not be frequently changing and varying in characteristics or in quantity to the extent that such changes cause upset in water treatment plant processing. The criterion for too much turbidity in water must relate to the capacity of the water treatment plant to remove turbidity adequately and continuously at reasonable cost.”

To paraphrase NTAC (1968), Table II-1 titled *Surface Water Criteria for Public Water Supplies*, turbidity criteria that could be applied as regulation are “*virtually absent*.” It should be noted, however, that this applies to a public water supply ready for distribution (i.e., following treatment, if diverted from a raw surface water source).

The 1972 water quality criteria document (NAS 1972) reiterated the above statements, and made the following conclusion:

“No [quantitative] recommendation is made, because it is not possible to establish a turbidity recommendation in terms of turbidity units; nor can a turbidity recommendation be expressed in terms of mg/l “undissolved solids” or “nonfilterable solids.”

In 1976, the USEPA stated in the “Red Book” (USEPA 1976) that “*Suspended solids and turbidity are important parameters in both municipal and industrial water supply*

practices. Finished drinking waters have a maximum limit of 1 turbidity unit where the water enters the distribution system. This limit is based on health considerations as it relates to effective chlorine disinfection.” The USEPA’s 1986 “Gold Book” (USEPA 1986) reiterates this same language. Finally, USEPA’s 1999 National Primary Drinking Water Standards (USEPA 1999b) state that final, treated drinking water supplies shall not exceed 5 NTUs, and systems that filter must ensure that the turbidity of finished drinking water supplies does not exceed 1 NTU. Similar to the NTAC (1968) language, USEPA documents (1976, 1986, 1999a) also stipulate that turbidity requirements for municipal and industrial uses are restricted to treated waters that are distributed for use. However the turbidity requirements are not intended for raw, untreated surface waters. Raw surface water supplies with turbidity levels less than 5 NTUs are suitable for municipal and industrial uses and have low turbidity relative to many source waters (e.g., Sacramento River and Delta waters). Standard water treatment processes can achieve the 1 NTU requirements for treated water, when the raw surface water has turbidity levels between 0 and 5 NTUs.

Based on historic national recommended criteria and the current national standards for finished (i.e., treated) drinking water supplies, the proposed turbidity amendment would be fully protective of Municipal and Domestic Supply (MUN), Industrial Service Supply (IND), and Industrial Process Supply (PRO) beneficial uses.

4.2.5.1.3 Effects on Agricultural Uses (AGR)

Water quality criteria, for agricultural uses, were addressed in Section IV of NTAC (1968). Table IV-1, p. 116, titled *Key Water Quality Criteria for Farmstead Uses*, contains a narrative recommendation that source water be “*substantially free*” of turbidity. Turbidity and suspended solids are not critical water quality parameters for livestock watering or irrigation uses, therefore, no quantitative recommendations were made. The proposed amendment, which is applicable to surface water turbidity levels between 0 and 1 NTU, will have no effect on agricultural uses (AGR) of surface waters.

4.2.5.1.4 Effects on Groundwater and Surface Water Replenishment

- Groundwater Recharge (GWR)
- Freshwater Replenishment (FRSH)

None of the water quality criteria specifically recommended a range of turbidity or limitations for groundwater recharge. However, the Department of Health Services released draft groundwater recharge reuse criteria on 1 December 2004, which specifies that recycled water used for groundwater recharge meet the secondary MCL for turbidity, which is 5 NTU. Additionally, suspended solids that contribute to turbidity are often filtered by soils overlying and within groundwater aquifers. Under the proposed amendment, the allowed average incremental increase in turbidity would be no more than 2 NTUs. The proposed turbidity objective would have no impact on the beneficial use of groundwater recharge (GWR).

Freshwater replenishment is the use of water for natural or artificial maintenance of surface water quantity or quality. The quality of treated water used for freshwater replenishment would be required to continue to support all existing beneficial uses. There are no special requirements for freshwater replenishment different than for other beneficial uses so there are no impacts specific to freshwater replenishment. The proposed turbidity amendment would be protective of beneficial uses and, therefore, would be protective of the freshwater replenishment use (FRSH).

4.2.5.1.5 Effects on Contact Recreation

- Water Contact Recreation (REC-1)
- Non-contact Water Recreation (REC-2)

Under its aesthetics recommendations, NTAC (1968) stated that surface waters should be free of substances resulting from discharges and free of wastes that produce "...objectionable turbidity."

Its successor criteria document, NAS (1972), stated:

"Surface waters will be aesthetically pleasing if they are virtually free of substances attributable to discharges or waste as follows:

- *materials that will settle to form objectionable deposits;*
- *floating debris, oil, scum, and other matter; substances producing objectionable color, odor, taste, or turbidity;*
- *substances and conditions or combinations thereof in concentrations which produce undesirable aquatic life."*

This report further stated:

"Clear waters are normally preferred for recreation. Because sediment-laden water reduces water clarity, inhibits the growth of plants, displaces water volume as sediments settle, and contributes to the fouling of the bottom, prevention of unnatural quantities of suspended sediments or deposits of sediments is desirable. Individual waters vary in the natural amounts of suspended sediments they carry; therefore, no fixed recommendations can be made. Management decisions should be developed with reference to historic base line data concerning the individual body of water."

In its 1976 Red Book and 1986 Gold Book water quality criteria documents, the USEPA published the following criteria for protecting the aesthetic qualities of water (USEPA 1976, 1986):

"All waters free from substances attributable to wastewater or other discharges that:

- 1) *settle to form objectionable deposits;*
- 2) *float as debris, scum, oil, or other matter to form nuisances;*
- 3) *produce objectionable color, odor, taste, or turbidity;*

- 4) *injure or are toxic or produce adverse physiological responses in humans, animals or plants; and,*
- 5) *produce undesirable or nuisance aquatic life.”*

The “Solids (Suspended, Settleable) and Turbidity” section of the USEPA’s 1976 criteria document stated that the less turbid the water, the more desirable it becomes for swimming and other contact recreational activities. This section further stated that suspended solids criteria that were developed for the protection of fish and other aquatic life would adequately protect other recreational pursuits, such as boating and fishing. No quantitative criteria were recommended for other types of recreation.

Relative to the Basin Plan’s current 0 - 5 NTU objective, the proposed turbidity amendment would allow discharges to cause slightly greater increases in receiving water turbidity levels, when ambient turbidity is less than 1 NTU. When ambient turbidity is < 1 NTU, the proposed objective would allow average turbidity to increase to no more than 2 NTUs. At turbidity levels below 2 NTUs, the human eye has difficulty detecting visual differences in the clarity of water. Water, with a turbidity less than or equal to 2 NTU, looks aesthetically very similar to water with a turbidity of 1 NTU or less (RBI, 2006b).

When the average ambient turbidity of a water body is 1 - 5 NTUs, the proposed amendment would allow increases in average turbidity of up to 1 NTU. Under this 1 - 5 NTU range of ambient conditions, the proposed objective is the same as the current objective, which limits increases to 1 NTU.

Based on the low ability of humans to visually discern turbidity changes when turbidity levels are below 2 NTUs, the equivalent nature of the proposed amendment’s restrictions when background turbidity is between 1 and 5 NTUs, and the other factors discussed above, the proposed turbidity objective would be protective of both contact (REC-1) and non-contact (REC-2) recreational uses of water bodies.

4.2.5.1.6 Effects on Aquatic Organisms and Associated Uses

- Commercial and Sport Fishing (COMM)
- Aquaculture (AQUA)
- Warm Freshwater Habitat (WARM)
- Cold Freshwater Habitat (COLD)
- Estuarine Habitat (EST)
- Rare, Threatened, or Endangered Species (RARE)
- Migration of Aquatic Organisms (MIGR)
- Spawning, Reproduction, and/or Early Development (SPWN)
- Shellfish Harvesting (SHELL)

Of the beneficial uses specified in the Basin Plan, aquatic life uses are among those affected most by turbidity levels of water. All of the beneficial uses listed above involve healthy populations of aquatic organisms, either directly or indirectly. Therefore, dis-

cussion of the effects of turbidity on aquatic life will also address turbidity effects on each of the individual uses listed in this category.

Based on available literature in 1965, the European Inland Fisheries Advisory Committee (EIFAC 1965) concluded the following:

- There was no evidence that concentrations of suspended solids less than 25 mg/l have any harmful effects on fish;
- It should usually be possible to maintain good or moderate fish populations in waters that normally contain 25-80 mg/l suspended solids; however, the yield of fish from such waters might be somewhat lower than from those in the preceding category;
- Waters that normally contain 80-400 mg/l suspended solids are unlikely to support good freshwater populations, although freshwater fish may sometimes be found at the lower concentrations within this range; and
- Only poor fisheries are likely to be found in waters that normally contain more than 400 mg/l suspended solids.

The freshwater organisms subsection of NTAC (1968) in Section III – Fish, Other Aquatic Life, and Wildlife, stated the following:

- “(1) Turbidity in the receiving waters due to the discharge of wastes should not exceed 50 Jackson units in warm-water streams or 10 Jackson units in cold-water streams.*
- (2) There should be no discharge to warm-water lakes which cause turbidities exceeding 25 Jackson units. The turbidity of cold-water or oligotrophic lakes should not exceed 10 units.”*

Its successor criteria document, NAS (1972) (drawn largely from EIFAC (1965)), made the following recommendations:

Based on the level of suspended solids, aquatic communities should be protected as follows:

- | | |
|--------------------------------|---------------|
| • High level of protection | 25 mg/l |
| • Moderate level of protection | 80 mg/l |
| • Low level of protection | 400 mg/l |
| • Very low level of protection | over 400 mg/l |

This recommendation further stated:

“The combined effects of color and turbidity should not change the compensation point more than 10 percent from its seasonally established norm, nor should such a change place more than 10 percent of the biomass of photosynthetic organisms below the compensation point.”

USEPA (1976) published the following criteria for freshwater fish and other aquatic life:

“Settleable and suspended solids should not reduce the depth of the compensation point for photosynthetic activity by more than 10 percent from the seasonably established norm for aquatic life.”

There is an extensive body of scientific literature addressing the effects of turbidity and suspended solids on aquatic life; for example, Hollis et al. (1964), Gammon (1970), Ritchie (1972), Sorensen et al. (1977) and Alabaster and Lloyd (1980). The data in the scientific literature support the conclusions drawn in the original EIFAC report (EIFAC 1965) and subsequent national criteria documents. Alabaster and Lloyd (1980) reiterated EIFAC’s bulleted statements above, as tentative water quality criteria for suspended solids. A summary of known effects of turbidity and suspended solids on aquatic life is provided in RBI (2006).

Newcombe and Jensen (1996) performed a “meta-analysis” of 80 published and adequately documented reports on fish responses to suspended sediments. They developed empirical equations that related observed biological responses to duration of exposure and suspended sediment concentration. The empirical data indicated that growth rates or fish density would be reduced for juvenile and adult salmonids and freshwater non-salmonids after exposure to suspended sediments concentrations of approximately 20 mg/l or more after 4 months. Newcombe (2003) evaluated the severity of effects (e.g., fish reactive distance, predatory prey dynamics, egg and larval growth rates, and habitat effects) for clear water fishes exposed to 2-10 NTU turbidity increases for exposure periods ranging from 1 hour to > 10 weeks. According to Newcombe (2003), 3 NTUs would be protective of clear water fishes for long-term exposures.

The turbidity levels that have measurable effects on aquatic life exceed the turbidity levels affected by the proposed amendment. Consequently, the proposed turbidity objective, applicable when ambient turbidity is between 0 and 1 NTU, would be fully protective of all beneficial uses that involve maintaining healthy populations of aquatic organisms.

4.2.5.1.7 Effects on Wildlife Habitat and Habitats of Special Significance

- Wildlife Habitat (WILD)
- Preservation of Biological Habitats of Special Significance (BIOL)

The wildlife habitat (WILD) beneficial use involves the use of water to support terrestrial habitats or wetlands and non-aquatic wildlife. Similarly, the preservation of biological habitats of special significance (BIOL) use is focused on the use of water to support specific habitats. The turbidity requirements of these habitat-related uses are equal to or less stringent than those required to protect fish and benthic macroinvertebrates that reside in water bodies throughout their life cycles. Therefore, the proposed turbidity amendment would be fully protective of the WILD and BIOL uses.

4.2.5.2 Hydrographic Unit Environmental Characteristics Considerations

Adoption of the proposed amendment to the turbidity objective would not affect the hydrology of any water body within the Basin.

4.2.5.3 Water Quality Conditions that could be Reasonably Achieved

Discharge and receiving water turbidity data indicate that compliance with the proposed turbidity objective, under existing and future hydrologic conditions, would be achieved.

4.2.5.4 Economic Considerations

Adoption of the proposed amendment to the turbidity objective will result in no additional costs to dischargers or any other parties.

4.2.5.5 Need for Housing

Adoption of the proposed amendment to the turbidity objective will have no impact on the need for, or ability to develop housing in the Basin.

4.2.5.6 Need to Develop and Use Recycled Water

Adoption of the proposed amendment to the turbidity objective will not adversely impact the ability to develop and use recycled water in the Basin.

5 ANTIDegradation ANALYSIS

Both the USEPA (40 CFR 131.12) and the State of California (State Water Board Resolution No. 68-16) have adopted antidegradation policies as part of their approach to regulating water quality. The Regional Water Board must assure that its actions do not violate the federal and State antidegradation policies. This section of the Staff Report analyzes whether approval of the proposed amendments to the pH and turbidity objectives would be consistent with federal and State antidegradation policies.

5.1 FEDERAL ANTIDegradation POLICY

The federal antidegradation policy, 40 CFR 131.12(a), states in part:

- “(1) Existing instream water uses and the level of water quality necessary to protect the existing uses shall be maintained and protected.*
- “(2) Where the quality of waters exceed levels necessary to support propagation of fish, shellfish, and wildlife and recreation in and on the water, that quality shall be maintained and protected unless the State finds, after full satisfaction of the intergovernmental coordination and public participation provisions of the State’s continuing planning process, that allowing lower water quality is necessary to accommodate important economic or social development in the area in which the waters are located...*
- “(3) Where high quality waters constitute an outstanding National resource, such as waters of National and States parks and wildlife refuges and waters of exceptional recreational or ecological significance, that water quality shall be maintained and protected.”*

5.2 STATE ANTIDegradation POLICY

Antidegradation provisions of State Water Board Resolution No. 68-16 ("Statement of Policy With Respect to Maintaining High Quality Waters in California") state, in part:

- “1. Whenever the existing quality of water is better than the quality established in policies as of the date on which such policies become effective, such existing high quality will be maintained until it has been demonstrated to the State that any change will be consistent with maximum benefit to the people of the State, will not unreasonably affect present and anticipated beneficial use of such water and will not result in water quality less than that prescribed in the policies.*

2. *Any activity which produces or may produce a waste or increased volume or concentration of waste and which discharges or proposes to discharge to existing high quality waters will be required to meet waste discharge requirements which will result in the best practicable treatment or control of the discharge necessary to assure that (a) a pollution or nuisance will not occur and (b) the highest water quality consistent with maximum benefit to the people of the State will be maintained.”*

5.3 ANTIDegradation ANALYSIS OF THE PROPOSED AMENDMENTS TO THE pH AND TURBIDITY OBJECTIVES

5.3.1 pH Objective

The proposed amendment would eliminate the second and third sentences of the current pH objective that limit the *change* in pH (due to discharges) to 0.5 units in freshwaters and provide an averaging period. The proposed amendment to the Basin Plan's current pH objective would not degrade water quality currently achieved in the Region. The component of the Basin Plan's current pH objective that requires pH to be maintained between 6.5 and 8.5 units, unless otherwise noted, will remain in effective under the proposed amendment.

The scientific information compiled and discussed in Section 4.1.5.1 and RBI (2004), indicates that the effects of pH changes on freshwater aquatic life, the beneficial use most sensitive to pH levels, are insignificant when resultant pH is maintained within the range 6.5 to 8.5. All other beneficial uses of surface waters also are protected, with regards to pH, if levels are maintained between 6.5 and 8.5. Changes in pH, within the 6.5 to 8.5 pH range, are considered to be neither beneficial nor detrimental; therefore, the proposed pH amendment will not result in degradation of water quality. Existing and potential beneficial uses of water bodies throughout the Region, and the level of water quality necessary to protect those uses, would be maintained under the proposed amendment.

The proposed pH amendment would alleviate the need for costly upgrades to treatment plants that discharge treated effluent to low flow streams (see RBI, 2004). Treatment plant upgrades to control effluent pH would involve addition of chemicals such as sodium hydroxide. However, consistent compliance could not be guaranteed and increased use of chemicals would contribute to further increases in TDS levels in water bodies throughout the Region, including the Delta.

Based on the regulatory, economic, and scientific findings discussed above, the proposed amendment to the Basin Plan's current pH objective is consistent with the maximum benefit to the people of the Region and the State. The proposed amendment would not result in water quality less than that prescribed in State water quality policies.

5.3.2 Turbidity Objective

The proposed amendment to the Basin Plan's current 0 - 5 NTU turbidity objective would not degrade the water quality currently achieved in the Region. The proposed amendment divides the first bullet of the general turbidity objective into two new bullets. The first new bullet would apply to cases where the natural turbidity is less than 1 NTU and the second new bullet would apply to cases where the natural turbidity is between 1 and 5 NTUs.

Under low natural turbidity conditions (i.e., average ambient turbidity less than 1 NTU), the proposed amendment would allow average turbidity to increase to no more than 2 NTUs. Water having a turbidity of ≤ 2 NTUs looks, aesthetically, essentially the same as water of ≤ 1 NTU when flowing through a creek channel (RBI, 2006b). The proposed amendment does not affect the current water quality objectives when average ambient turbidity is 1-5 NTUs.

The scientific information compiled and discussed in Section 4.2.5.1 and RBI (2006 and 2006b), indicates that the effects of anticipated turbidity changes under the proposed amendment would have no effect on aquatic life, and negligible, if any, effects on recreational uses. Aquatic life and recreational uses are the beneficial uses most affected by turbidity levels. Consequently, the potential for degradation of water quality under the proposed turbidity amendment would be minimal. Existing and potential beneficial uses of water bodies throughout the Region, and the level of water quality necessary to protect those uses, would be maintained.

In addition, the proposed turbidity amendment would alleviate the need for costly filtration upgrades to wastewater treatment plants that discharge treated effluent to low flow streams. The upgrades would not provide demonstrable benefits to any beneficial uses because of the already low effluent turbidity levels achieved by existing treatment plant filtration (e.g., effluent turbidity is currently required by NPDES permits to be < 2 NTUs (daily average) when discharging to waters having a natural turbidity between 0 - 5 NTUs).

Based on the regulatory, economic, and scientific findings discussed above, the proposed amendment to the Basin Plan's current turbidity objective is consistent with the maximum benefit to the people of the Region and the State. The proposed amendment would not result in water quality less than that prescribed in State water quality policies.

6 PROGRAMS FOR IMPLEMENTATION OF PROPOSED BASIN PLAN AMENDMENTS

The Porter-Cologne Water Quality Control Act states that Basin Plans consist of beneficial uses, water quality objectives, and a program of implementation for achieving the water quality objectives (California Water Code Section 13050(j)). California Water Code Section 13242 prescribes the necessary contents of a program of implementation, which include but are not limited to:

- 1) A description of the nature of the actions that are necessary to achieve the water quality objectives, including recommendations for appropriate action by any entity, public or private;
- 2) A time schedule for the actions to be taken; and
- 3) A description of surveillance to be undertaken to determine compliance with the objectives.

These requirements are discussed below.

6.1 ACTIONS NECESSARY TO ACHIEVE THE PROPOSED WATER QUALITY OBJECTIVES

6.1.1 pH

When the proposed amendment to the pH objective becomes effective, no specific actions would be necessary to achieve the objective. The proposed amendment removes an unnecessarily restrictive provision. The remaining provisions are unchanged so no additional actions are needed to achieve compliance with the proposed water quality objectives.

6.1.2 Turbidity

When the proposed amendment to the turbidity objective becomes effective, no specific actions would be necessary to achieve the objective. The proposed amendment is less restrictive than the current objective when ambient waters have turbidity less than 1 NTU. The proposed amendment accommodates current treatment protocols that are already in place. Therefore, no additional actions are needed to achieve compliance with the proposed water quality objectives.

6.2 TIME SCHEDULE FOR COMPLIANCE

No additional actions are necessary to implement the amended pH and turbidity water quality objectives, therefore, no schedule for compliance is needed.

6.3 MONITORING AND SURVEILLANCE PROGRAM

The proposed amendments modify existing water quality objectives and do not include new objectives or a new implementation program. Therefore, the existing monitoring and surveillance is adequate.

7 ENDANGERED SPECIES ACT CONSIDERATIONS

7.1 OVERVIEW AND BACKGROUND

The USEPA has final approval authority for Basin Plan amendments. USEPA's approval of new and revised state water quality standards is a federal action subject to the consultation requirements of Section 7(a)(2) of the federal Endangered Species Act (ESA) (65 FR 24647 (April 27, 2000)). Section 7(a)(2) of the ESA states that each federal agency shall ensure that any action authorized, funded, or carried out by such agency is not likely to jeopardize the continued existence of any endangered or threatened species or result in destruction or adverse modification of designated critical habitat. As part of its review and approval of the proposed Basin Plan amendments, USEPA may consult with the NMFS and the U.S. Fish and Wildlife Service (USFWS) under Section 7(a)(2) of the ESA. In addition to addressing the issues of "jeopardy" and "adverse modification" of designated critical habitat, this consultation also will address whether USEPA's approval action has the potential to result in "take" of any listed species, as defined under Section 9 of the ESA. Although consultation under the ESA is USEPA's obligation, the USEPA and the states acknowledge that states can assist USEPA in fulfilling its ESA obligations, and have a role in assuring that state standards adequately protect aquatic life and the environment, including species federally listed as threatened or endangered (65 FR 24643).

This section of the Staff Report has been prepared to assist the USEPA in meeting its obligations under Section 7(a)(2) of the ESA as part of its action to approve the proposed pH and turbidity amendments.

To assist the USEPA, Regional Water Board staff has met with both NMFS and the USFWS regarding the proposed amendments and has addressed their comments by making revisions to early drafts of this Staff Report.

The proposed amendments to the pH and turbidity water quality objectives are shown in Sections 4.1.4 and 4.2.4, respectively. The Regional Water Board, CDFG, NMFS, USFWS, and dischargers developed the proposed amendments cooperatively. The proposed Basin Plan amendments are protective of all beneficial uses of all waters within the Basin.

7.2 NMFS ESA CONSIDERATIONS

NOAA Fisheries has jurisdiction over most marine and anadromous fish listed under the Endangered Species Act (ESA). The California Central Valley Steelhead was listed as a threatened species on 19 March 1998; its threatened status was reaffirmed on 5 January 2006. The Sacramento River Winter-Run Chinook was listed as endangered on 4 January 1994; its endangered status was reaffirmed on 28 June 2005. The Central Valley Spring-Run Chinook was listed as a threatened species on 16 September 1999; its threatened status was reaffirmed on 28 June 2005. It was determined that list-

ing the Central Valley Fall-Run and late Fall-Run Chinook was not warranted on 16 September 1999 but these were classified as Species of Concern on 15 April 2004 due to specific risk factors. On 7 April 2006 NOAA Fisheries Service listed the southern distinct population segment of north American green sturgeon as threatened under the Endangered Species Act.

Because the proposed pH and turbidity amendments were developed to be fully protective of all beneficial uses of the waters of the Basin (see Sections 4.1.5.1.6 and 4.2.5.1.6), neither amendment would, upon adoption, result in conditions that would adversely affect federally listed salmonids or their habitats. Rather, the pH and turbidity conditions that would occur under the proposed amendments would be fully protective of these ESA-listed fish species.

At a resource agency workshop held to discuss the proposed amendments, a NMFS water quality specialist questioned whether allowing pH changes greater than 0.5 pH units, as allowed by the proposed amendment, would alter trace metal toxicity to aquatic life. Current state regulations already account for pH effects on metals toxicity.

7.3 USFWS ESA CONSIDERATIONS

The USFWS has regulatory jurisdiction over terrestrial and freshwater species listed under the federal ESA. The proposed federal action, for which consultation with USFWS is being conducted, is approval of the proposed amendments to the pH and turbidity objectives. Based on the scientific information summarized and discussed in this Staff Report, the proposed amendments would *not*: 1) affect the seasonal hydrology of any water body in the region; 2) change the Basin Plan's freshwater pH objective range of 6.5 to 8.5; 3) change water body turbidity at levels that could affect aquatic or terrestrial species (see Section 4.2.5.1.6 and RBI, 2006); and 4) affect any terrestrial habitats. Therefore, the USEPA's approval of the proposed amendments to the pH and turbidity objectives would not adversely affect any of the Region's listed species regulated by the USFWS.

8 ENVIRONMENTAL IMPACTS REVIEW

8.1 INTRODUCTION

As the Lead Agency for evaluating environmental impacts of changes to the Water Quality Control Plan for the Sacramento River and San Joaquin River Basins (Basin Plan), the Central Valley Regional Water Quality Control Board (Regional Water Board) is responsible for reviewing proposed changes and complying with requirements of the California Environmental Quality Act (CEQA). Public Resources Code (PRC) § 21000 et seq.) The Secretary of Resources has certified the planning process for Basin Plans as a regulatory program pursuant to PRC § 21080.5 and CEQA Guidelines § 15251(g). This certification means basin planning is exempt from CEQA provisions that relate to preparing Environmental Impact Reports and Negative Declarations. This document satisfies the requirements of State Board Regulations for Implementation of CEQA, Exempt Regulatory Programs, which are found in the California Code of Regulations, Title 23, Division 3, Chapter 27, Article 6, beginning with Section 3775.

The State Water Board regulations titled "Implementation of the Environmental Quality Act of 1970" describe the environmental documents required for planning actions. These documents include a written report (staff report), an initial draft of the amendment, and an Environmental Checklist Form. The documents must include either alternatives to the activity and mitigation measures to reduce any significant or potentially significant effect that the project may have on the environment or a statement that the project would not have a significant impact on the environment.

The checklist included in this section was prepared in compliance with this requirement and to assist in identifying potential impacts and outlining mitigation measures. Findings of the checklist are discussed in greater detail following the checklist.

8.2 PROPOSED PROJECT

The Regional Water Board is proposing to adopt amendments to the pH and turbidity water quality objectives in the Basin Plan. The proposed amendments would result in the following changes from the Basin Plan's current water quality objectives for pH and turbidity.

pH:

The proposed amendment will eliminate the "0.5 pH unit change" component of the current objective, and the "appropriate averaging periods" component associated with the 0.5 pH unit change. In addition, the proposed amendment would eliminate the site-specific pH objective for Deer Creek because it is the same as the amended pH objective, which would apply basin-wide upon its adoption and approvals. Thus, the amended

pH objective would apply to Deer Creek, thereby eliminating the future need for Deer Creek's current site-specific objective.

Turbidity:

The proposed amendment applies when natural turbidity is between 0 and 5 NTUs. The current objective limits turbidity increases to 1 NTU. Under the proposed amendment, the objective would provide that when natural turbidity is less than 1 NTU, turbidity of the downstream water should not be increased to more than 2 NTUs. The proposed amendment does not alter the current Basin Plan turbidity objective for waters with a natural turbidity above 1 NTU.

Because the proposed project is an amendment to an existing plan, this chapter also compares the physical circumstances that would result from compliance with the amended Basin Plan to those circumstances that would result from compliance with the existing Basin Plan. Anticipated pH and turbidity conditions under compliance with the Basin Plan's current objectives versus compliance with the proposed amendments could occasionally differ. However, potential differences would not be of sufficient magnitude to adversely affect any environmental resources or beneficial uses.

The purpose of the Basin Plan is to protect the beneficial uses of the waters in the Basin. The potential impacts to the beneficial uses of the waters were assessed in previous sections. The purpose of this section is to assess all potential environmental impacts in accordance with CEQA.

8.3 ENVIRONMENTAL CHECKLIST

1. Project Title:

Amendments to the Water Quality Control Plan for the Sacramento River and San Joaquin River Basins for pH and Turbidity

2. Lead Agency Name and Address:

California Regional Water Quality Control Board, Central Valley Region
11020 Sun Center Drive #200
Rancho Cordova, CA 95670

3. Contact Person and Phone Number:

Betty Yee, Senior Water Resource Control Engineer, (916) 464-4643,
byee@waterboards.ca.gov

4. Project Location:

The project location incorporates the basins of the Sacramento and San Joaquin Rivers. The boundaries of the basins are the crests of the Sierra Nevada on the east, the Coast Range and Klamath Mountains on the west, the Oregon border to the north, and the south bank of the San Joaquin River to the south.

5. Project Sponsor's Name and Address:

California Regional Water Quality Control Board, Central Valley Region
11020 Sun Center Drive #200
Rancho Cordova, CA 95670

6. General Plan Designation:

Not applicable

7. Zoning:

Not applicable

8. Description of Project:

The California Regional Water Quality Control Board, Central Valley Region (Regional Water Board) is proposing amendments to the pH and turbidity water quality objectives in the Basin Plan for the Sacramento and San Joaquin River Basins.

9. Purpose and Need for Project:

The purposes of the proposed amendments are to: 1) address regulatory and socio-economic issues associated with municipal and industrial discharges into surface waters; 2) eliminate unnecessarily stringent components of the existing pH and turbidity objectives that are causing regulatory compliance issues; and 3) update the scientific basis for the pH objective, while complying with antidegradation policies and protecting beneficial uses. Recognizing and addressing the needs associated with water bodies dominated by NPDES dischargers is a priority of the Regional Water Board that was identified during the latest triennial reviews of the Basin Plan, as well as previous triennial reviews. After reviewing literature regarding the effects of pH and low-level turbidity on beneficial uses, Regional Water Board staff recommends modification of the Basin Plan's current pH and turbidity objectives as defined herein.

10. Surrounding Land Uses and Setting:

The Sacramento River Basin covers 27,210 square miles and includes the entire area drained by the Sacramento River and includes all watersheds, tributary to the Sacramento River that are north of the Cosumnes River watershed. It also includes the closed basin of Goose Lake and drainage sub-basins of Cache and Putah Creeks. The principal watercourses are the Sacramento River and its larger tributaries: the Pit, Feather, Yuba, Bear, and American Rivers to the east; and Cottonwood, Stony, Cache, and Putah Creeks to the west. Major reservoirs and lakes include Lake Shasta, Lake Oroville, Folsom Lake, 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 and all watersheds tributary to the San Joaquin River and Delta south of the Sacramento River and south of the American River watershed. The southern planning boundary follows the southern watershed boundaries of the Little Panoche Creek, Moreno Gulch, and Capita Canyon to the

boundary of the Westlands Water District. From here, the boundary follows the northern edge of the Westlands Water District until its intersection with the Firebaugh Canal Company's Main Lift Canal. The basin boundary then follows the Main Lift Canal to the Mendota Pool and continues eastward along the channel of the San Joaquin River to Millerton Lake in the Sierra Nevada foothills, and then follows along the southern boundary of the San Joaquin River drainage basin. The principal streams in the San Joaquin River Basin are the San Joaquin River and its larger tributaries: the Cosumnes, Mokelumne, Calaveras, Stanislaus, Tuolumne, Merced, Chowchilla, and Fresno Rivers. Major reservoirs and lakes include Pardee Reservoir, New Hogan Reservoir, Millerton Lake, Lake McClure, Don Pedro Reservoir, and New Melones Lake.

11. Other public agencies whose approval is required:

1. State Water Resources Control Board
2. Office of Administrative Law
3. United States Environmental Protection Agency

ENVIRONMENTAL FACTORS POTENTIALLY AFFECTED

The environmental resource categories identified below are analyzed herein to determine whether the Proposed Project would result in adverse impacts to any of these resources. None of the categories below are checked because the Proposed Project is not expected to result in "significant or potentially significant impacts" to any of these resources.

- | | |
|--|---|
| <input type="checkbox"/> Aesthetics | <input type="checkbox"/> Biological Resources |
| <input type="checkbox"/> Hazards & Hazardous Materials | <input type="checkbox"/> Mineral Resources |
| <input type="checkbox"/> Public Services | <input type="checkbox"/> Utilities/Service Systems |
| <input type="checkbox"/> Agriculture Resources | <input type="checkbox"/> Cultural Resources |
| <input type="checkbox"/> Hydrology/Water Quality | <input type="checkbox"/> Noise |
| <input type="checkbox"/> Recreation | <input type="checkbox"/> Mandatory Findings of Significance |
| <input type="checkbox"/> Air Quality | <input type="checkbox"/> Geology/Soils |
| <input type="checkbox"/> Land Use Planning | <input type="checkbox"/> Transportation/Traffic |

On the basis of this initial evaluation:

- I find that the proposed Basin Plan Amendment could not have a significant effect on the environment.
- I find that although the proposed Basin Plan Amendment could have a significant effect on the environment, there will not be a significant effect in this case because feasible alternatives and/or feasible mitigation measures exist that would substantially lessen any significant impact. These alternatives are discussed in the attached written report.
- I find that the proposed Basin Plan Amendment may have a significant effect on the environment. There are no feasible alternatives and/or mitigation measures available which would substantially lessen any significant adverse impacts. See attached written report for a discussion of this determination.

/s/
PAMELA C. CREEDON, Executive Officer
Regional Water Quality Control Board
Central Valley Region

Date

EVALUATION OF ENVIRONMENTAL IMPACTS

The Environmental Checklist has been prepared in compliance with the requirements of CEQA relating to certified regulatory programs. A statement of facts, supportive discussions, and/or confirming data supports each finding of the checklist (see Evaluation of Potential Environmental Impacts).

<u>IMPACT</u>	<u>POTENTIALLY SIGNIFICANT IMPACT</u>	<u>POTENTIALLY SIGNIFICANT UNLESS MITIGATION INCORPORATION</u>	<u>LESS THAN SIGNIFICANT IMPACT</u>	<u>NO IMPACT</u>
I. AESTHETICS - Would the Project:				
a) Have a substantial adverse effect on a scenic vista?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
b) Substantially damage scenic resources, including, but not limited to, trees, rock outcroppings, and historic buildings within a state scenic highway?	<input type="checkbox"/>	<input type="checkbox"/>		<input checked="" type="checkbox"/>
c) Substantially degrade the existing visual character or quality of the site and its surroundings?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
d) Create a new source of substantial light or glare which would adversely affect day or nighttime views in the area?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
II. AGRICULTURE 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 Department of Conservation as an optional model to use in assessing impacts on agriculture and farmland. 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?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
b) Conflict with existing zoning for agricultural use, or a Williamson Act contract?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
c) Involve other changes in the existing environment which, due to their location or nature, could result in conversion of Farmland, to non-agricultural use?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

<u>IMPACT</u>	<u>POTENTIALLY SIGNIFICANT IMPACT</u>	<u>POTENTIALLY SIGNIFICANT UNLESS MITIGATION INCORPORATION</u>	<u>LESS THAN SIGNIFICANT IMPACT</u>	<u>NO IMPACT</u>
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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? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| b) Violate any air quality standard or contribute substantially to an existing or projected air quality violation? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 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)? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| d) Expose sensitive receptors to substantial pollutant concentrations? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| e) Create objectionable odors affecting a substantial number of people? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |

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 regulators, or by the California Department of Fish and Game or U.S. Fish and Wildlife Service? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 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? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 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? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |

<u>IMPACT</u>	<u>POTENTIALLY SIGNIFICANT IMPACT</u>	<u>POTENTIALLY SIGNIFICANT UNLESS MITIGATION INCORPORATION</u>	<u>LESS THAN SIGNIFICANT IMPACT</u>	<u>NO IMPACT</u>
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?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
e) Conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
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?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

V. CULTURAL RESOURCES – Would the Project:

a) Cause a substantial adverse change in the significance of a historical resource as defined in §15064.5?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
b) Cause a substantial adverse change in the significance of an archaeological resource pursuant to §15064.5?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
c) Directly or indirectly destroy a unique paleontological resource of site or unique geological feature?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
d) Disturb any human remains, including those interred outside of formal cemeteries?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

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:	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
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.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
ii) Strong seismic ground shaking?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

<u>IMPACT</u>	<u>POTENTIALLY SIGNIFICANT IMPACT</u>	<u>POTENTIALLY SIGNIFICANT UNLESS MITIGATION INCORPORATION</u>	<u>LESS THAN SIGNIFICANT IMPACT</u>	<u>NO IMPACT</u>
iii) Seismic-related ground failure,, including liquefaction?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
iv) Landslides?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
b) Result in substantial soil erosion or the loss of topsoil?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
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?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
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?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

VII. 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?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
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/	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
c) Emit hazardous emissions or handle hazardous or acutely hazardous materials, substances, or waste within one-quarter mile of an existing or proposed school?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
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?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
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	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

<u>IMPACT</u>	<u>POTENTIALLY SIGNIFICANT IMPACT</u>	<u>POTENTIALLY SIGNIFICANT UNLESS MITIGATION INCORPORATION</u>	<u>POTENTIALLY SIGNIFICANT LESS THAN SIGNIFICANT IMPACT</u>	<u>NO IMPACT</u>
people residing or working in the Project area?				
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?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
g) Impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
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?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
VIII. HYDROLOGY AND WATER QUALITY – Would the Project:				
a) Violate any water quality standards or waste discharge requirements?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
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 preexisting nearby wells would drop to a level which would not support existing land uses or planned uses for which permits have been granted?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
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?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
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 results in flooding on- or off-site?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

<u>IMPACT</u>	<u>POTENTIALLY SIGNIFICANT IMPACT</u>	<u>POTENTIALLY SIGNIFICANT UNLESS MITIGATION INCORPORATION</u>	<u>POTENTIALLY SIGNIFICANT LESS THAN SIGNIFICANT IMPACT</u>	<u>NO IMPACT</u>
e) Create or contribute runoff water which exceeds the capacity of existing or planned stormwater drainage systems or provides substantial additional sources of polluted runoff?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
f) Otherwise substantially degrade water quality?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
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?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
h) Place within a 100-year flood hazard area structures which would impede or re-direct flood flows?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
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?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
j) Inundation by seiche, tsunami, or mud-flow?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
IX. LAND USE AND PLANNING – Would the Project:				
a) Physically divide an established community?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
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?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
c) Conflict with any applicable habitat conservation plan or natural community conservation plan?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
X. 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?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

<u>IMPACT</u>	<u>POTENTIALLY SIGNIFICANT IMPACT</u>	<u>POTENTIALLY SIGNIFICANT UNLESS MITIGATION INCORPORATION</u>	<u>LESS THAN SIGNIFICANT IMPACT</u>	<u>NO IMPACT</u>
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?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
XI. 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?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
b) Exposure of persons to or generation of excessive groundborne vibration or groundborne noise levels?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
c) A substantial permanent increase in ambient noise levels in the Project vicinity above levels existing without the Project?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
d) A substantial temporary or periodic increase in ambient noise levels in the Project vicinity above levels existing without the Project?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
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?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
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?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
XII. 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)?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
b) Displace substantial numbers of existing housing, necessitating the construction of replacement housing elsewhere?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

<u>IMPACT</u>	<u>POTENTIALLY SIGNIFICANT IMPACT</u>	<u>POTENTIALLY SIGNIFICANT UNLESS MITIGATION INCORPORATION</u>	<u>LESS THAN SIGNIFICANT IMPACT</u>	<u>NO IMPACT</u>
c) Displace substantial numbers of people, necessitating the construction of replacement housing elsewhere?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
XIII. 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?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Police protection?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Schools?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Parks?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Other public facilities?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
XIV. 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?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
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?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
XV. TRANSPORTATION/TRAFFIC – Would the Project:				
a) Cause an increase in traffic which is substantial in relation to the existing traffic load and capacity of the street system (i.e., result in a substantial increase in either the number of vehicle trips, the volume to capacity ratio to roads, or congestion at intersections?)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
b) Exceed, either individually or cumulatively, a level of service standard estab-	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

<u>IMPACT</u>	<u>POTENTIALLY SIGNIFICANT IMPACT</u>	<u>POTENTIALLY SIGNIFICANT UNLESS MITIGATION INCORPORATION</u>	<u>LESS THAN SIGNIFICANT IMPACT</u>	<u>NO IMPACT</u>
lished by the county congestion/management agency for designated roads or highways?				
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?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
d) Substantially increase hazards due to a design feature (e.g., sharp curves or dangerous intersections) or incompatible uses (e.g., farm equipment)?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
e) Result in inadequate emergency access?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
f) Result in inadequate parking capacity?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
g) Conflict with adopted policies, plans, or programs supporting alternative transportation (e.g., bus turnouts, bicycle racks)?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
XVI. UTILITIES AND SERVICE SYSTEMS – Would the Project:				
a) Exceed wastewater treatment requirements of the applicable Regional Water Quality Control Board?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
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?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
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?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
d) Have sufficient water supplies available to serve the Project from existing entitlements and resources, or are new or expanded entitlements needed?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
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 exist-	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

<u>IMPACT</u>	<u>POTENTIALLY SIGNIFICANT IMPACT</u>	<u>POTENTIALLY SIGNIFICANT UNLESS MITIGATION INCORPORATION</u>	<u>LESS THAN SIGNIFICANT IMPACT</u>	<u>NO IMPACT</u>
ing commitments?				
f) Be served by a landfill with sufficient permitted capacity to accommodate the Project's solid waste disposal needs?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
g) Comply with federal, state, and local statutes and regulations related to solid waste?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

XVII. MANDATORY FINDINGS OF SIGNIFICANCE

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 of restrict the range of a rare or endangered plant or animal or eliminate important examples of the major periods of California history or prehistory?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
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 probably future projects)?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
c) Does the Project have environmental effects which will cause substantial adverse effects on human beings, either directly or indirectly?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

8.4 THRESHOLDS OF SIGNIFICANCE

Impacts were determined to be significant if the Proposed Project or its alternatives would result in one or both of the following:

- pH and/or turbidity conditions that would adversely affect beneficial uses in water bodies within the Basin; or

- Changes in environmental conditions that would, either directly or indirectly, cause a substantial loss of habitat or substantial degradation of water quality or other resources.

8.5 ENVIRONMENTAL IMPACTS OF THE PROPOSED PROJECT

Each resource category of the Environmental Checklist is supported by the following discussions and source information, as cited.

8.5.1 Aesthetics

The Proposed Project would revise water quality objectives for pH and turbidity through approval of the proposed Basin Plan amendments. Approval and implementation of the proposed pH and turbidity objectives could result in minor changes in pH conditions in some water bodies, relative to existing conditions. However, in the majority of water bodies, pH and turbidity conditions under the project would remain equivalent to conditions that occur under existing conditions. Under the Proposed Project, resultant water body pH would be maintained between 6.5 and 8.5 just as it is under the current Basin Plan. Anticipated pH and turbidity conditions under the proposed objectives would differ only slightly, and occasionally, from pH and turbidity conditions under compliance with the current Basin Plan objectives for these parameters. These slight differences in pH levels would have no perceptible effect on aquatic ecology, flows, riparian habitats, or any other aesthetic qualities of the water bodies within the Basin. Potential differences in average turbidity levels between current and proposed objectives would be minor, and would only occur when natural turbidities were below 1 NTU. When turbidity levels remain at or below 1 NTU, minor changes in turbidity levels are generally not apparent to the human eye (RBI, 2006). Moreover, the slight increases in average turbidities, when natural turbidities are below 1 NTU, would not adversely affect the aquatic ecology, flows, riparian habitats, or any other aesthetic qualities of these water bodies.

Overall, the proposed Basin Plan amendments would have a **less-than-significant** impact to aesthetics.

8.5.2 Agricultural Resources

The Proposed Project would revise water quality objectives for pH and turbidity through approval of the proposed Basin Plan amendments. Anticipated pH and turbidity conditions under the proposed objectives would differ only slightly and occasionally in some reaches of some water bodies, relative to pH and turbidity conditions under compliance with the current Basin Plan objectives for these parameters. By design, pH and turbidity conditions anticipated to occur under the proposed objectives would be protective of agricultural uses. Consequently, no agricultural resources, including farmland irrigation and livestock watering, would be affected by the Proposed Project.

Overall, the proposed Basin Plan amendments would have **no impact** on agricultural resources.

8.5.3 Air Quality

The Proposed Project would revise water quality objectives for pH and turbidity through approval of the proposed Basin Plan amendments. Because pH and turbidity do not affect air quality directly, there would be no direct impacts from the Proposed Project on air quality. Because implementation of the Proposed Project would not involve any construction-related activities that would generate increased concentrations of pollutants, objectionable odors, or obstruct the implementation of any air quality plan, there would be no secondary impacts from the Proposed Project on air quality. The proposed Basin Plan amendments would therefore, have **no impact** on air quality.

8.5.4 Biological Resources

8.5.4.1 pH

The proposed amendment to the pH objective would maintain pH between 6.5 and 8.5 pH units, which is the same range required under the current Basin Plan objective. The amendment only eliminates the “0.5-unit change” requirement of the current Basin Plan objective. Removal of this condition on allowable pH changes has no potential to adversely affect riparian vegetation, terrestrial organisms, or any other non-aquatic biological resource. Therefore, the remainder of this assessment will focus on the potential for pH changes to affect aquatic life when resultant pH remains between 6.5 and 8.5.

The scientific literature reviewed in RBI (2004) indicates that rapid pH changes within the range of 6.5 to 8.5 are not lethal, and have no long-term adverse effects on fish and benthic macroinvertebrates. Although studies have shown that rapid lowering of pH will likely trigger increased drift in some benthic macroinvertebrate communities (e.g., Kratz et al. 1994), according to communications with several macroinvertebrate experts (Cooper 1999, Haro 1999, and Harrington 1999), these sublethal effects, if any, are expected to be short-term in duration, occurring upon the pH change event. When the organisms have acclimated to the new pH, such behavioral effects cease.

It should be noted that photosynthesis and other natural biochemical processes alter pH within water bodies both diurnally and seasonally. These natural pH changes can be greater than 0.5 pH units over the course of a day, and are typically in excess of 1 pH unit over the course of a year.

During agency review of the proposed amendment, concern was expressed over the potential for increased metals toxicity due to allowing greater pH changes. Current state regulations already account for pH effects on metals toxicity.

In summary, approval and implementation of the proposed amendment to the pH objective might allow changes to pH conditions in some water bodies relative to existing conditions. However, the difference that could occur in pH between the proposed and current pH objectives would have no adverse effects on aquatic biota within the Basin’s water bodies.

Overall, the proposed pH objective would have a **less-than-significant impact** to biological resources.

8.5.4.2 Turbidity

Approval and implementation of the proposed amendment to the turbidity objective would not result in substantial changes in turbidity levels, relative to existing conditions. In addition, anticipated turbidity conditions under the proposed objectives would differ only slightly and occasionally from turbidity conditions under compliance with the current Basin Plan objectives for turbidity. The slight and occasional difference that could occur in turbidity between the proposed and current turbidity objectives would have no effects on aquatic biota within the region's water bodies, nor any other biological resources.

Under the Proposed Project, the Basin Plan's current turbidity objective that is applicable when natural turbidity is between 0 and 5 NTUs would be modified. The objective would be modified such that when the natural turbidity is less than 1 NTU, then the turbidity of the downstream water could be increased up to 2 NTUs. There is no proposed change to the objective when the natural, upstream water turbidity is between 1 and 5 NTUs. The other existing Basin Plan turbidity objectives for natural turbidities >5 NTUs would remain in effect.

Newcombe (2003) evaluated the severity of effects (e.g., fish reactive distance, predatory prey dynamics, egg and larval growth rates, and habitat effects) for clear water fishes exposed to 2-10 NTU turbidity increases for exposure periods ranging from 1 hour to > 10 weeks. According to the model presented in Newcombe (2003), 3 NTUs would be protective of clear water fishes for long-term exposures.

In summary, based on the available technical information, the proposed turbidity objective, that would be applicable when natural turbidity is between 0 and 1 NTUs, would be protective of aquatic life and, therefore, would have a **less-than-significant impact** to biological resources.

8.5.5 Cultural Resources

The Proposed Project would revise water quality objectives for pH and turbidity through approval of the proposed Basin Plan amendments. The Proposed Project would not involve any action or activity that would cause an adverse change in historical, archaeological, paleontological resources, or human remains (such as exposure, destruction, etc.). The proposed Basin Plan amendments would have **no impact** on cultural resources.

8.5.6 Geology and Soils

The Proposed Project would revise water quality objectives for pH and turbidity through approval of the proposed Basin Plan amendments. The Proposed Project would not involve any action or physical activity (e.g., construction) that would expose people or structures to the risk of loss, injury, or death involving: a known earthquake fault, strong seismic ground shaking, seismic related ground failure, or landslides. Also, because the Proposed Project affects low-level turbidities, it would not involve any action or result in any changing of hydrological regimes that would expose people or structures to increased soil erosion, unstable soil, or expansive soil. The proposed Basin Plan amendments would have **no impact** on geology or soils.

8.5.7 Hazards and Hazardous Materials

The Proposed Project would revise water quality objectives for pH and turbidity through approval of the proposed Basin Plan amendments. The Proposed Project affects non-hazardous levels of pH and turbidity and does not require use of hazardous materials to achieve compliance. The Proposed Project would not involve new hazards or any action or physical activity that would introduce or remove hazardous materials. The proposed Basin Plan amendments would have **no impact** on current or potential hazards and use of hazardous materials.

8.5.8 Hydrology and Water Quality

The Proposed Project would revise water quality objectives for pH and turbidity through approval of the proposed Basin Plan amendments. Approval and implementation of the proposed pH and turbidity objectives would have no direct effect on hydrology, relative to existing conditions. In addition, anticipated hydrology under the proposed objectives would be identical to hydrology under compliance with the current Basin Plan objectives for pH and turbidity.

Additionally, the Proposed Project would not affect erosion or siltation rates, existing drainage pattern of the site or area, or the amount of area runoff. The Proposed Project would not change the 100-year flood magnitude or route, expose people or structures to significant risk of loss, injury, or death involving flooding, or increase the potential for inundation by seiche, tsunami, or mudflow.

The Proposed Project has the potential to affect pH and turbidity water quality parameters, but would have no direct effect on other water quality parameters. However, the proposed amendments to the pH and turbidity objectives were developed to be protective of in-stream beneficial uses and provide the level of water quality necessary to protect these uses.

Approval and implementation of the proposed amendments to the pH and turbidity objectives would result in limited, minimal changes in pH and turbidity relative to existing conditions. However, the difference that could occur in pH and turbidity between the

proposed and current pH objectives would not adversely affect any beneficial uses of water bodies within the Basin.

The proposed Basin Plan amendments would have **no impact** on hydrology and less-than-significant impact on water quality of Basin water bodies.

8.5.9 Land Use and Planning

The Proposed Project would revise water quality objectives for pH and turbidity through approval of the proposed Basin Plan amendments. The Proposed Project would not involve any action, physical activity, or land use change that would divide any established community, conflict with any land use plan, policy or regulation, or conflict with any habitat conservation plan or natural community plan. The proposed Basin Plan amendments would have **no impact** on land use and planning.

8.5.10 Mineral Resources

The Proposed Project would revise water quality objectives for pH and turbidity through approval of the proposed Basin Plan amendments. The Proposed Project would not involve any action or physical activity that would result in the loss of any known mineral resource or known mineral resource site. The proposed Basin Plan amendments would have **no impact** on mineral resources.

8.5.11 Noise

The Proposed Project would revise water quality objectives for pH and turbidity through approval of the proposed Basin Plan amendments. The Project would not involve any action or physical activity (e.g., construction) that would result in increased noise levels or exposure of people to noise. The proposed Basin Plan amendments would have **no impact** on noise.

8.5.12 Population and Housing

The Proposed Project would revise water quality objectives for pH and turbidity through approval of the proposed Basin Plan amendments. The immigration of people to an area is typically influenced by such factors as job opportunities, affordable housing, quality schools and public services, and aesthetic quality, among others. Water quality objectives will not likely encourage or discourage people from moving to the Basin. Also, since the Proposed Project involves no action or physical activity associated with land conversions, no housing would need to be relocated or otherwise affected. Implementation of the proposed Basin Plan amendments would have **no impact** on population or housing.

8.5.13 Public Services

The Proposed Project would revise water quality objectives for pH and turbidity through approval of the proposed Basin Plan amendments. The Proposed Project would not

require the provision of new or physically altered governmental facilities or the need for new or physically altered governmental facilities. Moreover, it would not involve any action that would adversely affect fire protection, police protection, schools, parks, or any other public facility. The proposed Basin Plan amendments would have **no impact** on public services.

8.5.14 Recreation

The Proposed Project would revise water quality objectives for pH and turbidity through approval of the proposed Basin Plan amendments. The Proposed Project would have no impact on existing or probable future recreational facilities in that no new structures or alterations of existing facilities or land uses are proposed. The following discussion addresses the Proposed Project's potential to affect recreation in and along the Basin's water bodies.

8.5.14.1 pH

Approval and implementation of the proposed amendment to the pH objective would not change the aesthetics, aquatic ecology, wildlife use, flow rates, or any other observable characteristics of the region's water bodies, relative to existing conditions. Anticipated pH conditions under the proposed objectives would differ only slightly and occasionally from pH conditions under compliance with the current Basin Plan objectives for pH. The slight, and occasional, difference that could occur in pH between the proposed and current pH objectives would have no effect on aesthetics, aquatic ecology, wildlife use, flow rates, or any other observable characteristic that affect recreation in or along water bodies. This is because the proposed pH objective was developed to be protective of all beneficial uses, including recreation. The proposed Basin Plan amendment for pH would have **no impact** on the recreational uses of water bodies within the Basin.

8.5.14.2 Turbidity

Under the Proposed Project, the current Basin Plan turbidity objective applicable when natural turbidity is between 0 and 5 NTUs would be modified for periods when the natural turbidity is less than 1 NTU. Under these conditions, downstream turbidity would not be allowed to increase above 2 NTUs as a result of a discharge. No change to the objective is proposed when the natural, upstream turbidity is between 1 and 5 NTUs.

Under low turbidity conditions (i.e., turbidity of < 1 NTU), the proposed objective would allow average turbidity to increase to no more than 2 NTUs. Differences in turbidity levels between <2 NTUs are generally difficult for the human eye to discern in a creek channel (RBI, 2006). In other words, water having a turbidity of ≤ 2 NTUs looks, aesthetically, very similar to water of ≤ 1 NTU when flowing through a creek channel. Moreover, these levels of turbidity are far below levels that could adversely affect ecological characteristics in water bodies that receive discharges.

Regional water-related recreation destinations and average turbidity levels at those locations are presented in **Table 1**. As shown by this table, recreational activities such as swimming readily occur at locations with average turbidities exceeding the range af-

ected by the proposed turbidity objective (between 0 and 1 NTU). Therefore, it can be determined that turbidity levels in and above the range that would likely result from implementing the proposed turbidity objective would not deter existing or future recreational uses.

Based on the above findings, the proposed turbidity objective would have **less-than-significant** impacts on recreational opportunities in and along water bodies within the Basin.

Table 1. Average Turbidity Of Popular Recreational Destinations

Recreational Destination	Average Turbidity (NTU)
<i>Sacramento River at Freeport (1990-1995) /a/</i>	
March	22
June	6.2
September	9.8
December	8.1
<i>American River at Cal. State University (1977-1979) /a/</i>	
March	6.0
June	1.0
September	2.0
December	3.0
January	13.6
<i>Folsom Reservoir /b/ (approximate)</i>	
Summer Inflow	1.0-2.0
Top of Water	<1.0
Shoreline	<10.0
<i>Sly Park Reservoir /c/</i>	
Summer (open water)	1.0
Winter (open water)	3.0-12.0
<i>Clear Lake (1985-1992) /d/</i>	
Summer	8.1
Winter	8.8

/a/ Miyashita, 1998.

/b/ Vonich, 1998.

/c/ Cooper, 1998.

/d/ Richerson, 1998.

8.5.15 Transportation/Traffic

The Proposed Project would revise water quality objectives for pH and turbidity through approval of the proposed Basin Plan amendments. The Proposed Project would not involve any action that would affect amounts of traffic or congestion, road management, traffic patterns, traffic hazards, emergency access, parking, or current transportation

policies. The proposed Basin Plan amendments would have **no impact** on transportation or traffic.

8.5.16 Utilities and Service Systems

The Proposed Project would revise water quality objectives for pH and turbidity through approval of the proposed Basin Plan amendments. The Proposed Project would not involve any action that would affect the need for new utilities. However, the Proposed Project would result in water quality objectives for pH and turbidity that would improve regulatory compliance with the stated objectives for POTWs, as enforced by the Regional Water Board. Moreover, adoption of the proposed objectives would prevent the need for construction of new wastewater treatment facilities at many POTWs discharging to low flow streams, the construction of which could cause short-term environmental effects (e.g., noise, air quality, traffic).

The proposed Basin Plan amendments would have **no adverse impact, or a beneficial impact**, on utilities and service systems.

8.6 CUMULATIVE IMPACT ANALYSIS FOR THE PROPOSED PROJECT

Cumulative impacts refer to one or more individual effects which, when taken together, are considerable or which compound or increase other environmental impacts. Cumulative impacts are the result of the incremental impact of a project when added to other closely related past, present, and reasonably foreseeable future projects. Cumulative impacts can result from individually minor but collectively significant projects taking place over a period of time.

Any future development projects in the region would be required to comply with the proposed pH and turbidity objectives to the extent they are applicable. Accordingly, the impacts of individual development projects could not cumulate with the impacts of amending the pH and turbidity objectives. The Proposed Project would not have an incremental effect or a cumulatively considerable incremental effect on identified resources in light of any development projects.

8.7 ALTERNATIVES CONSIDERED

The objective of the proposed Basin Plan amendments is to resolve regulatory issues associated with municipal and industrial discharges into surface waters, while also improving consistency with the current science relating to pH and low-level turbidity and, in the case of pH, improving consistency with U.S. EPA's recommended criteria. Alternatives that would meet these objectives were discussed in Sections 4.1 and 4.2.

To improve the scientific basis for and compliance with the pH water quality objective, and provide consistency with existing Federal criteria, three alternatives were considered:

- 1) No action;

- 2) Adoption of the USEPA national ambient criteria for pH; and
- 3) Adoption of a basin-specific pH objective.

To improve the scientific basis for and compliance with the turbidity water quality objective when the natural turbidity is below 1 NTU three alternatives were considered:

- 1) No action;
- 2) Adoption of the USEPA national ambient criteria for turbidity; and
- 3) Adoption of a basin-specific turbidity objective.

The following criteria were used to assess the relative success of the options at resolving the regulatory problems:

- 1) Consistency with State and Federal water quality laws, policies (including antidegradation policies), and water quality criteria;
- 2) Protection of all designated beneficial uses;
- 3) Consistency with current science regarding the water quality that is necessary to reasonably protect beneficial uses;
- 4) Is not overly restrictive; and
- 5) Applicability to water bodies of the Basin.

Under each Alternative 1 (No Action) for pH and turbidity, the Basin Plan's current water quality objectives for pH and turbidity would continue to apply to all water bodies in the Basin. However, adoption of the No Action Alternatives would not resolve the regulatory problems associated with the current pH and turbidity water quality objectives, would not improve the scientific basis for the objectives, and, for pH, would be inconsistent with the Federal criteria. Scientific literature does not indicate a need for the restrictive objectives that are currently in the basin plan so the cost of treating discharges to comply with these objectives is not warranted.

Adoption of Alternative 2 (USEPA National Criteria) also would not satisfy the alternative selection criteria because, for pH, it provides a lower level of protection to sensitive aquatic organisms, especially salmonids (McKee and Wolf 1963, NAS 1972, Witschi and Ziebel 1979, and Modin, pers. comm., 1998).

To adopt Alternative 2 (USEPA National Criteria) for turbidity, it would be necessary to determine the seasonal norm for turbidity in each applicable water body and thus there would be no definitive turbidity criterion. Moreover, it may be difficult or infeasible to determine seasonal norms for turbidity in some low flow streams.

For both pH and turbidity, Alternative 3 (Basin-specific pH and turbidity objectives) is the preferred alternative and is referred to as the Proposed Project in this section. A Basin-specific pH objective would be slightly more restrictive than Alternative 2, would resolve

the regulatory problems associated with the current objective, would be protective of all beneficial uses and be consistent with current Federal criteria and scientifically supported pH requirements for aquatic life. For turbidity, a Basin-specific objective would resolve the regulatory problems associated with the current objective, would be protective of all beneficial uses, and would provide a definitive criterion without the necessity of determining seasonal norms for each water body as required for Alternative 2.

8.8 RECOMMENDED ALTERNATIVE

Regional Water Board staff recommends approval and implementation of the Proposed Project.

8.9 NO EFFECT FINDING

Regional Water Board staff, after consideration of the evidence, recommends that the Regional Water Board find that the proposed project has no potential for any effect, either individually or cumulatively on fish wildlife.

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APPENDIX A

RECOMMENDED FORMAT FOR COMMENT LETTERS

Comment letters to the Regional Water Board regarding staff recommendations serve two purposes: (1) to point out areas of agreement with staff recommendations; and (2) to suggest revisions to staff recommendations. The California Environmental Quality Act (CEQA) requires staff to respond to comments submitted by the public that suggest changes to staff recommendations pertaining to a Basin Plan Amendment. Clear statements of both areas of agreement and suggested revisions will assist staff to respond to the specific concerns of the commenter. The following format for comment letters is suggested.

FORMAT FOR SUGGESTING REVISIONS

Recommended format:

- Number the comment;
- State the topic of the comment in one sentence;
- Provide a supporting argument, and
- Make a recommendation.

Supporting arguments that include citations will assist staff in considering the comment.

Example

The Environmental Action Team (EAT) recommends the following revision to staff recommendations:

1. Proposed Xenon objective for Slug Slough

Staff has recommended a 0.001 ng/L Xenon objective to protect resident guppies in Slug Slough. The USEPA Xenon criteria for protection of guppies in fresh waters is currently 0.0001 ng/L – an order of magnitude lower than the staff recommendation. The USEPA criteria is supported by several studies in peer reviewed journals (e.g., Smith and Jones; J. Env. Qual. (1994); Johnson; J. Env. Qual. (1995)). Staff arguments, that the cost of analyzing for Xenon in water below 0.001 ng/L is prohibitive, do not support the adoption of a water quality that is not protective of beneficial uses. More cost effective analytical procedures may be developed in response to the need for more intensive Xenon analysis. EAT, therefore, strongly recommends the adoption of a 0.0001 ng/L Xenon objective to fully protect guppies in Slug Slough.

FORMAT FOR COMMENTS SUPPORTING STAFF RECOMMENDATIONS

If the commenter concurs with a staff recommendation, a statement to that effect will assist the Regional Water Board in determining what action, if any, to take on the staff recommendation. In general, it is not necessary to present a supporting discussion unless the commenter feels that the staff recommendation could be further enhanced or clarified.

Example

1. Proposed Neon objective for Slug Slough

EAT strongly supports the adoption of the 0.05 pg/L Neon objective proposed by staff for Slug Slough. In addition to arguments presented by staff, it should be pointed out that Harrison's recent work on goldfish (Harrison, et al, 1996) confirms the appropriateness of the proposed objective for the protection of fresh water aquatic life.

APPENDIX B

BENEFICIAL USES DEFINED IN THE BASIN PLAN

Municipal and Domestic Supply (MUN) -

Uses of water for community, military, or individual water supply systems including, but not limited to, drinking water supply.

Agricultural Supply (AGR) - Uses of water for farming, horticulture, or ranching including, but not limited to, irrigation (including leaching of salts), stock watering, or support of vegetation for range grazing.

Industrial Service Supply (IND) - Uses of water for industrial activities that do not depend primarily on water quality including, but not limited to, mining, cooling water supply, hydraulic conveyance, gravel washing, fire protection, or oil well repressurization.

Industrial Process Supply (PRO) - Uses of water for industrial activities that depend primarily on water quality.

Ground Water Recharge (GWR) - Uses of water for natural or artificial recharge of ground water for purposes of future extraction, maintenance of water quality, or halting of saltwater intrusion into freshwater aquifers.

Freshwater Replenishment (FRSH) - Uses of water for natural or artificial maintenance of surface water quantity or quality.

Navigation (NAV) - Uses of water for shipping, travel, or other transportation by private, military, or commercial vessels.

Hydropower Generation (POW) - Uses of water for hydropower generation.

Water Contact Recreation (REC-1) - Uses of water for recreational activities involving body contact with water, where ingestion of

water is reasonably possible. These uses include, but are not limited to, swimming, wading, water-skiing, skin and scuba diving, surfing, white water activities, fishing, or use of natural hot springs.

Non-contact Water Recreation (REC-2) - Uses of water for recreational activities involving proximity to water, but where there is generally no body contact with water, nor any likelihood of ingestion of water. These uses include, but are not limited to, picnicking, sunbathing, hiking, beachcombing, camping, boating, tidepool and marine life study, hunting, sightseeing, or aesthetic enjoyment in conjunction with the above activities.

Commercial and Sport Fishing (COMM) - Uses of water for commercial or recreational collection of fish, shellfish, or other organisms including, but not limited to, uses involving organisms intended for human consumption or bait purposes.

Aquaculture (AQUA) - Uses of water for aquaculture or mariculture operations including, but not limited to, propagation, cultivation, maintenance, or harvesting of aquatic plants and animals for human consumption or bait purposes.

Warm Freshwater Habitat (WARM) - Uses of water that support warm water ecosystems including, but not limited to, preservation or enhancement of aquatic habitats, vegetation, fish, or wildlife, including invertebrates.

Cold Freshwater Habitat (COLD) - Uses of water that support cold water ecosystems including, but not limited to, preservation or enhancement of aquatic habitats, vegetation, fish, or wildlife, including invertebrates.

Estuarine Habitat (EST) - Uses of water that support estuarine ecosystems including, but not limited to, preservation or enhancement of estuarine habitats, vegetation, fish, shellfish, or wildlife (e.g., estuarine mammals, waterfowl, shorebirds).

Wildlife Habitat (WILD) - Uses of water that support terrestrial or wetland ecosystems including, but not limited to, preservation and enhancement of terrestrial habitats or wetlands, vegetation, wildlife (e.g., mammals, birds, reptiles, amphibians, invertebrates), or wildlife water and food sources.

Preservation of Biological Habitats of Special Significance (BIOL) - Uses of water that support designated areas or habitats, such as established refuges, parks, sanctuaries, ecological reserves, or Areas of Special Biological Significance (ASBS), where the preservation or enhancement of natural resources requires special protection.

Rare, Threatened, or Endangered Species (RARE) - Uses of water that support aquatic habitats necessary, at least in part, for the survival and successful maintenance of plant or animal species established under state or federal law as rare, threatened or endangered.

Migration of Aquatic Organisms (MIGR) – Uses of water that support habitats necessary for migration or other temporary activities by aquatic organisms, such as anadromous fish.

Spawning, Reproduction, and/or Early Development (SPWN) - Uses of water that support high quality aquatic habitats suitable for reproduction and early development of fish.

Shellfish Harvesting (SHELL) - Uses of water that support habitats suitable for the collection of filter-feeding shellfish (e.g., clams, oysters, and mussels) for human consumption, commercial, or sports purposes.

Inside Back Cover

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