NORTH COAST REGION
WATER QUALITY CONTROL BOARD

303(d) LIST UPDATE RECOMMENDATIONS

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California Regional Water Quality Control Board
North Coast Region
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INTRODUCTION

To achieve the water quality goals of the federal Clean Water Act (CWA), the first objective of the United States Environmental Protection Agency (US EPA) is to ensure that technology-based controls on point sources are established and maintained. Where such controls are insufficient to attain and maintain water quality standards, water quality-based controls are required.

Section 303(d) of the CWA requires that the states develop a list of water bodies that are impaired. Impairment means water quality objectives are not being met or beneficial uses are not being supported. Each state must submit an updated list, called the 303(d) List of Impaired Water Bodies, to the US EPA by April of each even numbered year.

On March 12, 2001 the Regional Water Quality Control Board, North Coast Region (Regional Water Board) solicited information from the public for consideration in updating the 303(d) List. Information submitted by the public on or before May 15, 2001 was considered in this 303(d) Listing cycle. Based upon information received, as well as other readily available information, Regional Water Board staff developed draft recommendations for the 303(d) List update. The Public Review Draft was distributed to Interested Parties and posted on the Regional Board's web site on September 10, 2001. Comments on the Public Review Draft were reviewed by Regional Water Board staff and incorporated in these final 303(d) List Update Recommendations.

Staff's recommendations will be presented at the December 6, 2001 Regional Water Board meeting in Eureka, California. Public comment on the 303(d) List will be accepted at that meeting as well. However, such public comment should also be forwarded to the State Water Resources Control Board (SWRCB). Staff's recommendations have been forwarded to the SWRCB who will review recommendations from all the Regional Boards, hold a public hearing in February 2002 (date to be determined) and consider public comments, finalize the state-wide 303(d) List, and transmit the List to the US EPA in April 2002.

BACKGROUND

Under Section 303(d) of the Clean Water Act, states are required to develop a list of water bodies where technology based effluent limits or other legally required pollution control mechanisms are not sufficient or stringent enough to meet water quality standards applicable to such waters. Placement of a water body on the 303(d) List acts as the trigger for developing a pollution control plan, called a Total Maximum Daily Load (TMDL), for each water body and associated pollutant/stressor on the list. The TMDL serves as the means to attain and maintain water quality standards for the impaired water body. In addition to identifying the water bodies that are not meeting water quality standards, the 303(d) List also identifies the pollutant or stressor causing impairment, and establishes a prioritized schedule for developing the TMDL.

Updates of the 303(d) List must be performed according to Section 303(d) of the Clean Water Act. Updates include adding or removing waters, and indicating Regional Board priorities and schedules for developing TMDLs. The US EPA (40CFR 130.7[a][5]) directs States to "assemble and evaluate all existing and readily available water quality-related data and information" to develop the Section 303(d) List and priorities for

TMDLs. Ideally, this process should involve review of information such as monitoring data, scientific literature, or resource management agency files that document water quality conditions and trends.

Approach to Updating 303(d) List

The Regional Water Board staff used several factors in developing recommendations for changes to the 303(d) List. The general factors described below are from the "1998 Clean Water Act Section 303(d) Listing Guidelines for California" (August 11, 1997) (hereafter referred to as "Listing Guidelines"). The Regional Board staff supplemented the Listing Guidelines with its best professional judgement and its collective experience with the watersheds in the region. The Listing Guidelines were developed by an ad hoc workgroup of staff from the Regional Water Quality Control Boards, the State Water Resource Control Board, and the US EPA.

Unless otherwise specified, for each mainstem water body segment included on the Regional Water Board's 303(d) List, it is assumed that the beneficial uses are impaired throughout the portion of the watershed that is tributary to the listed water body segment. As more information is developed through subsequent 303(d) List updates or TMDL development, portions of the watershed that are found not to be impaired may be recommended for de-listing.

The Listing Guidelines are presented below, followed by a description of the evaluation approach used in developing recommendations for the 303(d) List update.

Listing Factors

According to the Listing Guidelines, water bodies may be added to the 303(d) List for specific pollutants or stressors if any one of these factors is met:

1. Effluent limitations or other pollution control requirements [e.g., Best Management Practices (BMPs)] are not stringent enough to assure protection of beneficial uses and attainment of SWRCB and RWQCB objectives, including those implementing SWRCB Resolution Number 68-16 "Statement of Policy with Respect to Maintaining High Quality of Waters in California."

2. Fishing, drinking water, or swimming advisory currently in effect. This does not apply to advisories related to discharges in violation of existing WDRs or NPDES permits.

3. Beneficial uses are impaired or are expected to be impaired within the listing cycle (i.e. in next two years). Impairment is based upon evaluation of chemical, physical, or biological integrity. Impairment will be determined by "qualitative assessment,"[1] physical/chemical monitoring, bioassay tests, and/or other biological monitoring. Applicable Federal criteria and RWQCB Water Quality Control Plans determine the basis for impairment status.

[1] Qualitative Assessment: An assessment based upon information other than ambient monitoring data. Information used may include land use data, water quality impacts, predictive modeling using estimated input variables, or fish and game biologist surveys. A sole reliance on professional judgement, literature statements (often judgement based), or public comments should not be the only basis for listing.

4. The water body is on the previous 303(d) List and either: (a) "monitored assessment"[2] continues to demonstrate a violation of objective(s) or (b) "monitored assessment" has not been performed.

5. Data indicate tissue concentrations in consumable body parts of fish or shellfish exceed applicable tissue criteria or guidelines. Such criteria or guidelines may include SWRCB Maximum Tissue Residue Level values, FDA Action Levels, NAS Guidelines, and US EPA tissue criteria for the protection of wildlife, as they become available.

6. The water quality is of such concern that the Regional Water Board determines the water body needs to be afforded a level of protection offered by a 303(d) Listing.

De-listing Factors

According to the Listing Guidelines, water bodies may be de-listed for specific pollutants or stressors if any one of these factors is met:

1. Objectives are revised (for example, Site Specific Objectives), and the exceedance is thereby eliminated.

2. A beneficial use is de-designated (after US EPA approval of a Use Attainability Analysis, if necessary) and the non-support issue is thereby eliminated.

3. Faulty data led to the initial listing. Faulty data include, but are not limited to typographical errors, improper quality assurance/quality control (QA/QC) procedures, or Toxic Substances Monitoring/State Mussel Watch Elevated Data Levels which are not confirmed by risk assessment for human consumption.

4. It has been documented that the objectives are being met and beneficial uses are not impaired based upon "Monitored Assessment" criteria.

5. A TMDL has been approved by the US EPA.

6. There are control measures in place which will result in protection of beneficial uses. Control measures include permits, cleanup and abatement orders, and watershed management plans which are enforceable and include a time schedule.

Establishing TMDL Priorities

A priority ranking is required for listed waters to guide TMDL planning pursuant to 40 CFR 130.7. TMDLs are ranked into high, medium, and low priority categories based on:

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[2] Monitored Assessment: For aquatic life uses, monitored assessment should be based upon a minimum of Level 2 information, as indicated in the 1996 305(b) guidance [Guidelines for Preparation of the 1996 State Water Quality Assessments ("305(b) Reports"), EPA 841 B-95-001, May 1995].

- water body significance (such as importance and extent of beneficial uses, threatened and endangered species concerns, and size of water body),
- legal obligations,
- degree of impairment or threat (such as number of pollutants/stressors of concern, and number of beneficial uses impaired or threatened),
- conformity with related activities in the watershed (such as existence of watershed assessment, planning, pollution control and remediation, or restoration efforts in the area),
- potential for beneficial use protection or recovery,
- degree of public concern, and
- available information.

It should be noted that the criteria can be applied in different ways to different water bodies and pollutants. For example, a water body may be severely impaired, but if there is little likelihood of beneficial use recovery then a lower priority might be given.

Evaluation Approach

Staff utilized a "weight of evidence" approach to develop recommendations for the 303(d) List update. Basically, the weight of evidence approach involves weighing available information as to its ability to demonstrate a credible line of reasoning leading to a conclusion about the condition of the water. Three possible conclusions exist: (1) the water body is not meeting standards; (2) the water body is meeting standards; and (3) based on the available information, standards attainment cannot be determined.

A determination that a water body is impaired is based on non-attainment of water quality standards. Water quality standards refer to both water quality objectives (both numeric and narrative) and designated beneficial uses. Water quality objective exceedance is determined by evaluating data relative to applicable water quality objectives in the *Water Quality Control Plan, North Coast Region* (Basin Plan). Other standards/criteria/ guidance used in evaluating data include:

1. Water quality standards, such as the California and National Toxics Rules.
2. Criteria developed by the US EPA, the California Department of Health Services, and other applicable criteria developed by government agencies.
3. Guidance or guidelines developed by agencies/entities such as the U.S. Food and Drug Administration, National Academy of Sciences, the California Department of Health Services, and the Office of Environmental Health Hazard Assessment.
4. Criteria or standards developed in other states, regions, or countries.

There are a variety of types of information that can be evaluated to determine whether water quality standards are being attained. These include, but are not limited to: water column chemistry, physical condition of the water body, fish tissue samples, aquatic habitat surveys, aquatic invertebrate and fisheries information, and land use history. Comparison to reference water bodies can provide insight on water quality impairment. In addition, peer reviewed literature can be used to evaluate whether narrative water quality objectives are being attained.

There are no specific minimum data requirements or a specific frequency of exceedences for making a finding that water quality standards are not attained. In general, more data are needed to interpret environmental results that are specific to time and geography. Less data are needed to make a determination based on environmental results that serve as integrators over space and time, such as bioaccumulation data. Also, less water column chemistry data may be needed to make an impairment determination (or lack of impairment determination) if there are other types of information to support the findings from the water column measurements. For instance, correlations could be made between specific land use activities/patterns and the presence of pollutants in surface water.

Staff evaluated the data quality assurance/quality control procedures associated with information submitted. Data sets with appropriate certified quality assurance/quality control were considered with the greatest weight.

Approach to Assessing Temperature Impairment

The narrative temperature objective for the North Coast Regional Water Board states:

> "The natural receiving water temperature of intrastate waters shall not be altered unless it can be demonstrated to the satisfaction of the Regional Water Board that such alteration in temperature does not adversely affect beneficial uses. At no time or place shall the temperature of any COLD water be increased by more than 5°F above natural receiving water temperature. At no time or place shall the temperature of WARM intrastate waters be increased more than 5°F above natural receiving water temperature."

Determination of "natural receiving water" temperatures is limited by the availability of natural background and ambient temperature monitoring data for a given waterbody. Therefore, for purposes of the 303(d) List update, determination of temperature impairment was based on assessment of the data with regard to literature detailing impacts to beneficial uses, particularly the growth and survival of a cold water fish, for watersheds that were known to support those uses.

In an effort to assess water temperature effects on salmonids it is useful to have measures of chronic (i.e. sub-lethal) and acute (i.e. lethal) temperature exposures for assessing stream temperature data. A common measure of exposure is the maximum weekly average temperature (MWAT), a measure of chronic exposure. The MWAT is the maximum value of the mathematical mean of multiple, equally spaced, daily temperatures over a 7-day consecutive period (Brungs and Jones 1977 [Ref. #101]). In different words, this is the highest value of the 7-day moving average of temperature. The MWAT for a particular waterbody can be compared to a calculated MWAT for growth

metric. The MWAT for salmonid growth is the upper temperature that allows optimum growth of salmonids.

Sullivan *et al.* (2000 [Ref. #102]) review sub-lethal and acute temperature thresholds from a wide range of studies, incorporating information from laboratory-based research, field observations, and risk assessment approaches. The author's report calculated MWAT metrics for growth ranging from 14.3°C to 18.0°C for coho salmon, and 14.3°C to 19.0°C for steelhead trout. The risk assessment approach used by Sullivan *et al.* (2000 [Ref. #102]) suggests that an upper threshold for the MWAT of 14.8°C for coho and 17.0°C for steelhead will reduce growth 10% from optimum, and that thresholds for the MWAT of 19.0°C for both coho and steelhead will reduce growth 20% from optimum.

While these thresholds relate to reduced growth, temperatures at sub-lethal levels also can effectively block migration, inhibit smoltification, and create disease problems (Elliot 1981 [Ref.#103]). Further, the stressful impacts of water temperatures on salmonids are cumulative and positively correlated to the duration and severity of exposure. The longer the salmonid is exposed to thermal stress, the less chance it has for long-term survival (Ligon *et al.* 1999 [Ref.#104]).

Jobling (1981 [Ref.#105]) reports that the upper lethal limit, that is the temperature at which death occurs within minutes, ranges from 27°C to 30°C for salmonids. Sullivan *et al.* (2000 [Ref. #102]) report acute threshold values, that is temperatures causing death or total elimination of salmonids from a location, which range from 21.0°C to 25.5°C for coho, and 21.0°C to 26.0°C for steelhead.

The temperature data evaluated for the update to the 303(d) List were reviewed by comparison to the MWAT ranges cited above, as well as an acute threshold value of 24°C as proposed by Brungs and Jones (1977 [Ref. #101]). In addition, the temperature data were evaluated with respect to the current and historic presence of cold water fish. If a stream which exhibits temperatures within the chronic reduced-growth MWAT ranges cited above, has a decreased salmonid fishery compared with historic levels, then it is inferred that historically the stream exhibited acceptable MWATs.

In streams, however, temperature is not uniform in space or time. Therefore, a single exceedance of the temperature thresholds does not necessarily mean that temperature conditions are impairing salmonids, and would not result in a determination of impairment in this 303(d) List update. On the other hand, consistent exceedance of these thresholds in disperse monitoring locations throughout a sub-basin and over two or more seasons likely does mean that temperature conditions are impairing salmonids, and therefore does lead to a determination of impairment in this 303(d) List update.

A determination not to list a sub-basin was reached if at least three years of monitoring data were available from more than one representative location within the sub-basin and the MWAT values from these data sets were nearly all below the 14.8°C threshold. Careful consideration was given to the location of the monitoring stations within the sub-basin, as well as the location of the sub-basin within the entire watershed, with particular attention to possible coastal influence on stream temperatures.

Pools deep enough to become stratified can provide critical thermal refugia in a waterbody that is otherwise above the optimal temperature range (Spence et al. 1996

[Ref.#106]). However, loss of pool volume due to sedimentation can result in a decrease of this valuable cold water habitat. Therefore, where available, information on instream sediment conditions was reviewed to provide additional insight on temperature conditions within a sub-basin.

Approach to Assessing Sediment Impairment

Determination of sediment impairment is based on non-attainment of water quality objectives and threat to designated beneficial uses. The applicable Basin Plan water quality objectives include those for sediment, settleable material, and turbidity.

The narrative water quality objective for sediment states:

> "The suspended sediment load and suspended sediment discharge rate of surface waters shall not be altered in such a manner as to cause nuisance or adversely affect beneficial uses."

The narrative water quality objective for settleable material states:

> "Water shall not contain substances in concentrations that result in deposition of material that causes nuisance or adversely affect beneficial uses."

The narrative water quality objective for turbidity states:

> "Turbidity shall not be increased more than 20 percent above naturally occurring background levels. Allowable zones of dilution within which higher percentages can be tolerated may be defined for specific discharges upon the issuance of discharge permits or waiver thereof."

These water quality objectives address conditions both in the water column (suspended sediment and turbidity) and on the stream bed (settleable material). Determination of sediment impairment can be reached by concluding that any one or more of these objectives are not being met.

With respect to cold freshwater habitat the beneficial use may be threatened due to conditions either in the water column (e.g. suspended sediment and/or turbidity) or on the stream bed (settleable material), or both. Indicators of stream bed condition include channel morphology (e.g. riffle – pool ratios, residual pool depth, V* -- a measure of the sediment which has filled in pools, cross-section and thalwag profiles) and substrate conditions (e.g. percent of fine sediment of the total bulk core sample, median particle size, and riffle embeddedness). Beneficial use impairment due to suspended sediment/ turbidity and/or substrate conditions is assessed by evaluating site specific suspended sediment concentrations, turbidity levels, and/or substrate conditions and comparing the data to threshold levels and/or critical salmonid life stage requirements presented in the literature. No specific threshold or life stage requirement was used as an absolute when making a 303(d) impairment determination, but rather this information was used as guidance.

Literature related to suspended sediment/turbidity and stream bed condition thresholds or life stage requirements are reviewed briefly here.

It is generally accepted that the severity of effect of suspended sediment on fish increases as a function of sediment concentration and duration of exposure (Newcombe and Jensen, 1996 [Ref.#75]). However, identification of a specific threshold causing impairment is difficult. While research to date is suitable for assessing effects of discrete suspended sediment (or turbidity) events, it is unsuitable for measuring the cumulative effect of multiple events over the course of a storm season. Newcombe and Jensen (1996 [Ref.#75]) indicate reduced short term feeding rates and feeding success when exposed to a suspended sediment concentration of 20 mg/L for three hours. Newcombe and Jensen (1996 [Ref.#75]) also report that juvenile and adult salmonids undergo major physiological stress and experience long-term reduction in feeding rates and feeding success when exposed to suspended sediment concentrations exceeding 148 mg/L for a duration of six days. Noggle (1978, cited in Meehan 1991 [Ref.#76]) reported that suspended sediment concentrations of 1,200 mg/L caused direct mortality of underyearling salmonids, while 300 mg/L caused reduced growth and feeding. Bisson and Bilby (1982 [Ref.#77]) reported that juvenile coho salmon avoided water with turbidities that exceeded 70 NTU (nephelometric turbidity units). Berg and Northcote (1985, as cited in Meehan 1991 [Ref.#76) reported that feeding and territorial behavior of juvenile coho salmon were disrupted by short-term exposures (2.5-4.5 days) to turbid water with up to 60 NTU. Finally, turbidities in the 25-50 NTU range (equivalent to 125-275 mg/l of bentonite clay) reduced growth and caused more newly emerged salmonids to emigrate from laboratory streams than did clear water (Sigler et al. 1984 [Ref.#78]). When sufficient data was available, the 20% above naturally occurring background level objective was used in assessing impairment.

Research shows that as the percentage of fine sediment in a channel increases as a proportion of the total bulk core sample, the survival to emergence decreases. The percent fines ≤ 0.85 mm is defined as the percentage of subsurface fine material in pool tail-outs ≤ 0.85 mm in diameter. Identifying a specific percentage of fines that can comprise the bulk core sample and still ensure adequate embryo survival is not clearly established in the literature. In a broad survey of literature reporting percent fines in unmanaged streams (streams without a history of land management activities), Peterson et al. (1992, as cited in Meehan, 1991 [Ref.#76]) found fines ≤0.85 mm ranging from 4% in the Queen Charlotte Islands to 28% on the Oregon Coast, with a median value for all the data of about 11%. Peterson et al. (1992, as cited in Meehan, 1991 [Ref.#76) recommended the use of 11% fines ≤ 0.85 mm as a target for Washington streams because the study sites in unmanaged streams in Washington congregated around that figure. None of the data summarized by Peterson et al. (1992, as cited in Meehan, 1991 [Ref.#76) were from California.

Burns (1970 [Ref.#113]) conducted three years of study in Northern California streams, including three streams he classified as unmanaged: Godwood and South Fork Yager creeks in Humboldt County and North Fork Caspar Creek in Mendocino County. He found a range of values for fines < 0.85 mm in each of these streams: 17-18% in Godwood Creek, 16-22% in South Fork Yager Creek, and 18-23% in Caspar Creek. The numeric target representative of properly functioning conditions for fines < 0.85 mm used in several TMDLs for North Coast streams is 14% based on the average of values reported for unmanaged streams in the studies by Peterson et al. (1992 [Ref.#114]) and Burns (1970 [Ref.#113]).

V* is a measure of the fraction of a pool's volume that is filled by fine sediment, and is representative of the in-channel supply of mobile bedload sediment (Lisle and Hilton 1992 [Ref.#115]). Lisle and Hilton (1999 [Ref.#116]) demonstrated the usefulness of the parameter by comparing annual sediment yields of select streams with their average V* values. The comparison indicated that V* was well correlated to annual sediment yield. They also demonstrated that V* values can quickly respond to changes in sediment supply. V* values in French Creek, a tributary to the Scott River, decreased to approximately one-third the initial value soon after an erosion control program focusing on roads was implemented. A study of over sixty streams in the Franciscan geology of Northern California found that mean V* values of 0.21 (21 %) or less represented good stream conditions (Knopp, 1993 [Ref.#47]). Lisle and Hilton (1999 [Ref.#116]) reported that V* values for Elder Creek, an undisturbed tributary of the South Fork Eel River in Coastal Belt Franciscan Geology, averaged only 0.09. The difference in the V* values presented by Knopp (1993 1993 [Ref.#47]) and Lisle and Hilton (1999 [Ref.#116]) is indicative of the variability inherent in V* measurements. The numeric target representative of properly functioning conditions for V* used in several North Coast TMDLs is 0.15, the average of 0.21 and 0.09 -- the results presented by both Knopp (1993 [Ref.#47]) and Lisle and Hilton (1999 [Ref.#116]).

Explanation of Listing Recommendations

Four types of recommendations are possible:

1. To de-list a waterbody/pollutant combination from the 303(d) List;
2. To add a waterbody/pollutant combination to the 303(d) List;
3. To put a waterbody/pollutant combination on a "Watch List"; and
4. To make No Change to the 303(d) List for a specific waterbody/pollutant combination.

The recommendations to list or de-list were based on the evaluation approach described above. Based upon the available information, staff has not recommended the de-listing of any waterbody/pollutant combinations.

The recommendation to put a waterbody/pollutant combination on a Watch List was made if: (1) there is conflicting information regarding water quality impairment, or (2) the available information is insufficient to make a water quality impairment determination. Placement of a waterbody/pollutant combination on a Watch List means that additional information is needed to determine water quality impairment. The intent of putting a waterbody/pollutant combination on a Watch List is to highlight the need to obtain the information needed to determine the condition of a water body prior to future 303(d) List updates.

The No Change recommendation was made when data or information was provided for a waterbody/ pollutant combination already on the 303(d) List, or when staff believed that a request to add or remove a waterbody/pollutant combination from the 303(d) List was not warranted by the weight of available information.

Regional Board Information Reviewed

Many potential data sources exist and/or were submitted in response to the public solicitation. Potential data sources considered in addition to those submitted in response to the public solicitation include:

- Water column monitoring data from regulated/unregulated discharges, volunteer/watershed monitoring groups, and Regional Water Board monitoring programs such as the Surface Water Ambient Monitoring Program;
- Information submitted to the Regional Water Board to fulfill regulatory reporting requirements;
- Tissue data from fish and other organisms collected under the State Mussel Watch/Toxic Substances Monitoring Programs and Bay Protection and Toxic Cleanup Program;
- Sediment samples from the Bay Protection and Toxic Cleanup Program and Regional Water Board studies;
- Fish population surveys, and aquatic habitat surveys from industry representatives, Department of Fish and Game, and volunteer/watershed monitoring groups; and
- Reports containing trend analysis/water quality assessment information.

Where available, each of these sources of information was utilized for the 303(d) List update.

303(d) LIST UPDATE RECOMMENDATIONS

A summary of the staff recommendations is presented in **Table 1**. Recommendations for additions to the 303(d) List are presented in **Table 2**. Recommendations for the Watch List are presented in **Table 3**. Explanations for the No Change recommendations are provided in **Table 4**. TMDL priority and end date recommendations are presented in **Table 5**.

The rationale for the 303(d) List update and Watch List recommendations are provided below, followed by a discussion of staff's recommendation pertaining to the existing Redwood Creek sediment listing.

303(d) List Recommendations

<u>Stemple Creek/Estero de San Antonio – Sediment</u>

Stemple Creek and Estero de San Antonio were first proposed for listing in the 1990 listing cycle. The original fact sheet developed during that listing cycle identified sedimentation, low dissolved oxygen (DO), and high ammonia from nonpoint source discharges as having impaired fish and wildlife habitat, and associated beneficial uses. At the time, the 303(d) List identified waterbodies as impaired but was not explicit about stressors associated with the impairments.

During the 1996 listing cycle, specific stressors associated with impairments to particular waterbodies were included in the 303(d) List. At that time, Stemple Creek and Estero de San Antonio were listed as impaired for nutrients. This constitutes a condensation of the

dissolved oxygen and ammonia concerns into a single stressor. The sedimentation problem was inadvertently not included as a stressor on the 303(d) List.

The Total Maximum Daily Load and Attainment Strategy for the Stemple Creek Watershed, approved by the North Coast Regional Water Board on December 11, 1997, support the intent of including sedimentation as a stressor. This document identifies excessive sediment as a stressor causing impairment, quantifies sediment yield from the watershed, associates sediment discharges with management activities in the watershed, quotes Basin Plan narrative standards for sediment, analyzes the sources of increased sediment yield in the watershed, includes numeric targets for sediment yield, sets a TMDL for sediment, allocates responsibility for reduced sediment yields, includes an implementation plan for reducing soil erosion, and proposes a monitoring plan that includes sediment. In other words, all of the elements of the Regional Water Board TMDL process are addressed.

To date, the Total Maximum Daily Load and Attainment Strategy for the Stemple Creek Watershed has not been fully implemented, and beneficial uses are still impaired by sediment. Therefore, staff recommends amending the current 303(d) List to include sediment as a stressor adversely affecting beneficial uses in the watershed, consistent with the original intent of the listing and with the existing approved TMDL for the watershed.

Santa Rosa Creek – Pathogens

Though the quantity of samples is sparse, microbiological monitoring in Santa Rosa Creek reveals high levels of indicator species. The California Department of Health Services recommends fresh water beach postings when fecal coliform, total coliform, Enterococcus, and/or E. coli levels exceed 400, 10,000, 61, or 235 MPN/100 mL for a single sample, respectively (California Department of Health Services, 2001 [Ref.#68]). Thirty percent of the samples taken in 1979 and 1980 (n=20) had fecal coliform concentrations exceeding the DHS recommended level (NCRWQCB, 1979-1980 [Ref.#66]). Monitoring results from June/July 2001 show high levels of total coliform, E. coli, and Enterococcus (City of Santa Rosa, 2001 [Ref.#64]). Seventy two percent of the samples (n=18) had total coliform and E. coli levels greater than the DHS recommended levels, and all of the samples had Enterococcus levels exceeding the DHS recommended level. A swimming advisory is currently in effect for Santa Rosa Creek. There is not enough data over a 30-day time period to make a determination of water quality objective exceedance for contact recreation (REC1), based on the Regional Water Board‘s Basin Plan objective for fecal coliform (NCRWQCB, 1994 [Ref.#91]). Based on these conditions, staff recommends adding Santa Rosa Creek to the 303(d) List for threat to public health due to pathogens.

Laguna de Santa Rosa – DO and Nutrients

The Laguna de Santa Rosa was added to the 303(d) List in 1990 for high levels of ammonia and low dissolved oxygen (DO) concentrations. A TMDL was completed for the Laguna for ammonia and dissolved oxygen in 1995. The TMDL concluded that high ammonia levels in the Laguna were the result of point and non-point source nitrogen inputs of various forms. Low dissolved oxygen concentrations were a result of inputs of

organic matter and nutrients which stimulate algal growth and subsequently cause depressed dissolved oxygen levels when the algae dies and decays.

The TMDL took the form of a Waste Reduction Strategy (WRS) which addressed the reduction of nitrogen loading from point and non-point sources. With the implementation of the WRS and operational improvements at the City of Santa Rosa Waste Water Treatment Plant as well as improvements in waste storage and disposal activities at local dairies, nitrogen inputs to the Laguna were significantly reduced. Following implementation of the WRS and the subsequent attainment of nitrogen-ammonia interim concentration goals, as stated in the WRS, the Laguna was removed from the 303(d) List for ammonia and dissolved oxygen in 1998, pursuant to a recommendation by US EPA.

However, dissolved oxygen levels in the Laguna continue to fall below the Regional Water Board's Basin Plan minimum DO objective of 7.0 mg/L and in many cases fluctuate significantly on a daily and seasonal basis. Recent monitoring of the Laguna by Regional Water Board staff showed dissolved oxygen concentrations range from a low of 0.2 to a high of 8.5 mg/L, with approximately 90 % of the records (n=1792) below 7.0 mg/L (NCRWQCB, August/September 2001 [Ref.#108]). Dissolved oxygen levels recorded in the Laguna by the City of Santa Rosa between January 1995 and July 1997 ranged from lows of less than 1.0 mg/L to highs of 20 mg/L (NCRWQCB, 1997 [Ref.#65]). An August 1997 review of the City of Santa Rosa's WRS monitoring results by the Regional Water Board found that "The goal for dissolved oxygen was not met at any of the four attainment points on the Laguna de Santa Rosa, with lowest dissolved oxygen levels occurring in the dry weather spring and summer months…with non-attainment of the WRS goal most often occurring between the months of April and September" (NCRWQCB, 1997 [Ref.#65]).

The report concludes that the Laguna generally meets the US EPA criterion for ammonia, but the US EPA phosphate criterion of 0.1mg/L total phosphorus is not consistently met (for streams or flowing waters not discharging into lakes or reservoirs). Based on available information, it appears that phosphorus may contribute to the dissolved oxygen fluctuations. The City of Santa Rosa began to monitor the Laguna for phosphorus in 1997 (Small, 2001 [Ref.#20]). Phosphorus levels recorded by the City have consistently exceeded the US EPA recommended 0.1 mg/L maximum criterion, including six sites that have exceeded this 100 percent of the time, with phosphorus concentrations as high as 3.0 mg/L. These six Laguna de Santa Rosa monitoring stations are located 100 feet upstream of Llano Road, at Llano Road, approximately 300 yards downstream of Llano Road, at Todd Road, upstream of the confluence with Colgan Creek, and upstream of the Laguna's confluence with Santa Rosa Creek.

The Regional Water Board also has conducted monitoring of the Laguna on a year-round basis since 1997 (NCRWQCB, 1997-2000 [Ref.#107]), and has recorded phosphorus levels above the US EPA criterion. Phosphorus levels recorded by the Regional Board at four monitoring stations located along the Laguna at Stony Point Road, Occidental Road, Guerneville Road, and Trenton-Healdsburg Road have consistently exceeded the US EPA criterion. The percentage of US EPA criterion exceedance at the four stations ranges from 89.6 percent of the samples collected at Guerneville Road to 100 percent of the samples collected at Occidental Road. Phosphorus concentrations were also recorded as high as 3.0 mg/liter at the Stony Point Road station.

Based on available information, staff has concluded that the dissolved oxygen objectives are not being met. However, the cause of the low dissolved oxygen levels is not certain. While phosphorus levels are below the US EPA criterion, nitrogen to phosphorus ratios,

based on recent Laguna measurements, indicate that nitrogen may be the macronutrient controlling plant growth in the Laguna (Roth, 2001 [Ref.#118]). Staff believes a TMDL addressing nutrients (both nitrogen and phosphorus) and dissolved oxygen is necessary for water quality objective attainment. Therefore, staff recommends adding Laguna de Santa Rosa to the 303(d) List for nutrients and low dissolved oxygen.

Russian River - Temperature

The Russian River is a coastal and interior watershed in Mendocino and Sonoma counties, with a watershed area of 1484 sq. miles. The most sensitive beneficial uses supported by the Russian River include uses associated with the cold water fishery and municipal and domestic supply. The Russian River provides habitat for coho salmon and steelhead trout, which are listed as a threatened species under the federal Endangered Species Act.

Recent (1997-2000) temperature data collected in the Russian River watershed (Slota, 2001 [Ref.#29], SCWA, 1997-1998 [Ref.#67]) indicate that high temperature levels may be a source of impairment of cold water fisheries in the watershed. For this review, data were available from 26 locations, with at least two years of record at 19 locations. MWAT values at 26 of 26 locations exceeded both the criteria of 14.8°C and 17°C for sub-lethal effects (10% reduced growth) on juvenile salmonids proposed by Sullivan and others (2000 [Ref. #102, with 22 locations exceeding the criteria for sub-lethal effects (20% reduced growth). Records indicate that maximum temperatures at 12 of the 26 locations were higher than 24°C, and may be lethal for coho.

Based on these results staff recommends adding the Russian River to the 303(d) List for temperature.

Russian River – Pathogens

Total and fecal coliform monitoring data for the Russian River was provided to TMDL Development Unit staff during the public review period for the Draft 303(d) List Update Recommendations. Staff assessed the available data from 1987 through August 2001 with respect to the Basin Plan's water quality objective for bacteria, which states "In waters designated for contact recreation, the median fecal coliform concentration based on a minimum of not less than five samples for any 30-day period shall not exceed 50/100 mL…". Seventy two percent of the fecal coliform sample sets collected at Healdsburg Memorial Beach between 1986 and 1994 exceeded the objective (NCRWQCB, 2001 [Ref.#111]). For the years 1995 through August 2001, 6%, 45%, 64%, 86%, 100%, 56%, and 100% of the 30-day medians for fecal coliform exceeded the objective, respectively (NCRWQCB, 2001 [Ref.#112]). Seventy five percent of the fecal coliform sample sets collected at Monte Rio beach between 1992 and 1994 exceeded the objective (NCRWQCB, 2001 [Ref.#111]). For the years 1996 through August 2001, 73%, 45%, 0%, 0%, 0%, and 88% of the 30-day medians for fecal coliform exceeded the objective, respectively (NCRWQCB, 2001 [Ref.#112]). All of the samples were collected during the summer months. Both Healdsburg Memorial Beach and Monte Rio Beach are popular swimming areas. Fecal coliform is an indicator organism. Based on this data, staff recommends adding the following reaches of the Russian River to the 303(d) List for pathogens: (1) the Monte Rio area from the confluence of Dutch Bill Creek to the

confluence of Fife Creek; and (2) Healdsburg Memorial Beach from the Highway 101 crossing to the railroad crossing upstream of the beach.

Gualala River – Temperature

The Gualala River is a coastal watershed in Mendocino and Sonoma counties, with a watershed area of about 300 sq. miles. The most sensitive beneficial uses supported by the Gualala River include uses associated with the cold water fishery and municipal and domestic supply. The Gualala River provides habitat for coho salmon and steelhead trout, which are listed as a threatened species under the federal Endangered Species Act. Populations of steelhead trout in the Gualala River watershed are in decline, while coho salmon appear to have all but vanished (NCRWQCB, 2001 [Ref.#69]).

Recent (1994-2000) temperature data collected in the Gualala River watershed indicate that high temperature levels may be a source of impairment of cold water fisheries in the watershed. For this review, data were available from 62 locations, with at least two years of record at 27 locations (Gualala Redwoods Inc., 2001 [Ref.#130). MWAT values at locations on the mainstems of the Gualala, N. Fork Gualala, S. Fork Gualala, Buckeye Creek, Rockpile Creek, and Wheatfield Fork exceeded available MWAT criteria for sub-lethal effects (10% reduced growth) on juvenile salmonids at all or most locations. MWAT values at locations on the mainstems of S. Fork Gualala, Buckeye Creek, Rockpile Creek, and Wheatfield Fork exceeded available MWAT criteria for sub-lethal effects (20% reduced growth) on juvenile salmonids at all or most locations. Records also indicate that maximum temperatures in at least one year at 15 locations were higher than 24°C and may be lethal to coho. Temperatures in the Little North Fork and Big Pepperwood Creek are generally below threshold levels and appear to exhibit properly functioning conditions with respect to stream temperature.

Based on these results staff recommends adding the Gualala River to the 303(d) List for temperature, with the exception of the Little North Fork and Big Pepperwood Creek.

Big River - Temperature

The Big River is a coastal watershed in Mendocino County, with a watershed area of about 200 sq. miles. The most sensitive beneficial uses supported by the Big River include uses associated with the cold water fishery and municipal and domestic supply. The Big River provides habitat for coho salmon and steelhead trout, which are listed as a threatened species under the federal Endangered Species Act. Populations of coho salmon and steelhead trout in the Big River are extremely low compared to historical levels (NCRWQCB, 2001 [Ref.#70]).

Recent (1996-2000) temperature data gathered in the Big River watershed (Slota, 2001 [Ref.#29]; CDF, 1994-1997 [Ref.#71]) indicate that high temperature levels may be a source of impairment of cold water fisheries in the river. For this review, data were available from 34 locations, with at least two years of record at 15 locations. Maximum recorded temperatures did not exceed 24°C at any of the locations. MWAT values at 29 of 34 locations, however, exceed the criterion of 14.8°C proposed by Sullivan and others (2000 [Ref. #102]). MWAT values at 19 locations - on the mainstems of the Big, N. Fork Big, S. Fork Big, and on Chamberlin, Daugherty, Gates, and Ramon Creeks - exceeded the upper end of the range of MWAT criteria (17°C) for sub-lethal effects (10%

reduced growth) on juvenile salmonids. MWAT values at 4 locations - on the mainstems of the Big and S. Fork Big - exceeded available MWAT criteria for sub-lethal effects (20% reduced growth) on juvenile salmonids.

Based on these results staff recommends adding the Big River to the 303(d) List for temperature. Staff recommends the listing be specific to the area of the watershed from the confluence with the North Fork Big River, including the watersheds of the mainstem Big and the North Fork Big.

Ten Mile River - Temperature

The Ten Mile River is a coastal watershed in Mendocino County, with a watershed area of 120 sq. miles. The most sensitive beneficial uses supported by the Ten Mile River include uses associated with the cold water fishery and municipal and domestic supply. The Ten Mile River provides habitat for coho and chinook salmon and steelhead trout; coho salmon and steelhead trout are listed as a threatened species under the federal Endangered Species Act. Populations of coho and chinook salmon have declined rapidly in the Ten Mile River watershed (NCRWQCB, 2001 [Ref.#70]).

Recent (1993-2000) temperature data collected in the Ten Mile River watershed (Hawthorn Timber Co., 2001 [Ref.#72]; Georgia Pacific West, Inc., 1999 [Ref.#73]; Campbell Timberland Management, 2000 [Ref.#74]) indicate that high temperature levels may be a source of impairment of cold water fisheries in the river. For this review, data were available from 37 locations, with at least two years of record at all but 3 locations. Data are available for 5 or more years from 26 locations. Maximum recorded temperatures did not exceed 24°C at any of the locations. MWAT values at 31 of 37 locations, however, exceed the criterion of 14.8°C proposed by Sullivan and others (2000 [Ref.#102]). MWAT values at 17 locations exceeded the upper end of the range of MWAT criteria (17°C) for sub-lethal effects (10% reduced growth) on juvenile salmonids. MWAT values at 3 locations - on the mainstems of the N. Fork and S. Fork, and on Buck Mathews Gulch - exceeded available MWAT criteria for sub-lethal effects (20% reduced growth) on juvenile salmonids. Temperatures in the Little North Fork are generally below threshold levels and appear to exhibit properly functioning conditions with respect to stream temperature.

Based on these results staff recommends adding the Ten Mile River to the 303(d) List for temperature, with the exception of the Little North Fork.

Jacoby Creek - Sediment

Jacoby Creek has a watershed area of approximately 17.3 sq. miles and drains to Humboldt Bay. Based on review of available information, the beneficial uses of Jacoby Creek appear to be threatened. Specifically, records show a decline in the salmonid fishery in Jacoby Creek, and this decline appears to be correlated with sedimentation. Quantitative measures of sedimentation include: (1) up to 1.6 feet of aggradation from 1992 to 2001, based on cross section surveys at Brookwood Bridge, and (2) turbidity and suspended sediment samples throughout the watershed at levels detrimental to salmonids (Finger, 2001 [Ref.#30]). Elevated turbidity levels have been recorded during small to

moderate rainfall events, and turbidity levels appear to remain elevated for several days in some instances, and remain high well after rainfall ceases. Further, Jacoby Creek residents state that recreational use of Jacoby Creek is impaired due to increased duration and magnitude of turbidity. Available literature pertaining to suspended sediment effects on salmonids (summarized in the Section "Approach to Assessing Sediment Impairment") was used in evaluating the suspended sediment and turbidity data for Jacoby Creek.

Based on the available information, staff recommends adding Jacoby Creek to the 303(d) List for threat or impairment due to sedimentation.

Mad River – Temperature

The Mad River is a coastal watershed in Humboldt and Trinity counties, with a watershed of 503 sq. miles. The most sensitive beneficial uses supported by the Mad River include uses associated with the cold water fishery and municipal and domestic supply.

Recent (1997-2000) temperature data collected on the mainstem of the Mad River (Natural Resources Management, 1997-1999 [Ref.#79]; CDFG, 1999 [Ref.#80]) indicate that high temperature levels may be a source of impairment of cold water fisheries in the river. For this review, data were available from 11 locations, with at least two years of record at most locations. MWAT values at all of the 11 locations exceeded 20°C, and are higher than any available temperature criteria for sub-lethal effects (reduced growth) on juvenile salmonids. Records also indicate that maximum temperatures at most of the 11 locations in most years are higher than 24°C. Eight of the eleven locations were in the lower reaches of the Mad River. The monitoring at these locations was conducted as part of the permitting process for gravel operators on the Mad River (Rische, 2001 [Ref.#117]).

Based on the available data staff recommends adding the Mad River to the 303(d) List for temperature.

Redwood Creek - Temperature

Redwood Creek is a coastal watershed in Humboldt County, with a watershed area of 294 sq. miles. The most sensitive beneficial uses supported by Redwood Creek include uses associated with the cold water fishery. Redwood Creek provides habitat for coho and chinook salmon and steelhead trout; coho salmon and steelhead trout are listed as a threatened species under the federal Endangered Species Act.

Recent (1994-2001) temperature data collected in the Redwood Creek watershed (Lewis et al., 2000 [Ref.#136]; Ozaki et al., 1998 [Ref.#137]; Redwood National and State Park, 2001 [Ref.#139]; and Simpson Timber Co., 2000 [Ref.#138]) indicate that high temperature levels may be a source of impairment of cold water fisheries in the river. For this review, data were available from 31 locations, with at least two years of record at 20 locations. MWAT values at 23 of 31 locations exceeded the criterion of 14.8°C proposed by Sullivan and others (2000 [Ref.#102]). MWAT values at 10 locations exceeded the upper end of the range of MWAT criteria (17°C) for sub-lethal effects (10% reduced growth) on juvenile salmonids. MWAT values at 5 locations – in the estuary, three

locations on the mainstem and one on Lacks Creek - exceeded available MWAT criteria for sub-lethal effects (20% reduced growth) on juvenile salmonids. Maximum recorded temperatures exceeded 24°C at 6 locations.

Based on these results staff recommends adding Redwood Creek to the 303(d) List for temperature.

Tule Lake and Lower Klamath Lake National Wildlife Refuge – pH

Data collected in 1996-1997 indicate that portions of the Klamath and Lost Rivers have exceeded pH objectives (NCRWQCB, 1995 [Ref.#81]; NCRWQCB, 1996-1997 [Ref.#82]). Values for pH were especially high at the Tule Lake Pump D sampling station and the Klamath Straits drain. Other NCRWQCB data for the Lower Lost River (1992-1995) indicate that all but one sampling station did not meet the objectives (NCRWQCB, 1995 [Ref.#81]; NCRWQCB, 1996-1997 [Ref.#82]). The pH of surface water can influence the toxicity of dissolved materials resulting in synergistic and direct effects on biological systems. High pH levels influence ammonia concentrations which can be toxic to fish. In addition, high pH levels can increase the solubility of minerals and metals, which can effect fish and other aquatic organisms. Photosynthetic activity of algae effects carbonate cycling, which influences pH. Elevated pH levels in Tule Lake and Lower Klamath Lake National Wildlife Refuge are likely due to photosynthetic activity of algae.

In 1996, data for the Klamath Straits from April through October showed 10 pH water quality objective exceedances out of 15 measurements (range from 7.7 to 9.7). In 1997, data for the Klamath Straits from April through October showed 7 pH exceedances out of 15 measurements (range from 7.5 to 9.8). In the 1992-1995 dataset, there were 3 exceedances out of 11 samples (range from 4.60 to 9.12).

In 1996, data for Tule Lake Pump D from April through October, showed 10 pH exceedances out of 15 measurements (range from 7.9 to 10.0). In 1997, data for the Tule Lake Pump D from April through October, showed 13 pH exceedances out of 15 measurements (range from 8.1 to 10.1). In the 1992-1995 dataset, there were 7 exceedances out of 11 samples (range from 5.00 to 10.20).

Based on these results, staff recommends adding portions of Tule Lake and Lower Klamath Lake National Wildlife Refuge in California to the 303(d) List for pH.

Watch List Recommendations

Santa Rosa Creek, Laguna de Santa Rosa, Russian River – Diazinon

A 1997 Department of Pesticide Regulation study (California Department of Pesticide Regulation, 1997 [Ref.#83]) of insecticide residues in four California rivers identified pesticide concentrations above the reporting limit in two of the fifty two samples collected in the Russian River during a 12-month sampling period (August 1994 – August 1995). Diazinon was detected at a concentration above that believed to be detrimental to freshwater organisms. In November 1999 the City of Santa Rosa tested for

pesticides (including Diazinon) from 5 Santa Rosa creeks that drain to the Russian River (Oliveri, 2001 [Ref.#28]). Diazinon was not detected in any of the samples. Based on these mixed results, staff recommends conducting additional screening-level monitoring of the Russian River watershed for pesticides to determine if beneficial uses are impaired by pesticide residues.

Santa Rosa Creek, Laguna de Santa Rosa - Chromium, Copper, and Zinc

Staff reviewed available data to determine whether chromium, copper, and zinc objectives are exceeded in the Laguna de Santa Rosa and Santa Rosa Creek, and evaluate whether beneficial uses are impaired by these metals. Santa Rosa Creek is a tributary to the Laguna de Santa Rosa, which is a tributary to the Russian River. Santa Rosa Creek and the Laguna de Santa Rosa receive urban storm water runoff and wastewater treatment plant effluent. Beneficial uses of the Laguna de Santa Rosa and its tributaries (including Santa Rosa Creek) are agricultural supply, industrial service supply, water contact and non-contact recreation, commercial and sport fishing, cold freshwater habitat, wildlife habitat, and potentially aquaculture. Beneficial uses of the Russian River in addition to those listed for the Laguna de Santa Rosa include municipal and domestic supply, industrial process supply, groundwater recharge, hydropower generation, warm freshwater habitat, migration of aquatic organisms, spawning, reproduction, and/or early development, and estuary habitat. Based on review of water quality criteria for chromium, copper, and zinc, relevant water quality criteria include concentrations protective of agriculture, State of California primary maximum contaminant levels, and public health goals for drinking water.

The City of Santa Rosa performs surface water monitoring on Santa Rosa Creek at Fulton Road (Oliveri, 2001 [Ref.#28]). The monitoring results indicate no exceedance of the primary maximum contaminant level for chromium (0.05 ppm) and copper (1.3 ppm) for the winters of 1997-2000 (based on 10 sampling events); there is no MCL for zinc (Marshack, 2000 [Ref.#57]). No exceedance of copper (0.2 ppm) and zinc (2 ppm) concentrations protective of agriculture are noted (from *Water Quality for Agricultur*e 1985, published by the Food and Agriculture Organization of the United Nations, in Marshack, 2000 [Ref.#57]); there is no chromium criteria for agriculture. The public health level goal for copper (0.17 ppm) was not exceeded. The public health level goal for total chromium (0.0025 ppm) was exceeded in 2 of 10 samples analyzed for dissolved chromium and 5 of 10 samples analyzed for total chromium. There is no public health level goal for zinc. City of Santa Rosa Laguna Wastewater Treatment Plant monthly monitoring reports for 2000 and 2001 (City of Santa Rosa, 200-2001 [Ref.#56]) were reviewed to determine whether exceedance of water quality criteria values listed above occurred in wastewater effluent discharges. It was determined that no exceedance of water quality criteria for copper or zinc as listed above occurred in wastewater effluent discharge. However, concentrations of chromium exceeded the public health level goal (0.0025 ppm) in effluent discharges on January 19, 2000 (0.0056 ppm total chromium), February 12, 2001 (0.0026 ppm total chromium, 0.0034 ppm dissolved chromium), and on February 21, 2001 (0.0065 ppm total chromium).

The Regional Water Board developed a draft report on “Sediment Sample Results for organic chemicals, metals, and nutrients in the Laguna de Santa Rosa/Mark West Creek System and the Russian River 1985-86 and 1995” (NCRWQCB, 1996 [Ref.#85]). Sediment samples were taken in the Laguna de Santa Rosa and Santa Rosa Creek

upstream of urban runoff and wastewater effluent discharges at a "reference" site and downstream to the mouth of Santa Rosa Creek. Report results indicate that chromium, copper, and zinc concentrations in stream sediments may be elevated downstream of the "reference" sites in both the Laguna de Santa Rosa and Santa Rosa Creek. Scatter is present in the data, however. The level of water quality impairment cannot be determined without further analysis of the data relative to surface water quality.

One 1994 fish tissue sample (Rasmussen, 1997 [Ref.#58]) and one 1987 invertebrate sample (Rasmussen, 1990 [Ref.#59]) from the Laguna de Santa Rosa indicated no exceedance of chromium, copper, or zinc median international standards for fish tissue or EDL-85 for shellfish tissue.

Staff recommends continuing review of Laguna de Santa Rosa monitoring reports, City of Santa Rosa storm water permit monitoring, and Toxic Substances Monitoring Program results for chromium, copper and zinc concentrations.

Lake Sonoma – Mercury

Tissue monitoring of fish caught in Lake Sonoma, as part of the Toxic Substances Monitoring Program (TSMP), reveal levels of mercury which exceed the Median International Standard (Rasmussen, 2000 [Ref.#86]) and US EPA fish tissue criterion (US EPA, 2001 [Ref.#87]). Composite samples, using six similar age class fish of a single particular species, were collected whenever possible. Two out of four samples collected in 1993 exceeded fish tissue criterion (Rasmussen, 1995 [Ref.#88]). Two out of two samples collected in 1995 exceeded fish tissue criterion (Rasmussen, 1997 [Ref.#58]). Preliminary 1999 results exceeded the Median International Standard of 0.5 ppm in five out of six and six out of six samples and exceeded the US EPA criterion of 0.3 ppm in six of six and six out of six samples (State Water Resources Control Board, 2001 [Ref.#89]). All six of the 1999 samples exceeded the Office of Environmental Health and Hazard Assessment guidelines for tissue levels for consumption rates of one meal per month (OEHHA, 2000 [Ref.#90]). These guidelines are for protection of pregnant women, fetuses, and children.

Regional Water Board staff are scheduled to conduct intensive monitoring of fish tissue mercury levels in Lake Sonoma in cooperation with the Office of Environmental Health and Hazard Assessment. This monitoring is scheduled for fall 2001 in order to evaluate the need for a Health Advisory for mercury contamination of fish tissue in Lake Sonoma. Staff recommends deferring action until this investigation is completed.

Lake Mendocino – Mercury

Tissue monitoring of fish caught in Lake Mendocino, as part of the Toxic Substances Monitoring Program (TSMP), reveal levels of mercury which exceed the Median International Standard and U.S. EPA fish tissue criterion. Composite samples, using six fish of each species, were collected whenever possible. Though none of the three samples collected in 1993 were in exceedance (Rasmussen, 1995 [Ref.#88]), preliminary 1999 results exceeded the Median International Standard in two of three samples and the U.S. EPA criterion in three of three samples (State Water Resources Control Board, 2001 [Ref.#89]). All of the samples exceeded the Office of Environmental Health and Hazard

Assessment guidelines for tissue levels for consumption rates of one meal per week (OEHHA 2000 [Ref.#90]). These guidelines are for protection of pregnant women, fetuses, and children.

Regional Water Board staff are scheduled to conduct intensive monitoring of fish tissue mercury levels in Lake Mendocino in cooperation with the Office of Environmental Health and Hazard Assessment. This monitoring is scheduled for fall 2001 in order to evaluate the need for a Health Advisory for mercury contamination of fish tissue in Lake Mendocino. Staff recommends deferring action until this investigation is completed.

Virgin Creek, Casper Creek, Pudding Creek – Pathogens

Anecdotal accounts of surfers getting sick (sinusitis/ear infections) after surfing in ocean waters near the mouths of coastal streams around Fort Bragg, particularly during the rainy season, have been presented (Booth, 2001 [Ref.#4]). No baseline data on pathogen levels are available for these coastal streams. A swimming advisory was posted at MacKerricher State Park, located at the mouth of Virgin Creek, on December 27, 2000, associated with a sewer line break near the mouth of the creek (Brown, 2001 [Ref.#6]). The sewer line break was repaired, but information gained as a result of the spill provides useful insight. According to an Environmental Health Specialist with the Mendocino County Department of Public Health who visited the Virgin Creek site following the spill, tidal action at the site had flushed the area. Monitoring for total and fecal coliform was conducted. Three samples were taken 14 days after the spill, and had results that may be indicative of a threat to public health. There is not enough data over a 30-day time period to make a determination of water quality objective exceedance for contact recreation, according to Basin Plan water quality objectives. While the results may be due to a residual effect of the sewer line break, the lack of baseline data makes it difficult to determine with any certainty. Given the anecdotal accounts of surfers getting sinusitis/ear infections, staff recommends putting Virgin Creek, Casper Creek, and Pudding Creek on the watch list and conducting baseline monitoring for pathogens to assess whether beneficial uses are threatened or impaired.

Elk Creek, Mallo Pass Creek, Brush Creek, Schooner Gulch - Sediment

These small (watershed area less than 30 sq. miles) southern Mendocino Coast streams all provide habitat for steelhead trout, as well as historic habitat for coho salmon (Brown and Moyle, 1991 [Ref.#49]). The drainages have similar geology and timber harvest histories (Pjerrou, 2001 [Ref.#41]) to other Mendocino Coast streams (Garcia and Navarro Rivers) that are currently on the 303(d) List for impairments to cold water fisheries. However, with the exception of Schooner Gulch, road densities on Mendocino Redwoods Company (MRC) lands are low relative to other disturbed watersheds (Pjerrou, 2001 [Ref.#41]). Pebble counts presented in MRC Timber Harvest Plans (Mendocino Redwoods Co., 2001 [Ref.#50]) on Elk Creek note mean D_{50} values of 63 and 57 mm for Elk Creek and South Fork Elk Creek, respectively. These data suggests low impact by fine sediments on the streambed. However, further information regarding instream sediment conditions is necessary to verify the transport capacity for Elk Creek and evaluate the conditions of the other southern Mendocino Coast streams.

Staff recommends conducting additional instream sediment assessments in these southern Mendocino Coast streams to determine whether spawning and rearing habitat of cold water fisheries and other beneficial uses are impaired due to sediments.

Alder Creek – Sediment and Temperature

Alder Creek is a small drainage on the southern Mendocino Coast which currently provides steelhead habitat (Pjerrou, 2001 [Ref.#41]). However, no documentation of historic coho habitat in Alder Creek is available. As with Elk Creek, the drainage has similar geology and timber harvest histories (Pjerrou, 2001 [Ref.#41]) to other Mendocino Coast streams (Garcia and Navarro Rivers) that are currently on the 303(d) List for impairments to cold water fisheries. Road density on MRC lands is low relative to other disturbed watersheds (Pjerrou, 2001 [Ref.#41]). Data regarding instream conditions and sediment impact are not available in this watershed.

Temperature data for Alder Creek provided by a recent survey (Pjerrou, 2001 [Ref.#41]) indicate that high temperature levels may be a source of impairment of cold water fisheries in Alder Creek. High temperatures in the creek range from 15.7 to 22.5º C, which exceed preferred temperature ranges for steelhead trout. Results of temperature monitoring, presented in recent Timber Harvest Plans (1-01-072 MEN and 1-01-316 MEN), show temperatures exceeding threshold levels (Mendocino Redwoods Co., 2001 [Ref.#51 and 92]. Additional information on the temporal and spatial extent of elevated temperatures, including MWATs, are required to determine the extent of stream temperature impairment.

Staff recommends conducting additional instream sediment and temperature assessments of Alder Creek to determine whether spawning and rearing habitat of cold water fisheries and other beneficial uses are impaired due to sedimentation and/or elevated temperatures.

Greenwood Creek – Sediment and Temperature

Greenwood Creek is a coastal stream in Mendocino County with a watershed area of approximately 24.4 sq. miles. A recap of the ten year harvest history shows that approximately 4,521 acres, or approximately 27% of the watershed, has been harvested or is planned to be harvested within the Greenwood Creek watershed (Mendocino Redwood Co., 2001 [Ref.#131]). The most sensitive beneficial uses supported by Greenwood Creek include uses associated with the cold water fishery and municipal and domestic supply.

Greenwood Creek provides habitat for steelhead trout, which are listed as a threatened species under the federal Endangered Species Act. Evidence also suggests that it provides (or historically provided) habitat for coho salmon also listed as threatened along the North Coast of California (Pjerrou, 2001 [Ref.#41]; Surfleet, 2001 [Ref.#109]).

There is conflicting evidence regarding the impairment of Greenwood Creek's instream conditions due to fine sediment. A 1993 study conducted by the Regional Water Board (Knopp, 1993 [Ref.#47]) on a 1,000 meter reach of Greenwood Creek presents a mean pool filling volume (called V*) of 49% and a mean substrate size (called D_{50}) of 36.5 mm. These values are consistent with measurements taken during the same study for highly disturbed watersheds on the Mendocino Coast such as the Gualala and Garcia

Rivers, and are generally representative of degraded instream habitat conditions. Another study reported few pools (75% of sites had ≤ one pool per 30 meter reach) along the entire length of Greenwood Creek (Forest, Soil and Water, 1996 [Ref.#48]). This study also found the mean filling of pool volume (V*) throughout the watershed to be 25%. The authors of this study concluded that these results suggest a creek in moderately good condition (Forest, Soil and Water, 1996 [Ref.#48]). A recent study of stream channel conditions reported a median D_{50} of 48 and 38 in lower and upper Greenwood Creek, respectively (Surfleet, 2001 [Ref.#109]). This study also reports percent fines less than 0.85 mm of 5%, and percent fines less than 6.3 mm of 27% in the bottom tailout of a pool in upper Greenwood Creek. The mean stream gravel permeability across this segment in upper Greenwood Creek was 5,059 cm/hr, representing moderately good spawning conditions (Surfleet, 2001 [Ref.#109]). The results of all of these studies are mixed, and seem to indicate, at a minimum, the existence of localized degradation of streambed quality due to fine sediments.

Furthermore, temperature data from two locations on Greenwood Creek spanning six years of record from 1992 to 2000 indicate that high temperature levels may be a source of impairment of cold water fisheries in Greenwood Creek (Surfleet, 2001 [Ref.#109]). Maximum-recorded temperatures did not exceed 24°C at any of the locations. MWAT values at both locations, however, consistently exceed the criterion of 14.8°C proposed by Sullivan and others (2000 [Ref.#102]). MWAT values equaled or exceeded the upper threshold for the MWAT of 17.0°C for sub-lethal effects (10% reduced growth) for steelhead in four of the six years of record in the lower monitoring location and in three of the five years of record in the upper monitoring location. The last two years of record indicate slightly lower MWAT values in the lower monitoring location.

Greenwood Creek provides the sole source of drinking water for the town of Elk, serving approximately 100 people and 15 businesses. The drinking water source is two shallow (18 and 25 feet deep) creekside wells, currently located approximately 25 and 75 feet from the outside bend of the creek under the Highway One Bridge. The shallow wells draw groundwater, but are clearly influence by surface water in Greenwood Creek. Major storm events in 1983 caused the creek to meander up to 100 feet, decreasing the distance between the creek and well locations (Acker, 2001 [Ref.#45]). After relocation of the stream channel the distance from the wells to the creek was further reduced due to bank erosion, and therefore the filtering capacity of the soil was decreased. Consequently, when turbidity levels in the creek are elevated during storm events, the turbidity levels in the wells also increase (Acker, 2001 [Ref.#45]). Due to elevated turbidity levels in Well #1 during winter months, the Elk County Water District only uses water from Well #2 during the winter. Following the 1998 *El Nino* storms the hydraulic connectivity of surface water to the wells increased, allowing surface water to enter Well #2 for the first time (Acker, 2001 [Ref.#45]).

Well #2 is treated to remove naturally occurring iron and manganese by advanced oxidation and sand filtration. Elevated turbidity levels overwhelmed the filtration system in March 1998, and led to a Boil Water Order. The California Department of Health Services' turbidity limit for drinking water is currently 1 NTU for systems that filter (Marshack, 2000 [Ref.#57]). Proposed drinking water regulations would require turbidity limits of 0.3 NTU 95th percentile and 1 NTU maximum for systems serving less than 10,000 people (Marshack, 2000 [Ref.#57]). The Water District plans to install microfiltration units to treat the high turbidity water and meet proposed State Department of Health Services requirements. The enhancement to the treatment system will likely

solve the drinking water problem. However, the water supply is still vulnerable to stream bank erosion.

At this time, staff is unable to determine the contributing factors causing the impairment to the domestic water supply. It is unclear, based upon the available information, whether upstream timber harvest practices contributed to the bank erosion. The channel lies in an alluvial floodplain in an active uplift area. The construction of the Highway One bridge over Greenwood Creek, as well as the presence of a mill pond near the mouth of the creek several hundred feet downstream in the early 1900s, may also have modified the channel morphology and contributed to the channel migration. It is possible, though not certain, that channel aggradation due to increased sedimentation may have contributed to bank erosion at the well site.

Based on the complicated circumstances regarding the drinking water supply, as well as the mixed information on the instream sediment conditions in Greenwood Creek, staff recommends putting Greenwood Creek on the watch list for sediment. This recommendation differs from that presented in the Draft report, and was reached based upon information received during the public review period for the Draft report, as well as a site visit by Water Board staff on October 22, 2001. Staff also recommends that Greenwood Creek be added to the watch list for temperature, and that additional temperature monitoring at more locations throughout the watershed be conducted to evaluate possible temperature impairment of the cold water fishery.

Cottaneva Creek, Hardy Creek, Juan Creek, Howard Creek - Sediment

These small (watershed area less than 30 sq. miles) northern Mendocino Coast drainages provide habitat for steelhead salmon (Pjerrou, 2001 [Ref.#41]), and historic habitat for coho salmon (Brown and Moyle, 1991 [Ref.#49]). The drainages have similar geology, timber harvest histories, and high road densities (Pjerrou, 2001 [Ref.#41]) compared to other Mendocino Coast streams (Garcia and Navarro Rivers) that are currently on the 303(d) List for impairments to cold water fisheries. However, information regarding sediment loading, instream conditions, and sediment transport capacity of these streams is insufficient to determine whether beneficial uses are impaired. Staff recommends conducting instream sediment and temperature assessments of these northern Mendocino Coast streams to determine whether beneficial uses are impaired due to sediments.

Dehaven Creek, Wages Creeks - Sediment

These streams are also small (8 and 13 sq. miles watershed area, respectively) northern Mendocino Coast drainages. Fish population data and timber harvest histories were not available for these watersheds. However, both these streams have been documented to provide historic habitat for coho salmon which are currently absent from the watersheds (Pjerrou, 2001 [Ref.#41]). Road densities on MRC lands in the Dehaven Creek watershed are high relative to other disturbed watersheds (Pjerrou, 2001 [Ref.#41]). Furthermore, McNeil samples taken from a Campbell Timberland THP (CTM, 2001 [Ref.#52]) indicate that fine sediments are impairing Dehaven Creek: percent fines (<0.85 mm) from 1993 to 1998 range from 14.7 to 21.5% (with no apparent trend), with an average of 18.7% during that time.

Due to lack of fish population data, it is difficult to determine whether the instream sediment conditions in Dehaven and Wages Creeks have impaired the cold water fishery and other beneficial uses. Staff recommends additional research to characterize historic fisheries conditions, as well as obtaining more information on harvest histories and instream conditions necessary for making a beneficial use impairment determination.

Usal Creek - Sediment

Usal Creek watershed is approximately 27.5 sq. miles along the northern Mendocino Coast. Electrofishing data from 1993 and 1996 by Georgia-Pacific West, Inc., found one coho cohort that was not present in 1999 (Campbell Timberland Management, 1993-2000 [Ref.#93]). A 1995 DFG stream inventory on Usal and South Fork Usal yielded steelhead trout but no coho salmon. A habitat survey conducted as part of this DFG inventory documented a lack of deep pool habitat (>3 feet deep) in both the streams, as well as marginal spawning substrate based on embeddedness ratings (CDFG, 1995 [Ref.#53]). According to DFG staff the watershed was logged heavily in the 1960s, yielding large volumes of sediment at its lower reaches that has caused considerable aggradation and widening of the channel. McNeil samples taken on the South Fork Usal by Campbell Timberland Management are variable, with percent fines (<0.85 mm) ranging from 21.8% in 1996 to 12.2% in 2000 (CTM, 2001 [Ref.#51]). In sediment TMDL analysis, Regional Water Board staff and US EPA have used a numeric target for percent fines of less than 14% (NCRWQCB, 2001 [Ref.#54]). THP data from Campbell Timberland (CTM, 2001 [Ref.#55]) indicated maximum stream temperatures in Usal Creek are below threshold values for coho salmon and steelhead trout.

The available data suggest that instream sediment conditions may contribute to a decline in the salmonid fishery. Staff recommends conducting additional instream monitoring and fish population surveys to determine whether spawning and rearing habitat of cold water fisheries and other beneficial uses are impaired due to sedimentation.

Humboldt Bay – Sedimentation

Sedimentation/siltation of Humboldt Bay is a historic problem. The U.S. Army Corps of Engineers began dredging the Bay in 1881 for ship passage. According to accounts submitted for the 303(d) List update, sedimentation from streams which drain into the Bay, such as Jacoby Creek, has led to aggradation near the mouths of these creeks (Friedrichsen, 2001 [Ref.#33]). Deposition of these sediments has led to decreased tidal flushing, and resulted in the establishment of plants which are not true salt marsh inhabitants (Wunner, 2001 [Ref.#34]). Beneficial use impairment associated with excessive sedimentation to coastal estuaries was evaluated in the Morro Bay Watershed Siltation TMDL. According to this TMDL, aquatic vegetation, fish, and bottom dwelling organisms can be smothered by excessive sedimentation, both in the estuary and in adjacent tributaries. Further, elevated turbidity and suspended solids can result in decreased light penetration through the water column, impacting aquatic plants such as eelgrass and the organisms dependent on them.

It is not clear based on the available information whether water quality objectives are being exceeded and beneficial uses impaired in Humboldt Bay. Staff recommends

additional study to determine whether beneficial uses are threatened due to sedimentation in Humboldt Bay.

Humboldt Bay – PCBs and Dieldrin

Preliminary 1999-2000 data (SWRCB, 2001 [Ref.#94]) from the State Mussel Watch Program (SMWP) shows levels of dieldrin and Total PCBs in transplanted California Mussels that exceed maximum tissue residue levels (MTRLs) for enclosed bays and estuaries (Humboldt Del Norte Pier, C Street, and J Street). The MTRLs were developed by SWRCB staff from human health water quality objectives in the 1997 *California Ocean Plan* and from the California Toxic Rule (40 CFR Part 131) as established in the *Policy for Implementation of Toxics Standards for Inland Surface Waters, Enclosed Bays and Estuaries of California*. The MTRLs were calculated by multiplying the human health water quality objectives by the bioconcentration factor for each substance as recommended in the US EPA Draft Assessment and Control of Bioconcentratable Contaminants in Surface Waters (Rasmussen, 2000 [Ref.#86]).

The MTRL for dieldrin (0.7 ppb) was exceed at one of the three locations (at J Street). The MTRL for Total PCBs (5.3 ppb) was exceeded in each of the three Humboldt Bay locations, with a high of 45.0 at the C Street site. 1997 SMWP data revealed one slight MTRL exceedance for both dieldrin and Total PCBs. Despite these MTRL exceedances, the shellfish tissue levels were far below the FDA Action Levels of 300 ppb and 2,000 ppb for dieldrin and Total PCBs, respectively. The 1998 Bay Protection and Toxic Cleanup Program report "Chemical and Biological Measures of Sediment Quality and Tissue Bioaccumulation in the North Coast Region" (SWRCB, 1998 [Ref.#95]) does not provide information on ambient water quality or sediment conditions relevant to these constituents at these sites.

Given that the SMWP results are considered preliminary, and the lack of supporting information, staff recommends conducting additional monitoring at these sites for Total PCBs and dieldrin through the State Mussel Watch Program. Additional study may be conducted through the Surface Water Ambient Monitoring Program.

Mad River Slough – PCBs

Preliminary 1999-2000 data (SWRCB, 2001 [Ref.#94]) from the State Mussel Watch Program (SMWP) shows levels of Total PCBs in transplanted California Mussels sampled at the mouth of Mad River Slough that exceed maximum tissue residue levels (MTRLs) for enclosed bays and estuaries (Rasmussen, 2000 [Ref.#86]). The Total PCBs wet weight was 18.6 ppb, a concentration that exceeds the MTRL of 5.3 ppb. This shellfish tissue level is far below the FDA Action Level of 2,000 ppb for Total PCBs, however. Samples taken at this same site in 1997 were below the MTRL for Total PCBs. The 1998 Bay Protection and Toxic Cleanup Program report "Chemical and Biological Measures of Sediment Quality and Tissue Bioaccumulation in the North Coast Region" does not provide information on ambient water quality or sediment conditions relevant to PCBs in Mad River Slough (SWRCB, 1998 [Ref.#95]).

Given that the SMWP results are considered preliminary and there is little supporting information, staff recommends conducting additional monitoring of Mad River Slough

for Total PCBs through the State Mussel Watch Program. Additional study may be conducted through the Surface Water Ambient Monitoring Program.

Beith and Grotzman Creek - Sediment

These are small watersheds (1-2 sq. miles) that drain from the eastern slopes above Arcata into Humboldt Bay. Beneficial uses of concern include those associated with cold water fisheries (commercial and sport fishing, spawning, reproduction, and/or early development). Chief threats are sedimentation and increased runoff, and possibly urban runoff (Farhi, 2001 [Ref.#40]). Based on the available information, it is difficult to determine whether the instream sediment conditions in Beith and Grotzman Creeks are impairing the cold water fishery. Additional information on instream sediment conditions, channel aggradation, and historic and current fish presence/absence is necessary to determine whether water quality objectives are being exceeded and beneficial uses impaired.

Klamath River – Sediment

Regional Water Board staff have suggested that beneficial uses may be impaired in portions of the mainstem Klamath (particularly in the lower Klamath River) and tributaries to the Klamath River (Beaver Creek and tributaries to the Klamath below the confluence with the Trinity River have been specifically identified) due to excessive sediment loading and instream sediment conditions. Insufficient information is available at this time to make a listing determination. Staff recommends focused study of the instream sediment conditions to assess beneficial use impairment of the mainstem and tributaries.

The Yurok Indian Reservation boundaries lie approximately one mile on either side of the Klamath River from the Pacific Ocean to the confluence with the Trinity River. The Yurok, Karuk, and Hoopa Tribes are very active throughout the Klamath basin in both fisheries and water quality monitoring efforts. The Yurok and Hoopa Tribe are actively pursuing approval of Clean Water Act authority from US EPA. Coordination among the Regional Water Board, State Water Board, the Tribes and US EPA is critical to successful development and implementation of TMDLs for the Klamath River basin.

East Fork Trinity River – Mercury

An assessment of water quality around abandoned mine sites in Trinity County revealed that water quality standards are being met, except at the site of the Altoona mercury mine at the northern end of Trinity County above the East Fork of the Trinity River (Trinity Journal, 2001 [Ref.#97]). A USGS monitoring program, to be completed in 2002, will evaluate the impact of abandoned mines such as the Altoona mine on federal lands in the Trinity River watershed. Staff recommends assessing the results of the study when available to determine whether beneficial uses are impaired by mercury.

Shasta River – Sediment and Nutrients

Information on instream sediment and nutrient conditions available during the 303(d) List update process was insufficient to determine whether water quality objectives are being met and beneficial uses supported in the Shasta River. The Regional Water Board is scheduled to complete temperature and dissolved oxygen TMDLs for the Shasta River by 2005. Staff suspects the low dissolved oxygen conditions in the river are linked to nutrient conditions. Nutrient and dissolved oxygen conditions in Shasta River will be monitored as part of the Surface Water Ambient Monitoring Program this year and as part of the North Coast Watershed Assessment Program in 2003. Based on all available data, nutrient impairment will be assessed during the water quality assessment for the dissolved oxygen TMDL.

The Department of Fish and Game conducted two spawning gravel quality studies in the Shasta River in 1994 and 1997 (Jong, 1994 [Ref.#98]; Ricker, 1997 [Ref.#99]). Both studies found that the mean percent fines (<0.85 mm) exceeded levels that are detrimental to salmonid egg survival and fry emergence. Mean percent fines found in the lower reach of the Shasta River were lower in 1997 (16.2%) than in 1994 (34.8%), however, indicating an improving trend. Based on these results, staff recommends additional assessment of instream sediment conditions, to evaluate whether beneficial uses are currently impaired as a result of excessive sediment.

Tule Lake/Lower Klamath Lake National Wildlife Refuge/ Lower Lost River – Dissolved Oxygen and Un-Ionized Ammonia

In the Lower Lost River and Tule Lake, dissolved oxygen data were collected in 1992-1995 and 1996-1998 (NCRWQCB, 1995 [Ref.#81]; NCRWQCB, 1996-1997 [Ref.#82]). These data indicate that DO concentrations are low even though the samples were taken during the daytime when higher diel DO levels are expected to occur. The available data, however, are insufficient to support a listing for numeric objective exceedance. In the 1992-1995 dataset, DO in the Lower Lost River and Tule Lake was less than the minimum objective of 5.0 mg/L six out of 48 times. The 1996 dataset showed six out of 56 samples did not meet the objective; the 1997 dataset showed 10 out of 75 samples did not meet the objective. The lowest value in the 1992 to 1995 dataset was 2.2 mg/L on the Lower Lost River at the Oregon border. The lowest value in the 1996 dataset was 2.1 mg/L in Tule Lake; the lowest value in the 1997 dataset was 3.2 mg/l in the J-Canal at stateline. Staff recommends continued monitoring of DO levels in Lower Lost River and Tule Lake.

California does not have a standard for un-ionized ammonia. US EPA criteria were used for assessment of available data collected in 1996-1997. The US EPA criteria vary depending on temperature, pH and sensitive species present; the criteria become stricter as pH and temperature increase (See the EPA 1999 Update to the Ammonia Ambient Water Quality Criteria). Using the US EPA criteria, and evaluating the worst-case pH and temperature conditions, the following water bodies could have exceeded the chronic criterion:

1. Klamath Straits Drain @ Stateline – Lower Klamath Lake National Wildlife Refuge
   1996 samples: Using the worst-case combination of 14 pH samples, 3 measured temperatures and 3 measured NH3 samples results, the chronic with early life stages

criterion was calculated, yielding a criterion of 0.114 mg/L. The maximum un-ionized ammonia concentration measured at that site was reported at 0.1277 mg/l.

1997 samples: Using the worst-case combination of 14 pH samples, 4 measured temperatures and 4 measured NH3 sample results, the chronic with early life stages criterion was calculated, yielding a criterion of 0.106 mg/L The maximum un-ionized ammonia concentration measured at that site was reported at 0.3544 mg/l.

2. Tule Lake @ Pump D (out)
   1996 samples: Using the worst-case combination of 14 pH samples, 3 temperature and NH3 samples, the chronic with early life stages criterion was calculated, yielding a criterion of 0.101 mg/L. The maximum un-ionized ammonia concentration at that site was reported at 0.1623 mg/L.

   1997 samples: Using the worst-case combination of 14 pH samples, 4 temperature and NH3 samples, the chronic with early life stages criterion was calculated, yielding a criterion of 0.111 mg/L The maximum un-ionized ammonia concentration at that site was reported at 0.1665 mg/L.

Based on the information available during the 303(d) List update period, there are not sufficient data to list these surface waters for un-ionized ammonia. These surface waters should, however, be prioritized for additional un-ionized ammonia testing, including pH and water temperature. Additional work is suggested to evaluate the toxicity of un-ionized ammonia and the protection of the beneficial uses of these waterbodies. In addition, the seasonal status of un-ionized ammonia concentrations should be examined.

No Change Recommendations

The rationale for the No Change Recommendations is presented in **Table 4**. The Redwood Creek sediment listing is discussed below.

Redwood Creek - Sediment

In response to the public solicitation for water quality information for the update to the 303(d) List, the Regional Water Board received two requests (Herman, 2001 [Ref.#27 and #129]; Bush, 2001 [Ref.#133]) to de-list Redwood Creek from the 303(d) List and two requests (Madej, 2001 [Ref.#25]; Hofstra, 2001 [Ref.#26]) for the continued listing of Redwood Creek for sediment impairment.

Redwood Creek was added to the 303(d) List in 1992. A draft Sediment TMDL was developed by the Regional Water Board staff, which was subsequently established as a final TMDL by US EPA in December 1998. The TMDL confirmed that Redwood Creek is impaired by sediment. To date the Regional Water Board staff has not finalized an Implementation Plan for the TMDL and the Regional Water Board has not yet adopted the TMDL. Given the conclusions presented in the TMDL, as well as a review of the information provided as part of this 303(d) List update, staff believes there is continued impairment or threat of impairment in Redwood Creek by sediment.

Provided below is a summary of the information submitted on Redwood Creek as part of the 303(d) List update. Given the volume of information submitted on Redwood Creek, a

single Reference # was assigned to the submittals. In addition, a database (NCRWQCB, 2001[Ref.#100]) was created to catalog all of the sources and content of the information submitted. A brief summary of the information presented is provided below, followed by staff's assessment of the conditions in Redwood Creek based on the available information.

- Submitted by Thomas M. Herman, representing Barnum Timber Company:

1) Letter to Matt St. John, NCRWQCB, requesting de-listing Redwood Creek.
2) *A Study in Change: Redwood Creek and Salmon* by Redwood Creek Landowners Association, Steve Mader and Ann Hovland, Technical Editors.
   -Includes summary fish, channel and precipitation data taken from other reports and a series of photos showing channel changes between 1902-1999.
3) Letter from Donald W. Chapman dated September 21, 2000.
   -Personal description of the status of Redwood Creek's fish habitat. Includes a table comparing chinook and steelhead yields per kilometer from different areas along the coast. Numerous references to other Redwood Creek studies.
4) A library of 479 sources of information related to conditions in Redwood Creek.
   - Staff has reviewed all of the references relative to Redwood Creek.
5) Reference lists to accompany library.
6) An electronic bibliography of the library contained in a database.
7) Summary Report on Salmon & Steelhead Outmigration, upper Redwood Creek, Humboldt County, California April 5-August 5, 2000, prepared by Michael Sparkman for Doug Parkinson and Associates.
   -Study designed to quantify the population of out-migrating juvenile salmonids in Redwood Creek. Data given for species and age of fish trapped. Population estimates shown graphically. This is a work in progress.
8) Microsoft Excel spreadsheet containing data from screw trap monitoring in Redwood Creek during 2000.
   -Electronic spreadsheets contain raw data from screw trap operations in 2000 and 2001.

- Submitted by Terrence D. Hofstra, Resource Management and Science Department Chief, Redwood National and State Parks:

1) Letter to Matt St. John, NCRWQCB, requesting continued listing of Redwood Creek.
2) Reversal of Suspended Sediment Trends Data.
   -Plots of annual peak flow and sediment yield. Tables showing annual water and sediment discharge data from two USGS gauging stations on Redwood Creek.
3) Redwood Creek Salmon Report Comments.
   -Four statements opposing conclusions from Redwood Creek Landowners Association report titled *A Study in Change: Redwood Creek and Salmon* with a specific example from the section about landslide processes in the watershed.
4) *Abstract of Baseline Suspended Sediment Characteristics and Juvenile Salmonids, North Coastal California* by Randy Klein and Bill Trush.
   -Study to show that suspended sediment concentration sampling is an effective monitoring method for examining negative impacts to juvenile salmonids.
5) *Suspended Sediment Concentrations and Fluxes in Redwood Creek Tributaries* by Randy Klein dated May 8, 2001
   -Discussion of suspended sediment concentration in the watershed through comparison of data from managed and unmanaged tributaries.
6) *Redwood Creek Long-Term Channel Stability Monitoring on Redwood Creek, 1995-1997 Progress Report* by Vicki Ozaki and Carrie Jones

-Cross-section plots included for 1973 to 1994 along with tables showing channel changes from year to year.

- Submitted by Mary Ann Madej, Ph.D., Research Geologist, U.S.G.S. Western Ecological Research Center

1) Letter to Matt St. John, NCRWQCB, requesting continued listing of Redwood Creek.
2) Data from an in-progress Master's thesis by Tera Curren involving a study of landslides in the Redwood Creek basin
   -Charts show numbers of landslides on mainstem and tributaries of Redwood Creek.
3) *Temporal and Spatial Variability in Thalweg Profiles of a Gravel-bed River* by Mary Ann Madej
   -Changes in channel topography in Redwood Creek analyzed using longitudinal thalweg profiles. Graphs showing variation in residual pool depth and thalweg profiles included for 1977-1997.
4) *Erosion and Sediment Delivery Following Removal of Forest Roads* by Mary Ann Madej
   -Analysis of sediment delivery after treatment of abandoned logging roads throughout watershed. Compared sediment runoff from different treatment methods.
5) Rebuttal and response to Rice (1999) paper from Mary Ann Madej
   -Discussion on the severity of the 1995-1997 floods and how roads have impacted erosion rates in the watershed.

Based on a review of the available information, staff recommends Redwood Creek remain on the 303(d) List. Staff has concluded that there is a continued impairment or threat of impairment of Redwood Creek by sediment.

Recent data on outmigrating salmon and steelhead populations in Redwood Creek are encouraging, particularly for chinook salmon (Sparkman, 2001 [Ref.#119]). Based on population estimates from a four-month rotary screw trap downstream migration study, populations of outmigrating 0+ chinook salmon and 0+ steelhead trout exceed populations measured in the Klamath River basin (Sparkman, 2001 [Ref.#119]). However, current populations of salmonids in Redwood Creek are far below historic levels (Van Kirk, 1994 [Ref.#120]). Further, no coho salmon were captured during the Sparkman (2001) study, and few coho were observed during salmon surveys conducted by staff of the Redwood National and State Park in 2000 and 2001 (Redwood National Park, 2001 [Ref.#123]). Based on channel gradient alone, coho salmon distribution within the Redwood Creek watershed should be greater than recent surveys show. In addition, based on summer steelhead dive surveys since 1981of an index reach (Lacks Creek to Tom McDonald Creek), the population of summer steelhead is declining in Redwood Creek (Redwood National Park, 1999 [Ref.#121]; Anderson, 1993 [Ref.#122]).

As discussed in the "Approach to Assessing Sediment Impairment" section, determination of sediment impairment is based on conditions on the stream bed (settleable material) and/or conditions in the water column (e.g. suspended sediment and/or turbidity). Conditions related to the stream bed and water column are reviewed here.

Extensive monitoring of long-term channel stability of Redwood Creek was initiated in 1973. Based on observations throughout the watershed, variation in channel bed

elevations was low and the percentage of the channel length occupied by riffles was high following a series of large storms from 1953 to 1975 (Madej, 1984 [Ref.#124]; Ozaki, V. and C. Jones, 1998 [Ref.#125]). Over the next 20 years the channel began to recover, exhibiting an increase in bed elevation variability and a decrease in the length of the channel occupied by riffles (Ozaki, V. and C. Jones, 1998 [Ref.#125]; Madej, 1999 [Ref.#126]. During this period, however, the mean stream bed particle size and D_{50s} at reference cross-sections throughout the watershed were smaller than the targets identified in the Sediment TMDL for Redwood Creek, and do not represent properly functioning conditions (NCRWQCB, 2001 [Ref.#135]; US EPA, 1998 [Ref.#127]). Further, following the January 1997 floods (a 12-year return interval flood) channel heterogeneity was reduced (Madej, 1999 [Ref.#126]). Madej (1999 [Ref.#126]; 2001 [Ref.#25]) concludes that this indicates that the sediment supply in Redwood Creek was still high enough in 1997 to cause filling of pools, a decrease in water depth, and a decrease in channel complexity. Based on this information, staff concludes that there is existing impairment and continuing threat to the beneficial uses of Redwood Creek associated with sediment in the channel, including threats to COLD, SPWN, MUN, REC-1 and REC-2.

In addition to impairment associated with conditions on the stream bed (settleable material), staff concludes there is impairment associated with suspended sediment. Based on sediment and flow monitoring during water year 1999, Klein (2001 [Ref.#128]) developed suspended sediment rating curves for two managed streams (Panther and Lacks Creeks) and two reference streams (Prairie and Little Lost Man Creeks) in the Redwood Creek watershed. Despite scatter of the rating points, the two managed streams exhibited higher suspended sediment concentrations at a given discharge compared with the reference streams (Klein, 2001 [Ref.#128]). Further, Klein (2001 [Ref.#128]) calculated the number of consecutive days that suspended sediment concentrations in the creeks exceeded 27 mg/L, a threshold level that affects the ability of juvenile salmonids to forage for food (Newcombe and Jensen, 1996 [Ref.#75]). The two managed streams exceeded the threshold level for 101 and 135 consecutive days, compared with the two reference streams which both exceeded the threshold level for 25 consecutive days.

Based on this information, staff concludes that the existing sediment load in the Redwood Creek watershed presents a continued threat to beneficial uses including COLD, SPWN, MUN, REC-1 and REC-2. The factors that led to the original listing of Redwood Creek are still present. Staff recommends Redwood Creek remain on the 303(d) List for sediment.

Table 1. Summary of Staff Recommendations

Waterbody	Proposed Action	Pollutant/Stressor(s)
Bodega HU		
Americano Creek	No Change	DO
Stemple Creek/ Estero de San Antonio	**Add to 303(d) List** No Change	Sediment DO
Russian River HU		
Santa Rosa Creek	**Add to 303(d) List** Watch List	Pathogens Cu, Cr, Zn
Green Valley Creek (tributary to the Russian River)	No Change – Already on 303(d) List for sediment No Change No Change No Change	Sediment DO Nutrients Temperature
Atascadero Creek (tributary to the Russian River)	No Change – Already on 303(d) List for sediment No Change No Change No Change	Sediment DO Nutrients Temperature
Laguna de Santa Rosa	**Add to 303(d) List** **Add to 303(d) List** Watch List	DO Nutrients Cu, Cr, Zn
Russian River	**Add to 303(d) List** Watch List	Temperature Diazinon
Russian River: • Dutch Bill Cr to Fife Cr • Healdsburg Memorial Beach	**Add to 303(d) List**	Pathogens
Lake Sonoma	Watch List	Mercury
Lake Mendocino	Watch List	Mercury
Mendocino Coast HU		
Gualala River (Excluding Little North Fork and Big Pepperwood)	**Add to 303(d) List**	Temperature
Big River (From the confluence with the North Fork Big River)	**Add to 303(d) List**	Temperature
Virgin Creek, Casper Creek, and Pudding Creek	Watch List	Pathogens
Ten Mile River (Excluding the Little North Fork)	**Add to 303(d) List**	Temperature
Greenwood Creek	Watch List Watch List	Sediment Temperature
Elk Creek Mallo Pass Creek Brush Creek Schooner Gulch	Watch List	Sediment

Alder Creek	Watch List Watch List	Sediment Temperature
Cottaneva Creek Hardy Creek Juan Creek Howard Creek DeHaven Creek Wages Creek	Watch List	Sediment
Usal Creek	Watch List	Sediment
Cape Mendocino HU		
Mattole River	No Change No Change	Sediment Temperature
Eel River HU		
Thatcher Creek	No Change No Change	Sediment Temperature
Upper Middle Fork Eel	No Change No Change	Sediment Temperature
Eureka Plain HU		
Humboldt Bay	Watch List Watch List	Sediment PCBs
Beith Creek/ Grotzman Creek	Watch List	Sediment
Jacoby Creek	**Add to 303(d) List**	Sediment
Liscomb Slough	No Change	Trash
Mad River Slough	Watch List	PCBs
Mad River HU		
Mad River	**Add to 303(d) List**	Temperature
Redwood Creek HU		
Redwood Creek	No Change **Add to 303(d) List**	Sediment **Temperature**
Smith River HU		
Lower N Fork Smith River	No Change – Not on 303(d) List	NA
Myrtle/Hardscrable	No Change – Not on 303(d) List	NA
Lower Klamath River HA		
Klamath River	Watch List	Sediment
Blue Creek	No Change No Change	Nutrients Temperature
Trinity River HAs		
East Fork Trinity River	Watch List	Mercury
Lower Trinity River	No Change	Sediment
North Fork Trinity River	No Change	Sediment
Stuart Creek	No Change	Sediment
Coffee Creek	No Change	Sediment
Salmon River HA		
Salmon River	No Change No Change	Sediment Nutrients
Upper S. Fork Salmon River	No Change No Change	Nutrients Temperature
North Fork Salmon River	No Change No Change	Nutrients Temperature

Wooley Creek	No Change No Change	Nutrients Temperature
Middle Klamath River HA		
Grider Creek	No Change No Change	Nutrients Temperature
Thompson Creek	No Change No Change	Nutrients Temperature
Clear Creek	No Change No Change	Nutrients Temperature
Shasta Valley HA		
Shasta River	Watch List Watch List	Sediment Nutrients
Lost River HA		
Tule Lake/ Lower Klamath Lake National Wildlife Refuge	**Add to 303(d) List**	pH
Tule Lake/ Lower Klamath Lake National Wildlife Refuge/ Lower Lost River	Watch List Watch List	DO Un-Ionized Ammonia

Table 2. Recommended Additions to 303(d) List

Waterbody	Issue of Concern	Recommendation	Reference(s)
Bodega HU			
Stemple Creek/ Estero de San Antonio	Sedimentation was inadvertently left off the 303(d) List as a stressor in a previous list update.	Add sediment as a stressor to Stemple Creek/ Estero de San Antonio on the 303(d) List.	60
Russian River HU			
Santa Rosa Creek	Threat to public health from high coliform, E. coli, and Enterococcus concentrations.	Add Santa Rosa Creek to 303(d) List for pathogens, due to public health concerns associated with elevated levels of indicator organisms.	63, 64, 66, 68
Laguna de Santa Rosa	Dissolved oxygen and biostimulatory substances objectives are not being met and are impairing beneficial uses.	Add Laguna de Santa Rosa to 303(d) List for impairment due to low dissolved oxygen and nutrients.	19, 20, 21, 65, 107, 118, 132
Russian River	Stream temperature objectives are not being met, causing impairment of the cold water fishery.	Add Russian River to the 303(d) List for impairment due to elevated temperatures.	29, 67, 102
Russian River: • Dutch Bill Cr to Fife Cr • Healdsburg Memorial Beach	Fecal coliform objectives are not being met in the specified reaches of the river, and may pose a threat to public health.	Add designated reaches of the Russian River to the 303(d) List for pathogens.	111, 112
Mendocino Coast HU			
Gualala River (Excluding the Little North Fork and Big Pepperwood Creek)	Elevated stream temperatures are impairing the cold water fishery.	Add Gualala River to the 303(d) List for impairment due to elevated temperatures.	69, 130, 134
Big River (From the confluence with the North Fork Big River)	Elevated stream temperatures are impairing the cold water fishery.	Add Big River to the 303(d) List for impairment due to elevated temperatures.	29, 70, 71, 102
Ten Mile River (Excluding the Little North Fork)	Elevated stream temperatures are impairing the cold water fishery.	Add Ten Mile River to the 303(d) List for impairment due to elevated temperatures.	15, 16, 70, 72, 73, 74, 102

Eureka Plain HU			
Jacoby Creek	Sedimentation and threat of sedimentation causing aquatic habitat impairment, loss of tidal wetland habitat, degradation of fishery, impaired irrigation water quality and domestic water supplies, and increased flooding.	Add Jacoby Creek to 303(d) List for threat or impairment due to sedimentation.	30, 31, 32, 33, 34, 35, 36, 75, 76, 77, 78
Mad River HU			
Mad River	Elevated stream temperatures are impairing the coho salmon fishery.	Add Mad River to the 303(d) List for impairment due to elevated temperatures.	79, 80, 171
Redwood Creek HU			
Redwood Creek	Elevated stream temperatures are impairing the cold water fishery.	Add Redwood Creek to the 303(d) List for impairment due to elevated temperatures.	136,137,138, 139
Lost River HA			
Tule Lake/ Lower Klamath Lake National Wildlife Refuge in California	Basin Plan objectives for pH are in exceedance, which contributes toward beneficial use impairment.	Add portions of Tule Lake and Lower Klamath Lake National Wildlife Refuge in California to the 303(d) List for impairment due to pH.	81, 82

Table 3. Watch List for 303(d) List

Waterbody	Issue of Concern	Recommendation	Reference(s)
Russian River HU			
Santa Rosa Creek, Laguna de Santa Rosa, Russian River	Diazinon has been detected in the Russian River at a level which may be detrimental to freshwater organisms.	Determine whether beneficial uses (WARM and COLD) are threatened due to diazinon. Conduct a pesticide runoff monitoring program within the Russian River watershed to evaluate potential threats to beneficial uses.	23, 24,28, 83
Laguna de Santa Rosa and Santa Rosa Creek	Copper, chromium, and zinc may be present at concentrations detrimental to beneficial uses and exceeding water quality objectives.	Regional Board staff should continue to review Laguna de Santa Rosa monitoring reports, City of Santa Rosa storm water permit monitoring, and Toxic Substances Monitoring Program results for chromium, copper and zinc concentrations.	28, 56, 57, 58, 59, 85
Lake Sonoma	Fish consumption: mercury levels in large mouth bass exceed the Median International Standard and US EPA fish tissue residue criterion for mercury.	Defer action until the Regional Board staff completes scheduled monitoring, as part of the Toxic Substances Monitoring Program, to support a Health Advisory investigation by the Office of Environmental Health and Hazard Assessment for mercury contamination of fish tissue.	58, 86, 87, 88, 89, 90
Lake Mendocino	Levels of mercury in large mouth bass sampled exceed the Median International Standard and US EPA fish tissue residue criterion for mercury.	Defer action until the Regional Board staff completes scheduled monitoring, as part of the Toxic Substances Monitoring Program, to support a Health Advisory investigation by the Office of Environmental Health and Hazard Assessment for mercury contamination of fish tissue.	86, 87, 88, 89, 90
Mendocino Coast HU			
Virgin Creek, Casper Creek, and Pudding Creek	Threat to public health associated with contact recreation (REC1) and commercial and sport fishing (COMM), due to potentially high pathogen levels.	Determine whether beneficial uses (REC1 and COMM) are threatened due to high pathogen levels originating in Fort Bragg area coastal streams. A monitoring program of coastal streams within the Fort Bragg area should be conducted to develop baseline bacteriological and viral water quality information.	4, 5, 6

Greenwood Creek	Threat of sedimentation causing aquatic habitat impairment and degradation of fishery, and impairment to cold water fishery due to elevated water temperatures.	Determine whether sedimentation and elevated temperature are impairing cold water fishery.	37, 41, 42, 43, 44, 45, 47, 48, 109, 110
Elk Creek Mallo Pass Creek Brush Creek Schooner Gulch	Sedimentation and threat of sedimentation causing aquatic habitat impairment and degradation of fishery.	Determine whether spawning and rearing habitat of cold water fisheries is impaired due to sedimentation.	41, 49, 50, 110
Alder Creek	Sedimentation and threat of sedimentation causing aquatic habitat impairment, degradation of fishery.	Determine whether spawning and rearing habitat of cold water fisheries is impaired due to sedimentation.	41, 110
Alder Creek	Elevated water temperatures causing impairment to cold water fishery.	Determine whether elevated temperatures are impairing cold water fishery.	41, 51, 92, 110
Cottaneva Creek Hardy Creek Juan Creek Howard Creek DeHaven Creek Wages Creek	Sedimentation and threat of sedimentation causing aquatic habitat impairment, degradation of fishery.	Determine whether spawning and rearing habitat of cold water fisheries is impaired due to sedimentation. Investigate historic presence of coho salmon in DeHaven and Wages Creeks.	41, 51, 92, 110
Usal Creek	Sedimentation and threat of sedimentation causing aquatic habitat impairment, degradation of fishery.	Determine whether spawning and rearing habitat of cold water fisheries is impaired due to sedimentation.	17, 51,53, 54, 55, 93
Eureka Plain HU			
Humboldt Bay	Sedimentation/siltation, threat of sedimentation/siltation causing loss of tidal wetland habitat.	Determine if objectives are being met and whether sedimentation/siltation is threatening beneficial uses.	33, 34
Humboldt Bay	Levels of dieldrin and Total PCBs in transplanted California mussels exceed the Maximum Tissue Residue Levels for enclosed estuaries and bays.	Regional Board staff should continue monitoring for Dieldrin and Total PCBs in transplanted California Mussels as part of the State Mussel Watch Program.	86, 94, 95
Mad River Slough	Levels of Total PCBs in transplanted California mussels exceed the Maximum Tissue Residue Levels for enclosed estuaries and bays.	Regional Board staff should continue monitoring for Total PCBs in transplanted California Mussels as part of the State Mussel Watch Program.	86, 94, 95

Beith Creek Grotzman Creek	Sedimentation and threat of sedimentation causing aquatic habitat impairment, degradation of fishery.	Determine if objectives are being met and whether sedimentation/siltation is threatening beneficial uses.	40
Lower Klamath River HA			
Klamath River	Sedimentation and threat of sedimentation causing aquatic habitat impairment, degradation of fishery.	Determine if objectives are being met and whether sedimentation/siltation is threatening beneficial uses in the mainstem Klamath and tributaries.	1, 8, 9, 96
Trinity River HA			
East Fork Trinity River	Toxicity of mercury from abandoned mines	Defer further action until the USGS completes a monitoring program to evaluate the impact of abandoned mines on federal lands in the Trinity River watershed.	97
Shasta Valley HA			
Shasta River	Beneficial uses are impaired due to instream sediment conditions and elevated nutrient concentrations.	Determine whether objectives are being met and beneficial uses are impaired due to elevated nutrient levels and instream sediment conditions.	1, 98, 99
Lost River HA			
Lower Lost River/ Tule Lake in California	DO objectives are not being met.	Determine whether DO objectives are being met and evaluate whether beneficial uses are impaired due to low DO concentrations	81, 82
Lower Lost River/ Tule Lake/ Lower Klamath Lake National Wildlife Refuge in California	EPA criterion for un-ionized ammonia are not being met, causing ammonia toxicity which threatens warm and cold water fishery.	Determine whether un-ionized ammonia criteria are being met.	81, 82

Table 4. No Change Recommendations

Reference #	Waterbody	Issue/Concern	Response/Action
Bodega HU			
1	Americano Creek	Dissolved Oxygen should be added as a pollutant causing impairment.	Based on Department of Fish and Game monitoring data from the Marin-Sonoma Counties Agricultural Runoff Investigation (Ref.#61), Americano Creek is meeting DO objectives.
1	Stemple Creek	Dissolved Oxygen should be added as a pollutant causing impairment.	Based on Department of Fish and Game monitoring data from the Marin-Sonoma Counties Agricultural Runoff Investigation (Ref.#61), Stemple Creek is meeting DO objectives.
Russian River HU			
2	Green Valley Creek	Sediment, DO, nutrient, and temperature impairment	Already listed for sediment as part of the Russian River watershed. Insufficient data to determine DO, nutrient, and temperature impairment.
2, 3	Atascadero	Sediment, DO, nutrient, and temperature impairment	Already listed for sediment as part of the Russian River watershed. Insufficient data to determine DO, nutrient, and temperature impairment.
46	NA	General comments pertaining to on-site wastewater treatment.	Comment noted.
Cape Mendocino HU			
11	Mattole River	De-list Mattole River	Sediment and temperature TMDLs are currently being developed for the Mattole River.

Eel River HU			
12	Thatcher Creek/ Upper Middle Fork Eel	De-list Thatcher Creek and Upper Middle Fork Eel based on USFS 'Reconnaissance Level Assessment for the National Forests of the Pacific Southwest Region" results, indicating waterbody is in "good condition".	There is insufficient information, based on that received within the information request period, to warrant de-listing. U.S. EPA is scheduled to complete sediment and temperature TMDLs for the Middle Fork Eel by 2003. Water quality objective attainment and beneficial use impairment of Thatcher Creek and Upper Middle Fork Eel River will be assessed as part of TMDL development efforts. If the water quality assessment determines that Thatcher Creek and Upper Middle Fork Eel are meeting water quality standards and that beneficial uses are being protected, then the Regional Board will recommend de-listing for these parameters at that time.
Eureka Plain HU			
39	Liscomb Slough	Illegal dumping of trash in Liscomb Slough affects water quality.	There is insufficient information to evaluate whether water quality objectives are exceeded or beneficial uses impaired.
Redwood Creek HU			
27, 129, 133	Redwood Creek	De-list Redwood Creek	See response in Discussion section.
25, 26	Redwood Creek	Keep Redwood Creek on 303(d) List.	See response in Discussion section.
Smith River HU			
12	Lower N Fork Smith River/ Myrtle/ Hardscrable	De-list Lower North Fork Smith River, Myrtle Creek, and Hardscrable Creek based on USFS 'Reconnaissance Level Assessment for the National Forests of the Pacific Southwest Region" results, indicating waterbody is in "good condition".	The Smith River is not on the 303(d) List.

Lower Klamath River HA			
12	Blue Creek	De-list Blue Creek based on USFS 'Reconnaissance Level Assessment for the National Forests of the Pacific Southwest Region" results, indicating waterbody is in "good condition".	There is insufficient information, based on that received within the information request period, to warrant de-listing. The Regional Water Board is scheduled to complete nutrient and temperature TMDLs for the mainstem Klamath River and tributaries by 2003. Water quality objective attainment and beneficial use impairment of Blue Creek will be assessed as part of TMDL development efforts. If the water quality assessment determines that Blue Creek is meeting water quality standards and that beneficial uses are being protected, then the Regional Board will recommend de-listing for these parameters at that time.
Trinity River HAs			
12	Lower Trinity River/North Fork Trinity River/ Stuart Creek/ Coffee Creek	De-list Lower Trinity River, North Fork Trinity River, Stuart and Coffee Creeks based on USFS 'Reconnaissance Level Assessment for the National Forests of the Pacific Southwest Region" results, indicating waterbody is in "good condition".	There is insufficient information, based on that received within the information request period, to warrant de-listing. U.S. EPA is scheduled to complete a sediment TMDL for the area tributary and including the Upper, Middle and Lower Trinity River by 2001.

Salmon River HA			
12	Upper S Fork Salmon River/ North Fork Salmon River/ Wooley Creek	De-list Upper South Fork Salmon River, North Fork Salmon River, and Wooley Creek based on USFS 'Reconnaissance Level Assessment for the National Forests of the Pacific Southwest Region" results, indicating waterbody is in "good condition".	There is insufficient information, based on that received within the information request period, to warrant de-listing. The Regional Water Board is scheduled to complete nutrient and temperature TMDLs for the Salmon River basin by 2004. Water quality objective attainment and beneficial use impairment of Upper South Fork Salmon River, North Fork Salmon River, and Wooley Creek will be assessed as part of TMDL development efforts. If the water quality assessment determines that these waterbodies are meeting water quality standards and that beneficial uses are being protected, then the Regional Board will recommend de-listing for these parameters at that time.
13	Salmon River	De-list the Salmon River for nutrients.	Nutrient and temperature listings for the mainstem Klamath River from the Oregon border to the Ocean include all areas tributary to the mainstem, including the Salmon River. The Regional Water Board is scheduled to complete nutrient and temperature TMDLs for the Salmon River basin by 2004. The Salmon River may not be nutrient impaired. Water quality objective attainment and beneficial use impairment of the Salmon River basin will be assessed as part of TMDL development efforts. If the water quality assessment determines that the Salmon River is meeting water quality standards and that beneficial uses are being protected, then the Regional Board will recommend de-listing for these parameters at that time.
13	Salmon River	Add Salmon River to 303(d) List due to sediment impairment.	There is insufficient information, based on readily available information, to determine whether beneficial uses are impaired due to instream sediment conditions.

Middle Klamath River HA			
12	Grider Creek/ Thompson Creek/ Clear Creek	De-list Grider Creek, Thompson Creek and Clear Creek based on USFS 'Reconnaissance Level Assessment for the National Forests of the Pacific Southwest Region" results, indicating waterbody is in "good condition".	There is insufficient information, based on that received within the information request period, to warrant de-listing. The Regional Water Board is scheduled to complete nutrient and temperature TMDLs for the mainstem Klamath River and tributaries by 2003. Water quality objective attainment and beneficial use impairment of Grider Creek, Thompson Creek and Clear Creek will be assessed as part of TMDL development efforts. If the water quality assessment determines that these waterbodies are meeting water quality standards and that beneficial uses are being protected, then the Regional Board will recommend de-listing for these parameters at that time.

Table 5. Recommended 303(d) List TMDL Priorities

Waterbody	Pollutant/Stressor	Priority	TMDL End Date
Bodega HU			
Stemple Creek/ Estero de San Antonio	Sediment DO	Low	1998
Russian River HU			
Santa Rosa Creek	Pathogens	High	2008
Laguna de Santa Rosa	DO Nutrients	Medium	2008
Russian River	Temperature Diazinon	Low	2012
Russian River: • Dutch Bill Cr to Fife Cr • Healdsburg Memorial Beach	Pathogens	High	2008
Mendocino Coast HU			
Gualala River	Temperature	Medium	2013
Big River	Temperature	Medium	2013
Ten Mile River	Temperature	Medium	2012
Eureka Plain HU			
Jacoby Creek	Sediment	Low	2014
Mad River HU			
Mad River	Temperature	Low	2014
Redwood Creek HU			
Redwood Creek	Temperature	Low	2015
Lost River HA			
Tule Lake/ Lower Klamath Lake National Wildlife Refuge	pH	Low	2015

REFERENCES

Reference	Last Name	First Name	Association	Date	Content
1	Elliott	Richard L.	Department of Fish and Game - Region 1	12/1/1997	Letter
2	Rosenblum	John	Rosenblum Environmental Engineering	12/11/1997	Letter
3	Brown	Margaret	private citizen	12/10/1997	Letter
4	Booth	Lyn	Environmental Health Department	5/14/2001	Letter
5	Cissne	John M.		4/13/2001	Letter w/ 2 attachments
6	Brown	Jon C.	Department of Parks and Mendocino	2/20/2001	Letter w/ photos and analytical results
7	Kelly	Scott	HJW & Associates, Inc.	12/11/1997	Letter
8	Quinn	Scott	Karuk Tribe of California	5/15/2001	Letter with 7 attachments, includes monitoring data
9	Koch	Donald B.	Department of Fish and Game - Region 1	8/31/1998	Letter
10	Tarvin	Jay	Humboldt Bay Municipal Water District	4/12/2001	Letter with monitoring data
11	Stansberry	Bob and Val		5/12/2001	Letter with photos
12	Boland	Margaret J.	Department of Agriculture	5/14/2001	Letter with 1 process paper
13	Brucker	Peter	Salmon River Restoration Council	5/14/2001	Letter
14	Conner	Kelly	Fruit Growers Supply Company	5/15/2001	Letter with 1 report
15	Rosen	Elyssa	Sierra Club	12/11/1997	Letter
16	Ambrose	Jon	Georgia-Pacific Corporation	12/11/1997	Letter
17	Gienger	Richard		5/15/2001	Letter with photos, and sediment data
18			Sotoyome Resource Conservation District		Russian River volunteer monitoring report
19	Adelman	Brenda	Russian River Watershed Protection Committee	5/15/2001	Letter with 3 referenced letters, 2 NCRWQCB summary reports, monitoring data, and 1 report.
20	Small	Lynn M.	City of Santa Rosa Utilities Department	5/14/2001	Letter with 4 yrs monitoring data
21	McEnhill	Don	Friends of the Russian River-RiverKeeper Project	5/15/2001	Letter with 1 report
22	McEnhill	Don	Friends of the Russian River-RiverKeeper Project	5/15/2001	Letter with monitoring data and 1 report

23	McEnhill	Don	Friends of the Russian River-RiverKeeper Project	5/15/2001	Letter with 3 reports
24	Starner	Keith	DPR	4/26/2001	Letter with monitoring data
25	Madej	Mary Ann	USDI, USGS, Western Ecological Research Center	5/11/2001	Letter with preliminary landslide data, and 3 reports
26	Hofstra	Terrence D.	USDI, CDPR, Redwood National and State Parks	5/15/2001	Letter with summary of data, and 3 reports
27	Herman	Thomas M.	Barnum & Herman	5/11/2001	Letter with library of 479 information sources, 3 additional reports and reference database
28	Oliveri	Mary Jane	City of Santa Rosa Public Works Department	5/15/2001	Letter with 4 sets of monitoring data
29	Slota	Dennis	Mendocino County Water Agency	5/15/2001	Letter with 4 yrs monitoring data
30	Finger	Elizabeth	Jacoby Creek Protection Association	5/14/2001	Letter with 3 yrs monitoring data, cross section surveys, 2 summary reports, photos, video, and 19 reports
31	Koken	Angela		5/10/2001	Letter
32	Schmidt	Erik		5/10/2001	Letter
33	Friedrichsen	Gary L.		5/10/2001	Letter
34	Wunner	Robert		5/10/2001	Letter
35	Blue	Gerry		5/10/2001	Letter
36	Dixon	Rex and Charlotte		5/10/2001	Letter
37	de Vall	Norman	Greenwood Watershed Association	12/11/1997	Letter
38	Fenton	Clark	Salmon Forever	5/14/2001	Letter with 3 yrs monitoring data for Humboldt Bay area water bodies
39	Halstead	Ted		4/7/2001	Letter with photos
40	Farhi	Seth		5/14/2001	Letter with monitoring data and 1 report
41	Pjerrou	Mary	Redwood Coast Watersheds Alliance	5/14/2001	Letter with summary letter/report, video, and 54 information sources
42	Shulz	Tom	Louisiana-Pacific	12/11/1997	Letter with 4 referenced letters and 1 summary report
43	Acker	Charles	Elk County Water District	12/5/1997	Letter with monitoring data
44	Euphrat	Fred	Forest, Soil & Water, Inc.	12/11/1997	Letter

45	Acker	Charles	Elk County Water District	5/10/2001	Letter with monitoring data, 2 memos, and 2 reports
46	Koch	Gene			Letter
109	Surfleet	Chris	Mendocino Redwood Company	10/1/2001	Letter with 5 reports and 1 memo.
110	Pjerrou	Mary	Redwood Coast Watershed Alliance	10/9/2001	Letter
117	Rische	Carol	Humboldt Bay Municipal Water District	10/29/2001	Letter
118	Roth	James	Merritt Smith Consulting	10/5/2001	Letter
129	Herman	Thomas	Barnum Timber Co.	10/5/2001	Letter
132	Brauner	Ed	City of Santa Rosa	10/8/2001	Letter
133	Bush	Bernard	Redwood Creek Landowners Assoc.	10/8/2001	Letter
134	Alden	Henry	Gualala Redwoods, Inc.	9/26/2001	Letter

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Reference #	Citation
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54	NCRWQCB. August 15, 2001. Gualala River Watershed Technical Support Document for the Total Maximum Daily Load for Sediment.
55	Campbell Timberland Management. Scudder Gulch Timber Harvest Plan. #1-01-172 MEN, Submitted 5/15/01.
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68	California Department of Health Services. July 24, 2001. Draft Guidance for Fresh Water Beaches.
69	NCRWQCB. August 15, 2001. Gualala River Watershed Technical Support Document for the Total Maximum Daily Load for Sediment.
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72	Hawthorne Timber Co. North Side Smith THP No. 1-01-206 MEN.
73	Georgia Pacific West, Inc. So. Fork Ten Mile River THP No. 1-99-167 MEN.
74	Campbell Timberland Management, LLC. Gulch 11/South Fork Ten Mile River THP No. 1-00-138 MEN.
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