[Add a new sub-section to the Water Quality Control Plan for the North Coast Region implementation chapter (Chapter 4) with the following Action Plan for the Shasta River. This section will be added after the "Action Plan for the Scott River Watershed Sediment and Temperature TMDL." In addition to adding the following language, several editorial revisions will be made, including appropriate changes to the Title Page, Table of Contents, Summary of Basin Plan Amendments (Appendix 1), page numbers, table and figure numbers, footnote numbers, and headers and footers to reflect the new language. The final locations of tables and figures in relation to the text may also be changed to accommodate the existing formatting of the Basin Plan.]

ACTION PLAN FOR THE SHASTA RIVER WATERSHED TEMPERATURE AND DISSOLVED OXYGEN TOTAL MAXIMUM DAILY LOADS[1]

The Shasta River watershed (CalWater Hydrologic Area 105.50), which includes all tributaries and Lake Shastina, comprises approximately 508,734 acres (795 mi^2) in Siskiyou County. The Shasta River is tributary to the Klamath River. This *Action Plan for the Shasta River Temperature and Dissolved Oxygen Total Maximum Daily Loads*, hereinafter known as the Shasta River TMDL Action Plan, includes temperature and dissolved oxygen total maximum daily loads (TMDLs) and describes the implementation actions necessary to achieve the TMDLs and attain water quality standards in the Shasta River watershed. The goal of the Shasta River TMDL Action Plan is to achieve the TMDLs, and thereby achieve dissolved oxygen and temperature related water quality standards, including the protection of the beneficial uses of water in the Shasta River watershed.

The Shasta River TMDL Action Plan sets out the loads and conditions to be considered and incorporated into regulatory and non-regulatory actions in the Shasta River watershed. The Shasta River TMDL Action Plan is not directly and independently enforceable, except as incorporated into appropriate permitting or enforcement orders.

A glossary defining key terms (**bolded first time used**) is located at Part IX of this Action Plan.

I. Problem Statement

The Shasta River watershed was listed as impaired for organic enrichment/dissolved oxygen in 1992, and as impaired for temperature in 1994, pursuant to Section 303(d) of the Clean Water Act. These listings were confirmed in the TMDL analysis. Dissolved oxygen concentrations are regularly too low to comply with the Basin Plan dissolved oxygen objectives. Water temperature conditions regularly exceed temperature thresholds protective of **salmonids**.

Low dissolved oxygen concentrations and elevated water temperatures in the Shasta River, its tributaries, and Lake Shastina have resulted in degraded water quality conditions that do not meet applicable water quality objectives and that impair designated beneficial uses. The designated beneficial uses that are not fully supported include: cold freshwater habitat (COLD); rare, threatened, and endangered species (RARE); migration of aquatic organisms (MIGR); and spawning, reproduction, and/or early development of fish (SPWN), commercial and sport fishing (COMM); and contact and non-contact water recreation (REC-1 and REC-2). The designated beneficial uses associated with the cold freshwater salmonid fishery (COMM, COLD, RARE, MIGR, SPWN) are the designated beneficial uses most sensitive to the dissolved oxygen and water temperature impairments. Important species in the Shasta River watershed include coho and Chinook salmon, trout, and lamprey. These, as well as green sturgeon, are also significant species in the Klamath River.

The Klamath River, to which the Shasta River is a major tributary, is also listed as impaired for low dissolved oxygen, high water temperature, and high nutrient levels. The Klamath River has additional beneficial uses that are not designated for the Shasta River that may be adversely affected by inputs from the Shasta River. These beneficial uses include the Native American cultural use (CUL) that supports cultural and traditional rights of indigenous people, such as ceremonial uses, and the subsistence fishing use (FISH).

[1] Adopted by the North Coast Regional Water Quality Control Board on [insert date]. Adopted by the State Water Resources Control Board on [insert date]. Approved by the State Office of Administrative Law on [insert date]. Approved by the United States Environmental Protection Agency on [insert date].

II. Watershed Restoration Efforts

Throughout the Shasta River watershed, many individuals, groups, and agencies have been working to enhance and restore fish habitat and water quality. These groups include, but are not limited to, the Shasta Valley Resources Conservation District, the Shasta River Coordinated Resources Management and Planning Committee, private timber companies, the Natural Resource Conservation Service, Siskiyou County and the Five Counties Salmonid Conservation Program, the California Department of Fish and Game, the California Department of Water Resources, the United States Forest Service, and the Klamath River Basin Fisheries Task Force. The past and present efforts of these stakeholders have improved water quality conditions in the Shasta River and its tributaries.

III. Temperature

A. Shasta River Temperature Source Analysis

The Shasta River temperature source analysis identifies the sources (or factors) that affect the temperature of the Shasta River watershed. Five primary factors have been identified as affecting stream temperatures in the Shasta River watershed. Human activities have affected, or have a potential to affect, each of these factors. The factors include:

- Reduced stream shade resulting from agricultural practices including grazing and livestock activities;
- **Tailwater return flows**;
- Flow modification and diversion;
- spring inflow; and
- Lake Shastina and minor channel impoundments.

In addition, microclimate alterations resulting from near-stream vegetation removal may increase temperatures, where microclimates exist. Changes in channel geometry from natural conditions can also negatively affect water temperatures. These factors have not been quantified for the Shasta River temperature TMDL.

B. Shasta River Temperature TMDL

The “loading capacity” refers to the total loading of a pollutant that a water body can assimilate and still meet water quality objectives and protect beneficial uses. For the temperature TMDL the water quality objective of concern is the temperature objective, which prohibits the alteration of the natural receiving water temperature unless such alteration does not adversely affect beneficial uses. The loading capacity provides a reference for calculating the amount of pollutant load reduction needed to bring a water body into compliance with standards. The starting point for the load allocation analysis is the equation that describes the Total Maximum Daily Load or loading capacity:

$$\text{TMDL} = \text{Loading Capacity} = \Sigma\text{WLAs} + \Sigma\text{LAs} + \text{Natural Background}$$

where Σ = the sum, WLAs = waste load allocations, and LAs = load allocations. Waste load allocations are contributions of a pollutant from point sources, while load allocations are contributions from management-related non-point sources. There are no point source heat loads in the Shasta River watershed, and therefore no waste load allocations apply.

The Shasta River watershed temperature TMDL loading capacity is equal to the **potential percent solar radiation transmittance** for the mainstem Shasta River below Dwinnell Dam, **adjusted potential effective shade** for the Shasta River above Dwinnell Dam and on tributaries, no net increase in receiving water temperature from tailwater return flows, and a flow regime that results in reductions in maximum daily temperature of 1.5^{o}C, 1.2^{o}C, and 2.1^{o}C for compliance points at river miles (RM) 24.1, 15.5, and 5.6, respectively.

The TMDL equation is:

TMDL = Loading Capacity =
Potential Percent Solar Radiation Transmittance of the Shasta River
+ Adjusted Potential Effective Shade of the Tributaries
+ No Net Increase in Temperature from Tailwater Return Flows
+ Flow Increases that Achieved Specific Temperature Reductions at Compliance Locations.

C. Shasta River Temperature Load Allocations

In accordance with the Clean Water Act, the Shasta River temperature TMDL is allocated to sources of elevated water temperature in the watershed. As there are no known point source heat loads to the Shasta River watershed, the TMDL is allocated among the non-point source heat loads in the watershed. The non-point sources include (1) solar heat load (i.e., sunlight) at streamside (riparian) locations in the watershed, (2) heat load from tailwater return flows, and (3) reduced assimilative capacity from surface water flow reductions.

In order to quantify the part of the TMDL focused on solar heat loads that arise from changes in streamside vegetation, and to be able to compare it to current conditions, two surrogate measures are used: (1) potential percent solar radiation transmittance at locations along the mainstem Shasta River below Dwinnell Dam, and (2) adjusted potential effective shade at locations upstream of Dwinnell Dam and along tributary streams (see Glossary). Landowners and operators in the mainstem Shasta River below Dwinnell Dam are allocated loads equal to potential percent solar radiation transmittance, as tabulated in Table 1 and depicted in Figure 1. Landowners and operators on the Shasta River above Dwinnell Dam and on tributaries are allocated loads equal to adjusted potential effective shade, which is equal to 90% of site potential shade, to allow for natural riparian disturbances such as floods, wind throw, disease, landslides, and fire.

The load allocation for tailwater return flow sources within the Shasta River watershed is a zero net increase in receiving water temperature.

The load allocation for flow is reductions in the maximum daily stream temperatures of 1.5°C, 1.2°C, and 2.1°C from baseline at RM 24.1, RM 15.5, and RM 5.6, the temperature compliance locations for the TMDL.

Table 1. Solar heat load allocations for the mainstem Shasta River, expressed as the potential percent solar radiation transmittance by river reach.

River Reach	Upstream River Mile	Downstream River Mile	Potential Reach Average Percent Transmittance[1]
Dwinnell Dam to Riverside Road	40.6	39.9	30
Riverside Road to u/s of A12	39.9	28.3	50
U/S of A12 to near DeSoza Lane	28.3	22.0	85
Near DeSoza Lane to u/s of Montague-Grenada Road	22.0	16.1	30
Near Montague-Grenada Road	16.1	14.6	10
D/S Montague-Grenada Road to Hwy 263	14.6	7.3	30
Hwy 263 to mouth	7.3	0	30 to 50[2]

[1] Daylight-hour average percent transmittance for given reach.
[2] Alternates between 30 and 50% every 10 percent of reach length.

Table 2 summarizes the temperature load allocations for the Shasta River watershed.

Figure 1: Existing (baseline) and potential solar radiation transmittance for the left bank (A) and right bank (B) of the Shasta River

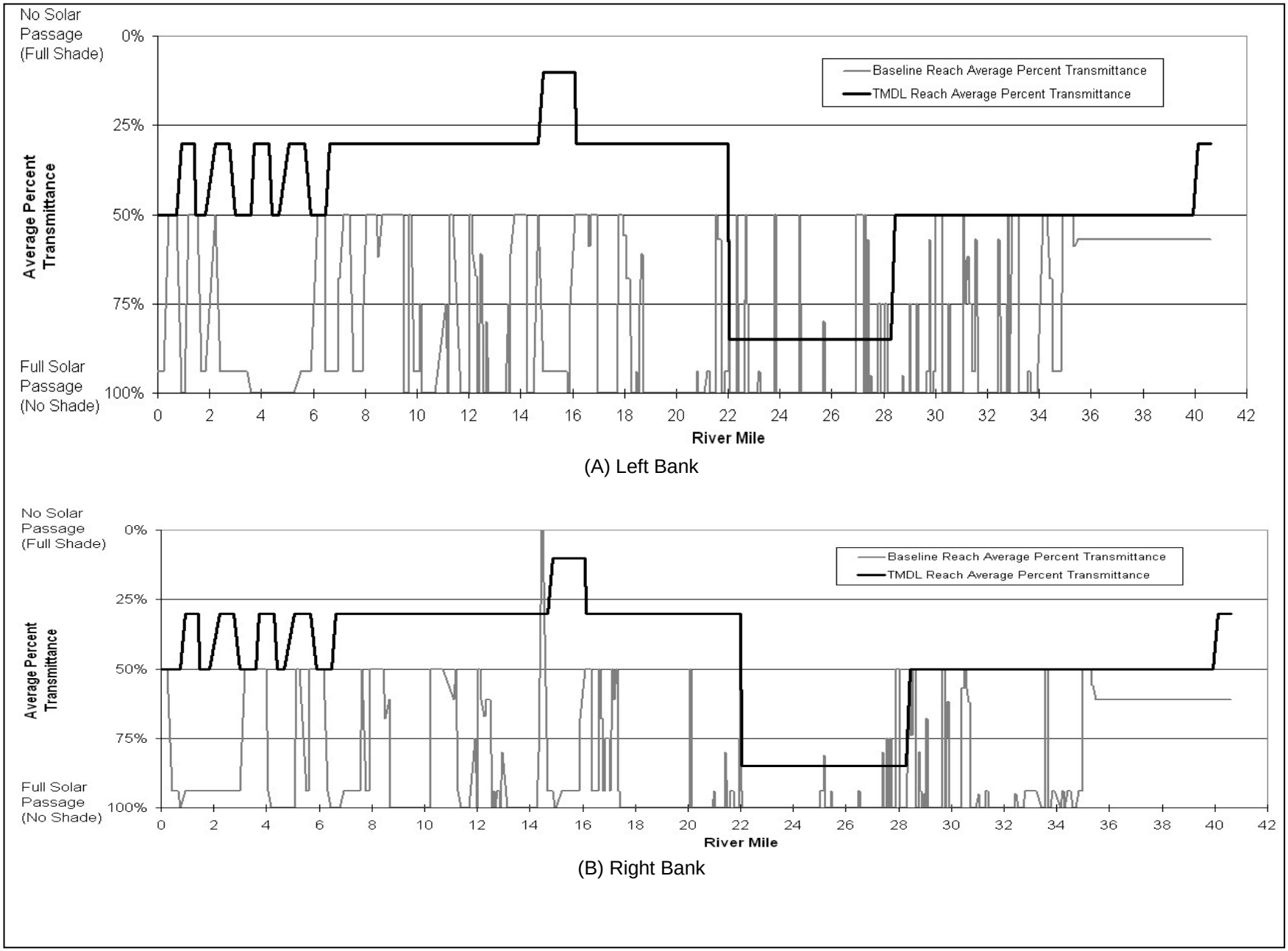

Table 2: Shasta River watershed temperature load allocations

Source	Allocation
Change in Riparian Vegetation	***Shasta River below Dwinnell Dam***: Reach average potential solar radiation transmittance, as presented in Table 1 and Figure 2. ***Shasta River above Dwinnell Dam and Tributaries***: Adjusted potential effective shade = 90% of site potential effective shade.
Irrigation Return Flow	No net increase in receiving water temperature.
Surface Water Flow	Reductions in the maximum daily stream temperatures of 1.5°C, 1.2°C, and 2.1°C from baseline at RM 24.1, RM 15.5, and RM 5.6

D. Shasta River Temperature Margin of Safety, Seasonal Variations, and Critical Conditions

The temperature TMDL includes an implicit margin of safety, based on conservative assumptions and uncertainties. The **water quality compliance model scenario** incorporated temperature reductions from Big Springs Creek and Parks Creek to account for improvements associated with riparian shade and tailwater management, but did not incorporate temperature reductions from Yreka Creek and other small tributaries to the Shasta River, and provides a margin of safety. Topographic shade was not considered in the temperature model and is likely a factor in the Shasta canyon, and provides a margin of safety. Some improvements in stream temperature that may result from reduced **sediment** inputs are not quantified. Reduced sediment loads could lead to increased frequency and depth of pools, independent of changes in solar radiation input. These changes tend to result in lower stream temperatures overall and increase the amount of lower temperature pool habitat. These expected changes are not directly accounted for in the TMDL. Finally, the effects of changes to streamside riparian areas toward mature trees will tend to create microclimates that will lead to improvements in stream temperatures. These effects were not accounted for in the temperature analysis and provide a margin of safety.

To account for annual and seasonal variability, the Shasta River temperature TMDL analysis evaluated temperatures and thermal processes from late-spring through mid-fall, considered the most critical time period for the most sensitive beneficial uses. The critical period, defined as May 15 to October 15, accounts for seasonal variation and provides an implicit margin of safety because during this period the air temperature is above average, the flow is below average, and the most sensitive beneficial uses – SPWN and COLD – are present. Sensitive life stages exist in Shasta River watershed throughout the year, but summer water temperatures represent the most critical conditions with respect to temperature and the most sensitive beneficial uses.

IV. Dissolved Oxygen

A. Shasta River Dissolved Oxygen Source Analysis

Dissolved oxygen levels in surface waters are controlled by a number of interacting processes including: photosynthesis, respiration, **carbonaceous deoxygenation**, **nitrogenous deoxygenation** and **nitrification**, **reaeration**, **sediment oxygen demand**, water temperature, salinity, flow, and atmospheric pressure. The primary processes affecting dissolved oxygen concentrations in the Shasta River watershed are photosynthesis and respiration of aquatic plants, nitrogenous deoxygenation (termed **nitrogenous biochemical oxygen demand** or NBOD), and sediment oxygen demand (SOD). The following anthropogenic sources or factors, in no special order, adversely affect dissolved oxygen conditions in the Shasta River:

- Tailwater return flows;
- City of Yreka nonpoint and wastewater infiltration sources;
- Lake Shastina and minor impoundments;
- Agricultural practices including grazing and livestock activities that reduce riparian shade and deliver oxygen consuming materials to surface waters; and
- Flow modification and diversion.

B. Shasta River Dissolved Oxygen TMDL

The dissolved oxygen "loading capacity" of the Shasta River is the total net daily oxygen demand that results in attainment of the dissolved oxygen objectives. For the dissolved oxygen TMDL the water quality objective of concern is the minimum dissolved oxygen objective of 7.0 mg/L for the Shasta River. There are no known point sources of oxygen-demanding constituents to the Shasta River and tributaries. Each of the components that exert an oxygen demand on the Shasta River is attributed to nonpoint sources, and includes respiration of aquatic plants, SOD, and NBOD.

The dissolved oxygen loading capacity of the Shasta River is 12,353 pounds of oxygen demand per day, and is expressed as the following Shasta River dissolved oxygen TMDL equation:

TMDL = Loading Capacity = 12,353 lbs O_2/day

C. Shasta River Dissolved Oxygen Load Allocations

In accordance with the Clean Water Act, the Shasta River dissolved oxygen TMDL is allocated to the sources of oxygen demand in the watershed. There are no known point sources of oxygen-demanding constituents in the Shasta River watershed, and therefore the waste load allocation is set to zero. Therefore, the TMDL includes oxygen demand from natural and non-point anthropogenic sources. The load allocations are assigned to reaches of the Shasta River as identified in Table 3, and account for the total net daily oxygen demand for the designated river reaches. Responsibility for meeting these river reach allocations is assigned to the landowners whose operations contribute to water quality conditions within the specified reaches. In addition to these river reach load allocations, allocations are applied to several river inputs that require NBOD reductions in order to achieve water quality compliance, including Dwinnell Dam outflow, Yreka Creek and tailwater return flow. These allocations are assigned as NBOD concentrations of 0.91 mg/L for both Dwinnell Dam outflow and Yreka Creek, and 0.85 mg/L for all tailwater return flow.

Meeting the dissolved oxygen TMDL and load allocations requires:

- Fifty percent reduction in respiration rates of instream aquatic plants;
- Fifty percent reduction in SOD rates behind minor impoundments;
- Reduced NBOD input concentrations; and
- Increased dedicated cold water instream surface water flow.

D. Shasta River Dissolved Oxygen Margin of Safety, Seasonal Variations, and Critical Conditions

The TMDL includes an implicit margin of safety to account for uncertainties in the analysis and because conservative assumptions are used in the TMDL analysis. The water quality compliance model scenario, which is the basis for the dissolved oxygen TMDL, includes a 50% reduction of sediment oxygen demand only at locations behind minor impoundments in the Shasta River. Fine sediment and organic material load reductions from tailwater return flows that can be achieved via controls targeting NBOD reductions would result in reductions in sediment oxygen demand in the entire river, not just behind impoundments. This represents a margin of safety. In addition, the water quality compliance model scenario does not include **biochemical oxygen demand** (CBOD) concentration reductions. Controls targeting NBOD reductions from tailwater return flows, Dwinnell Dam outflow, and Yreka Creek would result in reductions in CBOD concentrations, and provide a margin of safety.

The dissolved oxygen analysis was conducted for the period from late- spring through mid-fall. This critical period, defined as May 15 to October 15, accounts for seasonal variation and provides an implicit margin of safety, because during this period the air temperature is above average, the flow is below average, and the most sensitive beneficial uses – SPWN and COLD – are present. Sensitive life stages exist in the Shasta River watershed throughout the year, but summer conditions represent the most critical conditions with respect to dissolved oxygen. This critical period also corresponds to the time of greatest photoperiod and highest water temperature, both of which contribute to low dissolved oxygen concentrations. To account for the possibility that excursions below the TMDL may occur during periods of time other than the critical period, the TMDL is established as a year-round load.

Table 3: Shasta River TMDL river reach load allocations and total oxygen demand reductions needed for water quality compliance

REACH	Reach Length (mi)	Hourly Demand Existing (Baseline) Conditions (lbs/hr)	Hourly Demand Water Quality Compliance Conditions (lbs/hr)	Reduction In Oxygen Demand Needed To Achieve Water Quality Compliance	
				(lbs/hr)	%
Dwinnell Reservoir - Riverside Drive	0.7	(12)	(8)	4	30%
Riverside Drive - Parks Creek	5.0	(72)	(40)	32	44%
Parks Creek - Big Springs Creek	1.3	(33)	(21)	13	38%
Big Springs Creek - Highway A-12	9.6	(331)	(217)	114	35%
Highway A-12 - Shasta River @ Freeman Lane	5.0	(147)	(93)	54	37%
Shasta River @ Freeman Lane - DWR Weir	3.6	(73)	(39)	33	46%
DWR Weir - Yreka-Ager Road	4.4	(62)	(31)	31	50%
Yreka-Ager Road - Anderson Grade Road	3.1	(52)	(27)	26	49%
Anderson Grade Road - Mouth	8.1	(77)	(39)	38	49%

REACH	Reach Length (mi)	24 Hour Demand Existing (Baseline) Conditions (lbs/day)	24 Hour Demand Water Quality Compliance Conditions (lbs/day)	Reduction In Oxygen Demand Needed To Achieve Water Quality Compliance	
				(lbs/day)	%
Dwinnell Reservoir - Riverside Drive	0.7	(285)	(198)	87	30%
Riverside Drive - Parks Creek	5.0	(1,722)	(957)	765	44%
Parks Creek - Big Springs Creek	1.3	(797)	(494)	304	38%
Big Springs Creek - Highway A-12	9.6	(7,937)	(5,197)	2,741	35%
Highway A-12 - Shasta River @ Freeman Lane	5.0	(3,529)	(2,226)	1,303	37%
Shasta River @ Freeman Lane - DWR Weir	3.6	(1,749)	(947)	803	46%
DWR Weir - Yreka-Ager Road	4.4	(1,492)	(749)	743	50%
Yreka-Ager Road - Anderson Grade Road	3.1	(1,253)	(637)	616	49%
Anderson Grade Road - Mouth	8.1	(1,857)	(948)	909	49%

V. Implementation

Specific implementation actions that the Regional Water Board and other responsible parties shall pursue to achieve the TMDLs and meet the dissolved oxygen and temperature related water quality standards in the Shasta River and tributaries are described in Table 4. Table 4 is organized by source or land use activity, and responsible party(ies) considered appropriate to implement TMDL actions. Responsible parties may find that more than one implementation action is applicable to their circumstances. Action items are fully independent from each other and require 100% implementation within each Source or Land Use category. The implementation actions are designed to encourage and build upon on-going, proactive restoration and enhancement efforts in the watershed. Additionally, the implementation actions described in Table 4 are necessary to comply with the California's Nonpoint Source Pollution Control Program (NPS Policy), and include the five required key elements as described in the NPS Policy.[2]

The Regional Water Board hereby waives the requirement to file a Report of Waste Discharge (RWD) and obtain Waste Discharge Requirements (WDR), pursuant to Water Code section 13269, for discharges addressed by this Action Plan for dischargers that choose to participate in the on-going collaborative programs and implement recommended measures as applicable, as described in Table 4. Should a discharger choose not to participate, or if the Regional Water Board's Executive Officer determines additional measures are necessary and provides the discharger with written notice to that effect, the discharger must submit a Report of Waste Discharge (RWD) and filing fee to the Regional Water Board immediately or in accordance with the written notice.

If the implementation actions identified in Table 4 fail to be implemented by the responsible party or if the implementation actions prove to be inadequate the Regional Water Board shall take additional permitting and/or enforcement actions, as necessary. The State and Regional Water Board shall require compliance with the conditions pursuant to which the waiver is granted. This conditional waiver shall not apply to any discharges for which a WDR, waiver, or prohibition is issued under a separate action of the Board. This conditional waiver expires upon Regional Water Board adoption of a superseding regulatory action after the evaluation period specified below for each source category, or after five years, whichever occurs first. This waiver is conditional and may be terminated at any time by the State or Regional Water Board.

Table 4: Shasta River Dissolved Oxygen and Temperature TMDL Implementation Actions

Source or Land Use Activity	Responsible Parties	Actions to Address Dissolved Oxygen and Water Temperature Impairment
Range and Riparian Land Management	• Parties Conducting Grazing Activities • Landowners and managers owning and operating property adjacent to the Shasta River and its tributaries	**Landowner/User Actions:** Landowners should employ land stewardship practices and activities that minimize, control, and preferably prevent discharges of fine sediment, nutrients and other oxygen consuming materials from affecting waters of the Shasta River and tributaries. Landowners should also employ land stewardship practices and activities that minimize, control, and preferably prevent elevated solar radiation loads from affecting waters of the Shasta River and its **Class I and II tributaries**. Those that oversee and manage grazing and range land activities in the Shasta River watershed should implement the applicable management measures for agriculture and grazing from the following sources: • *Policy for the Implementation and Enforcement of the Nonpoint Source Pollution Control Program* (NPS Policy) (SWRCB,

[2] The *Policy for the Implementation and Enforcement of the Nonpoint Source Pollution Control Program* (NPS Policy).

Table 4: Shasta River Dissolved Oxygen and Temperature TMDL Implementation Actions

Source or Land Use Activity	Responsible Parties	Actions to Address Dissolved Oxygen and Water Temperature Impairment
Range and Riparian Land Management (cont.)		2004 or as amended). • *Shasta Watershed Restoration Plan* (November 1997). • *Shasta Valley Resource Conservation District Master Incidental Take Permit* (ITP) *Application* (Shasta RCD 2005). • *Recovery Strategy for California Coho Salmon* (Coho Recovery Strategy) (CDFG 2004). See Appendix A of this Action Plan for examples of some of these applicable measures. Landowners may need to develop and implement management measures in addition to those specified above to address site-specific conditions. This may include determining appropriate riparian widths for tree planting activities such that the appropriate width buffer is created to ensure effective stream shading and oxygen consuming material discharge elimination. Landowners shall submit annually to the Regional Water Board a written summary of all range and riparian management actions taken to achieve compliance with water quality standards, the TMDLs, and the NPS Policy, either individually or through the Shasta Valley RCD and its CRMP or through the CDFG coho ITP.
	• Shasta Valley Resource Conservation District (Shasta Valley RCD) • Shasta Coordinated Resource Management and Planning Committee (Shasta CRMP)	**RCD Actions:** The Shasta Valley RCD and its CRMP should: • Assist landowners in developing and implementing management practices that minimize, control and preferably prevent discharges of fine sediment, nutrients and other oxygen consuming materials, as well as elevated solar radiation loads from affecting waters of the Shasta River and tributaries. • Assist landowners in developing and implementing a monitoring program to evaluate and document implementation and effectiveness of the range and riparian management actions taken by the landowner.
	• California Department of Fish and Game (CDFG)	**State Actions:** CDFG will: • Assist landowners in developing and implementing management practices that minimize, control, and, preferably prevent discharges of fine sediment, nutrients and other oxygen consuming materials, as well as elevated solar radiation loads from affecting waters of the Shasta River and tributaries.

Table 4: Shasta River Dissolved Oxygen and Temperature TMDL Implementation Actions

Source or Land Use Activity	Responsible Parties	Actions to Address Dissolved Oxygen and Water Temperature Impairment
Range and Riparian Land Management (cont.)	• Regional Water Board	• Administer the Coho Recovery Strategy and the ITP (when approved). The Regional Water Board will: • Work cooperatively with the Shasta Valley RCD and its CRMP to: 1. Provide technical support and information to individuals, landowners, and community members in the Shasta River watershed, 2. Coordinate monitoring, educational and outreach efforts, and 3. Develop a monitoring program to evaluate and document implementation and effectiveness of the range and riparian management actions taken by the landowners. • Should efforts fail to be implemented or effective, the Regional Water Board's Executive Officer shall require, on a site specific as-needed basis, the appropriate responsible parties to develop, submit, and implement a ranch management plan designed to prevent discharges of fine sediment, nutrients and other oxygen consuming materials, as well as elevated solar radiation loads from affecting waters of the Shasta River and tributaries. • The ranch management plan shall describe in detail: 1. Locations discharging and/or with the potential to discharge nutrients and other oxygen consuming materials, and elevated solar radiation loads to watercourses which are caused by livestock grazing or related activities. 2. How and when identified sites are to be controlled and monitored, and management practices that will be implemented to prevent and reduce future discharges of nutrient and other oxygen consuming materials, and elevated solar radiation loads to the Shasta River and its tributaries. Group and/or individual ranch management plans shall be implemented upon review, comment, and approval by Regional Water Board staff and their Executive Officer for compliance with water quality standards, the TMDLs, and the NPS Policy. • In addition, the Regional Water Board shall address the removal and suppression of vegetation that provides shade to a water body through development of a Stream and Wetland System Protection Policy. This will be a comprehensive, region-wide riparian policy that will address the importance of shade on instream water temperatures and will potentially propose riparian setbacks and buffer widths. The Policy will likely propose new rules and regulations, and will therefore

Table 4: Shasta River Dissolved Oxygen and Temperature TMDL Implementation Actions

Source or Land Use Activity	Responsible Parties	Actions to Address Dissolved Oxygen and Water Temperature Impairment
Range and Riparian Land Management (cont.)	Regional Water Board (cont.)	take the form of an amendment to the Basin Plan. Other actions under this section may be modified for consistency with this policy, once adopted. With funding already available through a grant from the U.S. EPA, Regional Water Board staff are scheduled to develop this Policy for Regional Water Board consideration and adoption by the end of 2007. • Within two years of EPA approval of the TMDL Action Plan, the Regional Water Board's Executive Officer shall report to the Regional Water Board on the status of the preparation and development of appropriate permitting actions. • The Regional Water Board shall take appropriate permitting actions as necessary to address the removal and suppression of vegetation that provides shade to a water body in the Shasta River watershed. Such actions may include, but are not limited to, prohibitions, waste discharge requirements (WDRs) or waivers of WDRs for grazing and rangeland activities, farming activities near water bodies, stream bank stabilization activities, and other land uses that may remove and/or suppress vegetation that provides shade to a water body. Should prohibitions, waivers or WDRs be developed, they may apply to the entire North Coast Region or just to the Shasta River watershed. • Within ten years of EPA approval of the TMDL, all identified discharges associated with riparian land use activities shall be in compliance with water quality standards, the TMDLs, and the NPS Policy.
Tailwater Return Flows	• Irrigators	**Landowner Actions:** Those that oversee and manage tailwater discharges from irrigated lands in the Shasta River watershed, which may include landowners, lessees, and land managers (collectively referred to as irrigators), should employ land stewardship and irrigation management practices and activities that minimize, control, and preferably prevent discharges of fine sediment, nutrients and other oxygen consuming materials, and elevated water temperatures from affecting waters of the Shasta River and its tributaries. Irrigators should implement the applicable management measures for tailwater return flows from the following sources: • *Policy for the Implementation and Enforcement of the Nonpoint Source Pollution Control Program* (NPS Policy) (SWRCB 2004 or as amended). • *Shasta Watershed Restoration Plan* (November 1997). • *Shasta Valley Resource Conservation District Master Incidental Take Permit* (ITP) *Application* (Shasta RCD 2005). • *Recovery Strategy for California Coho Salmon* (Coho Recovery Strategy) (CDFG 2004). See Appendix B of this Action Plan for examples of some of these

Table 4: Shasta River Dissolved Oxygen and Temperature TMDL Implementation Actions

Source or Land Use Activity	Responsible Parties	Actions to Address Dissolved Oxygen and Water Temperature Impairment
Tailwater Return Flows (cont.)	Irrigators (cont.)	tailwater return flow measures. In addition, landowners may develop and implement management measures suitable for their site-specific conditions. Irrigators should submit annually to the Regional Water Board a written summary of all tailwater return flow management actions taken to help achieve compliance with water quality standards, the TMDLs, and the NPS Policy, either individually or through the Shasta Valley RCD and its CRMP or through the CDFG coho ITP.
	• Shasta Valley RCD • Shasta CRMP	**RCD Actions:** The Shasta Valley RCD and its CRMP should: • Assist irrigators in developing and implementing management practices that minimize, control and preferably prevent discharges of fine sediment, nutrients and other oxygen consuming materials, and elevated water temperatures from affecting waters of the Shasta River and its tributaries. • Implement the recommended actions specified in the Shasta Watershed Restoration Plan, Coho Recovery Strategy and the ITP (when approved). • Assist irrigators in developing and implementing a monitoring program to evaluate and document implementation and effectiveness of the tailwater management actions taken by the irrigators.
	• CDFG	**State Actions:** CDFG will: • Assist irrigators in developing and implementing management practices that minimize, control, and preferably prevent discharges of fine sediment, nutrients and other oxygen consuming materials, and elevated water temperatures from affecting waters of the Shasta River and its tributaries. • Administer the Coho Recovery Strategy and the ITP (when approved).
	• Regional Water Board	Regional Water Board will: • Work with the Shasta Valley RCD and its CRMP to develop a monitoring program to evaluate and document implementation and effectiveness of the tailwater management actions taken by the irrigators. • Evaluate the effectiveness of tailwater management actions and develop recommendations for the most effective regulatory vehicle to bring tailwater discharges into compliance with water quality standards, the TMDLs, and the NPS Policy.

Table 4: Shasta River Dissolved Oxygen and Temperature TMDL Implementation Actions

Source or Land Use Activity	Responsible Parties	Actions to Address Dissolved Oxygen and Water Temperature Impairment
Tailwater Return Flows (cont.)	Regional Water Board (cont.)	• Should efforts fail to be implemented or effective, the Regional Water Board's Executive Officer may require irrigators, on a site specific as-needed basis, to develop, submit, and implement, upon review, comment and approval by the Regional Water Board's Executive Officer, a tailwater management plan designed to prevent discharges of fine sediment, nutrients and other oxygen consuming materials and elevated solar radiation loads from affecting waters of the Shasta River and its tributaries. • Within one year of EPA approval of the TMDL, the Regional Water Board's Executive Officer shall report to the Regional Water Board on the status of the preparation and development of appropriate permitting actions to bring the discharge into compliance with water quality standards, the TMDLs, and the NPS Policy. • Within five years of EPA approval of the TMDL and based on Regional Water Board staff recommendation(s) derived from the evaluation phase for tailwater management, the Regional Water Board shall adopt prohibitions, WDRs, waivers of WDRs, or any combination, thereof, as appropriate. • Within ten years of EPA approval of the TMDL, the discharge of all tailwater return flow shall be in compliance with water quality standards, the TMDLs and the NPS Policy.
Water Use and Flow	• Water Diverters	**Water Diverter(s) Actions:** Water diverters should employ water management practices and activities that result in increased **dedicated cold water instream flow** in the Shasta River and its tributaries. Water diverters should participate in and implement applicable flow-related measures outlined in the following sources: • *Policy for the Implementation and Enforcement of the Nonpoint Source Pollution Control Program* (NPS Policy) (SWRCB 2004 or as amended). • *Shasta Watershed Restoration Plan* (November 1997). • *Shasta Valley Resource Conservation District Master Incidental Take Permit* (ITP) *Application* (Shasta RCD 2005). • *Recovery Strategy for California Coho Salmon* (Coho Recovery Strategy) (CDFG 2004). See Appendix C of this Action Plan for examples of flow related measures. In addition, landowners may develop and implement management measures suitable for their site-specific conditions. Within two years, and again within four years, of EPA approval of the TMDL, water diverters shall report in writing to the Regional Water Board, either individually or through the Shasta Valley RCD and its CRMP, on the measures taken to increase the dedicated cold water

Table 4: Shasta River Dissolved Oxygen and Temperature TMDL Implementation Actions

Source or Land Use Activity	Responsible Parties	Actions to Address Dissolved Oxygen and Water Temperature Impairment
Water Use and Flow (cont.)	Water Diverters (cont.)	instream flow in the Shasta River by 45 cfs or alternative flow regime that achieves the same temperature reductions from May 15 to October 15. Within five years of EPA approval of the TMDL, water diverters shall provide a final report to the Regional Water Board, either individually or through the Shasta Valley RCD and its CRMP, on documenting dedicated cold water instream flow in the Shasta River in relation to the 45 cfs goal or alternative flow regime that achieves the same temperature reductions from May 15 to October 15. This recommended flow measure does not alter or reallocate water rights in the Shasta or Klamath River watersheds, nor bind the Regional Water Board in future TMDLs, the State Water Board, Division of Water Rights in any water rights decision, or state and federal courts.
	• Shasta Valley RCD • Shasta CRMP	**RCD Actions:** The Shasta Valley RCD and its CRMP should: • Assist water diverters in developing and implementing management practices that increase dedicated cold water instream flows in the Shasta River and tributaries. • Assist water diverters in developing and implementing a monitoring program to evaluate and document implementation and effectiveness of the actions taken to increase dedicated cold water instream flows in the Shasta River.
	• CDFG	**State Actions**: CDFG will: • Assist water diverters in developing and implementing management practices that increase dedicated cold water instream flows in the Shasta River and tributaries. • Administer the Coho Recovery Strategy and the ITP (when approved). • Assist in developing and implementing a monitoring program to evaluate and document implementation and effectiveness of the actions taken by the water diverters to increase dedicated cold water instream flows in the Shasta River.
	• Department of Water Resources (DWR)	DWR should: • Coordinate and assist water diverters in developing and implementing a monitoring program through a watermaster service to evaluate and document implementation and effectiveness of the actions taken by the water diverters to increase dedicated cold water instream flows in the Shasta River.

Table 4: Shasta River Dissolved Oxygen and Temperature TMDL Implementation Actions

Source or Land Use Activity	Responsible Parties	Actions to Address Dissolved Oxygen and Water Temperature Impairment
Water Use and Flow (cont.)	• Regional Water Board • State Water Resources Control Board (State Water Board)	The Regional Water Board will: • Work cooperatively with water diverters, the Shasta Valley RCD, its CRMP, CDFG and DWR, wholly or in part, to establish monitoring and reporting programs to gauge implementation and effectiveness of the actions taken by responsible parties. • If the Executive Officer receives credible evidence that the Shasta River flows are diminishing, the Executive Officer shall promptly report this to the Regional and State Water Board. • If after five years, the Regional Water Board's Executive Officer finds that the above-measures have failed to be implemented or are otherwise ineffective, the Regional Water Board may recommend that the State Water Board consider seeking modifications to the decree (*In re* Waters of Shasta River and its Tributaries, No. 7035 (Super. Ct. Siskiyou County Dec.29, 1932)), conducting proceedings under the public trust doctrine, and/or conducting proceedings under the waste and unreasonable use provisions of the California Constitution and the California Water Code.
Irrigation Control Structures, Flashboard Dams, and other minor impoundments (Collectively referred to as minor impoundments)	• Individual Irrigators • Irrigation Districts • DWR • Others owning, operating, managing, or anticipating construction of minor impoundments • Shasta Valley RCD • Shasta CRMP	**Irrigator(s) Actions**: Irrigation districts, individual irrigators, and others that own, operate, manage, or anticipate construction of instream minor impoundments, or other structures capable of blocking, impounding, or otherwise impeding the free flow of water in the Shasta River system shall comply with one or more of the following measures: • Permanently remove minor impoundments in the Shasta River mainstem. • Re-engineer existing impoundments to decrease surface area of impoundment. • Not construct new impoundments unless they can be shown to have positive effects to the beneficial uses of water relative to water quality compliance and the support of beneficial uses, including the salmonid fishery, in the Shasta Valley. Within one year of EPA approval of the TMDL, report in writing to the Regional Water Board methods and management practices they shall implement that will reduce sediment oxygen demand rates by 50% from baseline behind all minor impoundments. **RCD Actions:** The Shasta Valley RCD and its CRMP should: • Assist in developing and implementing minor impoundment removal, re-engineering or initial design work for compliance with water quality standards, the TMDLs, and the NPS Policy. • Implement the recommended actions specified in the Shasta Watershed Restoration Plan and the ITP (when approved). • Assist in developing and implementing a monitoring program to

Table 4: Shasta River Dissolved Oxygen and Temperature TMDL Implementation Actions

Source or Land Use Activity	Responsible Parties	Actions to Address Dissolved Oxygen and Water Temperature Impairment
Minor impoundments (cont.)		evaluate and document implementation and effectiveness of the actions taken to remove, re-engineer or limit construction of minor impoundments on the mainstem Shasta River.
	• CDFG	**State Actions**: CDFG will: • Assist in developing and implementing removal, re-engineering or limitation on the construction of minor impoundments in the Shasta River mainstem. • Administer the Coho Recovery Strategy and the ITP (when approved). • Assist in the development and implementation of a monitoring program to evaluate and document implementation and effectiveness of the actions taken to remove, re-engineer or limit construction of minor impoundments on the mainstem Shasta River.
	• Regional Water Board	The Regional Water Board will: • Work with CDFG to establish monitoring and reporting elements of their programs in order to gage their effectiveness. • Work with the Shasta Valley RCD and its CRMP to establish monitoring and reporting programs to gage the implementation and effectiveness of the Shasta Watershed Restoration Plan. • Include appropriate conditions in Clean Water Act water quality certification permits for minor impoundment removal or re-engineering activities that comply with water quality standards, the TMDL, and the NPS Policy.
Dwinnell Dam	• Montague Water Conservation District (MWCD)	Within 2 years of EPA approval of the TMDL, the MWCD shall report in writing to the Regional Water Board on a plan to bring the discharge from Dwinnell Dam into compliance with water quality standards, the TMDLs, and the NPS Policy.
Lake Shastina	• MWCD • City of Weed • County of Siskiyou • Caltrans • Communities of Lake Shastina	Within 2 years of EPA approval of the TMDL, the responsible parties shall complete a study of water quality conditions and factors affecting water quality conditions in Lake Shastina, and develop a plan for addressing factors affecting water quality conditions to bring Lake Shastina into compliance with water quality standards, the TMDLs, and the NPS Policy. The study and plan shall be submitted to the Regional Water Board Executive Officer for review, comment and approval. Within 5 years of EPA approval of the TMDL, the responsible parties shall begin implementing the plan.

Table 4: Shasta River Dissolved Oxygen and Temperature TMDL Implementation Actions

Source or Land Use Activity	Responsible Parties	Actions to Address Dissolved Oxygen and Water Temperature Impairment
Lake Shastina (cont.)	• U.S. Forest Service (USFS) • U.S. Bureau of Land Management (BLM) • Private timberland owners	(See above)
City of Yreka Wastewater Treatment Facility (Yreka WWTF)	• City of Yreka • Regional Water Board	**Yreka Wastewater Treatment Facility Actions**: The Yreka WWTF shall comply with existing Regional Water Board Orders and Monitoring and Reporting Programs. **Regional Water Board Actions**: The Regional Water Board will: • Pursue aggressive compliance with Order No 96-69, and CAO No.R1-2004-0037. • Continue vigorous oversight and enforcement of Monitoring and Reporting Program No. R1-2003-0047 to ensure timely submittal of sampling and analytical results from the operators of the Yreka WWTF.
Urban and Suburban Runoff	• City of Yreka • City of Weed • City of Montague • Community of Edgewood • Communities of Lake Shastina • Other landowners with suburban runoff	**Actions:** The cities of Yreka, Weed, Montague, the communities of Lake Shastina, and other landowners with suburban runoff should identify possible pollutants, their sources, and volumes of polluted runoff from urban and suburban sources within their spheres of influence that may discharge, directly or indirectly, to waters of the Shasta River watershed. Cities and other landowners with suburban runoff should implement the applicable measures from the NPS Policy. See Appendix D of this Action Plan for examples of some of these applicable measures. Within two years of EPA approval of the TMDL, cities and landowners with suburban runoff shall develop a plan to minimize, control, and preferably prevent discharges of fine sediment, nutrients and other oxygen consuming materials and elevated temperature waste discharge from affecting waters of the Shasta River and its tributaries. The plan shall be submitted to the Regional Water Board's Executive Officer for review, comment and approval. Within 5 years of EPA approval of the TMDL, cities and landowners with suburban runoff shall begin implementing the plan.

Table 4: Shasta River Dissolved Oxygen and Temperature TMDL Implementation Actions

Source or Land Use Activity	Responsible Parties	Actions to Address Dissolved Oxygen and Water Temperature Impairment
Urban and Suburban Runoff (cont.)	• Regional Water Board	**State Actions**: The Regional Water Board will: • Work cooperatively with responsible parties to implement their plan, including appropriate management measures and reasonable time schedules which minimize, control, and preferably prevent discharges of fine sediment, nutrients and other oxygen consuming materials and elevated temperature waste discharge from affecting waters of the Shasta River and its tributaries.
Activities on Federal Lands	• USFS	**USFS Actions**: The USFS should consistently implement the best management practices for timber harvest activities, grazing and other activities included in the: • *Klamath National Forest Land and Resource Management Plan* (USFS 1995) or as amended as long as equivalent or better water quality protections are required. • Shasta-Trinity National Forest Land and Resource Management Plan (USFS 1995) or as amended as long as equivalent or better water quality protections are required. • *Water Quality Management for Forest System Lands in California, Best Management Practices* (USFS 2000) or as amended as long as equivalent or better water quality protections are required. See Appendix E of this Action Plan for some examples of these measures.
	• Regional Water Board	**Regional Water Board Actions**: The Regional Water Board will: • Continue its involvement with the USFS to periodically reassess the mutually agreed upon goals of the 1981 Management Agency Agreement between the SWRCB and the USFS. • Work with the USFS to draft and finalize a Memorandum of Understanding (MOU). The MOU shall be drafted and ready for consideration by the appropriate decision-making body of the USFS within two years of EPA approval of the TMDL. The MOU shall include, in part, buffer width requirements and other management practices as detailed in Appendix E.

Table 4: Shasta River Dissolved Oxygen and Temperature TMDL Implementation Actions

Source or Land Use Activity	Responsible Parties	Actions to Address Dissolved Oxygen and Water Temperature Impairment
Activities on Federal Lands (cont.)	• BLM	**BLM Actions**: BLM shall implement best management grazing strategies that are detailed in a joint management agency document titled: • *Riparian Management, TR 1737-14, Grazing Management for Riparian-Wetland Areas, USDI-BLM, USDA-FS (1997).* See Appendix F of this Action Plan for some examples of these measures.
	• Regional Water Board	**Regional Water Board Actions**: The Regional Water Board will work with the BLM to draft and finalize a Memorandum of Understanding (MOU). The MOU shall be drafted and ready for consideration by the appropriate decision-making body of the BLM within two years of EPA approval of the TMDL. The MOU shall include buffer width requirements and other management practices as detailed in Appendix F of this Action Plan.
Timber Harvest Activities on Non-Federal Lands	• Private Parties Conducting Timber Harvest Activities	**Timber Harvest Related Actions**: Parties conducting timber harvest activities should employ land stewardship practices that minimize, control, and preferably prevent discharges of fine sediment, nutrients and other oxygen consuming materials from affecting waters of the Shasta River and tributaries. Landowners should also employ land stewardship practices and activities that minimize, control, and preferably prevent elevated solar radiation loads from affecting waters of the Shasta River and its Class I and II tributaries.
	• California Department of Forestry (CDF)	**State Actions:** CDF will: Ensure timber operations in the Shasta River watershed are in compliance with the water quality standards, the TMDLs, and NPS Policy.
	• Regional Water Board	Regional Water Board Actions: The Regional Water Board shall use appropriate permitting and enforcement tools to regulate discharges from timber harvest activities in the Shasta River watershed, including, but not limited to: • Participation in the CDF timber harvest review and approval process. • Use of general or specific WDRs and waivers of WDRs if applicable, to regulate timber harvest activities on private lands in the Shasta River watershed. • Timber harvest activities on private lands in the Shasta River watershed are not eligible for Categorical Waiver C included in the Categorical Waiver of *Waste Discharge Requirements for Discharges Related to Timber Harvest Activities on Non-Federal Lands in the North Coast Region* (Order No. R1-2004-0016) simply

Table 4: Shasta River Dissolved Oxygen and Temperature TMDL Implementation Actions

Source or Land Use Activity	Responsible Parties	Actions to Address Dissolved Oxygen and Water Temperature Impairment
Timber Harvest Activities on Non-Federal Lands (cont.)	Regional Water Board (cont.)	through the adoption of this TMDL Action Plan. However, timber harvest activities on private lands in the Shasta River watershed may be eligible for Categorical Waivers A, B, D, E, and F, as appropriate. • If the California Forest Practice Rules (Title 14 CCR Chapters 4, 4.5 and 10) are changed in a manner that reduces water quality protections, the Regional Water Board shall require plan submitters to maintain the level of water quality protection provided by the 2006 Forest Practice Rules. See Appendix G of this Action Plan for select examples of 2006 Forest Practice Rules.
California Department of Transportation Activities (Caltrans)	• Caltrans • Regional Water Board	**Caltrans Actions**: Caltrans shall implement the requirements of its stormwater program. **Regional Water Board Actions**: Regional Water Board shall: • Within two years of EPA approval of the TMDL, complete an initial evaluation of the Caltrans Stormwater Program. • After the initial two-year evaluation is completed, the Regional Water Board shall continue periodic reviews of the program to assure ongoing compliance.

VI. Enforcement

The Regional Water Board shall take enforcement actions for violations of the Shasta River TMDL Action Plan where elements of the TMDL Action Plan are made enforceable restrictions in a specific permit or order, as appropriate. If necessary, Regional Water Board staff may propose appropriate enforcement actions for human activities that result in discharges, including but not limited to the removal or suppression of vegetation that provides shade to a water body in the Shasta River watershed. Enforcement implementation is ongoing. Nothing in this TMDL Action Plan precludes actions to enforce any directly applicable prohibition or provisions found elsewhere in the Basin Plan or to require clean up and abatement of existing sources of pollution where appropriate.

VII. Monitoring

Monitoring is important for determining the success of the TMDL Action Plan in achieving dissolved oxygen and temperature water quality standards. Monitoring shall be conducted upon the request of the Regional Water Board's Executive Officer in conjunction with existing and/or proposed human activities that will likely result in increased dissolved oxygen and reduced water temperatures in the Shasta River watershed. Monitoring may involve implementation, upslope effectiveness, photo documentation, instream and near-stream effectiveness (e.g. riparian buffer establishment affecting nutrient discharges), and / or **compliance and trend monitoring** (e.g. temperature and dissolved oxygen, Potential Percent Solar Radiation Transmittance, time predicated dissolved oxygen sampling, nutrients, sediment oxygen demand, nitrates and nitrites, and any other parameters reflective of improvements toward achieving the TMDL). Monitoring parameters and frequency, numeric and narrative objectives, and other appropriate metrics shall be based on locations consistent with those reaches representative of the TMDL.

The Regional Water Board's Executive Officer will base the decision to require monitoring on site-specific conditions, the size and location of the discharger's ownership, and/or the type and intensity of land uses being conducted or proposed by the discharger. If monitoring is required, the Regional Water Board's Executive Officer may direct the discharger to develop a monitoring plan and may describe specific monitoring requirements to include in the plan.

VIII. Reassessment and Adaptive Management

The Regional Water Board will review, reassess, and possibly revise the Shasta River TMDL Action Plan. Reassessment is likely to occur every three years during the Basin Planning Triennial Review process. Regional Water Board staff will report to the Regional Water Board at least yearly on the status and progress of implementation activities, and on whether current efforts are reasonably calculated and on track to achieve water quality standards. In addition to the evaluation periods for individual source categories specified in Table 4, Regional Water Board staff will conduct a comprehensive and formal assessment of effectiveness of collaborative efforts in the on-going programs and additional efforts recommended by the Action Plan within 5 years from the date of EPA approval. A more extensive reassessment will occur 10 years from the date the TMDL Action Plan is effective, or sooner, if the Regional Water Board determines it necessary. During reassessment, the Regional Water Board is likely to consider how effective the requirements of the TMDL Action Plan are at meeting the TMDLs, achieving dissolved oxygen and temperature water quality objectives, and protecting the beneficial uses of water in the Shasta River watershed.

IX. Glossary

Adjusted potential effective shade:
The percentage of direct beam solar radiation attenuated and scattered before reaching the ground or stream surface from the potential vegetation conditions, reduced by 10% to account for natural disturbance such as fire, windthrow, disease, and earth movements that reduce actual riparian vegetation below the site potential.

Biochemical Oxygen Demand (CBOD):
An analytical method used as an indicator for the concentration of biodegradable organic matter present in a sample of water. It measures the rate of uptake of oxygen by micro-organisms in the sample of water over a given period of time, and can be used to infer the general quality of the water and its degree of pollution.

Carbonaceous Deoxygenation:
Refers to the consumption of oxygen by bacteria during the breakdown of (decomposition) of organic (carbon-containing) material.

Class I tributary:
This watercourse must have one of the following properties in order to be considered a Class I tributary, according to California Forest Practice Rules: (1) domestic supplies, including springs, on site and/or within 100 feet downstream of the operations area, and/or (2) fish are always or seasonally present onsite, includes habitat to sustain fish migration and spawning.

Class II tributary:
This watercourse must have one of the following properties in order to be considered a Class II tributary, according to California Forest Practice Rules: (1) fish always or seasonally present offsite within 1000 feet downstream and/or (2) is an aquatic habitat for nonfish aquatic species, (3) excludes Class III waters that are tributary to Class I waters.

Compliance and Trend Monitoring:
Monitoring intended to determine, on a watershed scale, if water quality standards are being met, and to track progress towards meeting water quality standards.

Dedicated cold water instream flow:
Water remaining in the stream in a manner that that the diverter, either individually or as a group, can ensure will result in water quality benefits. Temperature, length and timing are factors to consider when determining the water quality benefits of an instream flow.

Implementation Monitoring:
Monitoring used to assess whether activities and control practices were carried out as planned. This type of monitoring can be as simple as photographic documentation, provided that the photographs are adequate to represent and substantiate the implementation of control practices.

Instream Effectiveness Monitoring:
Monitoring of instream conditions to assess whether pollution control practices are effective at keeping waste from being discharged to a water body. Instream effectiveness monitoring may be conducted upstream and downstream of the discharge point or before, during, and after the implementation of pollution control practices.

Irrigation Return Flows:
See Tailwater Return Flow.

Natural Potential Vegetation Conditions:
The most advanced seral stage that nature is capable of developing and making actual at a site in the absence of human interference. Seral stages are the series of plant communities that develop during ecological succession from bare ground to the climax community (e.g., fully mature, old-growth).

Nitrification:
The oxidation of an ammonium (NH_4^+) compound to nitrite (NO_2^-) and nitrate (NO_3^-), a process that consumes oxygen.

Nitrogenous Deoxygenation:
The conversion of organic nitrogen to ammonium (NH_4^+) and the subsequent oxidation of ammonium to nitrite (NO_2^-) and then to nitrate (NO_3^-), a process that consumes oxygen

Nitrogenous Biochemical Oxygen Demand (NBOD):
A measure of the amount of oxygen consumed from the conversion of organic nitrogen to ammonium (NH_4^+) and the oxidation of ammonium to nitrite (NO_2^-) and subsequently (NO_3^-).

Nitrogenous Oxygen Demand:
The conversion of organic nitrogen to ammonium by bacteria, a process that consumes oxygen.

Potential Effective Riparian Shade:
That shade resulting from topography and natural potential vegetation that reduces the heat load reaching the stream. The difference between existing (baseline) and adjusted potential effective shade reflects the amount of effective riparian shade increase (i.e. reduced solar transmittance) that is necessary to achieve natural receiving water temperatures.

Potential Solar Radiation Transmittance:
Potential solar radiation transmittance is the amount of solar radiation that passes through the vegetation canopy and reaches the water surface, when natural potential vegetation conditions are achieved.

Reaeration:
The process whereby atmospheric oxygen is transferred to a waterbody.

Salmonids:
Fish species in the family *Salmonidae*, including but not limited to, salmon, trout, and char.

Sediment:
Any inorganic or organic earthen material, including, but not limited to: soil, silt, sand, clay, peat, and rock.

Sediment Oxygen Demand (SOD):
The consumption of oxygen by sediment and associated organisms (such as bacteria and invertebrates) through both the decomposition of organic matter and respiration by plants, bacteria, and invertebrates.

Solar Radiation Transmittance:
Solar radiation transmittance is defined as the amount of solar radiation that passes through the vegetation canopy and reaches the water surface. A value of 1.0 represents no shade; a value of 0.0 represents complete shade.

Tailwater Return Flow:
Water applied to a field for irrigation at rates that exceed soil infiltration and evaporation rates, resulting in runoff of irrigation water to a surface water body. Same as Irrigation Return Flows.

Water Quality Compliance Model Scenario:
A computer water quality model scenario developed by Regional Water Board staff that characterizes Shasta River watershed conditions under which the Basin Plan narrative temperature objective and numeric dissolved oxygen are met in the Shasta River.

Appendix A

Range and Riparian Land Management Measures
(1) Protect sensitive areas (including streambanks, lakes, wetlands, estuaries, and riparian zones) by (a) excluding livestock, (b) providing stream crossings or hardened access to watering areas, (c) providing alternative water locations away from surface water, (d) locating salt and additional shade, if needed, away from sensitive areas, or (e) use improved grazing management (e.g. herding) to reduce the physical disturbance and direct loading of animal waste and sediment caused by livestock; and (2) Achieve the following on range, pasture and other grazing lands not addressed under (1) above: implement the range and pasture components of a Resource Management Systems (RMS) as defined in the United States Department of Agriculture (USDA) Natural Resource CS Field Office Technical Guide applying the progressive planning approach of the USDA NRCS to reduce erosion. **NPS Policy (MM 1E) (SWRCB, 2004)**
On properties owned by participants in the ITP, livestock fencing shall be in place on at least 90% of that person's owned stream bank length where there is a potential to affect coho, or fencing shall be in active progress towards implementation along those streams with installation by January 1, 2008, and/or shall have CDFG approved livestock management measures in place that will provide similar protections to the streambanks and riparian zone. Livestock riparian exclusion fencing built after 3-30-05 needing to comply with the permit must be approved by SVRCD, will be expected to have a setback of at least 35 feet from normal high water line, and shall be maintained in good working order as long as the permit is in place and livestock are present. **Draft Shasta ITP (Minimization Measures B) (RCD, 2005)**
SVRCD will work with landowners and DFG on appropriate methodology and riparian species selection on a site by site basis. **Draft Shasta ITP (Minimization Measures C) (RCD, 2005)**
Grazing along the steam corridor may occur as a mechanism of riparian management and will be coordinated with the SVRCD, the landowners and CDFG staff. **Draft Shasta ITP (Table 1-1) (RCD, 2005)**
Planting of riparian vegetation along stream banks will be coordinated with the SVRCD, the landowners and CDFG staff. **Draft Shasta ITP (Table 1-1) (Table 1-1) (RCD, 2005)**
Address factors that contribute to high temperatures. **Coho Recovery Strategy (HM-5a, b) (CDFG, 2004)**
Promote coho salmon recovery by minimizing diversion entrainment, protecting riparian vegetation, and encouraging effective land use practices. **Coho Recovery Strategy (P-1 through P-7) (CDFG, 2004**)
Increase riparian vegetation. **Coho Recovery Strategy (HM-4a-d) (CDFG, 2004)**
Continue program of riparian fencing and native tree planting. **Shasta Watershed Restoration Plan (SRCRMP, 1997)**

Appendix B

Tailwater Return Flow Management Measures
Develop and implement comprehensive nutrient management plans for areas where nutrient runoff is a problem affecting coastal waters and/or water bodies listed as impaired by nutrients. Such plans would include a plant tissue analysis to determine crop nutrient needs; crop nutrient budget; identification of the types, amounts, and timing of nutrients necessary to produce a crop based on realistic crop yield expectations; identification of hazards to the site and adjacent environment; soil sampling and tests to determine crop nutrient needs; and proper calibration of nutrient equipment. When manure from confined animal facilities is to be used as a soil amendment and/or is disposed of on land, the plan shall discuss steps to assure that subsequent irrigation of that land does not leach excess nutrients to surface or ground water. **NPS Policy (MM 1C) (SWRCB, 2004)**
Capture of additional tailwater from on-site or neighboring fields. **Draft Shasta ITP (Table 1-1) (RCD, 2005)**
The Shasta RCD will assist landowners/sub-permittees in designing and implementing tailwater capture systems that intercepts and reuses runoff from on-site and off-site properties in accordance to standards outlined by the NRCS. **Draft Shasta ITP (Table 1-1) (RCD, 2005)**
Conduct assessments of tailwater return flows, promote opportunities to eliminate, minimize, reclaim and reuse, where feasible. **Coho Recovery Strategy (WUE-7a-c) (CDFG, 2004)**
Manage tailwater return flows so that entrained constituents, such as fertilizers, fine sediment and suspended organic particles, and other oxygen consuming materials are not discharged to nearby watercourses. This could include modifications to irrigation systems that reuse tailwater by constructing off-stream retention basins, active (pumping) and or passive (gravity) tailwater recapture/redistribution systems. **(U.C. Davis 1998; NRCS 1997)**
Seek ways to reduce irrigation tailwater, or capture for reuse. **Shasta Watershed Restoration Plan (SRCRMP, 1997)**

Appendix C

Instream Flow Management Measures
Promote effective irrigation while reducing pollutant delivery to surface and ground waters. Pursuant to this measure, irrigation water would be applied uniformly based on an accurate measurement of cropwater needs and the volume of irrigation water applied, considering limitations raised by such issues as water rights, pollutant concentrations, water delivery restrictions, salt control, wetland, water supply and frost/freeze temperature management. Additional precautions would apply when chemicals are applied through irrigation. **NPS Policy (MM 1F) (SWRCB, 2004)**
All persons covered by the permit and diverting water from within the Shasta River watershed will be expected to support ongoing watermaster services (either by DWR or by some other entity should DWR cease to provide service) and pay their proportionate cost of that service to provide watermaster service in the Shasta Valley between April 1 and October 1 when instream flows are likely to be most critical to coho. Individual proportional costs for this activity are expected to continue to be collected by the County of Siskiyou via annual property taxes. Those participants exercising riparian rights and not subject to watermaster control will cooperate with the watermaster in assuring they are within their legal rights and will inform the watermaster of any changes in the quantities of water they will be diverting. **Draft Shasta ITP (Avoidance Measures III. A. i.) (RCD, 2005)**
DFG, DWR and the SVRCD shall develop and implement a management plan to coordinate and monitor irrigation season start up so as to minimize rapid deductions in instream flows. A draft Ramped Diversion Plan will be submitted to DFG by January 1, 2007 with a finalized plan submitted by January 1, 2008. **Draft Shasta ITP (Avoidance Measures III. A. ii.) (RCD, 2005)**
All persons covered by the ITP shall endorse continued efforts by DWR or other private watermaster organizations, to assure that flows year round shall not be allowed to fall below 20 cfs at the Shasta River near Montague (SRM) gage, a quantity that has been historically the watermaster's minimum target for flow at that location, nor that flows at A-12 shall fall below 45 cfs at any time during the summer, a quantity that will assure that substantial cold water refugia areas are retained upstream of the point. **Draft Shasta ITP (Avoidance Measures III. A. iii.) (RCD, 2005)**
The SVRCD will develop a dry and critically dry year plan to assure that stranding, or elimination of needed cold water refugia areas does not occur during extremely dry years. The dry year plan will be developed by SVRCD and will insure that previously described flows at 50 cfs at A-12 and 20 cfs at Montague-Grenada Road are achieved. A draft Dry Year Plan will be completed by the SVRCD one year from the issuance of the permit. **Draft Shasta ITP (Avoidance Measures III. F) (RCD, 2005)**
The SVRCD will work with those entities seeking coverage under the ITP to assist them in their efforts to upgrade overall irrigation efficiency. Potential projects that may be implemented to improve flows include upgrade of water delivery systems to reduce waste, upgrade of water application systems, monitoring crop water requirements vs. soil moisture, etc. **Draft Shasta ITP (Minimization Measures V. A. i.) (RCD, 2005)**
Encourage the Shasta CRMP to develop a dry year water plan for the Shasta River. **Shasta Coho Recovery Strategy (WM-1a) (CDFG, 2004)**
Add additional oversight and more people to verify water use and better manage water in current watermaster service areas. **Coho Recovery Strategy (WM-2a) (CDFG, 2004)**
Institute a cooperative agreement between diverters to stage/stagger their irrigation starts and completions (ramped flows) to gradually change flows over several days. **Coho Recovery Strategy (WM-3a) (CDFG, 2004**)
CRMP, CDFG, and voluntary landowner participation: agree to pull diversions for a limited time period to produce a pulsed flow downstream. **Coho Recovery Strategy (WM-4a)**
Determine unused diversion rights and approach those diverters about providing flows for instream use without affecting the water rights of others. **Coho Recovery Strategy (WM-5c) (CDFG, 2004)**

Instream Flow Management Measures (cont.)
For critical streams/reaches, diverters could rotate irrigations so diversions do not coincide when increased flows are critical for fish. **Coho Recovery Strategy (WM-6a)**
Provide headgates and measuring devices for diversions located in riparian areas. **Coho Recovery Strategy (WM-7a) (CDFG, 2004)**
Study and forecast correlation of stream flow with other parameters to predict weekly flow rates. Can be based on snow surveys, precipitation, aquifer condition, etc. **Coho Recovery Strategy (WM-8b) (CDFG, 2004)**
Seek funding to conduct instream flow studies to determine flow-habitat relationships. **Coho Recovery Strategy (WM-9) (CDFG, 2004)**
Provide a structured process for willing participants to donate, sell, or lease water rights to provide improved stream flow. **Coho Recovery Strategy (WA-1b, c, d & WA-7a, b, c) (CDFG, 2004)**
Acquire water rights that shall be dedicated to instream flow. **Coho Recovery Strategy (WA-7) (CDFG, 2004)**
Support preparation of a water balance study. Apply study results to water management, augmentations, and Habitat enhancement recommendations. **Coho Recovery Strategy (WM-1b) (CDFG, 2004)**
Study feasibility of building storage reservoirs to capture excess winter runoff (solely) for the benefit of coho salmon, not for irrigation augmentation. **Coho Recovery Strategy (WA-2a & WA-3b) (CDFG, 2004)**
Identify and prioritize benefits and/or detriments to lining/piping surface ditch systems; promote ongoing diversion ditch maintenance. **Coho Recovery Strategy (WUE-3; WUE-4) (CDFG, 2004)**
Promote and/or retain water efficient irrigation practices. **Coho Recovery Strategy (WUE-5a-e) (CDFG, 2004)**
Prepare a comprehensive groundwater study to determine the current status of groundwater in the Shasta Valley and its relationship to surface flows. **Coho Recovery Strategy (WM-10a) (CDFG, 2004)**
Continue pulsed flow program to flush salmonids downstream during lethal water temperature conditions. **Shasta Watershed Restoration Plan (I B-2) (SRCRMP, 1997)**
Support creation of dedicated instream flows for fish and wildlife. **Shasta Watershed Restoration Plan (I B-2) (SRCRMP, 1997)**
Contemplate the impacts of readjudication of both surface and ground water. **Shasta Watershed Restoration Plan (I B-9) (SRCRMP, 1997)**
Continue pulse flows until water quality is improved. **Shasta Watershed Restoration Plan (III B-3.e) (SRCRMP, 1997)**
Seek funding for purchase of water for instream flows from willing sellers. **Shasta Watershed Restoration Plan (III B-6) (SRCRMP, 1997)**
Where other means of adequate protection (for fish) are unlikely, support the purchase of key (property) areas from voluntary sellers whose sale would protect remaining land uses in the Shasta Valley. **Shasta Watershed Restoration Plan (III B-7) (SRCRMP, 1997)**

Appendix D

Urban and Suburban Runoff Management Measures
Develop a watershed protection program to 1. Avoid conversion, to the extent practicable, of areas that are particularly susceptible to erosion and sediment loss; 2. Preserve areas that provide important water quality benefits and/or are necessary to maintain riparian and aquatic biota; 3. Protect to the extent practicable the natural integrity of water bodies and natural drainage systems associated with site development – including roads, highways and bridges; 4. Limit increases of impervious surfaces; and 5. Provide education and outreach to address NPS pollution. **NPS Policy (MM 3.1A) (SWRCB, 2004)**
Plan, design and develop sites to: 1. Protect areas that provide important water quality benefits necessary to maintain riparian and aquatic biota, and/or are particularly susceptible to erosion or sediment loss; 2. Limit increase in impervious areas; 3. Limit land disturbance activities such as clearing and grading and cut and fill to reduce sediment loss; and, 4. Limit disturbance of natural drainage features and vegetation. **NPS Policy (MM 3.1B) (SWRCB, 2004)**
By design or performance: 1. After construction has been completed and the site is permanently stabilized, reduce the average total suspended solids (TSS) loading by 80 percent (for purposes of this measure, an 80 percent TSS reduction is to be determined on an average annual basis); or 2. Reduce the post-development loading of TSS so that the average annual TSS loadings are no greater than pre-development loadings. 3. To the extent practicable, maintain post-development peak runoff rate and average volume at levels similar to pre-development levels. **NPS Policy (MM 3.1C) (SWRCB, 2004)**
1. Reduce erosion and to the extent practicable, retain sediment on site during and after construction; and, 2. Prepare and implement, prior to land disturbance, an effective, approved erosion and sediment control plan or similar administrative document that specifies erosion and sediment control provisions. **NPS Policy (MM 3.2.A) (SWRCB, 2004)**
1. Limit application, generation, and mitigation of toxic substances; 2. Ensure the proper storage and disposal of toxic materials; 3. Apply nutrients at rates necessary to establish and maintain vegetation without causing nutrient runoff to surface waters; and, Pre and implement, prior to the use or storage of toxic material on site, an effective, approved chemical control plan or similar administrative document that contains chemical control provisions (e.g. minimize use of toxic materials; ensure proper containment if toxic materials are to be used /stored on site). **NPS Policy (MM 3.2.B) (SWRCB, 2004)**
Develop and implement watershed management programs to reduce runoff pollutant concentrations and volumes from existing development: 1. Identify priority local and/or regional watershed pollutant reduction opportunities (e.g. improve existing urban runoff control structures); 2. Specify a schedule for implementing appropriate controls: 3. Limit destruction of natural conveyance systems; and, Where appropriate, preserve, enhance, or establish buffers along surface waters and their tributaries. **NPS Policy (MM 3.3A) (SWRCB, 2004)**

Appendix E

Recommended Interim Riparian Reserve Widths for Klamath National Forest and Shasta-Trinity National Forest Lands in the Shasta River Watershed[1]

RIPARIAN RESERVE TYPE	**Riparian Reserve Widths**
Fish-bearing streams.	Include the stream and: area on each side from active channel edges to the top of inner gorge, or outer edge of 100 year flood plain, or to outer edge of riparian vegetation, or height of two site potential trees[2], or 300 feet slope distance, whichever is greatest.
Perennial, nonfish bearing streams	Include the stream and: area on each side from active channel edges to the top of inner gorge, or outer edge of 100 year flood plain, or outer edge of riparian vegetation, or height of one site potential tree[2], or 150 feet slope distance, whichever is greatest.
Lakes and natural ponds	Include the body of water and: area to the outer edge of riparian vegetation, or extent of seasonally saturated soil, or extent of unstable and potentially unstable areas, or height of one site potential tree[2], or 300 feet slope distance, whichever is greatest.
Constructed ponds, reservoirs and wetlands >1-acre in size	Include the body of water or wetland and: area to outer edges of riparian vegetation, or to seasonally saturated soil, or the extent of unstable and potentially unstable areas, or distance of one site potential tree, or 150 feet slope distance from wetland edge >1 acre, or the maximum pool elevation of constructed ponds, reservoirs, whichever is greatest.
Seasonally flowing or intermittent streams[3] wetlands <1-acre in size, and unstable or potentially unstable areas	At a minimum include: extent of unstable and potentially unstable areas (includes earthflows), stream channel and extend to top of inner gorge, stream channel or wetland and area from the edges of the stream channel or wetland to outer edges of riparian vegetation, and extension from edges of stream channel to height of one site potential tree[2], or 100 feet slope distance, whichever is greatest.

[1]Information from the Land and Resource Management Plans for the Klamath and Shasta-Trinity National Forests, Klamath National Forest LRMP (1995), Shasta-Trinity National Forest LRMP (1995).

[2]Site potential tree, depending on site class, is an average maximum height of the tallest dominant tree, ≥ 200 years old.

[3] Intermittent stream defined as any nonpermanent flowing drainage feature with a definable channel having evidence of annual scour or deposition, includes ephemeral streams meeting these physical criteria.

Grazing Standards and Guidelines for Shasta-Trinity and Klamath National Forests
Adjust grazing practices to eliminate impacts that retard or prevent attainment of Aquatic Conservation Strategy objectives. If adjusting practices is not effective, eliminate grazing
Locate new livestock handling and/or management facilities outside Riparian Reserves. For existing livestock handling facilities inside the Riparian Reserve, ensure that Aquatic Conservation Strategy objectives are met. Where these objectives cannot be met, require relocation or removal of such facilities.
Limit livestock trailing, bedding, watering, loading, and other handling efforts to those areas and times that will ensure Aquatic Conservation Strategy objectives are met.

From Shasta - Trinity LRMP

Appendix F

BLM Grazing Management Measures
Grazing management must provide an adequate cover and height of vegetation on the banks and overflow zones to promote natural stream function (sediment filtering, bank building, flood energy dissipation, aquifer recharge and water storage).
Control the timing of grazing to prevent damage to streambanks when they are most vulnerable to trampling.
Ensure sufficient vegetation during periods of high flow to protect streambanks, dissipate energy, and trap sediment.
Techniques that restrict livestock from riparian areas, including fencing or fence relocation, barriers such as thickets or brush wind rows, water gaps in erosion-resistant stream reaches, hardened crossings or water access, and relocation of bed grounds and management facilities.

Riparian Management, TR 1737-14 1997, Grazing Management for Riparian-Wetland Areas, USDI-BLM, USDA-FS

Appendix G

Examples of Select Management Measures for Timber Harvest Activities on Non-federal Lands from the 2006 California Forest Practice Rules
Every timber operation shall be planned and conducted to prevent deleterious interference with watershed conditions that primarily limit the values set forth in "the rules" (e.g. sediment load increase where sediment is the limiting factor, thermal load increase where water temperature is the primary limiting factor, etc). Section 916.9, 936.9 (a)
Comply with the terms of a Total Maximum Daily Load that has been adopted to address factors that may be affected by timber operations, if a TMDL has been adopted, or not result in any measurable sediment load increase to watercourses of lakes. Section 916.9, 936.9 (a) (1)
Not result in any measurable stream flow reduction during critical low water periods except as part of an approved water drafting plan. Section 916.9, 936.9 (a) (4)
Protect maintain and restore the quality and quantity of vegetative canopy needed to: (a) provide shade to the watercourse or lake, (b) minimize daily and seasonal temperature fluctuations, (c) maintain daily and seasonal temperature within the preferred range for anadromous salmonids. Section 916.9, 936.9 (a) (6)
Any timber operations or silvicultural prescriptions within 150 feet of any Class I watercourse or lake transition line or 100 feet of any Class II watercourse or lake transition line shall have protection, maintenance, or restoration of beneficial uses of water or the populations and habitat of anadromous salmonids or listed aquatic or riparian-associated species as significant objectives. Section 916.9, 936.9 (c)
The minimum WLPZ width for Class I waters shall be 150 feet from the watercourse or lake transition line. Section 916.9, 936.9 (f)
Within a WLPZ for Class I waters, at least 85 percent overstory canopy shall be retained within 75 feet of the watercourse or lake transition line. Section 916.9, 936.9 (g)