



Quartz Valley Indian Reservation

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To: North Coast Regional Water Quality Control Board staff
From: Quartz Valley Indian Community
Date: September 25, 2008
Re: Preliminary comments on *Administrative Draft (Chapters 1-5) Staff Report for the Klamath River Basin Temperature, Dissolved Oxygen, and Nutrient Total Maximum Daily Loads*

The Quartz Valley Indian Community would like to thank the Regional Water Quality Control Board staff for the hard work and effort in developing the Administrative Draft Staff Report Klamath TMDL. An ecologically healthy Klamath River is critical for the restoration and sustainability of the Tribe's greatest of cultural resources, salmonids.

The Quartz Valley Reservation is located in the Scott River basin, a tributary to the Klamath River, anadromous salmonids and lamprey produced in the Scott must use the Klamath River as a corridor to the ocean, it is for this reason that the Tribe is so dependant on a healthy Klamath River.

Thank you for this opportunity to provide our comments on the draft report, we look forward to working together in an effort to restore this once abundant ecosystem.

Sincerely,

Crystal Bowman
Environmental Director
Quartz Valley Indian Reservation

SUMMARY

Summary of Comments

Overall, the *Draft Klamath TMDL* is an impressive document, reflecting excellent work by the TMDL team. The document clearly recognizes Tribal Treaty Rights and takes a comprehensive approach to Klamath River water quality problems as Work Group comments had previously recommended. Of particular note is the attention given to problems with maintaining beneficial uses for Tribes (Pierce, 1998; 2002), including avoidance of health impacts on Tribal members (Norgaard, 2005; Reed, 2005) through provision of salmon. The scientific references that form the foundation of the TMDL are exhaustive and include current research in the basin (e.g. Strange, 2007). It also draws upon the most current quality assured data available for the basis of its models and for use in checking model outputs. The report is also well illustrated with excellent summary charts and maps. The final *Klamath TMDL* is likely to be of enduring value as a reference document.

Chapter 1 lays out the TMDL objectives and approach as well as providing useful background information. Chapter 2 contains the Problem Statement and is extremely well done, covering all aspects of Klamath River water quality and relating it to the decline of fisheries and other beneficial uses. Chapter 3 clearly describes the analytical approach used to develop the TMDLs. Chapter 4 presents the pollutant source analysis, including solid evidence for the causes for water quality degradation and the relative contributions of each. The pollution reductions specified in Chapter 5 (Pollutant Load Allocations) are well-justified and, *if properly implemented*, should result in substantial protection and restoration of beneficial uses.

Appendix 1 is superb and comprehensive compendium of information on how water quality stressors affect salmonids. Appendix 2 describes Pacific salmon stocks and trends based mostly on the *Klamath Long Range Plan* (Kier Associates, 1991) and the NRC (2004) *Endangered Fishes* report. Appendix 4 presents a review of nutrient dynamics in the Klamath River, including a comparison of free-flowing river reaches and impounded reaches. Appendix 7 uses newly-developed tools to assess whether the pollution reductions specified in the TMDL will reduce algal blooms in reservoirs and periphyton in free-flowing river reaches.

We fully support the substantial pollution reductions required by the *Draft Klamath TMDL*. The three most important of these are:

- Requiring that thermal impacts of Iron Gate and Copco Reservoirs at not allowed; we know of no other way to do this other than dam removal.
- Requiring substantial reductions in nutrient pollution from upstream sources related to discharges from agricultural activities and municipal/industrial wastewater.

- Requiring “zero temperature increase caused by substantial human-caused sediment-related channel alteration” and “shade provided by topography and full potential vegetation conditions at a site” in the Klamath River and its tributaries.

Our comments below provide suggestions for how this already excellent draft document could be improved and clarified. Among other things, we note that there is no flow allocation set for the Shasta and Scott Rivers in the *Draft Klamath TMDL*. Lack of flow is clearly an important driver of water quality problems in the Shasta and Scott Basins, and therefore merits action to resolve the problem. We have not yet formulated an opinion on whether a flow allocation is the proper course of action, but would like to have discussions with Regional Water Board staff regarding this option.

The development of a strong implementation plan, and the successful execution of that plan, will be a difficult task. We look forward to providing further guidance and support to the NCRWQCB regarding the development of a successful implementation plan, and proceed with cautious optimism.

Organizational Structure of Comments

In general, the Detailed Comments section below is structured according to the same chapter/section numbering system used in the *Draft Klamath TMDL*. We have not commented on every sub-section of the TMDL, so there are gaps in the numbering system. Following the Detailed Comment section is list of References. Insignificant issues such as typographic/grammar errors are included as Appendix A.

DETAILED COMMENTS

Chapter 1 (Introduction)

General Comments on Chapter 1

The background material on the Klamath Basin and changes in water quality caused by human uses is soundly researched and clearly stated. For example: “The conversion of wetlands to farmland and other land uses has exposed the nutrient and organic rich soils to oxidation, resulting in the release to the water column of nitrogen and phosphorus previously stored in the soil and wetland vegetation.”

The *Draft Klamath TMDL* recognizes that flow must be considered, because of its profound impact on water quality, and describes clearly how human use has altered basin flow regimes. One deficiency is that water rights discussions do not mention riparian rights, which do not require a State Water Resources Control Board (SWRCB) permit, or interactions of ground water withdrawal and relationship to reduced surface flows.

Relevant overlapping regulatory processes are clearly described, including Tribal Trust responsibilities: “The California Regional Water Board must consider federal Tribal

Trust responsibilities in the Klamath River basin since TMDLs are subject to the approval of the U.S. EPA.” Discussions of Treaty Rights extend not just to fishing but also ceremonial uses. The document specifically mentions the water quality authority of Tribes and cites all completed tribal water quality plans. Discussions regarding the Klamath Hydroelectric Project (KHP) clearly define the reservoirs as water quality nuisances and note a SWRCB letter stating that PacifiCorp has not provided enough evidence to demonstrate that the company’s proposal to relicense the KHP will resolve the reservoirs’ water quality impacts and meet requirements for 401 Certification.

1.4 Regulatory Framework and Purpose of the TMDL

The TMDL states on pages 6 and 7 that “The geographic scope of these TMDLs includes the entire Klamath River hydrologic area (HA) in California, not including those reaches of the Klamath River that lie within the Hoopa Valley Indian Reservation and Yurok Reservation.” Some Lower Klamath tributaries have their headwaters outside the Yurok Reservation but have their lower reaches and join with the Klamath River inside the Reservation (e.g. Turwar, Blue, Tully, Ah Pah, and McGarvey Creeks, etc.); thus, a supplemental sentence should be added to explicitly clarify that the TMDL does indeed apply to portions of those watersheds that lie outside the Yurok Reservation.

1.6.6 Water Use

The TMDL states on page 21 that “An additional, smaller, out-of-basin diversion occurs from the upper tributaries in the Fall Creek-Jenny Creek watershed in Oregon and into the Rogue River watershed in Oregon.” It is our understanding (though we could be mistaken), based on the information provided in PacifiCorp’s (2004) *Final License Application* and other FERC filings, that this statement is not fully accurate. Considerable water from the upper reaches of the Jenny Creek watershed is diverted into Rogue River watershed. Most of the flow in Spring Creek (a spring-fed tributary to Fall Creek) is diverted into Fall Creek to increase electrical output at PacifiCorp’s Fall Creek hydroelectric facilities; no portion of Fall Creek is diverted into the Rogue River basin.

Chapter 2 (Problem Statement)

General Comments on Chapter 2

The problem statement is well-organized and presents a compelling description of Klamath River water quality problems and the various inter-related causal mechanisms. The first sentence in this chapter is indicative of the inclusive approach taken in the *Draft Klamath TMDL* to water quality problems:

“In the Klamath River in California increased water temperatures, elevated nutrient levels, low dissolved oxygen concentrations, elevated pH, potential ammonia toxicity, increased incidence of fish disease, an abundance of aquatic plant growth - high Chlorophyll-a levels (both planktonic and periphytic algae), and high concentrations of potentially toxic blue-green algae, particularly in

the impounded reaches, decrease the quality and quantity of suitable habitat for fish and aquatic life, and have disrupted traditional cultural uses of the river by resident Tribes. These conditions contribute to the non-attainment of beneficial uses, including the most sensitive beneficial uses: those associated with the cold water fishery (specifically the salmonid fishery) in California, and those related to cultural uses and practices.”

The TMDL uses very solid references (U.S. EPA, 2003; Tetra Tech, 2006) for choice of water quality parameters and numeric end points indicative of pollution and takes an approach generally compatible with the *Water Quality Control Plan for the Hoopa Valley Indian Reservation* (HVTEPA, 2008). There is an impressive amount of detail on interaction of different water quality problems and their implication for fish health. This includes the recently discovered relationships between nutrient enrichment and the proliferation of the deadly pathogen *Ceratomyxa shasta*. Two innovative flow charts (Figure 2.1, 2.2) are exemplary of the analytical power of graphics in the draft. These figures present pathways for nutrient pollution, including toxigenic algae (Figure 2.1) and relationships of water temperature stress, river ecosystem response, fish physiological response and impact on beneficial use (Figure 2.2)

The amount of data assimilated and interpreted by the *Draft Klamath TMDL* shows a huge amount of effort and many of the summary charts and maps are innovative and very powerful. Particularly useful examples include a temperature summary of Klamath River tributaries (Figure 2.7) a limnological profile of Iron Gate Reservoir (Figure 2.8) showing that areas having temperature and dissolved oxygen suitable for trout do not overlap, charts summarizing exceedance of D.O. (Figure 2.21 and 2.22) and pH (Figure 2.23), and a map of river reaches where fish kills have occurred (Figure 2.25).

2.2 Water Quality Standards

A footnote on page 3 of TMDL states that “The Hoopa Valley Tribe owns land, 12 miles by 12 miles, primarily in the Trinity River watershed but intersecting with the Klamath River at Saints Rest Bar upstream of the confluence with the Trinity (www.Hoopansn.gov).” This statement should be revised to reflect that fact that the Hoopa Valley Tribe has more jurisdiction of the land than simple ownership; it is a part of a sovereign nation.

Page 3 of TMDL states that “The Yurok and Karuk Tribes have also adopted water quality standards, as has the Resighini Rancheria. These water quality plans and standards have not yet been approved by U.S. EPA, however, and the California Regional Water Board will consider their content and use for guidance, as appropriate.” We are glad see that the NCRWQCB will consider the content of these standards and use them for guidance. One clarification is in order though. The phrase “These water quality plans and standards have not *yet* been approved by U.S. EPA” implies that Resighini Rancheria is in the process of seeking U.S. EPA approval for its standards. It is our understanding, based on previous conversations with Phil Smith (former Resighini EPA director), that

Resighini Rancheria is not seeking U.S. EPA approval for its water quality standards. Consequently, we suggest that the word “yet” be removed from the sentence.

2.2.1.1 Beneficial Uses

We are glad to see Native American Culture (CUL) listed as a beneficial use. This had previously been requested by various Tribes.

2.2.1.2 Water Quality Objectives

The TMDL states on page 4 that “Additionally, pH is discussed as it influences nutrient related parameters such as ammonia toxicity.” We agree that it is true, and important, that pH influences ammonia toxicity. Additionally, it is also true that high pH can be directly stressful to salmonids, either on its own or as a cumulative stressor in conjunction with other water quality parameters (Wilkie and Wood, 1995; *Draft Klamath TMDL* Appendix 1). In fact, the Basin Plan standard for pH is exceeded on a daily basis across much of the Klamath River in the warm summer months (Hoopa TEPA, 2008). Thus, we suggest that the sentence be revised as follows: “Additionally, pH is discussed because high pH can be directly stressful to salmonids and it also influences nutrient related parameters such as ammonia toxicity.”

The TMDL states on page 6 that “In those waterbodies identified as COLD, but unable to meet the salmonid life cycle requirements due to natural conditions, a minimum 85% saturation limit, as calculated based on natural water temperatures, will be proposed.” It is unclear as to why 85% dissolved oxygen saturation is proposed, as no justification is provided. As is noted on page 9 of the TMDL, the Hoopa Valley Tribe (HVTEPA, 2008) set a standard that if the 7-day moving averages of the daily minimum DO standards “are not achievable due to natural conditions, then the COLD and SPAWN standard shall instead be DO concentrations equivalent to 90% saturation under natural receiving water temperatures.” The *Klamath TMDL* should provide justification as to why 85% is an appropriate standard, rather than 90%. Until we see the justification for 85%, we withhold judgment on whether 85% or 90% is a more appropriate standard.

2.2.2.2 Hoopa Valley Tribe Water Quality Criteria

The TMDL states on pages 8 and 9 that “As stated in a footnote within the Hoopa’s Basin Plan, these natural conditions *are to be defined* through consultation on the *Klamath River TMDL*.” [emphasis added] That is a paraphrase that does not reflect the exact meaning of the Hoopa Valley Tribe’s standards. The TMDL should use the exact language from the standard: “Through consultation, the ongoing TMDL process for the Klamath River *is expected to further define* these natural conditions.” [emphasis added]. The Hoopa Valley Tribe, NCRWCB, and U.S. EPA have not yet reached agreement on what natural conditions are in the Klamath River, and the Hoopa Valley Tribe retains the right to make its own decision regarding what definition of natural conditions it will use in its own water quality standards. The *Klamath TMDL* document should be revised to accurately reflect that reality.

2.3.1 Klamath River Nutrient and Temperature Conceptual Models

Overall, this section presents very informative and complete conceptual models regarding Klamath River water quality.

Figure 2.1 of the TMDL presents an excellent nutrient conceptual model for the Klamath River in California. We recommend the following addition to this diagram to make it more complete. The primary habitat of the polychaete that infects *C. shasta* is fine benthic organic matter (FBOM) organic matter and its secondary habitat is dense beds of *Cladophora*, a filamentous green algal species that thrives in nutrient-rich waters. The FBOM can be derived from breakdown products of any type of particulate organic matter, including periphyton or phytoplankton. Thus, an arrow should be added connecting “Elevated Phytoplankton and Cyanobacterial Growth” (nB2) and “Increased Polychaete Habitat” (nB4). Also, see comments on 2.3.2.3 Nutrient Risk Cofactors below.

Figure 2.2 of the TMDL presents an excellent temperature conceptual model for the Klamath River in California. It is unclear why “Increased Coarse Sediment Load” (tA2) is listed as a Driver/Stressor, but “Increased Fine Sediment Load” is not listed, because fine sediment can alter channel morphology in similar ways as coarse sediment (i.e. increasing width/depth ratio by filling pools)(PWA, 1997). “Increased Fine Sediment Load” should be considered for addition as a Driver/Stressor.

2.3.2.1 Nutrient Related Affects on Productivity

The TMDL states on page 19 that: “The limiting factor for the presence of *C. shasta* appears to be the presence and abundance of the polychaete in the Klamath River.” This statement may not be entirely correct. The dynamics between *C. shasta*, the polychaete, and salmonid are complex. While we agree that the presence and abundance of the polychaete is a very important factor influencing *C. shasta* in the Klamath River, another that is probably equally important is the massive loads of myxospores that returning adult salmon deliver to a concentrated area below Iron Gate Dam. We suggest that sentence be changed to “One limiting factor for the presence of *C. shasta* appears to be the presence and abundance of the polychaete in the Klamath River.”

Page 21 of the TMDL states “The polychaetes are filter feeders and feed on various forms of phytoplankton, and most preferably diatoms.” This statement should be revised to include mention of fine organic detritus, because Stocking (2006) noted “Examination of live specimens revealed a diet consisting of very fine (2 – 3 μm) detritus and small diatoms.” The significance of this is that any particulate organic matter (whether originally from diatoms, cyanobacteria, or aquatic macrophytes) can break down and become food for the polychaetes.

Page 22 of the TMDL states “These conditions are found in Copco and Iron Gate Reservoirs, coupled with elevated nutrient concentrations, which promote nuisance

blooms of blue-green algae (NB6), particularly *Microcystis aeruginosa* and *Anabaena flos-aquae*. Both of these species of blue-green algae are capable of producing cyanotoxins.” Analyses of phytoplankton data collected in Copco and Iron Gate Reservoirs have found *Aphanizomenon flos-aquae* is more abundant than *Anabaena flos-aquae* (Kann and Asarian, 2006, 2007). Therefore, we suggest that the passage be revised to state “These conditions are found in Copco and Iron Gate Reservoirs, coupled with elevated nutrient concentrations, which promote nuisance blooms of blue-green algae (NB6); the most common are *Microcystis aeruginosa*, *Aphanizomenon flos-aquae*, *Anabaena flos-aquae*, and *Gleotricia echinulata*. All four of these species are capable of producing cyanotoxins; however, toxins have not been detected in any *Aphanizomenon flos-aquae* strains present in the Klamath Basin (Jacob Kann, pers. comm.).”

2.3.2.3 Nutrient Risk Cofactors

This section should also mention channelization and diking as nutrient risk co-factors, and Figure 2.1 should be revised accordingly.

An issue that is underappreciated, yet critically important, is that channelization and diking impairs natural river processes that retain (i.e. remove from the water column) nutrients through denitrification, growth of attached algae, and the settling of organic matter. The result of channelization and diking in the upper Klamath River basin is higher downstream nutrient loading than would have occurred historically. As described by Bernot and Dodds (2005):

“Several additional management methods that have not been regularly employed may prove to be useful in maximizing N retention and removal in lotic ecosystems. These include: 1) Maximizing substrata heterogeneity within the stream channel and creating backwaters where high rates of N flux can occur (for example, encouraging both nitrification and denitrification). ... 3) Restoring channelized lotic ecosystems that inherently decrease the ability of the system to handle increased N loads. *This restoration should include reversion to historical sinuosity, channel complexity, and connectivity to riparian wetlands as well as decreasing mean depth of the water column in the river channel.*” (emphasis added)

For example, studies in an agricultural area of Illinois (Opdyke et al., 2006) found that sediment denitrification was 390% and 99% higher in two meandering study reaches than in adjacent channelized reaches.

Also, the discussion on page 23 of Impoundments (nC7) should mention bed coarsening. Dam construction typically halts the downstream transport of gravel, resulting in more coarse substrates (Biggs, 2000). The Klamath Hydroelectric Project has had this effect on the Klamath River below Iron Gate Dam (FERC 2007). Larger substrates like cobble and boulder require higher flows to scour them than smaller substrates like gravel and sand. These coarse substrates are more stable, increasing the amount of periphyton and aquatic macrophytes than can grow (Biggs, 2000; Anderson and Carpenter 1998).

2.3.4.4 Increased Incidence of Fish Disease (*Ceratomyxa Shasta* and *Columnaris*) (Da4)

The TMDL states on page 31 “Elevated nutrient concentrations allow for the proliferation of prime polychaete habitat (periphyton) and thus large numbers of polychaetes and high infectious spore load in the river.” Because fine benthic organic matter is also prime polychaete habitat (see comments above regarding section 2.3.1), this sentence should be revised to “Elevated levels of nutrient and organic matter allow for the proliferation of prime polychaete habitat (periphyton and pockets of fine benthic organic matter) and thus large numbers of polychaetes and high infectious spore load in the river.”

2.4.3.1 Nutrient Concentrations

Outputs from model runs of nitrogen (N) and phosphorous (P) appear shown in Figures 2.9 and 2.10 do not appear to reflect appropriate values for “natural” conditions or background levels for sites in the Klamath River from below Salmon River to Turwar when compared with existing data, indicating that further model refinement may be needed. We doubt that these two aspects of the model’s predictions of nutrient concentrations are correct:

- N and P concentrations remain relatively constant between Iron Gate Dam and the estuary under natural conditions (they should decrease due to dilution and natural river purification processes).
- Natural N concentrations are higher than currently measured N concentrations.

We attribute these apparently erroneous predictions to a combination of two factors:

- The RMA model’s under-representation of nutrient reduction in free-flowing river reaches. Detailed comments regarding this subject have been submitted to NCRWQCB, U.S. EPA and Tetra Tech in writing by various Tribes (e.g. Yurok Tribe, 2006 and QVIC, 2006) and Kier Associates (Asarian 2007a; 2007b), so will not be discussed in detail herein. The subject has been also discussed in numerous inter-agency/inter-tribal meetings and conference calls.
- Problems with the N and P concentrations in the boundary conditions (model input) for Scott River, Salmon River, and Trinity River, where nutrient concentrations were too high (Upper Klamath Lake, Shasta River, and the unnamed tributaries below Iron Gate were fine).

From recent conversations with NCRWQCB staff, we understand that these tributary boundary conditions have been improved and that some of the model scenarios are being re-run and that the results will be included in future drafts of the TMDL. We expect that correction of these tributary boundary conditions should *partially* fix the problem we had previously identified that the model was over-estimating concentrations in the lower mainstem Klamath, although we are quite confident that model still does under-represent nutrient retention processes in free-flowing river reaches.

We request that when the updated model runs are completed, we would like to receive and examine the model outputs for the natural conditions and current conditions model scenarios so that we can assess how much improvement was made to the model and refine our comments regarding the *Draft Klamath TMDL* accordingly.

Additionally, we request additional information regarding exactly what recent changes were made to the tributary boundary conditions for the Scott, Trinity and Salmon Rivers. Tables 5.15 and 5.16 list the calculated TN, TP, and CBOD values for those tributary boundary conditions, but we would also like to know what the actual values are for the nutrient-containing model parameters (nitrate/nitrite, ammonia, orthophosphorus, organic matter, and algae).

2.4.2.2 Tributaries to the Klamath River

Although discussions several years ago between Work Group members, the NCRWQCB and U.S. EPA showed an initial reluctance to deal with Middle Klamath Tributary temperature problems, they are fully described and immediate action to remediate problems is recommended in the TMDL:

- “Temperature data from the mouths of Klamath tributaries indicate that the seasonal maximum temperatures of the majority of the tributaries are not supportive of beneficial uses.” (page 36)
- “It is well known that historic mining, road building, and silvicultural practices have resulted in riparian disturbances and consequent reductions of stream shade in many tributaries.” (page 37)
- “Therefore, California Regional Water Board staff concludes that enough information exists to confirm impairment and justify TMDL development and implementation.” (page 37)

Klamath National Forest data in Figure 2.24 that show riparian channel scour associated with debris torrents on January 1, 1997 indicates the magnitude of temperature problems related to cumulative watershed effects in Middle Klamath River tributaries (Figure 1). We fully support the TMDL’s technical analysis regarding water temperatures in the Klamath Tributaries, and hope that the NCRWQCB will follow analysis with a strong implementation plan required to restore and protect beneficial uses.

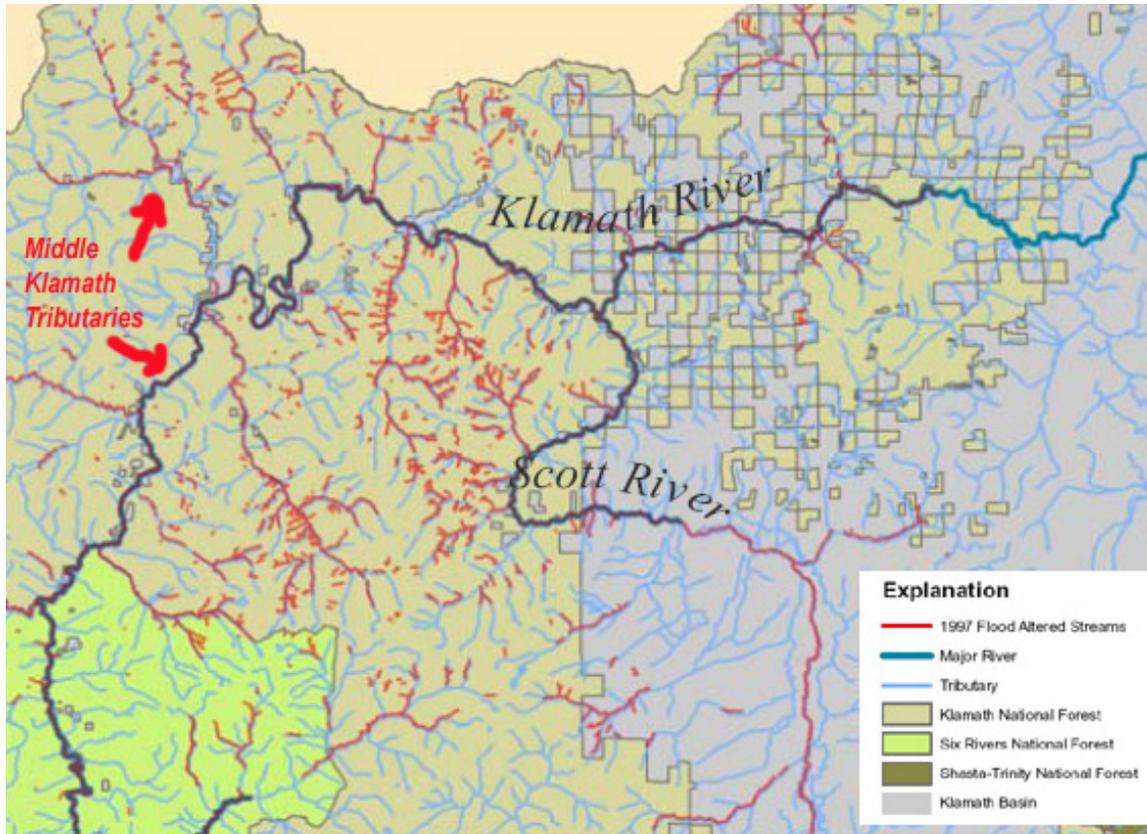


Figure 1. Map taken from Figure 2.24 highlights channel scour caused by debris torrents on January 1, 1997 showing magnitude of cumulative effects related temperature problems in Middle Klamath River tributaries.

2.4.4.2 Summary of Blue-Green Algae and Microcystin Conditions

This section regarding *Microcystis aeruginosa* and other toxic algae species is probably longer and more detailed than it needs to be (e.g. language could be condensed, and some of the data charts could be replaced with a smaller number of summary charts such as box plots), but it does provide useful information and serves the intended purpose of documenting the existence of toxic algae problems in the Klamath River and its reservoirs. We appreciate the attention given to this topic in the TMDL, even though the Klamath River below Iron Gate Dam is not formally listed as impaired for *Microcystis* or microcystin (the reach of river/reservoirs between Stateline and Iron Gate Dam is listed).

The TMDL states on page 47 that “From early 1990 through 2004 blue-green algae, including *Aphanizomenon flos-aquae* and *Microcystis aeruginosa*, were documented in samples collected by PacifiCorp as occurring downstream from Link River dam in Oregon through Copco and Iron Gate Reservoirs in California (PacifiCorp 2006). This statement is probably erroneous. The PacifiCorp document cited makes no such statement, and we are not aware of any phytoplankton sampling conducted by PacifiCorp prior to 2001. The statement would be true if “1990” were changed to “2001” and Kann and Asarian (2006) used as a citation rather than PacifiCorp (2006).

There is a phytoplankton dataset for Upper Klamath Lake (UKL) beginning in 1990. As described by Kann (2006), *Microcystis* was found in UKL, with the highest concentrations found in Agency Lake (a lake attached to the northern end of UKL).

2.4.5 Dissolved Oxygen and 2.4.6 pH

The figures and tables presented in this section are an excellent way of summarizing a complex dataset into a form where longitudinal patterns can be easily seen.

2.6 Problem Statement Synthesis

Chapter 2 concludes with a clear synthesis of Klamath River water quality problems that show a compelling need for action. The conclusions stated in the bullets are well-supported by scientific evidence presented in the problem statement.

Chapter 3 (Analytic Approach):

General Comments on Chapter 3

This section clearly describes the methods and tools used in the construction of the TMDL. In our comments below, we provide some suggestions to further improve it.

3.2.1 Models Applied

It is our opinion that changes that TetraTech made to PacifiCorp's water quality model are good and have resulted in improved model performance; however, we still have concerns regarding the model's under-representation of nutrient reductions in the free-flowing river reaches (see comments above in section 2.4.3.1 Nutrient Concentrations).

3.2.1.1 Model Configuration and Testing

The only year for which the TMDL water quality model was run downstream of Iron Gate Dam was 2000. This is unfortunate because there are only very limited nutrient data for locations downstream of Iron Gate Dam in that year. As such, we were unable to assess how the model predicts longitudinal (i.e. upstream/downstream) trends in nutrient concentration by comparing model predictions with data from the same year. Instead we had to look at what field data showed for longitudinal trends in other years, and compare them with longitudinal trends predicted by the model for 2000 (Asarian, 2007a; 2007b). While we acknowledge there are substantial variations in nutrient concentrations from year to year, some trends are consistently observed in the field data, yet are not observed in the model. For example, during the low flow summer period, once Iron Gate Dam flows drop to or near summer lows, field data total nitrogen loads at Orleans are almost always lower than at Iron Gate Dam (presumably because denitrification, algal assimilation, and settling outweigh the additional tributary loading in the reach); however, the TMDL water quality model predicts the opposite (presumably because the

model underestimates algal assimilation and does not include denitrification). For more discussions of this issue, see our comments above on section 2.4.3.1 above.

Had the TMDL water quality model been run below Iron Gate Dam for 2002, as it was for the upper portion of the Klamath River, it would have been easier to make “apples-to-apples” comparisons.

3.2.2.1 Current Conditions (S1)

It is not made clear in the text on page 7 whether hydropower peaking between the J.C. Boyle Powerhouse and the Copco Reservoir is included in the Current Conditions (S1) scenario. Since hydropower peaking typically does occur on days when average daily flow is less than ~2800 cfs (most of the year) in this reach, it would seem logical to have hydropower peaking in the Current Conditions model scenario. This should be clarified.

3.2.2.2 Natural Baseline Conditions (T1BS)

The TMDL (p. 7) states: “results for two model runs; one that used current conditions flows from Upper Klamath Lake and one that used estimated flows from a natural regime (USBR, 2005), were compared and not found to be substantially different. A comparison of the temperatures resulting from the current condition flows and natural regime flows is presented in Section 4.2.1.” It is not completely clear from looking at Section 4.2.1 which figure shows the comparison; the figure number should be explicitly stated.

Page 7 of the TMDL states that in the Natural Conditions Baseline (T1BS) scenario “The Lost River Diversion Channel (LRDC) and Klamath Straits Drain (KSD) were represented using current conditions flow, however, their water quality and temperature were set to be the same as Upper Klamath Lake.” This seems like a reasonable assumption for temperature, but perhaps not nutrients; however, it is a source of uncertainty and should probably be noted as such in the text.

It is not made clear in the text on page 7 whether hydropower peaking between the J.C. Boyle Powerhouse and the Copco Reservoir is included in the Natural Conditions Baseline (T1BS) scenarios. Page 7 states that “Current flow was again used to maintain consistency with the current conditions scenario”, yet it section 3.2.2.1 is not noted whether or not hydropower peaking occurs in the Current Conditions (S1) scenario. This should be clarified.

3.2.2.3 TMDL Compliance

Similar to our comment above regarding the Current Conditions (S1) and Natural Conditions Baseline (T1BS) scenarios, it is unclear whether the TMDL Compliance scenarios include hydropower peaking between the J.C. Boyle Powerhouse and the Copco Reservoir. This should be clarified.

Temperature Compliance in California (TCT1 and TCT2)

The meaning of this sentence on page 8 of the TMDL is very unclear and should be revised: “TCT2 is the same as TCT1, however, contributions are different for the Shasta, Scott, and Trinity Rivers.” In addition, this section has a description of how natural conditions were derived for the Shasta, Scott, Salmon, and Trinity Rivers, but does not mention the other smaller tributaries. It is our understanding based on previous inter-agency/inter-tribal meetings that in the natural conditions (T1BS) and the temperature compliance in California (TCT1 and TCT2) model scenarios, these smaller tributaries had their temperatures reduced by 2°C; however, this is not mentioned in this section of the TMDL, nor is there any presentation in Chapter 4 of modeling results indicating what effect this 2°C decrease had on mainstem temperatures. The text should be revised to clarify this issue, and if applicable, present the results in Chapter 4.

On page 9, the TMDL states that for Scott River tributaries downstream of Canyon Creek, the temperatures were reduced by 2°C in the natural conditions scenario based on studies by Wilder (2006). We had previously reviewed the Wilder (2006) study and found it to be reasonable (Yurok Tribe 2006; QVIC 2006b).

3.2.3 Nutrient Numeric Endpoint Analysis

Once the model runs with improved tributary boundary conditions (see comments in section 2.4.3.1 Nutrient Concentrations above) are completed, the following two statements should be re-evaluated in light of the new results to see if any changes are warranted:

“NNE benthic biomass spreadsheet scoping tool is uncertain, due to limited data on reach-averaged periphyton chlorophyll a densities. Application of the tool suggests that achieving the target of 150 mg/m² would require reductions in summer TN concentrations of up to 85 percent relative to current conditions, with the largest reductions needed in the reaches immediately below Iron Gate dam.” (page 12)

“The dams-out natural conditions run of the RMA model predicts TN concentrations in the Klamath River below Iron Gate that are somewhat above the targets estimated by the benthic biomass scoping tool; however, the model results are tempered by the fact that the frequency of scouring events that limit periphyton biomass development would also increase in a dams-out scenario.” (page 13)

Chapter 4 (Pollutant Source Analysis):

General Comments on Chapter 4

This chapter is well researched, scientifically sound, and contains nice illustrations (e.g. the conceptual source loading diagrams) that make subjects easily understandable. Sources of pollution in all areas of the Klamath Basin are clearly described, including Klamath Hydroelectric Project reservoirs, and data

that show levels of pollution are displayed in easy to read charts. The introductory paragraph that explains why the Klamath was known as the “river of renewal” succinctly describes the current problem: “source loads have overwhelmed the historic renewal capabilities of the Klamath, leading to its impaired status. The intent of the source analysis is to assess how and what loading scenarios will allow the river once again be restored through its own unique renewal capabilities.”

4.1.1 Pollutant Source Categories

This section recognizes and clearly describes the interplay of sediment contributions in Klamath River tributary watersheds and resulting impacts on water temperature and nutrients. This may obviate the need to develop a separate sediment TMDL; thus, implementation to reduce the risk of cumulative watershed effects can begin immediately (rather than waiting for a new sediment TMDL) with the goal of protecting and restoring critical salmonid cold water refugia. The recognition of the importance of refugia, and the description of how they work synergistically with the whole river to support cold water fisheries, reflects cutting-edge understanding of Klamath River ecology and is in accordance with U.S. EPA (2003) guidance on Pacific salmon, temperature and TMDL development.

4.1.2 Natural Background

This section provides interesting geologic background information that explains the Klamath River’s lack of buffer capacity and; therefore, its susceptibility to nutrient pollution. We generally agree with the information presented in this section and with conclusion that:

“These natural background heat, nutrient, and organic matter loads to the Klamath River underscore the very limited capacity of the river to assimilate anthropogenic pollutant sources, and the necessity for establishing load allocations that will result in attainment of water quality standards.” (p 4-5)

In the discussion regarding historically high ambient air temperatures, it would be good to add a note regarding the historical status of thermal refugia. Prior to widespread logging and agricultural development, which have increased sediment levels, reduced stream canopy, and depleted flows, there were likely a greater abundance of high-quality cool-water refugia due to more (and colder) water in tributaries and greater connection with hyporheic flow in the mainstem. U.S. EPA (2003) states that this was generally true for most large rivers in the Pacific Northwest:

“Alluvial floodplains with a high level of groundwater exchange historically provided high quality habitat that served as cold water refugia

during the summer for large rivers in the Columbia River basin and other rivers of the Pacific Northwest. These alluvial reaches are interspersed between bedrock canyons and are like beads on a string along the river continuum. Today, most of the alluvial floodplains are either flooded by dams, altered through diking and channelization, or lack sufficient water to function as refugia.”

While much of the length of the Klamath River does flow through canyons, there are many small alluvial features (i.e. gravel bars) in those canyons that should exhibit some hyporheic flow (particularly in historical conditions prior to clogging of pore spaces by fine sediments). In addition, there are some significant alluvial valleys including Seiad Valley, Scott Valley, and the areas now impounded under Keno, Copco, and J.C. Boyle Reservoirs.

Snyder (1931) made the following observation related to water temperature that suggests hyporheic connection at some locations in the 1920’s:

“One may at times find a difference of two degrees between the water flowing along the north and south banks where the river is not more than 250 feet across, and where there are neither springs nor tributaries to affect it.”

4.1.3 Pollutant Source Loads – Overview

Tables 4.2, 4.3 and 4.4 (displayed graphically in Figures 4.1, 4.2 and 4.3) present a good summary of tributary and mainstem loading for nitrogen, phosphorus, and organic matter. However, some aspects of the Figures and Table are confusing or ambiguous.

For example, the text does not adequately explain how Figures 4.1, 4.2, and 4.3 were constructed, saying only “The Klamath TMDL models were used to calculate loads...”. Upon close examination it appears that Figures 4.1, 4.2 and 4.3, were constructed by summing tributary loads, but do not actual make use of model outputs and/or take into account nutrient retention and loss. For example, according to Appendix 4, “For TP, the annual retention rate estimated for the model is 6.11 percent for Iron Gate and 1.22 percent for Copco”, yet the load shown in Figure 4.1 for the outflow of Iron Gate Dam is 824917 lbs, almost exactly the same as the sum of loads from reservoir tributaries, reservoir benthic loads, and mainstem load at Stateline:

756036	Klamath River at Stateline
60170	Minor Tributary Inputs (i.e. Jenny Creek)
1940	Benthic Load, Copco Reservoir
6772	Benthic Load, Iron Gate Reservoir
<hr/>	
824918	Sum

Thus, the text should be revised to indicate that the loads shown for each reach outputs are the sums of upstream tributary/benthic loads, not actual loads for reach outputs (the sum of tributary loads will generally be higher than the actual loads of reach outputs, due to retention/loss). Alternatively, the figures could be revised to explicitly show retention/loss as a term (arrow) in each reach.

Also, it is not clear what the units are for CBOD (Table 4.4 and Figure 4.3). Is it pounds of dry weight of organic matter, wet weight of organic matter, or pounds of oxygen?

On a related note: what are the stoichiometric ratios used in the model for OM:CBOD:ON: OP:OC? From looking at the modeling appendices, it would appear to be OM=1 (organic matter), CBOD (carbonaceous biochemical oxygen demand) =1.4, ON (organic nitrogen) = 0.07, OP (organic phosphorus) = 0.0055, and OC (organic carbon) = 0.45. Can you confirm that is an accurate characterization of what the model is using?

In Table 4.2, why is Trinity N:P load ratio 1.5:1 for the critical period and but 3.59 for the entire year? This seems erroneous, because it is inconsistent with the information presented in Table 5.15 (in Chapter 5), the Trinity N:P concentration ratio is 2:1 for dry season (May – October) and 3:1 for the wet season (November – April).

4.2.2.1 Temperature (Copco 1 and 2 and Iron Gate Reservoirs)

This section clearly establishes the problems with Klamath River fall water temperature increases due to the thermal mass of Iron Gate Reservoir and the subsequent depressed temperatures during the egg incubation and fry rearing stages of fall chinook salmon in the early months of the following year. The TMDL should specifically reference the potential for a shift in fall chinook run timing associated with selective pressures exerted by temperature change (Figure 2). Maintaining water temperatures above optimal for spawning for an extra two to three weeks annually has a potential to decrease spawning success and fecundity of early returning fish. Also prolonged severe cold during winter would lengthen egg incubation time and stunt growth of juvenile fall chinook. Later hatching smaller fish have slower migration to the sea, greater susceptibility to disease, and lower survival.

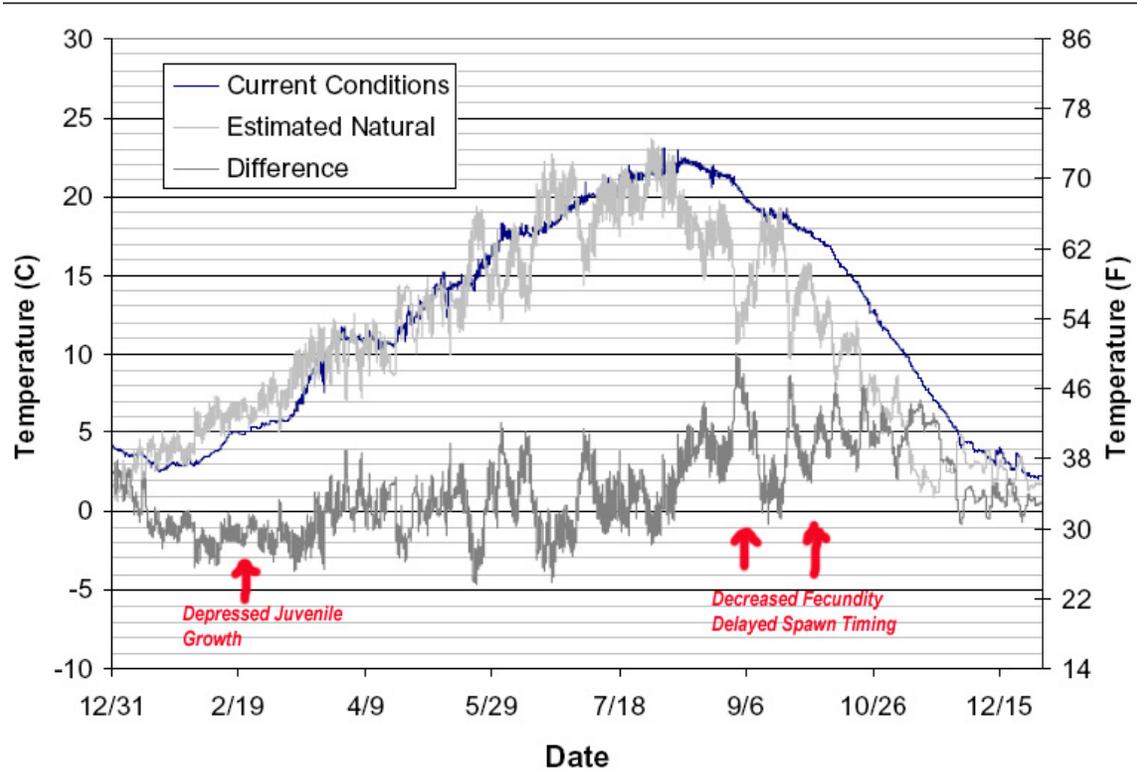


Figure 2. This chart is taken from the *Klamath TMDL* Figure 2.6 and highlights critical periods of Iron Gate thermal mass temperature shifts and impacts to different fall chinook life history phases.

Figure 2.2 (Temperature Conceptual Model for the Klamath River in California) should be modified with regard to “fish related responses” in Response/Outcome #4 to include reduced spawning success and decreased juvenile growth (Figure 3).

All the temperature figures in sections 4.2.2.1 and 4.2.4.1 show daily maximum or 7-day average of daily maximum temperatures. We agree that these are good metrics to use, but there is no discussion in the text of why these metrics were chosen, or if the use of different metrics (e.g. mean or 7-day average of daily mean) would have resulted in different conclusions.

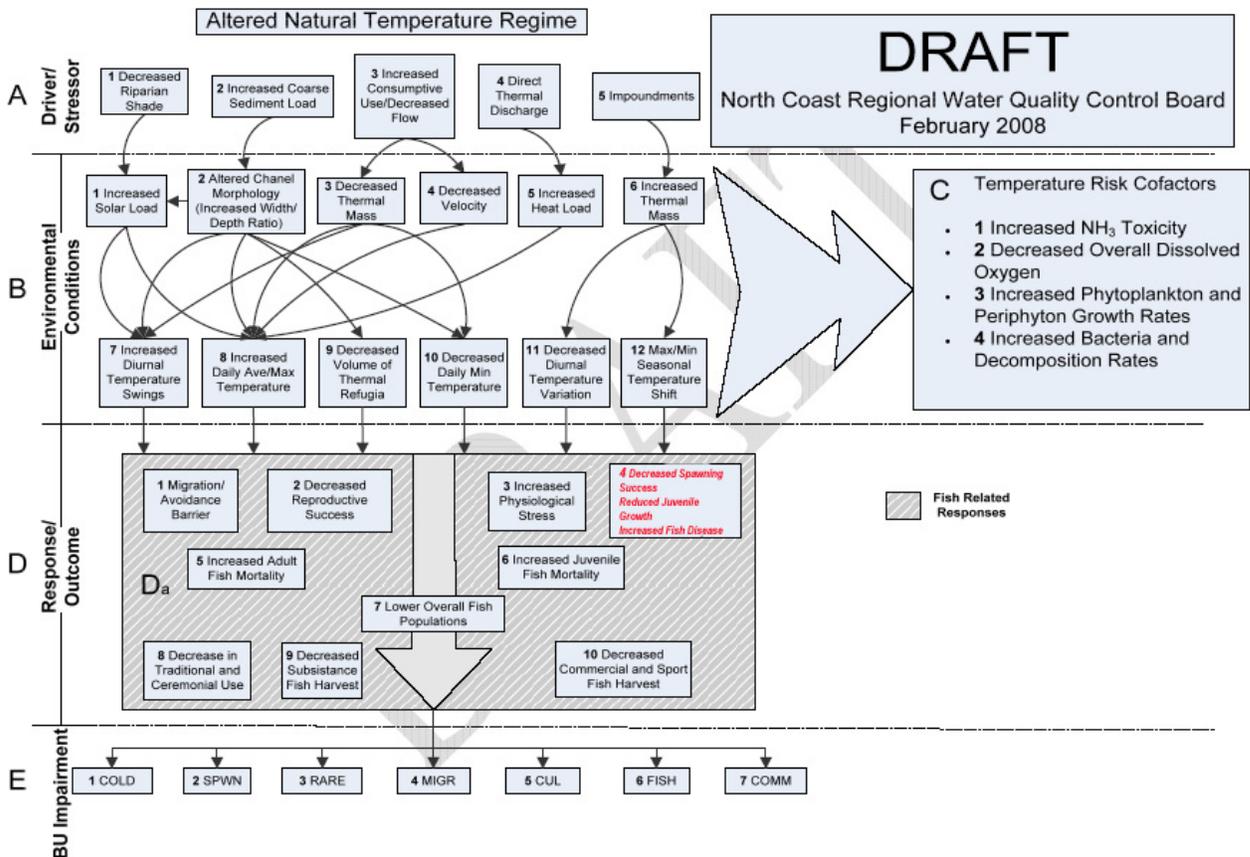


Figure 3. This flow chart from the *Klamath TMDL* Figure 2.2 has been modified to reflect temperature impacts to all life history phases of fall chinook.

4.2.2.2 Nutrients, Organic Matter, and D.O. (Copco 1 and 2 and Iron Gate Reservoirs)

This section does a good job of describing how Copco 1 and 2 and Iron Gate Reservoirs cycle nutrients, sometimes trapping them at depth and sometimes releasing pulses downstream. Of particular interest is Iron Gate Reservoir, since it is the source of water for the Lower Klamath River. The description of how reservoirs can release nutrients from biologically active surface waters or depth is very clear, including how nutrient release occurs from the bottom sediments and organic deposits where anoxic conditions prevail.

It is unclear exactly whether Figures 4.9 and 4.10 represent total annual loads or for the critical summer period. It seems to indicate in the text that these are total annual loads, but the chart captions should explicitly state which time period is displayed.

4.2.4.1 Temperature (Tributaries)

This section makes reasonable assumptions with regard to improvement in temperature conditions in the Shasta, Scott and Trinity rivers and benefits to mainstem temperature reduction.

The *Klamath TMDL* modeling effort has provided excellent information regarding the differences in water temperatures between current and natural conditions, but some key conclusions resulting from the model outputs should be presented in a more clear and comprehensive fashion. Figures 4.21, 4.22, and 4.23 present some very important information regarding the consequences of NCRWQCB’s decision not to require full restoration of flows in the Shasta and Scott Rivers as part of the *Klamath TMDL*. Because the CA Compliance scenario (used to set the pollutant allocations in Chapter 5) does not require restoration of full natural flows in the Shasta and Scott, maximum temperatures in the Klamath River will still be 1-2°C warmer than natural in mid-summer (Figure 4). The model results presented in Figures 4.21, 4.22, and 4.23 show that natural flows in the Shasta and Scott are not necessary to result in near-natural (i.e. <1°C difference) temperature conditions during the fall chinook spawning (i.e. September-October); the *Klamath TMDL*’s required mitigation of thermal impacts from the reservoirs (e.g. by dam removal) will be sufficient in that regard.

Those two points described in the previous paragraph should be made more explicitly clear in the TMDL text:

- Dam removal will result in near-natural temperatures for fall chinook spawning).
- Natural flows in the Shasta and Scott would be required to result in natural summer mainstem Klamath temperatures, and the TMDL is not going to require the restoration of full natural flows)

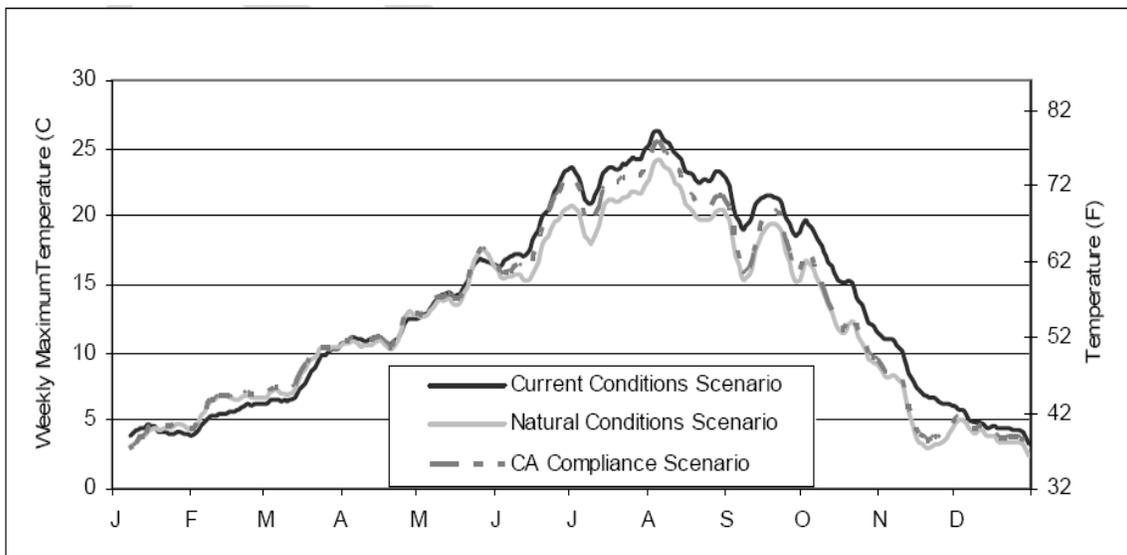


Figure 4. Klamath River 7-day average of daily maximum temperatures downstream of Scott River (Figure 4.23 from the *Klamath TMDL*)

The figures presented in this section of the *Klamath TMDL* (Figure 4.16 through 4.23) are all focused on how various scenarios regarding how tributaries (especially the Shasta and Scott Rivers) and the reservoirs affect mainstem Klamath River temperatures. Little or no information is presented in this section regarding the potential role of the confluences of

Shasta and Scott Rivers as major thermal refugia for the mainstem Klamath River. Thus, we recommend that some additional discussion and figures be added to show what the Shasta and Scott River models predict regarding this potential in each of three major scenarios (current, natural, and TMDL compliance). The following four additional graphs should be added showing (one graph, with each scenario being a different line):

- 7-day average of daily maximum temperatures of Scott River for each of the three scenarios.
- Flow of Scott River for each of the three scenarios.
- 7-day average of daily maximum temperatures of Shasta River for each of the three scenarios.
- Flow of Shasta River for each of the three scenarios.

This is unique information that has never been previously available. The Klamath TMDL has exerted considerable effort to model temperatures, it would be unfortunate if valuable results from that modeling effort were not presented in a clear fashion and made available to stakeholders.

Effects of Shade on Klamath River Tributaries and Effects of Sediment Loads on Klamath River Tributaries

The discussion of effects of shade and increased sediment loads on thermal regimes of Klamath River tributaries is scientifically framed and comes to an appropriate conclusion:

“Given the similarity of Klamath River tributaries to other north coast watersheds, and the universal nature of the laws of thermodynamics, Regional Water Board staff have determined that the conclusions of shade-related analyses from previous temperature TMDLs stated above apply region-wide, and especially to Klamath tributaries not already assigned TMDL shade allocations. Riparian shade controls are needed in many Klamath River tributaries not subject to an existing TMDL Action Plan.”

Chapter 5 (Pollutant Allocations):

General Comments on Chapter 5:

This chapter presents pollutant load allocations and numeric targets. The pollutant load allocations are well-justified and, *if properly implemented*, should result in substantial protection and restoration of beneficial uses.

5.1.2 Temperature Load Allocations

This section makes a clear statement regarding narrative standards for temperature which does not allow increases over natural background: “Because water temperatures in Klamath basin streams already adversely affect the beneficial uses during critical time

periods, the natural receiving water condition becomes the temperature objective, and no increase is permissible.”

5.1.3 Nutrient and Organic Matter Load Allocations

We agree that dissolved oxygen *Basin Plan* targets are appropriate, and that setting Iron Gate and Copco reservoir nutrient standards to limit “chlorophyll-a at levels sufficient to limit blue-green algae density” is also constructive. Mainstem Klamath reaches below Iron Gate will have targets of “benthic algal biomass (periphyton) that will reduce the incidence of fish disease and meet DO objectives”; we agree with this approach. Load allocations for monthly mean concentrations of total nitrogen (TN), total phosphorous (TP) and organic matter (CBOD) are also acceptable.

5.3.1 Dissolved Oxygen and Temperature (Within Reservoir)

We support the strong allocation presented in this section regarding the dissolved oxygen and temperature compliance lens and think it will be protective of beneficial uses.

5.3.2.1 Targets (Within Reservoir: Nutrients and Organic Matter)

Page 9 of the TMDL states “Nutrient and organic matter targets that are expressed as monthly mean TN, TP, and CBOD concentrations at the tailraces of the dams (Table 5.6).”

If the purpose of the standards is to prevent toxic algae blooms in the reservoir, would it not make more sense for the targets to apply to the photic zone (i.e. top 10 meters) that is subject to phytoplankton blooms, rather than the dam tailraces?

5.3.2.2 Allocations (Within Reservoir: Nutrients and Organic Matter)

We support the strong standard in the section and think it will be protective of beneficial uses.

5.4.1.2 Allocations (Reservoir Tailrace: Temperature)

We support the strong allocation presented in this section regarding temperature of the reservoirs’ tailrace and think it will be protective of beneficial uses.

5.4.2 Nutrients, Organic Matter, and Dissolved Oxygen (Reservoir Tailrace)

This section is mostly satisfactory, but we do have one question. Why is there no allocation list for dissolved oxygen for the reservoir tailrace?

5.6.1 Temperature (Tributaries)

Page 15 states “Watershed-wide temperature allocations are presented in Section 5.7. Regional Water Board staff have not assigned a load allocation for flows from the Shasta, Scott, and Trinity Rivers. Potential options for allocating these sources will be presented to the Regional Water Board at a future date. The allocations will be set pursuant to the direction of the Regional Water Board.”

We are interested to learn more regarding what potential options Regional Water Board staff are considering. As shown by water quality model outputs in section 4.2.4.1 of the

Draft Klamath TMDL, restoration of full natural flow in the Shasta and Scott Rivers would result in reduced summer maximum temperatures across a substantial portion of the mainstem Klamath River; however, this would likely require a very large reduction in agricultural water use. Therefore, a compromise option that Regional Water Board staff should explore is to determine what level of flow increases in the Shasta and Scott Rivers would be necessary to result in localized thermal refugia where they enter the mainstem Klamath River, and consider setting flow allocations accordingly. This would probably be a more realistic and achievable allocation than providing enough water to have a substantial effect on aggregate mainstem Klamath River water temperatures.

We will be paying close attention to this issue. Lack of flow is clearly an important driver of water quality problems in some parts of the Klamath Basin (especially the Shasta and Scott Basins), and therefore merits action commensurate with the level of the problem. We have not yet formulated an opinion on whether a flow allocation is the proper course of action, but would like to have discussions with Regional Water Board staff regarding this option.

For the restoration of Klamath River water quality, it is essential that issues be viewed in a basinwide context, and that all TMDLs in the Klamath Basin be successfully implemented. This includes the TMDLs for the following watersheds: Upper Klamath Lake, California/Oregon portions of the Mainstem Klamath, California/Oregon portions of the Lower Lost River, Shasta River, Scott River, Salmon River, Trinity River, and South Fork Trinity River.

5.6.2.1 Targets (Tributaries: Nutrients, Organic Matter, and Dissolved Oxygen)

Page 15 states: “The primary targets associated with tributary loadings are dissolved oxygen conditions within the Klamath River mainstem. The monthly mean and monthly minimum DO targets are calculated from the California compliance scenario. The primary DO target compliance location is located downstream of the Salmon River immediately upstream of the boundary of Hoopa Valley Indian Reservation, and the targets are presented in Table 5.13.”

Why is there only this one mainstem location that is not associated with a discharge? If the purpose is to meet the Hoopa Valley Tribe’s water quality standard for D.O. then the metric of the D.O. target should be a 7-day average of the daily minimums. Table 5.13 does not specify whether values are 7-day average of daily minimums (or some other metric). The revised *Klamath TMDL* should have an amended caption that clarifies this.

5.7.1 Riparian Shade (Watershed-Wide Temperature-Related Allocations)

This section states that “Regional Water Board staff have concluded that the load allocation for excess solar radiation assigned in previous TMDLs is also an appropriate allocation for excess solar radiation in the Klamath River watershed in California.” The specific antecedent TMDLs should be referenced. Although we have pointed out in the past TMDL comments that maximum water temperature are also driven by ambient air temperature and relative humidity over the stream (Bartholomew, 1989), not just solar radiation, we accept that riparian shade will be a sufficiently powerful surrogate to serve as a watershed index and to shape targets for minimizing disturbance and allowing

recovery of natural tributary temperature regimes and protection and restoration of cold water refugia.

5.7.2.2 Targets (Tributary Sediment)

Instream targets limiting sediment inputs to prevent resultant temperature increases are appropriate; however, upland targets for sediment prevention are weak and should be strengthened. Hence, we will here provide a recap of previous comments on this topic provided for the Scott TMDL Action Plan (QVIC, 2006a)

Disturbance related to logging in many Klamath Basin watersheds well exceeds levels known to cause damage to aquatic habitat (de la Fuente and Elder, 1998). Cumulative effects from logging and road building include (Ligon et al., 1999; Dunne et al., 2001; Collison et al., 2003):

- Changes in peak discharge and sediment yield resulting in channel simplification,
- Major changes in canopy cover in the transient snow zone increase risk of catastrophic flooding,
- Lack of forest growth on harsh sites in Middle and Lower Klamath watersheds is likely to prolong period of elevated risk of rain on snow events (and channel damage),
- Timber harvest on unstable soil types has elevated risk of both sediment and temperature (i.e. decomposed granitic geology), and
- Direct removal of riparian trees through harvest or loss due to channel scour.

Without the explicit recognition of the above problems, NCRWQCB timber harvest review staff will lack specific guidance to remediate problems with cumulative watershed effects through the Waste Discharge Requirement (WDR) or waiver processes. Table 1 restates prudent risk limits that would be effective in preventing water temperature pollution problems by restoring natural hydrologic function and sediment regimes.

Table 1. Upland target conditions needed to minimize cumulative effects risk and to insure recovery of aquatic conditions.

Parameter	Upland Target Conditions	References
Road Densities	<2.5 mi./sq. mi.	NMFS (1996)
Road-Stream Crossings	<2 road crossings per mile of stream	Armentrout et al. (1999)
Timber Harvest	<25% of a watershed in 30 years	Reeves et al. (1993)
Unstable Slopes and Soils	No disturbance in SHALSTAB high risk zones or DG soils w/o geologic review	Dietrich et al. (1998) Sommerstrom et al (1991)
Management in Rain-on-Snow Zone	Trend towards normative hydrologic conditions	Jones and Grant (1996)

Kier Associates (2005) used the widely recognized shallow landslide stability (Dietrich et al., 1998) to show that 80% of active landslides in the lower western portion of the Scott River basin intersect with 7% of the landscape indicated as “very high in risk.” Since NCRWQCB staff are reluctant to cite or utilize SHALSTAB, the Klamath TMDL may not achieve success in preventing disturbance to these areas as part of timber harvest review; hence, patterns of disturbance, increased sediment yield, and temperature pollution will likely continue.

One note of caution is needed regarding the definition of sediment impairment and its application during TMDL implementation. The draft TMDL states that “human-caused alteration of stream channel dimensions that increases channel width, decreases depth, or removes riparian vegetation to a degree that alters stream temperature dynamics and is caused by a increased sediment loading” (Chapter 5, page 19). We recommend that NCRWQCB staff consider adding the following qualification: “Restoration projects that may have substantial short-term sediment impacts, but will result in long-term net ecological benefits, such as dam removal, will be exempt from this allocation, at the discretion of the executive officer of the NCRWQCB.”

5.8.1 Temperature TMDL

We support the strong standards in the section and think it will be protective of beneficial uses. However, this statement on page 20-21 may not be correct: “However, because no heat load is allocated to human-caused sources (i.e. the TMDL is set at natural conditions), there is no uncertainty about whether the load allocations will achieve water quality standards. Thus, the margin of safety is unnecessary for the temperature TMDL.” It appears as though the TMDL is indirectly allowing human-caused sources of heat because it is not requiring restoration of full natural flows in the Shasta and Scott Rivers. This flow depletion is an indirect source of human-caused heat load to the mainstem Klamath River.

5.8.3 Dissolved Oxygen TMDL

Page 23 of the TMDL states:

“The Klamath River TMDLs have not assigned any allocations for dissolved oxygen. Rather the approach to address dissolved oxygen impairments has been to address those factors contributing to low dissolved oxygen conditions including: temperature, nutrients, and organic matter. The allocations given for temperature, nutrients, and organic matter ensure that the dissolved oxygen targets (NCRWQCB Basin Plan water quality objective for DO) is achieved at all locations within the Klamath River. Therefore the TMDL for dissolved oxygen is the sum of the equations for temperature, nutrients, and organic matter.”

Why are dissolved oxygen allocations for Iron Gate and Copco Reservoirs not included?

5.8.4 Margin of Safety - Nutrients, Organic Matter, and Dissolved Oxygen

“The numeric model used to predict the impact of allocations assumes that sediment oxygen demand (SOD) does not improve in the riverine sections. The magnitude of SOD will likely decrease with the decrease of organic loading allocated by the TMDL and result in a shorter season of DO concentrations less than numeric criteria.” If our understanding of the model is correct, this statement is incorrect because SOD is only present in the CE-QUAL-W2 model used for reservoirs, not in the RMA model used for free-flowing riverine sections. If “riverine” were changed the “reservoir”, the statement would be correct.

Appendix 1 (Effects of Temperature, Dissolved Oxygen/Total Dissolved Gas, Ammonia, and pH on Salmonids):

General Comments on Appendix 1:

Overall, this appendix presents an excellent literature review of the effects of temperature, dissolved oxygen/total dissolved gas, ammonia, and pH on salmonids.

Less information is presented regarding pH than the other parameters. We suspect that is probably mostly due to a relative paucity of research regarding the effects of pH on salmonids; however, Wilkie and Wood (1995) is an excellent reference this is not cited in Appendix 1 but we recommend that it be included upon revision.

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APPENDIX A:
Typographic/grammar errors and other less significant comments

Chapter 1: Introduction

Page 1. “PacifiCorps” should be “PacifiCorp”

Chapter 2: Problem Statement

Page 31. “early1900’s” should be “early 1900’s”

Page 55. Figure 2.24 has large “\$” sign in upper left corner that should be removed.

Chapter 4: Pollutant Source Analysis

Page 22-23. The flows for Iron Gate Hatchery are listed in MGD; it would also be helpful if they were listed in cubic feet per second (cfs) in parentheses following the MGD numbers.

Page 24 of the TMDL states “...prior to settlement and water resource development in the 1850s...” This overlooks the fact that had already large numbers of people living along the Klamath River for thousands of years prior to 1850. A more appropriate way to say it would be: “...prior to European-American immigration and water resource development in the 1850s...” or “...prior to European-American settlement and water resource development in the 1850s...”

Page 24. “Figure 4.16 present” should be “Figure 4.16 presents”

Page 27. In the caption of Figure 4.21, “Scott” should be “Trinity”