Appendix E: Comments on Salmon River Temperature TMDL

Compiled by NCRWQCB staff

List of Comment Letters:

1 United States Department of Agriculture, Forest Service, Klamath National Forest, Margaret J. Boland, Forest Supervisor

Thank you for the opportunity to comment on the Salmon River Temperature TMDL.

The Forest Service values watershed conditions that support favorable water quality and beneficial uses in the Salmon River. The Forest Service designated the Salmon River as a Key Watershed and supported its Federal designation as a component of the Wild and Scenic River (WSR) system. Both the Key Watershed status and the WSR designation were linked to the presence of several anadromous salmonid stocks, including spring Chinook.

Forest delineation of Riparian Reserves, implementation of specific Land and Resource Management Plan Standards and Guides (USFS, 1995), and Best Management Practices, all help meet water quality standards. This type of management care ensures attainment of the temperature TMDL over time. Please incorporate the following language in the final TMDL:

> *The Standards and Guidelines under the Northwest Forest Plan and USFS Best Management Practices are expected to result in attainment of water quality standards throughout much of the Salmon River Basin. Where attainment of the TMDL may not be occurring, these practices will facilitate vegetative recovery over time that should result in attainment of the TMDL. The USFS's active watershed restoration program will reduce the risk of future exceedance of the TMDL. These activities are therefore considered part of the Margin of Safety in the TMDL. No new programs beyond these are needed to protect and restore water quality and to meet the TMDL.*

The Forest has been implementing an aggressive watershed restoration program for the past decade in the Salmon River watershed. We remain committed to reducing risks to water quality by implementing priority projects in the watershed as funding permits.

Jointly, our staffs are working collaboratively on a Memorandum of Understanding that will prioritize the remaining work to add to the margin of safety for water temperature. Such a strategy should be based on an understanding of how certain treatments affect shade and, in turn, watershed-wide water temperature.

Two important concepts we continue to work closely on are:

- An assessment of whether historic mine site revegetation can yield relatively significant reductions in water temperature.
- The relationship between road restoration and reduction of debris torrent risk. Debris torrents can destroy riparian vegetation through channel scour resulting in increased water temperature. The Forest will place priority on correcting road-stream crossings that pose a high risk for triggering debris torrents.

We support the 2-party MOU between our agencies proposed in the Implementation Strategy section (page 5-2). The Forest Service will continue to consult on our activities with all applicable tribes on a government-to-government basis, as well as consult all interested parties.

We previously provided detailed information to your staff in March 2005 in response to the pre-public review draft. If you have any questions, please contact Roberta Van de Water of my staff (530) 841-4534. We look forward to working with the Board on the development of the MOU to implement the Salmon River Temperature TMDL.

2 Karuk Tribe of California, Sandi Tripp, Director of Natural Resources

The Karuk Tribe of California (KTOC) supports the Salmon River total maximum daily load (TMDL) for temperature. In 1996, temperature was identified as an issue in the mainstem Salmon River in the Karuk Tribal Module for Mainstem Salmon River Watershed Analysis. In that document shading, pool frequency, and large woody debris were identified as components of concern for temperature in the mainstem. Although KTOC supports the TMDL, we would like to submit some comments before the draft is finalized.

Karuk ancestral territory covers sixty percent of the Salmon River watershed, and KTOC are the original stewards of all Karuk ancestral territory. Therefore, KTOC should be recognized as co-managers of the watershed. A partnership with the United States Forest Service (USFS) is not adequate. KTOC needs to be consulted by USFS for both implementation and monitoring for the TMDL. A memorandum of understanding (MOU) currently exists between Six Rivers (SRNF) and Klamath National Forests (KNF) and KTOC. However, representatives from the Salmon River Ranger District rarely participate in government to government meetings with KTOC. Therefore, we are not confident that our current MOU with USFS will be sufficient for guaranteeing us an active role in Salmon River TMDL implementation and monitoring. A new MOU with USFS and/or State Water Resources Control Board (SWRCB) needs to be created. Since KTOC wants an active role in Klamath, Salmon, and Scott watershed management and TMDL's, the MOU should encompass all of these areas.

KTOC is not confident in USFS's ability to implement and monitor its restoration strategy that would achieve the goals of the TMDL. Funding for USFS is annually decreased. KNF is reducing the number of biologists it employs as well as field crew size. These actions barely allow KNF to keep up with monitoring, much less being able to have funding available for implementing restoration projects.

KTOC is interested in proper and wise management of these watersheds and timely implementation and monitoring of the Salmon River TMDL. When restoration and management efforts improve temperature and water quality conditions in the river, then fish health improves. This can increase tribal trust fish populations and enhance tribal subsistence fishing.

Single species management of forestry resources by USFS has changed the landscape from oak woodlands to mixed conifers. This is not a dynamic shift in vegetation (TMDL Section 2.7, paragraph 2), but rather poor management practices due to exclusion of native people's involvement in land management. USFS management led to clear-cutting forests and fire suppression. These practices enabled damaging catastrophic fires to occur with subsequent salvage logging into riparian areas until 1987. USFS continue to allow gold mining in the river. These actions destabilize river banks, damage fish habitat, disturb fish refugia areas, and displace larval tribal trust fish species.

KTOC feels that managing with a watershed perspective should be emphasized (TMDL Section 2.7, paragraph 3). If the watershed is managed for cultural resources and tribal trust species, then the entire watershed will benefit. Management areas should include, not only riparian areas, but also upslope areas. Along with fuels reduction, fire should be reintroduced to the landscape. Trees in the Salmon River watershed will greatly benefit once the fire regime is returned to its natural state. For example, fire in oak stands decreases the insects in the acorns, which leads to higher quality acorns for subsistence food and oak recruitment.

Along with the comments for the tone of the document, KTOC would like to see additional study sites used in developing the TMDL. Sites should include areas where stand-replacing catastrophic fires occurred. In the 1987 fires, areas on the north side of the South Fork sub basin were disturbed the most (TMDL Section3.3.4.1). However, no study sites were selected in these areas, so at least one site should be added downstream of Black Bear Creek.

Thank you for all of your hard work on the Salmon River temperature TMDL. We feel that it is a well-written and comprehensive document and appreciate your efforts. If you would like any clarification or further assistance please contact Susan Corum, Water Resources Coordinator.

Sincerely,

Sandi Tripp

Director of Natural Resources
Karuk Tribe of California

3 Shasta Nation Tribe of California, Gary Lake, Vice Chair

"The Shasta Nation Tribe of California opposes the involvement of the Karuk (Karok, Kahruk, Karock) Tribe in the implementation of a TMDL on the Salmon River. The Salmon River historically is known as the aboriginal territory of the Konomihu-Shasta Native American people, commencing approximately 1 ½ miles up river from the confluence of the Klamath River with the Salmon River.

We vehemently oppose the interloping Karuk Tribe's illegal encroachment into our aboriginal territorial lands as well as their unscrupulous meddling with regards toour Tribal concerns. Any empowerment given to the Karuk Tribe inside the Shasta Nation's aboriginal land will most assuredly be a detrimental infringement to the Shasta Nation's ongoing dialogue with the USFS in pursuing these very same goals.

If you have any questions please feel free to call Gary Lake, Vice-Chairman Shasta Nation, (541)621-0119, or Councilwoman Kathy Varnell, Secretary, (530)468-2557.

We thank you for the opportunity to submit our comments on this volatile issue."

4 The Klamath Basin Coalition, Glen Spain, Coalition Co-Chair

RE: Comments on proposed Salmon River Total Maximum Daily Load for Temperature (*TMDL or Salmon River TMDL*) and Implementation Plan (Plan)
Dear Mr. Gwynne and Mr. Leland,
This comment letter is on behalf of the above named local, regional and national organizations, all dedicated to conserving and restoring the biological resources of the west's once-great Klamath Basin. We appreciate the opportunity to comment on the proposed *Salmon River TMDL* and Plan for the Salmon River prepared by North Coast Regional Water Quality Control Board Total Maximum Daily Load Development Unit staff in partial fulfillment of the requirements of Section 303(d) of the federal Clean Water Act. The Salmon River is almost exclusively in Siskiyou County, with a small portion in the Upper South Fork located in Trinity County, California.

4.1 General Comments

We realize that this is the first technical TMDL document that the North Coast Regional Water Quality Control Board (NCRWQCB or Board) has released for comment in the California portion of the Klamath Basin. We would like to thank and commend the Board and its TMDL staff for creating a high quality product that takes a sound scientific approach with regards to assumptions and methods. It uses a well recognized temperature model, which commonly has been used in temperature TMDLs but also recognizes other factors that may influence temperature but that are less easily quantifiable and, consequently, cannot be modeled readily. The model focuses on seven stream/river segments that are in fair to good condition, but did not incorporate the more impacted segments of the river into the model simulations for riparian shade. Linking the *Salmon River TMDL* with existing management and restoration plans was a good idea. It builds on both the existing management and restoration frameworks to facilitate speedy implementation. To improve consistency between the Salmon River TMDL and the Plans, we recommend that the Salmon River Sub-basin Restoration Strategy (SRSRS) be updated to include new information and direction found in the Salmon River TMDL.
Although the document appropriately recommends that the Salmon River Sub-basin Restoration Strategy: Steps to Recovery and Conservation of Aquatic Resources (Elder et al., 2002) be followed, it is non-specific with regard to guidance on monitoring necessary for effective adaptive management. Linkage to Klamath National Forest management documents that help achieve Northwest Forest Plan objectives insures that most concerns regarding cumulative effects will be met. However, risk of damaging increased peak flows is not addressed, which could potentially confound the success of Salmon River TMDL implementation.

4.1.1 Fisheries

The quality of the fisheries section (Appendix A) is not equal to the rest of the document and is in need of greater revision. Specific and more detailed comments for Appendix A and salmonids of the Salmon River are provided below in the "Specific Comment" section.
Green sturgeon and Pacific lamprey are identified early in the text as living in the Salmon River. However, other than identifying that green sturgeon and Pacific lamprey are known to live in the Salmon River, the document lacks any subsequent discussion or assessment. This should be remedied. In the lower seven miles of the Salmon River green sturgeon are known to hold as adults, spawn, rear and outmigrate as juveniles. The 2004 Salmon River Weak Stocks Report (SRRC-2004) identifies that the Karuk Tribe and the SRRC fisheries staff held sturgeon dives in the months of April and May of 2003. A total of thirteen adult green sturgeon were observed in the lower seven miles of the Salmon

River. These crews conducted larval surveys and over one hundred larval green sturgeon were caught. Rapid growth of green sturgeon was noted when crews began catching juveniles several months after the larval stage. Over 450 juvenile green sturgeon were caught in the rotary screw trap, near the mouth of the Salmon River in 2003. There were over 300 Pacific lamprey trapped as well in 2003 (2001-2003 Salmon River Rotary Screw Trap Final Report – 2004). Green sturgeon are identified by the US Forest Service as being a sensitive species in Region 5.

Pacific lamprey, also listed by the US Forest Service in Region 5 as a sensitive species, is a key traditional spring food source for the Karuk tribal members living on the Salmon and Klamath River. The once abundant numbers of the Pacific Lamprey in the Salmon River have dwindled to a low level. Local native people have complained about the lack of availability of this important food source in the Salmon River. (Personal communications with Stanshaw 2002 – Karuk tribal member) Both the green sturgeon and Pacific lamprey are of significant cultural value to the Tribes of the Klamath Basin but are in danger of extirpation in the Salmon River.

4.1.2 Stakeholder Coordination

We recognize the value of having active partners such as the United States Forest Service (USFS), Salmon River Restoration Council, US Fish and Wildlife Service, and the Karuk Tribe in the management and restoration of this sub-basin. These entities have brought a wealth of data and knowledge to the process. The 13 years of available water temperature data was impressive and obviously helped you perform this comprehensive assessment. We recommend that you require the stakeholders, and in particular the USFS, to continue and expand the current level of their commitment to coordination efforts associated with the Salmon River Sub-basin Restoration Strategy.

4.1.3 Tribal Involvement

Most of the Salmon River sub-basin is within the Karuk Tribe’s ancestral territory. The entire sub-basin affects the cultural resources of the Karuk Tribe of California. The TMDL should recognize the Karuk Tribe as a key stakeholder that brings valuable resources to the table as co-managers of this sub-basin. This already is articulated somewhat by the USFS’s government-to-government relationship with the Karuk Tribe, and the associated Memorandum of Understanding between these two entities. However, this reality also should be reflected in the TMDL and its implementation plan.

The cultural and trustee resources of Native American Tribes in the Klamath Basin associated with water quality in the Salmon River are numerous and include several aquatic species in addition to the salmonids, such as green sturgeon, Pacific lamprey, Pacific giant salamanders, crayfish and other aquatic species and their habitat. Many of these aquatic species as well as various ceremonial activities associated with the Karuk Tribe’s cultural resources require high quality water.

4.1.4 Key Existing Beneficial Uses of the Salmon River

The following are the key existing beneficial uses found on the Salmon River, as numbered in the TMDL:

1. Municipal and Domestic Supply (MUN)
5. Groundwater Recharge (GWR)
6. Freshwater Replenishment (FRSH)
9. Water Contact Recreation (REC-1)
10. Non-Contact Water Recreation (REC-2)
11. Commercial or Sport Fishing (COMM) *
13. Cold Freshwater Habitat (COLD) *
14. Biologically Significant Area (BSA)
15. Wildlife Habitat (WILD)
16. Rare, Threatened, or Endangered Species (RARE) *
17. Migration of Aquatic Organisms (MIGR) *

18. Spawning, Reproduction, and/or Early Development (SPWN) *
19. Shellfish Harvesting (SHELL)
20. Native American Culture (CUL) *.

4.1.5 The TMDL Should Adequately Recognize the Biological Significance of the Salmon River in the Klamath Basin

The TMDL does not adequately identify or discuss the significance of the Salmon River aquatic resources to the larger ecological context in the Klamath Basin. The Salmon River sub-basin, a major tributary to the Klamath River, makes a significant contribution to the fisheries and water resources of the Klamath Basin. The 2004 NRC Report "Endangered Fish of the Klamath Basin" states that:

> "Within the lower Klamath watershed, the Salmon River remains the most pristine tributary; it has a natural, unregulated hydrograph, no significant diversions, and limited agricultural activity. Although it is not well documented, runs of all the remaining anadromous fishes in the Klamath watershed occur in the Salmon River (Moyle et al 1995, Moyle 2002)."

The NRC Report further continues:

> "[T]he tributaries of the lower watershed dominate the total runoff of the Klamath watershed. Their high runoff stems from their high relief and the orographic influence of the Coast Ranges, Trinity Alps, and the Marble, Salmon, and Russian mountains. For example, one relatively small tributary, the Salmon River, supplies runoff about equal to that of the entire upper watershed, but from less than one-fifth of the area.
>
> "The Salmon River's unique characteristics stem from its mountainous terrain and public ownership of land. At 750 sq. miles, the Salmon River is the smallest of the four major tributary watersheds in the Klamath basin. Even so, the annual runoff from the Salmon is twice that of the Scott and 10 times as great as that of the Shasta River."

The almost half a million acre Salmon River sub-basin is designated by the Northwest Forest Plan as a key watershed due to its outstanding and remarkable fisheries resource. Several portions of the river have designations under the federal and state Wild and Scenic Acts. The TMDL needs to articulate more comprehensively the significance of the Salmon River in the Klamath Basin.

4.2 Specific Comments

4.2.1 Impaired Status of the Salmon River

a) Temperature Listing: It is appropriate that the Salmon River is listed as impaired for temperature. The water quality of the Salmon River has outstanding values that offer the beneficial users unique and remarkable opportunities in the Klamath Basin. It is one of
the few sub-basins of the Klamath Basin that are known to have green sturgeon or wild spring chinook spawning and rearing in them. With water temperatures often rising above 75 degrees Fahrenheit in the summer in some locations in the center of this sub-basin, it is no wonder adult spring chinook have to hold in colder refugia pools, often at the mouths of colder streams. Human resource uses have led to the lack of riparian shade, insufficient coarse woody debris, and sub-optimal water temperatures largely in the summer. Lack of functioning hyporheic water flows in the river also increases water temperatures. These and other reasons certainly justify listing the Salmon River as impaired under the 303(d) Section of the Clean Water Act.

4.2.1.1 **Nutrient Listing: Although we agree that the Salmon River should be de-listed for** nutrients, the original listing of the Salmon River as nutrient impaired is somewhat of a mystery to us. <u>We recommend that the TMDL identify why the Salmon River was listed for nutrients and discuss what if anything has occurred since the original listing to ameliorate the circumstances that led to the listing.</u> Conversely, it seems that this more biologically intact watershed is likely deficient of nutrients due to lack of coarse woody debris as indicated in Upper South Fork (1994) and Lower South Fork (1997) Watershed Analyses.

4.2.1.2 Sediment Listing: The health of the Salmon River is threatened by impacts to the natural sediment regime and should have been listed as impaired by excessive sediment loading. This is supported by various sources. The 2004 NRC Report states, "the Salmon River watershed, although nearly pristine, may have geologic and hydrologic characteristics that are suboptimal for salmon. Under these conditions, human activities that increase sedimentation or raise stream temperature in the basin could have an especially large effect on salmon and steelhead."

4.2.1.3 Furthermore a primary focus of the Salmon River Sub-basin Restoration Strategy is to implement watershed/fisheries recovery actions that reduce sediment delivery to the aquatic habitat of the Salmon River. An over abundance of sediment impacts the beneficial uses of water quality in the Salmon River by reducing hyporheic flows in the river and streams; inundating spawning and rearing habitat; reducing pool depth and frequency; increasing water temperatures, and producing other detrimental impacts. The next revision of the 303 (d) list of impaired water bodies should identify the Salmon River as being impaired by sediment.

4.2.2 Assumptions and Methods

The Salmon River TMDL employs the widely used and trusted SSTEMP model (Bartholow, 2002) and the document clearly states its assumptions, which are met, and follows methods that are scientifically sound. The key assumption is that water temperature impairment is best estimated by gauging riparian conditions and shade over the stream and best controlled by improving riparian conditions over time. Field verification of the model demonstrated that shade was an important factor in controlling water temperature and that riparian condition was less than optimal in many stream reaches because of timber harvest, fires, debris torrent impacts and historic mining.

The University of California at Davis Information Center for Environment (ICE) vegetation modeling also used standard remote sensing data and assumptions with regard to tree heights and site potential (in Appendix B). Field verification and subsequent model runs showed improvement as shade conditions improve with riparian recovery over time, as expected. Because of stream width and other factors, lower order streams show a much greater response than larger tributaries and mainstem reaches.

4.2.3 Impacts to Riparian Zone Section Overlooks Potential Cumulative Effects

The Salmon River TMDL lists several factors that can influence riparian stand structure and stream channels, including landslides, fire, flooding, timber harvest and roads. These discussions are adequate, but fail to point out the interconnected nature of these potential impacts – a discussion that generally falls into the category of cumulative watershed effects (Ligon et al., 1999; Dunne et al, 2000; Collison et al., 2003). Although the TMDL needs to remain focused on temperature, relationships should be acknowledged fully and identified for further study in the full Salmon River TMDL Implementation Plan or through monitoring related to it. For example:

- Streamside landslides related to large earth flows are described, but accumulated debris torrents and increased peak flows can trigger additional catastrophic landslides known as inner gorge failure;
- Flood damage and channel changes can be caused by increased peak discharge resulting from accumulated disturbance related to timber harvest and road building, especially in the rain-on-snow zone (Jones and Grant, 1996);
- Fire risk may be elevated by timber harvest, which can reduce relative humidity in the forest and leave fuels in the form of slash, and management outside riparian zones can change fire behavior resulting in hot fires that spread into them;
- Multiple stream crossings (known as "stacked" culverts) pose greater risk of catastrophic channel scour from debris torrents (Armentrout et al., 1999; de la Fuente and Elder, 1998); and

- Extensive disruption of riparian areas due to hydraulic mining may have altered cold water feeds from gravel bars that could have provided refugia for salmon and steelhead during low flow, high temperature periods (U.S. EPA, 2003).

The U.S. EPA (2003) Guidance for Pacific Northwest State and Tribal Temperature Water Quality Standards specifically notes how to deal with problems that cannot be captured in a model, but that may be important in long-term recovery of natural temperature regimes or patterns and recovery of Pacific salmon stocks:

> "Those human impacts that cannot be captured in a model (e.g., loss of cooling due to loss of hyporheic flow) should be identified in the TMDL assessment document (i.e., supporting material to the TMDL itself) along with rough or qualitative estimates of their contribution to elevated water temperatures. Estimates of natural conditions should also be revisited periodically as our understanding of the natural system and temperature modeling techniques advances."

Snyder (1931) in Salmon of the Klamath River describes temperature variability across mainstem Klamath River transects where no tributaries were nearby that likely described hyporheic connections, and also describes stratification in pools where colder water resided at the bottom of pools. It also is likely that prior to disturbance by hydraulic mining the Salmon River had more well-distributed thermal refugia due to hyporheic connections and cold water lenses in the depths of pools. Long-term studies regarding hydrology and water temperature regimes might focus on differences in Wooley Creek and the North Fork Salmon River, which have much different land use histories.

4.2.4 Implementation Strategy

We are supportive of using the Standards and Guidelines (S&G) for Riparian Reserves as prescribed in the current Land and Resource Management Plans for the Klamath National Forest (1995) and Six Rivers National Forest (1995) as directed by the Northwest Forest Plan (1994). These S&G's help insure that riparian areas will continue to be protected, moving towards watershed and fisheries recovery. In addition, the Salmon River Sub-basin Restoration Strategy (SRSRS) (Elder et al., 2002) also is a good avenue for guiding restoration of riparian areas as well as other watershed habitats. It offers a way to begin immediate implementation and help speed actions to prevent further flood damage that would cause channel aggradation and riparian damage. There needs to be consistency between the TMDL document and Implementation Strategy documents. We recommend that the Salmon River Sub-basin Restoration Strategy be updated to improve consistency in a few areas to better accommodate new information and direction found in the Salmon River TMDL.

The Memorandum of Understanding (MOU) between the NCRWQCB and Klamath National Forest, in addition to the targets and guidelines established through management plans and watershed analyses, make it likely that appropriate actions will be taken. Specifically:

- High quality waters (refugia) will be protected to maintain beneficial use and areas of the highest importance to salmon and steelhead;
- Road decommissioning will target watersheds with the best aquatic habitats as a priority;
- Road densities will be reduced to minimize flood damage risk;
- Land management will avoid unstable ground disturbance; and,
- Riparian areas will be protected out to at least two site potential tree heights on perennial streams, including up to the height of any unstable inner gorge.

Continuing to expand the multi-stakeholder involvement likely will be the most effective and realistic approach to implementing a recovery strategy and attaining the desired water temperature conditions prescribed in the TMDL document. The Salmon River Sub-basin Restoration Plan has a mechanism described in its Action Matrix (page 43), the Salmon Learning and Understanding Group (SLUG), that can best accommodate the necessary multi-stakeholder coordination needs. The SLUG focuses on

fisheries/watershed recovery. SLUG participants have included the Klamath and Six Rivers National Forest, Salmon River Restoration Council, Karuk Tribe, and the Klamath Forest Alliance. The SRSRS Action Matrix prescribes the development of a five-year restoration plan for the Salmon River outlining specific actions. There currently are several resource related working sub-groups made up of multiple stakeholders on the Salmon River that currently coordinate activities associated with program areas such as: 1) Fish and Water; 2) Fire; Fuels and Forest; 3) Watershed Monitoring; 4) Noxious Weeds and Native Plants;
5) Roads; 6) Watershed Education; and, 7) River Clean Up. The Salmon River TMDL and associated Plans should foster and expand the role and membership of the SLUG and the various coordinated sub-groups to develop a more detailed five-year implementation plan.

This approach is recognized and supported by the National Research Council (NRC) in their 2004 Report Endangered Fish of the Klamath Basin, which states:

> "Because the Salmon River watershed is owned principally by the federal government, there has been comparatively little controversy surrounding management and restoration efforts within the basin. A small but growing stakeholder group is cooperating with state and federal agencies and tribal interests in the Salmon River basin. High priority has been placed on monitoring of salmon and steelhead runs, improvements in riparian habitat, management of fuels, and assessment and rehabilitation of logging roads (Elder et al. 2002). Given proper funding and agency participation, these efforts may be sufficient to improve conditions for coho and other salmon and steelhead in the watershed."

4.2.5 Cumulative Watershed Effects

The NCRWQCB should define cumulative effects risk factors more clearly in the TMDL, rather than simply incorporating them by reference from USFS documents during subsequent TMDLs. This need is critical in the Scott River and Middle Klamath basins because of the existence of substantial private timberland holdings, where voluntary compliance with riparian recovery strategies and sediment abatement programs will be unlikely. Also, the linkage between upland management, debris torrents and channel scour in the lower Scott River basin and Middle Klamath basin as a result of the January 1997 storm is much more established than in the Salmon River (de la Fuente and Elder, 1998).

4.2.6 Fisheries (Appendix A)

While the Salmon River TMDL is a polished document and shows considerable effort in preparation, the fisheries element (Appendix A) would benefit from revision. Graph sizes should also be expanded so that the X-axis is readable.

4.2.6.1 Spring Chinook:

The discussions of spring chinook life history are generic, drawing on Central Valley life history descriptions, when in fact there is sufficient knowledge to provide descriptions unique to Klamath and Salmon River spring chinook stocks. Appendix A confuses the life history designation of "ocean type" as indicative of both adult behavior and juvenile behavior, when they really only are applicable to the later. Snyder (1931) analyzed scales of spring chinook adults and found:

> "Of the 35 spring fish, 29 possessed scales of the ocean nuclear type. There were five male and 21 female four-year-old fish measuring from 70 to 83.5 cm. The stream type of nucleus was represented by only six fish."

This indicates that most spring chinook juveniles that successfully survived to adulthood were heading down and out of the river almost immediately upon emergence from the gravel. The minority were rearing in the Klamath or its tributaries for some time before entering the ocean. Myer et al. (1998) noted that there are now "a significant proportion of yearling smolts," a third life history type, but their characterization includes all southern Oregon and northwestern California streams (SONC ESU) and both spring and fall chinook stocks. The findings of Snyder (1931) may have been indicative of genetically driven behavior, but it could also have been a behavioral adaptation to lack of appropriate freshwater habitat at that time due to streams not having recovered from previous mining impacts. Regardless, the strength of each juvenile behavior life history type within any given year class likely varies with flow years, as fish that remain in freshwater for longer periods of time are likely to be more successful when flows are high and habitat abundant and suitable than they would be during drought years. Similarly, the success of the ocean-type component of a year class will vary from year to year depending on variables associated with estuarine and oceanic condition.

In 1990, West and Olson found juvenile chinook salmon in the Salmon River as late as November. Reimers (1973) found that freshwater residence time played an important role in survival to adulthood of some Oregon coastal chinook salmon stocks. Juvenile spring-run chinook have been observed in the Salmon River system as late as January (Olson, personal communication), confirming Sullivan's findings (1989) which indicate the presence of Type III fish in the Salmon River system.

Adult spring chinook in the Klamath River, identified by the US Forest Service in Region 5 as a sensitive species, are recognized as entering the mouth of the river as early as February with run strength picking up in March and April before peaking in May and tapering off in June (Snyder, 1931). Although the first period of entry into the Salmon River of adults is not readily discernable due to high flow conditions, the period of entry could conservatively be estimated as from April through June. Appendix A should note that spring chinook are adapted to spawning in mid-September at higher elevation where temperatures cool earlier, which results in temporal as well as spatial segregation from fall-run spawning. Early spawning is also an advantage for egg survival as protection from severe cold stream conditions that can occur at higher elevation during winter. Emergence of fall and spring chinook juveniles may have similar timing because warmer stream temperatures at lower elevations give eggs and alevin shorter gestation periods.

Discussion of historic population levels in Appendix A are unnecessarily confused. The historical record is clear. The decline of spring chinook is tied clearly to the first major wave of land use by miners in the mid- to late 1800s, and attributable to both habitat loss and poaching (Snyder, 1931). Snyder (1931) indicated that "the spring migration has now lost its economic importance, and seems to have almost entirely disappeared." A spring chinook fishery was operated from 1919-1921, but it harvested only 250-1700 fish annually and was not economically viable. The resurgence in chinook that led to harvest in the hundreds of thousands early in the period between 1912 and 1930 likely is due to habitat recovery after the first wave of land use, but the predominant life history favored was that of fall fish, undoubtedly because deep pools for adult holding in tributaries like the Salmon River had not yet recovered from mining impacts. The destructive impacts of early mining in the Salmon River were extreme and wide-spread and leave an imprint on the stream even today.

While the fact that the Salmon River harbors the last wild run of spring chinook in the Klamath River is touted as "good news," that characterization is inappropriate because the population exists at extremely low numbers and in fact is approaching levels at which genetic diversity is compromised (Kier Associates, 1991). Appendix A stresses the importance of maintaining a remnant, wild population; various fisheries related stakeholders hope that the Salmon River spring chinook population can serve as a source for re-expansion throughout the species' historic range after PacifiCorp hydroelectric dams are removed and other tributaries like the Scott and Shasta Rivers are recovered.

Discussions of limiting factors pertaining to spring chinook in Appendix A are joined with those of other anadromous species except for poaching. Poaching problems in the Salmon River were recognized as a significant potential limiting factor for spring chinook (Kier Associates, 1991), but educational efforts, community outreach and neighborhood watch programs by SRRC and residents have helped substantially end this threat (Kier Associates, 1999).

4.2.6.2 Fall Chinook:

Spawning is described as taking place from October through December in the Salmon River, which means that egg incubation would start in October, not in November as stated. Fall chinook trends in the Salmon River are not improving, despite recent favorable ocean conditions (Collision et al., 2003) that are leading to improved fall chinook runs in other SONC ESU streams. The 2004 fall chinook run in the Salmon River was the lowest on record. This likely indicates survival bottlenecks in the mainstem Klamath River (see Limiting Factors discussion below).

4.2.6.3 Steelhead:

Appendix A lumps all races of steelhead in the Salmon River together. This is inappropriate because differences in life histories of summer steelhead are well recognized and population data are available. Although there likely are important distinctions between fall and winter steelhead stocks, there currently is insufficient data to separate them.

Summer steelhead have similar adult behavior to spring chinook, entering the Klamath River in spring and moving up to holding areas in tributaries such as the Salmon River by June. Studies by Kesner and Barnhart (1972) showed that 27% of Klamath basin summer steelhead migrated to the ocean after 1 year in fresh water, 65% after 2 years, and 8% after 3 years. Summer steelhead are recognized as often returning to freshwater precociously after just three or four months in the ocean in a life history known as the "half-pounder." Hopelain (2001) used a length criterion of 24-44mm for half-pounders and found that, while only 50% of Trinity River tributary summer steelhead exhibited this life history, nearly 90% of Klamath River tributary stocks did so. This may have implications for survival to adulthood (see Limiting Factors below). Summer steelhead spawn timing and location is not documented and represents a data gap.

Klamath River steelhead are known to feed on the continental shelf between the Rogue and Klamath Rivers (Kier Assoc., 1991) and the recent rebound suggests strong ties between summer steelhead populations trends in the Salmon River and the Pacific Decadal Oscillation (PDO) cycle (Collison et al, 2003), which has been favorable since 1995. The PDO is also associated with wetter climatic cycles on land that favor enhanced carrying capacity for juvenile steelhead.

Fall-Winter Steelhead: There is no data to support the statement that "steelhead trout populations appear more resilient than chinook" and "appear to be more tolerant of rearing conditions." Rather, steelhead juvenile life history makes them <u>more vulnerable</u> to such factors as poor water quality in the mainstem Klamath River (Kier Assoc., 1999) (see Limiting Factors discussion below). The run timing of adult steelhead entry into the Salmon River should be noted as September through April, not December as noted in Appendix A.

4.2.6.4 Coho Salmon:

The discussion of coho salmon is adequate because there is so little known specifically about coho salmon in the Salmon River. The reference to there only being one meta-population of coho salmon, owing to spreading of hatchery stocks from the Columbia should be dropped entirely. It has <u>no basis</u> in data and the remnant wild coho known to persist in tributaries and populations have resurged in recent years (Maurer, 2002). Short-term increases would be expected coincident with the shift in the PDO since 1995 because coho salmon feed off the continental shelf of Oregon, California and Washington (Hare et al., 1999).

4.2.6.5 Limiting Factors for Salmonids:

Although the Salmon River TMDL needs to stay focused on temperature, Appendix A needs to acknowledge periodic problems posed by sediment that compromise habitat for all salmonid species at all life stages (Kier Associates, 1991; 1999). Fires and land use have elevated risks of sediment yield well over background, and sediment evulsions from tributaries have been documented after the 1987 fires (de la Fuente and Haessig, 1994; Kier Assoc., 1999).

While mainstem Salmon River temperature regimes may take additional decades for recovery, the Salmon River TMDL and Appendix A need to make more explicit reference to the fact that restoring sub-basins can establish or maintain refugia at the mouths or in lower reaches of streams as recommended by U.S. EPA (2003). The spatial distribution of these refugia may be very important and could help confirm priorities of the Salmon River Restoration Strategy (Elder et al., 2002).

Massive hydraulic mining in the mid- to late 1800s flattened stream channels and mobilized tons of sediment that likely took fifty years to cycle through, but the legacy of stream channel simplification remains. Large woody debris would have been dislodged by this early land use history, and then further depleted by logging and subsequent flood damage and fire. Complex stream channels with large wood tend to have increased pool frequency and increased ability to sort sediment. This sorting would have resulted in diversity of substrate types whereas today's Salmon River channels tend to be cobble dominated. Reeves et al. (1993) documented the relationship between loss of habitat complexity and salmonid species diversity, and the low numbers of coho could be linked to diminished habitat complexity as well as carrying capacity. Poole and Berman (2001) point out that large wood can force local upwelling from the hyporheic zone, thereby increasing the incidence of local cold-water refugia.

The Salmon River is one of the healthier tributaries of the Klamath River, but anadromous salmonids must migrate through the Lower Klamath in order to reach the ocean. Kier Associates (1999) used data showing divergent population trends of Trinity River and Klamath River tributary summer steelhead populations as indicative of poor water quality in the mainstem Klamath River limiting the latter. They also assert that the high occurrence of the half-pounder life history in Klamath summer steelhead stocks would be a selective disadvantage because these fish return during periods of very poor water quality and may be subjected to stress from angling.

The Salmon River TMDL needs to recognize the existence of now well-recognized cycles of ocean productivity and favorability of on-land climatic regimes attendant with the PDO (Collison et al., 2003; Hare et al., 1999). This recognition would promote a greater sense of urgency to improve freshwater habitat in the Salmon River and other Klamath TMDL basins before the switch to less favorable oceanic conditions for salmon and steelhead some time from 2015-2025 (Collison et al., 2003).

4.2.7 Data Gaps

"Before effective action can be taken to restore fish populations, project planners should have enough information to determine which factors are limiting the production of the species to be restored." (Klamath Plan, 1991; pg. 3-8)

Managers, scientists and local organizations have collected a large amount of physical and biological information on the Salmon River sub-basin. While this information appears to provide a data-rich environment for planning purposes, care must be taken to understand and evaluate the scale and quality of data. Without an understanding of data limitations, incorrect conclusions mistakenly could be drawn from conducted analyses.

Many of the data layers currently used on the Salmon River were generated for the Klamath National Forest Land Management Plan, which was a coarse assessment of land management options for the entire Forest.

The following is a description of some of the data layers and associated information needs identified in the Salmon River Sub-basin Restoration Strategy - Implementation Plan, the 2003 and 2004 Weak Stocks Report, the 2002 and 2003 Salmon River Rotary Screw Trap Report, by the Fish and Water Work Group, and in the TMDL document. There are additional data gaps existing in the information, but these are some priorities to address, including:

A) Inventory and prioritize Riparian Reserve revegetation opportunities (SRSRS-2002).

B) Determine mine tailing pile restoration potential and priorities (SRSRS-2002)

C) Identify and collect any data needed to establish baseline flow and water quality conditions throughout the Salmon River (Salmon River Fish and Water Work Group).

D) Identify specific life history, limiting factors, and other pertinent fisheries information to accurately assess distribution, abundance, health, and trends for spring chinook, green sturgeon, coho, summer steelhead, and Pacific lamprey (Weak Stocks Report-2003 and Salmon River Fish and Water Work Group).

E) No formal accuracy assessment of the vegetation or fuels information has been conducted. The need for updating or re-creating this data layer is well recognized. The vegetation layer is currently the most important and highest priority data gap identified in the SRSRS.

F) An important consideration to the Salmon's overall high fuel loading and risk of catastrophic fire return is the managed stand plantations. The threat of (and to) these plantations has never been quantified. There is a great need for this question to be answered in an overall Strategic Fire Plan (SRSRS-2002).

G) Identifying the impacts that the existing sediment load in the river is having on pools and cold water refugia for anadromous fisheries. Are these areas getting shallower, less frequent, with a reduction of habitat complexity? Is there thermal stratification occurring in these areas? (Weak Stocks Report – 2004)

H) A comprehensive Noxious Weed Inventory and Management Plan is needed to help managers update and implement a successful eradication and control strategy for prioritized invasive species (SRSRS-2002).

I) Perform analysis and run the SSRT Model on stream reaches that are heavily impacted. We recommend that you perform model runs on streams such as: the lower and middle portion of Indian, Negro, Big, and/or Olson Creeks.

4.2.8 Monitoring

The Salmon River TMDL defers monitoring to the implementation phase, during which various actions to take regarding implementation and effectiveness monitoring will be identified. One such action that currently is being called for is the development of a 5-year or more monitoring plan for the SRSRS. It is anticipated that the development of the monitoring plan would have oversight by the SLUG. We suggest that the Salmon River Fish and Water Monitoring Work Group development the basic document.

To insure better consistency between the TMDL and the Implementation Plan, the TMDL needs to give some guidance in regard to monitoring by articulating standard methods that might be applied for trend monitoring so that success of impairment abatement can be gauged. Focused monitoring, with specifically defined requirements for when and how measurements need to be taken, is needed to determine the success of the technical TMDL and Implementation Plan. The Independent Science Review Panel (ISRP) (2003) described this need:

> "The trajectory toward or away from recovery in these watersheds is a function of the cumulative spatial and temporal distribution of natural events and human activities within their boundaries. Without a clear quantitative definition of what constitutes recovery, coupled with a clear definition of what constitutes background conditions against which to measure recovery, and adequate quantitative effectiveness monitoring data, it is not possible to determine if these disturbed watersheds are moving toward a more impaired condition, or moving toward recovery."

The ISRP (2003) also pointed out that such monitoring should not just include biological resources because of lag time in response to aquatic and watershed conditions:

> "Clayton (2002) showed that in order to distinguish a statistically meaningful change in signal through the noise of natural variability required a monitoring period on the order of twenty to fifty years for biological indicators, compared to five to ten years for physical indicators."

Aquatic invertebrate communities have short life cycles. Furthermore, their life cycles rely on local habitat conditions and are very responsive to habitat change; therefore, they may be an exception in terms of lag time of community response (Barbour et al., 1999).

The SRSRS under the direction of the TMDL should recommend a mix of monitoring tools that reflect the complex nature of mechanisms driving temperature in the Salmon River basin, including those more typically associated with a sediment driven TMDL:

- Water Temperatures
- Longitudinal Profiles and/or Cross Sections
- Riparian Condition, i.e. RAPID from Grant (1988)
- Flows

Water temperature measures should recognize tributaries as more controllable with regard to temperature flux through minimizing cumulative effects risk. Flow changes should be measured to see whether shifts in hydrographs from early storm peaks can be shifted back towards the normal range of hydrologic variability (Jones and Grant, 1996).

For road decommissioning, effectiveness could be measured in smaller tributary stream channels using McNeil samples (McNeil and Ahnell, 1964) and V-star (Hilton and Lisle) as well aquatic macro-invertebrates, which show rapid response to changes in fine sediment (Higgins, 2003).

Fisheries monitoring should continue through the existing programs and be coordinated by the Fish and Water Monitoring Work Group for the Salmon River. Stakeholders should continue to monitor and offer protection for various species and runs as outlined in the Salmon River Weak Stocks Program.

4.2.9 Procedure For De-Listing Salmon River As An Impaired Water Body

The Salmon River TMDL should describe what procedure would be used and the conditions that must be met in order to de-list the Salmon River as impaired for temperature.

4.2.10 Current Mining

Many Salmon River placer claims are used for the entire period of July 1 – September 15, not just for a 2-4 week period as the Salmon River TMDL incorrectly states. What is moderate use? The New 49'ers, a recreational mining club, hold miles of claims along the Salmon River, and for the past 2 seasons have been dredging at very high densities at various locations on the river. As many as 14 dredges have been counted on a single ¼ mile stretch of the mainstem Salmon River. This relatively new use (i.e., recreational mining clubs) is likely to cause significant impacts to water quality and should be addressed in the Salmon River TMDL and Plan.

4.2.11 Invasive Plants

Invasive plants are known to occupy key riparian and upslope habitats in the Salmon River sub-basin. Riparian areas often are subject to disturbance due to high water, flooding, and debris torrents. Several species of invasive plants present in the Salmon River are known to respond favorably to riparian disturbance. Species present on the Salmon River such as spotted knapweed, tree of heaven, Italian thistle, scotch broom, Marlahan mustard and others are known to reduce riparian vegetation recovery, thereby reducing shade to the water. The Salmon River TMDL should address the need to control prioritized species to insure that these aggressive plants do not significantly hinder riparian recovery.

4.3 SUMMARY

The Salmon River is one of the best sub-basins for water quality and fisheries recovery in the entire Klamath Basin. It should accordingly be given elevated attention in regards to recovery.
The NRC Report 2004 states that an "emphasis on cold water bearing tributaries is likely to yield the most benefit for salmonid restoration." With its large amount of public lands, comparatively intact natural resources with less output demand, good cooperation amongst stakeholders, completed restoration strategy, and impressive restoration track record, we are optimistic about the restoration road ahead for the Salmon River. In closing, we recommend that you incorporate our comments into the final Salmon River TMDL document.
Thank you for the opportunity to comment, and we look forward to the finalization and approval of the Salmon River TMDL and Implementation Plan. We also will be actively participating in all of the TMDL's and Implementation Plans for all impaired water bodies in the Klamath Basin. If you have any questions or other needs, please contact us as soon as possible at the address indicated above.
Sincerely,
Glen H. Spain, Northwest Regional Director
Institute for Fisheries Resources
and the Pacific Coast Federation of Fishermen's Associations
for himself and the following:
Earthjustice
Kristen Boyles, J.D.
Headwaters
Cindy Deacon Williams
Conservation Director
Oregon Natural Resources Council
Steve Pedery
Conservation Program Director

4.4 Selected References

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5 Klamath Forest Alliance, Petey Brucker, Rivers Coordinator

RE: Comments on proposed Salmon River Total Maximum Daily Load for Temperature (*TMDL or Salmon River TMDL*) and Implementation Plan (Plan)

Dear Mr. Gwynne and Leland,

This comment letter is on behalf of the Klamath Forest Alliance KFA). We appreciate the opportunity to comment on the proposed *Salmon River TMDL* and Plan for the Salmon River prepared by North Coast Regional Water Quality Control Board Total Maximum Daily Load Development Unit staff in partial fulfillment of the requirements of Section 303(d) of the federal Clean Water Act. The Salmon River is almost exclusively in Siskiyou County, Siskiyou County with a small portion in the Upper South Fork located in Trinity County, California.

5.1 General Comments

We realize that this is the first technical TMDL document that the North Coast Regional Water Quality Control Board (NCRWQCB or Board) has released for comment in the California portion of the Klamath Basin. We would like to thank and commend the Board and its' TMDL staff for creating a high quality product that takes a sound scientific approach with regards to assumptions and methods. It uses a well recognized temperature model, which has been commonly used in temperature TMDLs but also recognizes factors that may influence temperature but that are less quantifiable and, consequently, cannot be modeled. The model focuses on seven stream/river segments that are in fair to good condition, but did not incorporate the more impacted segments of the river into the model simulations for riparian shade. Linking the *Salmon River TMDL* with existing management and restoration plans was a good idea. It both builds on the existing management and restoration frameworks to allow for the speedy implementation. To improve consistency between the *Salmon River TMDL* and the Plans, we recommend that the Salmon River Subbasin Restoration Strategy (SRSRS) be updated to include new information and direction found in the *Salmon River TMDL*.

Although the document appropriately recommends that the *Salmon River Subbasin Restoration Strategy: Steps to Recovery and Conservation of Aquatic Resources* (Elder et al., 2002) be followed, it is non-specific with regard to guidance on monitoring necessary for adaptive management. Linkage to Klamath National Forest management documents that help achieve Northwest Forest Plan objectives insures that most concerns regarding cumulative effects will be met. However, risk of damaging increased peak flows is not addressed, which could potentially confound the success of *Salmon River TMDL* implementation.

5.1.1 1) Fisheries

The quality of the fisheries section (Appendix A) is not equal to the rest of the document and is in need of greater revision. Specific and more detailed comments for Appendix A and salmonids of the Salmon River are provided below in the "Specific Comment" section.

Green sturgeon and Pacific lamprey are identified early in the text as living in the Salmon River. In the lower seven miles of the Salmon River green sturgeon are know to hold as adults, spawn, rear and outmigrate as juveniles. The 2004 Salmon River Weak Stocks Report (SRRC-2004) identifies that the Karuk Tribe and the SRRC Fisheries staff held sturgeon dives in the months of April and May of 2003. A total of thirteen adult green sturgeon were observed in the lower seven miles of the Salmon River. These crews conducted larval surveys and over one hundred larval green sturgeon were caught. Rapid growth of green sturgeon was noted when crews began catching juveniles several months after the larval stage. Over 450 juvenile green sturgeon were caught in the rotary screw trap, near the mouth of the Salmon River in 2003. There were over 300 Pacific lamprey trapped as well in 2003 (2001-2003 Salmon River Rotary Screw Trap Final Report – 2004). Green sturgeon are identified by the US Forest Service as being a sensitive species in Region 5. Pacific lamprey, also listed by the US Forest Service in Region 5 as a sensitive species, is a key traditional spring food source for the Karuk tribal members living on the Salmon and Klamath River. The once abundant numbers of the Pacific Lamprey in the Salmon River have dwindled to a low level. Local native people have complained about the lack of availability of this important food source in the Salmon River. (Personal communications with Stanshaw 2002 – Karuk tribal member) Both the green sturgeon and Pacific lamprey are of significant cultural value to the tribes of the Klamath Basin that are in danger of survival in the Salmon River. Other than identifying that green sturgeon and Pacific lamprey are known to live in the Salmon River, the document lacks any subsequent discussion or assessment.

5.1.2 2) Stakeholder Coordination

We recognize the value of having active partners such as the United States Forest Service (USFS), Salmon River Restoration Council, US Fish and Wildlife Service, and the Karuk Tribe in the management and restoration of this subbasin. These entities have brought a wealth of data and knowledge to the process. The 13 years of available water temperature data was impressive and obviously helped you perform this comprehensive assessment. We recommend that you require the stakeholders, and in particular the USFS, to continue and expand the current of coordination efforts associated with the Salmon River Subbasin Restoration Strategy.

5.1.3 3) Tribal Involvement

Most of the Salmon River subbasin is within the Karuk Ancestral territory. The entire subbasin affects the cultural resources of the Karuk Tribe of California. The TMDL should recognize the Karuk tribe as a key stakeholder that brings valuable resources to the table as co-managers of this subbasin. This is already articulated somewhat by the USFS's government to government relationship with the Karuk Tribe, and the associated Memorandum of Understanding between these two entities. The cultural resources of Native American tribes in the Klamath Basin associated with water quality in the Salmon River are numerous. These include several aquatic species in addition to the salmonids such as green sturgeon, Pacific lamprey, Pacific giant salamanders, crayfish and other aquatic species and their habitat. Various ceremonial activities associated with the Karuk Tribe's cultural resources require high quality water.

5.1.4 4) Key Existing Beneficial Uses of the Salmon River

The following are the key existing beneficial uses found on the Salmon River, as numbered in the TMDL.

1. Municipal and Domestic Supply (MUN)
5. Groundwater Recharge (GWR)
6. Freshwater Replenishment (FRSH)
9. Water Contact Recreation (REC-1)
10. Non-Contact Water Recreation (REC-2)
11. Commercial or Sport Fishing (COMM) *
13. Cold Freshwater Habitat (COLD) *
14. Biologically Significant Area (BSA)
15. Wildlife Habitat (WILD)
16. Rare, Threatened, or Endangered Species (RARE) *
17. Migration of Aquatic Organisms (MIGR) *
18. Spawning, Reproduction, and/or Early Development (SPWN) *

19. Shellfish Harvesting (SHELL)
20. Native American Culture (CUL) *.

5.1.5 5) The TMDL Should Adequately Recognize the Biological Significance of the Salmon River in the Klamath Basin

The TMDL does not adequately identify the significance of the Salmon River aquatic resources to the larger context in the Klamath Basin. The Salmon River subbasin, a major tributary to the Klamath River, makes a significant contribution to the fisheries and water resources of the Klamath Basin. The 2004 NRC Report "Endangered Fish of the Klamath Basin" states that, " Within the lower Klamath watershed, the Salmon River remains the most pristine tributary; it has a natural, unregulated hydrograph, no significant diversions, and limited agricultural activity. Although it is not well documented, runs of all the remaining anadromous fishes in the Klamath watershed occur in the Salmon River (Moyle et al 1995, Moyle 2002)." The Report continues with " the tributaries of the lower watershed dominate the total runoff of the Klamath watershed. Their high runoff stems from their high relief and the orographic influence of the Coast Ranges, Trinity Alps, and the Marble, Salmon, and Russian mountains. For example, one relatively small tributary, the Salmon River, supplies runoff about equal to that of the entire upper watershed, but from less than one-fifth of the area. " The Report further states, "The Salmon River's unique characteristics stem from its mountainous terrain and public ownership of land. At 750 mi^2, the Salmon River is the smallest of the four major tributary watersheds in the Klamath basin. Even so, the annual runoff from the Salmon is twice that of the Scott and 10 times as great as that of the Shasta River." The almost ½ million acre Salmon River is designated by the Northwest Forest Plan as a key watershed due to its outstanding and remarkable fisheries resource. Several portions of the river have designations under the federal and state Wild and Scenic Acts. The TMDL needs to better articulate the significance of the Salmon River in the Klamath Basin.

5.2 Specific Comments

5.2.1 Impaired Status of the Salmon River

5.2.1.1 Temperature Listing

It is appropriate that the Salmon River is listed as impaired for temperature. The water quality of the Salmon River has outstanding values that offer the beneficial users with unique and remarkable opportunities in the Klamath Basin. It is one of the few subbasins of the Klamath Basin that are know to have Green Sturgeon or wild Spring Chinook spawning and rearing in them. With temperatures often rising above 75 degrees Fahrenheit in the summer in some locations in the center of this subbasin, it is no wonder adult spring Chinook have to hold in colder refugia pools often a the mouths of colder streams. Human resource uses have lead to the lack of riparian shade, insufficient coarse woody debris, and sub-optimal water temperatures largely in the summer. Lack of functioning hyporheic water flows in the river also increase water temperatures. These and other reasons justify why the Salmon River is listed as impaired under the 303 (d) Section of the Clean Water Act.

5.2.1.2 Nutrient Listing

Although we agree that the Salmon River should be de-listed for nutrient, the listing of the Salmon River as being impaired for nutrient is somewhat of a mystery to us. <u>We recommend that the TMDL identify why the Salmon River was listed for nutrient.</u> Conversely, it seems that this more biologically intact watershed is deficient of nutrient due to lack of Coarse Woody Debris as indicated in Upper South Fork (1994) and Lower South Fork (1997) Watershed Analyses.

5.2.1.3 Sediment Listing

The health of the Salmon River is threatened by sediment and should have been listed as impaired by sediment. This is supported by various sources. The 2004 NRC Report states, "the Salmon River watershed, although nearly pristine, may have geologic and hydrologic characteristics that are suboptimal for salmon. Under these conditions, human activities that increase sedimentation or raise stream temperature in the basin could have an especially large effect on salmon and steelhead." Furthermore a primary focus of the *Salmon River Subbasin Restoration Strategy is* to implement watershed/fisheries recovery actions that reduce sediment delivery to the aquatic habitat of the Salmon River. An over abundance of sediment impacts the beneficial uses of water quality in the Salmon River by reducing hyporheic flows in the river and streams; inundation of spawning and rearing habitat; reducing pool depth and frequency; increase water temperatures, and other impacts. The next revision of the 303 (d) list of impaired water bodies should include the Salmon River as being impaired by sediment

5.2.2 2) Assumptions and Methods

The *Salmon River TMDL* employs the widely used and trusted SSTEMP model (Bartholow, 2002) and the document clearly states its assumptions, which are met, and follows methods that are scientifically sound. The key assumption is that water temperature impairment is best estimated by gauging riparian conditions and shade over the stream and best controlled by improving riparian conditions over time. Field verification of the model demonstrated that shade was an important factor in controlling water temperature and that riparian condition was less than optimal in many stream reaches because of timber harvest, fires, debris torrent impacts and historic mining.

The University of California at Davis Information Center for Environment (ICE) vegetation modeling also used standard remote sensing data and assumptions with regard to tree heights and site potential (Appendix B). Field verification and subsequent model runs showed improvement as shade conditions improve with riparian recovery over time, as expected. Because of stream width and other factors, lower order streams show a much greater response than larger tributaries and mainstem reaches.

5.2.3 3) Impacts to Riparian Zone Section Overlooks Potential Cumulative Effects

The *Salmon River TMDL* lists several factors that can influence riparian stand structure and stream channels, including landslides, fire, flooding, timber harvest and roads. These discussions are adequate, but fail to point out the interconnected nature of these potential impacts that generally fall into the category of cumulative watershed effects (Ligon et al., 1999; Dunne et al, 2000; Collison et al., 2003). Although the TMDL needs to remain focused on temperature, relationships should be fully acknowledged and relegated to further study in the full Salmon River TMDL Implementation Plan or through monitoring related to it. For example:

- Streamside landslides related to large earthflows are described, but accumulated debris torrents and increased peak flows can trigger additional catastrophic landslides known as inner gorge failure,
- Flood damage and channel changes can be caused by increased peak discharge resulting from accumulated disturbance related to timber harvest and road building, especially in the rain-on-snow zone (Jones and Grant, 1996),
- Fire risk may be elevated by timber harvest, which can reduce relative humidity in the forest and leave fuels in the form of slash, and management outside riparian zones can change fire behavior resulting in hot fires that spread into them,
- Multiple stream crossings (known as "stacked" culverts) pose greater risk of catastrophic channel scour from debris torrents (Armentrout et al., 1999; de la Fuente and Elder, 1998), and
- Extensive disruption of riparian areas due to hydraulic mining may have altered cold water feeds from gravel bars that could have provided refugia for salmon and steelhead during low flow, high temperature periods (U.S. EPA, 2003).

The U.S. EPA (2003) *Guidance for Pacific Northwest State and Tribal Temperature Water Quality Standards* specifically notes how to deal with problems that cannot be captured in a model, but that may be important in long-term recovery of natural temperature regimes or patterns and recovery of Pacific salmon stocks:

> "Those human impacts that cannot be captured in a model (e.g., loss of cooling due to loss of hyporheic flow) should be identified in the TMDL assessment document (i.e., supporting material to the TMDL itself) along with rough or qualitative estimates of their contribution to elevated water temperatures. Estimates of natural conditions should also be revisited periodically as our understanding of the natural system and temperature modeling techniques advance."

Snyder (1931) in *Salmon of the Klamath River* describes temperature variability across mainstem Klamath River transects where no tributaries were nearby that likely described hyporheic connections and also stratification in pools, where colder water resided at the bottom of pools. It is also likely that prior to disturbance by hydraulic mining that the Salmon River had more well distributed refugia due to hyporheic connections and cold water lenses in the depths of pools. Long term studies regarding hydrology and water temperature regimes might focus on differences in Wooley Creek and the North Fork Salmon River, which have much different land use histories.

5.2.4 4) Implementation Strategy

We are supportive of using the Standards and Guidelines (S&G) for Riparian Reserves as prescribed in the current Land and Resource Management Plans for the Klamath National Forest (1995) and Six Rivers National Forest (1995) as directed by the Northwest Forest Plan (1994). These S&G's help insure that riparian areas will continue to be protected, moving towards watershed and fisheries recovery. In addition, the Salmon River Subbasin Restoration Strategy (SRSRS) (Elder et al., 2002) is also a good avenue for guiding restoration of riparian areas as well as other watershed habitats. It offers a way to begin immediate implementation and help speed actions to prevent further flood damage that would cause channel aggradation and riparian damage. There needs to be consistency between the TMDL document and Implementation Strategy documents. We recommend that Salmon River Subbasin Restoration Strategy be updated to improve consistency in a few areas to better accommodate new information and direction found in the *Salmon River TMDL*.

The Memorandum of Understanding (MOU) between the NCRWQCB and Klamath National Forest, in addition to the targets and guidelines established through management plans and watershed analyses make it likely that appropriate actions will be taken:

- High quality waters (refugia) will be protected to maintain beneficial use and areas of the highest importance to salmon and steelhead,
- Road decommissioning will target watersheds with the best aquatic habitats as a priority,
- Road densities will be reduced to minimize flood damage risk,
- Land management will avoid unstable ground disturbance, and
- Riparian areas will be protected out to at least two site potential tree heights on perennial streams, including up to the height of any unstable inner gorge.

Continuing to expand the multi-stakeholder involvement will likely be the most effective and realistic approach to implementing a recovery strategy and attaining the desired water temperature conditions prescribed in the TMDL document. The Salmon River Subbasin Restoration Plan has a mechanism described in its' Action Matrix (page 43), the Salmon Learning and Understanding Group (SLUG) that can best accommodate the necessary multi-stakeholder coordination needs. The SLUG focuses on fisheries/watershed recovery. SLUG participants have included the Klamath and Six Rivers National Forest, Salmon River Restoration Council, Karuk Tribe, and the Klamath Forest Alliance. The SRSRS Action Matrix prescribes the development of a five-year restoration plan for the Salmon River outlining specific action. There are currently several resource related sub-work groups made up of multiple stakeholders on the Salmon River that currently coordinate activities associated with program areas such as: 1) Fish and Water, 2) Fire, Fuels and Forest, 3) Watershed Monitoring, 4) Noxious Weeds and Native Plants, 5) Roads, 6) Watershed Education, and 7) River Clean Up. The <u>Salmon River TMDL</u> an associated Plans should foster and expand the role and membership of the SLUG and the various

coordinated sub-work groups to develop a more detailed five-year implementation plan.
This approach is recognized and supported by the National Research Council (NRC) in their 2004 Report *Endangered Fish of the Klamath Basin* (Report), which states" "Because the Salmon River watershed is owned principally by the federal government, there has been comparatively little controversy surrounding management and restoration efforts within the basin. A small but growing stakeholder group is cooperating with state and federal agencies and tribal interests in the Salmon River basin. High priority has been placed on monitoring of salmon and steelhead runs, improvements in riparian habitat, management of fuels, and assessment and rehabilitation of logging roads (Elder et al. 2002). Given proper funding and agency participation, these efforts may be sufficient to improve conditions for coho and other salmon and steelhead in the watershed."

5.2.5 Cumulative Watershed Effects

The NCRWQCB should more clearly define cumulative effects risk factors that are incorporated by reference from USFS documents in the Scott River and Middle Klamath basins during subsequent TMDLs because of substantial private timberland holdings, where voluntary compliance with riparian recovery strategies and sediment abatement will be unlikely. Also, the linkage between upland management, debris torrents and channel scour in the lower Scott River basin and Middle Klamath basin as a result of the January 1997 storm is much more established than in the Salmon River (de la Fuente and Elder, 1998).

5.2.6 Fisheries (Appendix A)

While the Salmon River TMDL is a polished document and shows considerable effort in preparation, the fisheries element (Appendix A) would benefit from revision. Graph sizes should be expanded to where the X-axis is readable.

5.2.6.1 Spring Chinook

a) Spring Chinook: The discussions of spring Chinook life history are generic, drawing on Central Valley life history descriptions, when in fact there is sufficient knowledge to describe Klamath and Salmon River spring Chinook stocks. Appendix A confuses the life history designation of "ocean type" as indicating both adult behavior with juvenile behavior, when they really only are applicable to the later. Snyder (1931) analyzed scales of spring Chinook adults and found:

> "Of the 35 spring fish, 29 possessed scales of the ocean nuclear type. There were five male and 21 female four-year-old fish measuring from 70 to 83.5 cm. The stream type of nucleus was represented by only six fish."

This indicates that most spring Chinook juveniles that successfully survived to adulthood were heading down and out of the river almost immediately upon emergence from the gravel. The minority were rearing in the Klamath or its tributaries for some time before entering the ocean. Myer et al. (1998) noted that there are now "a significant proportion of yearling smolts," a third life history type, but their characterization includes all southern Oregon and northwestern California streams (SONC ESU) and both spring and fall Chinook stocks. The findings of Snyder (1931) may have been indicative of genetically driven behavior, but it could also have been a behavioral adaptation to lack of appropriate freshwater habitat at that time due to streams not having recovered from previous mining. Juvenile behavior may also vary with flow years, as fish remain in freshwater when flows are high and habitat abundant and suitable.

In 1990 West and Olson found juvenile Chinook salmon in the Salmon River as late as November. Reimers (1973) found that freshwater residence time played an important role in survival to adulthood of some Oregon coastal Chinook salmon stocks. Juvenile spring-run Chinook have been observed in the Salmon River system as late as January (Olson, personal communication), confirming Sullivan's findings (1989) which indicate the presence of Type III fish in the Salmon River system.

Adult spring Chinook in the Klamath River, identified by the US Forest Service in Region 5 as a sensitive species, are recognized as entering the mouth of the river as early as February but that runs picked up in March and April before peaking in May and tapering off in June (Snyder, 1931). Although the first period of entry into the Salmon River of adults is not discernable due to high flow conditions, the period of entry could be conservatively estimated as from April through June. Appendix A should note spring Chinook are adapted to spawning in mid-September at higher elevation where temperatures cool earlier, which results in temporal as well as spatial segregation from fall run spawning. Early spawning is also an advantage for egg survival as protection from severe cold stream conditions that can occur at higher elevation during winter. Emergence of fall and spring Chinook juveniles may have similar timing because of warmer stream temperatures at lower elevation give eggs and alevin shorter gestation.

Discussion of historic population levels in Appendix A are confused while the historical record is clear. The decline of spring Chinook is clearly tied to the first major wave of land use by miners in the mid- to late 1800s, including both habitat loss and poaching (Snyder, 1931). Snyder (1931) indicated that "the spring migration has now lost its economic importance, and seems to have almost entirely disappeared." A spring Chinook fishery was operated from 1919-1921, but it harvested only 250-1700 fish annually and was not economically viable. The resurgence in Chinook that lead to harvest in the hundreds of thousands early in the period between 1912-1930 is likely due to habitat recovery after the first wave of land use, but the predominant life history favored was that of fall fish. This is likely because deep pools for adult holding in tributaries like the Salmon River had not yet recovered from mining impacts. The destructive impacts of mining in the Salmon River were extreme and wide-spread and leave an imprint on the stream today.

While the fact that the Salmon River harbors the last wild run of spring Chinook in the Klamath River is touted as "good news", that characterization is inappropriate because of extremely low population levels approaching levels for where genetic diversity is compromised (Kier Associates, 1991). Appendix A stresses the importance of maintaining a remnant, wild population; various fisheries related stakeholders hope that the Salmon River spring Chinook population can be used to re-expand the range of the species after PacifiCorp hydroelectric dams are removed and other tributaries like the Scott and Shasta Rivers are recovered.

Discussions of limiting factors pertaining to spring Chinook in Appendix A are joined with those of other anadromous species except for poaching. Poaching problems in the Salmon River were recognized as a significant potential limiting factor for spring Chinook (Kier Associates, 1991), but educational efforts, community outreach and neighborhood watch programs by SRRC and residents have helped substantially end this threat (Kier Associates, 1999).

5.2.6.2 Fall Chinook

Spawning is described as taking place from October through December in the Salmon River, which means that egg incubation would start in October, not in November as stated. Fall Chinook trends in the Salmon River are not improving, despite favorable ocean conditions (Collision et al, 2003) that are leading to improved fall Chinook runs in other SONC ESU streams. The 2004 fall Chinook run in the Salmon River is the lowest on record. This likely indicates survival bottlenecks in the mainstem Klamath River (see Limiting Factors discussion below).

5.2.6.3 Steelhead

Appendix A lumps all races of steelhead in the Salmon River together, which is inappropriate because differences in life histories of summer steelhead are well recognized and population data are available. Although there may be distinctions between fall and winter steelhead stocks, there is insufficient data to separate them, however.

Summer steelhead have similar adult behavior to spring Chinook, entering the Klamath River in spring and moving up to holding areas in tributaries such as the Salmon River by June. Studies by Kesner and Barnhart (1972) showed that 27% of Klamath basin summer steelhead migrated to the ocean after 1 year in fresh water, 65% after 2 years, and 8% after 3 years. Summer steelhead are recognized as often returning to freshwater precociously after just three or four months in the ocean in a life history known as the "half-pounder." Hopelain (2001) used a length criteria of 24-44mm for half-pounders and found that, while only 50% of Trinity River tributary summer steelhead exhibited this life history, nearly 90% of Klamath River tributary stocks did so. This may have implications for survival to adulthood (see Limiting Factors below). Summer steelhead spawn timing and location is not documented and represents a data gap.

Klamath River steelhead are known to feed on the continental shelf between the Rogue and Klamath Rivers (Kier Assoc., 1991) and the recent rebound suggests strong ties between summer steelhead populations trends in the Salmon River and the Pacific Decadal Oscillation (PDO) cycle (Collison et al, 2003), which has been favorable since 1995. The PDO is also associated with wetter climatic cycles on land that favor enhanced carrying capacity for juvenile steelhead.

Fall-Winter Steelhead: There is no data to support the statement that "steelhead trout populations appear more resilient than Chinook" and "appear to be more tolerant of rearing conditions." Rather steelhead juvenile life history makes them more vulnerable to such factors as poor water quality in the mainstem Klamath River (Kier Assoc., 1999) (see Limiting Factors discussion below). The run timing of adult steelhead entry into the Salmon River should be noted as September through April, not December as noted in Appendix A.

5.2.6.4 Coho Salmon

The discussion of coho salmon is adequate because there is so little known specifically about coho salmon in the Salmon River. The reference to there only being one meta-population of coho salmon, owing to spreading of hatchery stocks from the Columbia should be dropped. It has no basis in data and remnant, wild coho are known to persist in tributaries and populations have resurged in recent years (Maurer, 2002). Short-term increases would be expected coincident with the shift in the PDO since 1995 because coho salmon feed off the Continental Shelf of Oregon, California and Washington (Hare et al., 1999).

5.2.6.5 Limiting Factors for Salmonids

Although the *Salmon River TMDL* needs to stay focused on temperature, Appendix A needs to acknowledge periodic problems posed by sediment that compromise habitat for all salmonid species at all life stages (Kier Associates, 1991; 1999). Fires and land use have elevated risk of sediment yield well over background and sediment evulsions from tributaries have been documented after the 1987 fires (de la Fuente and Haessig, 1994; Kier Assoc., 1999).

While mainstem Salmon River temperature regimes may take additional decades in recovery, the *Salmon River TMDL* and Appendix A need to make more explicit reference to the fact that restoring sub-basins can establish or maintain refugia at the mouths or in lower reaches of streams as recommended by U.S. EPA (2003). The spatial distribution of these refugia may be very important and could help confirm priorities of the Salmon River Restoration Strategy (Elder et al., 2002).

Massive hydraulic mining in the mid- to late 1800s flattened stream channels and mobilized tons of sediment that likely took fifty years to cycle, but the legacy of stream channel simplification remains. Large woody debris would have been dislodged by this early land use history, then further depleted by logging and subsequent flood damage and fire. Complex stream channels with large wood tend to have increased pool frequency and to sort sediment. This sorting would have resulted in diversity of substrate types whereas today's Salmon River channels tend to be cobble dominated. Reeves et al. (1993) documented the relationship between loss of habitat complexity and salmonid species diversity, and the low numbers of coho could be linked to diminished habitat complexity and carrying capacity. Poole and

Berman (2001) point out that large wood can force local upwelling from the hyporheic zone increase local cold-water refugia.

The Salmon River is one of the healthier tributaries of the Klamath River, but anadromous salmonids must migrate through the Lower Klamath in order to reach the ocean. Kier Associates (1999) used data showing divergent population trends of Trinity River and Klamath River tributary summer steelhead populations as indicative of poor water quality in the mainstem Klamath River limiting the latter. They also asserted that the high occurrence of the half-pounder life history in Klamath summer steelhead stocks would be a selective disadvantage because these fish return during periods of very poor water quality and may be subjected to stress from angling.

The *Salmon River TMDL* needs to recognize the existence of now well-recognized cycles of ocean productivity and favorability of on-land climatic regimes attendant with the PDO (Collison et al., 2003; Hare et al., 1999). This recognition would promote a greater sense of urgency to improve freshwater habitat in the Salmon River and other Klamath TMDL basins before the switch to less favorable conditions for salmon and steelhead some time from 2015-2025 (Collison et al., 2003).

5.2.7 Data Gaps

Before effective action can be taken to restore fish populations, project planners should have enough information to determine which factors are limiting the production of the species to be restored." (Klamath Plan, 1991; pg. 3-8)

Managers, scientists and local organizations have collected a large amount of physical and biological information on the Salmon River subbasin. While this information appears to provide a data-rich environment for planning purposes, care must be taken to understand and evaluate the scale and quality of data. Without an understanding of data limitations, incorrect conclusions will be drawn from conducted analyses.

Many of the data layers currently used on the Salmon River were generated for the Klamath National Forest Land Management Plan, which was a coarse assessment of land management options for the entire Forest.

The following is a description of some of the data layers and associated information needs identified in the Salmon River Subbasin Restoration Strategy - Implementation Plan, 2003 and 2004 Weak Stocks Report, 2002 and 2003 Salmon River Rotary Screw Trap Report, Fish and Water Work Group, and the TMDL document. There are additional data gaps existing in the information, but these are some priorities, including:

A) Inventory and prioritize Riparian Reserve revegetation opportunities. (SRSRS-2002)
B) Determine mine tailing pile restoration potential and priorities (SRSRS-2002)
C) Identify and collect any data needed to establish baseline flow and water quality conditions throughout the Salmon River. (Salmon River Fish and Water Work Group)
D) Identify specific life history, limiting factors, and other pertinent fisheries information to accurately assess distribution, abundance, health, and trends for spring Chinook, green sturgeon, coho, summer steelhead, and Pacific lamprey. (Weak Stocks Report- 2003 and Salmon River Fish and Water Work Group)
E) No formal accuracy assessment of the vegetation or fuels information has been conducted. The need for updating or re-creating this data layer is well recognized. The vegetation layer is currently the one of the highest priority and most important data gap identified in the SRSRS.
F) An important consideration to the Salmon's overall high fuel loading and risk of catastrophic fire return is the managed stand - plantations. The threat of (and to) these plantations has never been quantified. There is a great need for this to be answered in an overall Strategic Fire Plan. (SRSRS-2002)
G) Identifying the impacts that the existing sediment load in the river is having on pools and cold

water refugia for anadromous fisheries. Are these areas getting shallower, less frequent, with a reduction of habitat complexity? Is there thermal stratification occurring in these areas? (Weak Stocks Report – 2004)

H))A comprehensive Noxious Weed Inventory and Management Plan is needed to help managers update and implement a successful eradication and control strategy for prioritized species. (SRSRS-2002)

I) The Perform analysis and run SSRT Model stream reaches that are heavily impacted. We recommend that you perform model runs on streams such as: the lower and middle portion of Indian, Negro, Big, and/or Olson Creeks.

5.2.8 Monitoring

The *Salmon River TMDL* defers monitoring to the implementation phase, which identifies various actions to take regarding implementation and effectiveness monitoring. One such action that is currently being called for is the development of a 5year or more monitoring plan for the SRSRS. It is anticipated that the development of the monitoring plan would be have oversight by the SLUG. We suggest that the Salmon River Fish and Water Monitoring Work Group development the basic document.

To insure better consistency between the TMDL and the Implementation Plan, the TMDL needs to give some guidance in regard to monitoring by articulating standard methods that might be applied for trend monitoring so that success of abatement of impairment can be gauged. Focused monitoring with specifically defined requirements for when measurements need to taken to determine the success of the technical TMDL and Implementation Plan. The Independent Science Review Panel (2003) described this need:

> "The trajectory toward or away from recovery in these watersheds is a function of the cumulative spatial and temporal distribution of natural events and human activities within their boundaries. Without a clear quantitative definition of what constitutes recovery, coupled with a clear definition of what constitutes background conditions against which to measure recovery, and adequate quantitative effectiveness monitoring data, it is not possible to determine if these disturbed watersheds are moving toward a more impaired condition, or moving toward recovery".

The ISRP (2003) also pointed out that such monitoring should not just include biological resources because of lag time in response to aquatic and watershed conditions:

> "Clayton (2002) showed that in order to distinguish a statistically meaningful change in signal through the noise of natural variability required a monitoring period on the order of twenty to fifty years for biological indicators, compared to five to ten years for physical indicators."

Aquatic invertebrate communities have short life cycles, have a life cycle that relies on local habitat conditions and are very responsive to habitat change; therefore, they may be an exception in terms of lag time of community response (Barbour et al., 1999).

The SRSRS under the direction of the TMDL should recommend a mix of monitoring tools which reflect the complex nature of mechanisms driving temperature in the Salmon River basin, including those more typically associated with a sediment driven TMDL:

- Water Temperatures
- Longitudinal Profiles and/or Cross Sections
- Riparian Condition i.e. RAPID from Grant (1988)
- Flows

Water temperatures should recognize tributaries as more controllable with regard to temperature flux through minimizing cumulative effects risk and control streams within the basin used as targets. Flow changes should be measured to see whether shifts in hydrographs from early storm peaks can be shifted back towards the normal range hydrologic variability (Jones and Grant, 1996).

For road decommissioning, effectiveness could be measured in smaller tributary stream channels using McNeil samples (McNeil and Ahnell, 1964) and V-star (Hilton and Lisle) as well aquatic macro-invertebrates, which show rapid response to changes in fine sediment (Higgins, 2003).
Fisheries monitoring should continue through the existing programs and coordinated by the Fish and Water Monitoring Work Group for the Salmon River. Stakeholders should continue to monitor and offer protection for various species and runs as outlined in the Salmon River Weak Stocks Program.

5.2.9 Procedure for de-listing Salmon River as an impaired water body

The Salmon River TMDL should describe what procedure would be used and condition needing to be met in order to de-list the Salmon River as being impaired for temperature.

5.2.10 Current Mining

Many Salmon River placer claims are used for the entire period of July 1 – September 15. Not just for a 2-4 week period as the Salmon River TMDL states. What is moderate use? The New 49'ers, a recreation mining club, hold miles of claims along the Salmon River, and for the past 2 seasons, have been dredging at very high densities at various locations on the River. As many as 14 dredges have been counted on a single ¼ mile stretch of the Mainstem Salmon. This relatively new use (recreation mining club) is likely to cause impacts to water quality and should be articulated in the *Salmon River TMDL* and Plan.

5.2.11 Invasive Plants

Invasive plants are known to occupy key riparian and upslope habitats in the Salmon River subbasin. Riparian areas are often subject to disturbance due to high water, flooding, and debris torrents. Several species of invasive plants present in the Salmon River are known to respond favorably to riparian disturbance. Species present on the Salmon River such as spotted knapweed, tree of heaven, Italian thistle, Scotch Broom, Marlahan mustard and others are known to reduce riparian vegetation recovery reducing shade to the water. The Salmon River TMDL should address the need to control prioritized species to insure that these aggressive plants do not significantly hinder riparian recovery.

5.3 Summary

The Salmon River, being one of the best subbasins for water quality and fisheries in the Klamath Basin, should be given elevated attention in regards to recovery. The 2004 NRC Reports states that an "Emphasis on cold water bearing tributaries is likely to yield the most benefit for salmonid restoration." With its large amount of public lands, comparatively more intact natural resources with less output demand, good cooperation amongst stakeholders, completed restoration strategy, and impressive restoration track record, we are optimistic about the restoration road ahead for the Salmon River. In closing, we recommend that you incorporate our comment into the final Salmon River TMDL document.

Thank you for the opportunity to comment, and we look forward to the finalization and approval of the Salmon River TMDL and Implementation Plan. We will also be actively participating in all of the TMDL's and Implementation Plans for all impaired water bodies in the Klamath Basin. If you have any questions or other needs, please contact us as soon as possible.

5.4 References

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6 Salmon River Restoration Council, Jim Villaponteaux and Lyra Cressey

Here are more comments from the Salmon River Restoration Council. I hope they help.

6.1 Appendix A:

6.1.1 Page A-9 under A.5 states:

"Perusing the literature one gets the impression that coho salmon use the Salmon River watershed, but little is known about their relative numbers, distribution, or trends. It is generally accepted that coho salmon populations have declined in number and distribution throughout California, probably to less than six percent of their 1940s numbers (Moyle 2002, Moyle et al. 1998). Additionally, there has been considerable mixing of hatchery stocks from the Columbia River Basin, ergo the decision by the Klamath River Basin Stock Identification Committee in 1994 that coho in the Klamath River Basin constituted a single metapopulation (Barnhart 1994)."

6.1.2 It would be more accurate to quote the State Coho Recovery Strategy:

"Historically, coho salmon habitat was estimated to include 105 miles along the Salmon River and its tributaries (CDWR 1965). More recent estimates suggest that coho salmon have access to about 85 miles (CH2M HILL 1985) in this HA. DWR estimated historical coho salmon runs in the Salmon River at 2,000 fish (CDWR 1965). The Department's annual coho salmon spawning escapement estimate for the early 1960s was 800 fish (CDFG 1965). Between 1985 and 1991, the Department operated a weir in the Salmon River near its mouth and recorded a low of two coho salmon in 1985 and a high of 75 coho salmon in 1987. Problems facing coho salmon in the Salmon River watershed include invasive exotic species, barriers to fish passage, depleted LWD, high sediment loads from the extensive road system, large wildfires, limited riparian function due to mine tailings, unscreened water diversions, and unstable spawning gravels."

6.1.3 This should also replace the two paragraphs on page A-10:

"Information on run sizes is sketchy for coho in the Klamath River Basin and virtually non-existent for the Salmon River. Barnhart cites CDFG (1965) as estimating a run size in the Klamath River Basin of 15,000 fish in the 1960s. Moyle et al. (2002) cites historical escapement estimates of 15,000-20,000 fish, with hatchery returns in 1990 of 1,700 and 1991 of 3,100. As mentioned above, it is generally accepted that the species has declined in numbers and distribution. However, no information specific to the Salmon River was located in research conducted for preparation of this report.

Likewise, information on the distribution of coho salmon in the Salmon River watershed is difficult to find. Elder et al (2002) mention coho in passing. West et al. (1989) observed no coho juveniles in their surveys of the South and North forks and Nordheimer Creek. USFS (1995b), *North Fork Watershed Analysis*, provides information on "suspected" distribution. USFS (1997 and 1995a), *Lower South Fork of the Salmon River Ecosystem Analysis* and *Main Salmon Ecosystem Analysis*, lump coho distribution in with summer and fall Chinook as using the mainstem areas."

6.2 On Monitoring:

The development of a long term monitoring plan should be an essential component of the TMDL. The monitoring plan should include filling data gaps that have been identified during the TMDL process. The plan should be a cooperative document involving the USFS, SRRC, NCRWQCB, CDFG, Karuk Tribe, and others.

The TMDL should clearly state that monitoring data collected by all partners should be input into a widely distributed and easy to use database that can be accessed by the public, researchers, and scientist. For the Salmon River, KRIS has much of the data available for the Salmon and is currently in version 3 on CD and on the internet (www.krisweb.com). Rather than reinvent the wheel, KRIS should be routinely updated to include new data and bibliographical information that can be used in implementing actions called for in the TMDL Plan and showing the accomplishments to that end.

If the SRRC can be of assistance in further updating the Fisheries section after the comment period has closed, please let us know. We have recent coho survey data for the Salmon River, which could be included. An updated Spring Chinook population graph is attached.

7 Patrick Higgins, Consulting Fisheries Biologist

I am submitting comments as an independent consulting fisheries biologist on the *Draft Salmon River, Siskiyou County, California Total Maximum Daily Load for Temperature and Implementation Plan* (*Salmon River TMDL*) (NCRWQCB, 2005) which was released for review on April 15, 2005. My relevant experience with regard to comments provided here include authorship of three chapters in the *Long Range Plan for the Klamath River Basin Conservation Area Fishery Restoration Program* (Kier Assoc., 1991), major contributions to the *Mid-term evaluation of the Klamath River Basin Fisheries Restoration Program*, and a 15 years of involvement in development and maintenance of the Klamath Resource Information System (see www.krisweb.com). I relied heavily on the *U.S. EPA Region 10 Guidance for Pacific Northwest State and Tribal Temperature Water Quality Standards* (U.S. EPA, 2003) which provides a state-of-the-art understanding of the relationship of water temperature to the health of Pacific salmon populations, and how temperature problems facing salmon can be remedied through the TMDL process.

7.1 Summary

The Draft *Salmon River TMDL* takes a sound scientific approach to abating temperature problems in the Salmon River basin with regard to assumptions and methods. It uses a well recognized temperature model, which has been frequently used in other northern California temperature TMDLs. It also recognizes factors that may influence temperature but that are less quantifiable and, consequently, cannot be modeled. The document appropriately recommends that the *Salmon River Subbasin Restoration Strategy: Steps to Recovery and Conservation of Aquatic Resources* (Elder et al., 2002) be followed to allow for speedy implementation of remedial measures, but is non-specific with regard to guidance on monitoring necessary for adaptive management. Linkage to Klamath National Forest management documents that help achieve Northwest Forest Plan (FEMAT, 1993) objectives insures that most concerns regarding cumulative effects previously described by Kier Associates (2004) will be met. Risk of damaging increased peak flows is not addressed, which could potentially confound the success of TMDL implementation.

The fisheries section (Appendix A) uses regional and Central Valley references to discuss Salmon River anadromous fish. Klamath Basin information and references are provided here because understanding locally adapted stocks is a necessary part of their protection from temperature impairment (U.S. EPA, 2003).

7.2 Assumptions and Methods

The Draft *Salmon River TMDL* employs the widely used and trusted SSTEMP model (Bartholow, 2002) and the document clearly states its assumptions, which are met, and follows methods that are scientifically sound. The key assumption is that water temperature impairment is best estimated by gauging riparian conditions and shade over the stream and best controlled by improving riparian conditions over time. Field verification of the model demonstrated that shade was an important factor in controlling water temperature and that riparian condition was less than optimal in many stream reaches because of timber harvest, fires, debris torrent impacts and historic mining.

The University of California at Davis Information Center for Environment (ICE) vegetation modeling also used standard remote sensing data and assumptions with regard to tree heights and site potential (Appendix B). Field verification and subsequent model runs showed improvement as shade conditions improve with riparian recovery over time, as expected. Because of stream width and other factors, lower order streams show a much greater response than larger tributaries and mainstem reaches.

7.3 Impacts to Riparian Zone Section Overlooks Potential Cumulative Effects

The *Salmon River TMDL* lists several factors that can influence riparian stand structure and stream channels, including landslides, fire, flooding, timber harvest and roads. These discussions are adequate, but fail to point out the interconnected nature of these potential impacts that generally fall into the category of cumulative watershed effects (Ligon et al., 1999; Dunne et al, 2000; Collison et al., 2003). Although the TMDL needs to remain focused on temperature, relationships should be fully acknowledged and relegated to further study in the full Salmon River TMDL Implementation Plan and monitoring related to it. For example:

- Streamside landslides related to large earthflows are described, but accumulated debris torrents and increased peak flows can trigger additional catastrophic landslides known as inner gorge failure (LaVen and Lehre, 1977),
- Flood damage and channel changes can be caused by increased peak discharge resulting from accumulated disturbance related to timber harvest and road building, especially in the rain-on-snow zone (Berris and Harr, 1987; Heeswijk et al., 1995; Jones and Grant, 1996),
- Fire risk may be elevated by timber harvest, which can reduce relative humidity in the forest and leave fuels in the form of slash, and management outside riparian zones can change fire behavior resulting in hot fires that spread into them,
- Multiple stream crossings (known as “stacked” culverts) pose greater risk of catastrophic channel scour from debris torrents (Armentrout et al., 1999; de la Fuente and Elder, 1998), and
- Extensive disruption of riparian areas due to hydraulic mining may have altered cold water feeds from gravel bars that could have provided refugia for salmon and steelhead during low flow, high temperature periods (U.S. EPA, 2003).

U.S. EPA (2003) specifically notes how to deal with problems that cannot be captured in a model, but that may be important in long term recovery of natural temperature regimes or patterns and recovery of Pacific salmon stocks:

> “Those human impacts that cannot be captured in a model (e.g., loss of cooling due to loss of hyporheic flow) should be identified in the TMDL assessment document (i.e., supporting material to the TMDL itself) along with rough or qualitative estimates of their contribution to elevated water temperatures. Estimates of natural conditions should also be revisited periodically as our understanding of the natural system and temperature modeling techniques advance.”

Snyder (1931) in *Salmon of the Klamath River* describes temperature variability across mainstem Klamath River transects where no tributaries were nearby that likely described hyporheic connections and also stratification in pools, where colder water resided at the bottom of pools. It is also likely that prior to disturbance by hydraulic mining that the Salmon River had similar more well distributed refugia due to hyporheic connections and cold water lenses in the depths of pools.

7.4 Implementation Strategy

The linkage to *Salmon River Restoration Strategy* (Elder et al., 2002) as a way to begin immediate implementation is sound and is to be commended because it will help speed actions to prevent further flood damage that would cause channel aggradation and riparian damage. The Memorandum of Understanding (MOU) between the NCRWQCB and Klamath National Forest, in addition to the targets and guidelines established through management plans and watershed analyses, make it likely that appropriate actions will be taken:

- High quality waters (refugia) will be protected to maintain beneficial use and areas of the highest importance to salmon and steelhead,
- Road decommissioning will target watersheds with the best aquatic habitats as a priority,
- Road densities will be reduced to minimize flood damage risk,
- Land management will avoid unstable ground disturbance, and
- Riparian areas will be protected out to at least two site potential tree heights on perennial streams, including up to the height of any unstable inner gorge.

The USFS commitment to a strategy compatible with TMDL objectives, the MOU between the NCRWQCB and Klamath National Forest is an acceptable approach.

7.5 Fisheries (Appendix A)

The draft *Salmon River TMDL* Appendix A captures some information related to Salmon River fish stocks, but frequently references Central Valley literature, while behavior, range and population information regarding Klamath Basin stocks is available. Since the Salmon River TMDL is trying to restore Pacific salmon as a "beneficial use" under the Clean Water Act, it is useful to have the most detailed information possible on behavior and distribution of locally adapted stocks of fish. Such information is supplied below by species and life stage and similar information will likely be included in comments on the *Salmon River TMDL* from the Karuk Tribe and Salmon River Restoration Council (SRRC).

Some minor points: The author of the Appendix uses the non-specific and confusing "system" when he means river, tributary or watershed. Graph sizes need to be expanded to make the X-axes readable.

7.5.1 Spring Chinook

The Salmon River spring chinook population is the last available for use in re-expanding the range of the species after PacifiCorp hydroelectric dams are removed and other tributaries like the Scott and Shasta Rivers are recovered. The *Salmon River TMDL* should clearly characterize spring chinook as a stock at risk of extinction because it is approaching levels where genetic diversity could be compromised (Kier Associates, 1991). References should be restricted to those specifically regarding Klamath Basin stocks where they are available.

Juvenile Life History:

Appendix A confuses the life history designation of "ocean type" as referring to both adult and juvenile behavior, when the term applies only to the latter. Snyder (1931) analyzed scales of spring chinook adults in the spring of 1920 and found:

> "Of the 35 spring fish, 29 possessed scales of the ocean nuclear type…... The stream type of nucleus was represented by only six fish."

This indicates that most spring chinook juveniles that successfully survived to adulthood were heading down and out of the river almost immediately upon emergence from the gravel (i.e. ocean type). The minority were rearing in the Klamath or its tributaries for some time before entering the ocean (stream type). West (1991) noted that Salmon River spring chinook juveniles exhibited all three life history types, but that yearlings were rare.

The low incidence of stream type or yearling spring chinook life history found by Snyder (1931) could have been a behavioral adaptation to lack of appropriate freshwater habitat due to lingering mining damage as opposed to genetic factors. Juvenile behavior may also vary with flow years as fish remain in freshwater longer when flows are high and habitat abundant and suitable.

Adult Life History: Adult spring chinook in the Klamath River are recognized as entering the mouth of the river as early as February but with runs picking up in March and April before peaking in May and tapering off in June (Snyder, 1931). The first period of entry into the Salmon River spring chinook adults is not discernable due to high flow conditions, but entry usually ceases in June as flows decrease and water temperatures increase. Appendix A should note spring chinook are adapted to spawning in mid-September at higher elevation where temperatures cool earlier, which results in temporal as well as spatial segregation from fall run spawning. Early spawning is also an advantage for egg survival as protection from severe cold stream conditions that can occur at higher elevation during winter. Emergence of fall and spring chinook juveniles may have similar timing because of warmer stream temperatures at lower elevation give eggs and alevin shorter gestation.

Adult Population Trends: Discussion of historic population levels in Appendix A are confused, while the historical record is clear. The decline of spring chinook is clearly tied to the first major wave of land use by miners in the mid- to late 1800s, including both habitat loss and poaching (Snyder, 1931). Snyder (1931) indicated that as of 1920 "the spring migration has now lost its economic importance, and seems to have almost entirely disappeared." A spring chinook fishery was operated from 1919-1921, but it harvested only 250-1700 fish annually and was not economically viable. The resurgence in chinook that lead to harvest in the hundreds of thousands in the period between 1912-1930 was predominantly fall fish. This is likely because deep pools for adult spring chinook holding in tributaries like the Salmon River had not yet recovered from mining impacts. The destructive impacts of mining in the Salmon River were extreme and wide-spread and leave an imprint on the stream today (see Limiting Factors).

7.5.2 Fall Chinook

Most life history and distribution information in Appendix A for fall chinook of the Salmon River is largely correct. Spawning is described as taking place from October through December in the Salmon River, which means that egg incubation would start in October, not in November as stated. Fall chinook trends in the Salmon River are not improving, despite favorable ocean conditions (Collision et al, 2003) that are leading to improved fall chinook runs in other SONC ESU streams. This likely indicates survival bottle necks in the mainstem Klamath River (see Limiting Factors).

7.5.3 Steelhead

Appendix A lumps all races of steelhead in the Salmon River together, which is inappropriate because differences in life histories of summer steelhead are well recognized and population data are available. Although there may be distinctions between fall and winter steelhead stocks, there is insufficient data to separate them for the purpose of discussion.

Summer steelhead have similar adult behavior to spring chinook, entering the Klamath River in spring and moving up to holding areas in tributaries such as the Salmon River by June. Studies by Kesner and Barnhart (1972) showed that 27% of Klamath basin summer steelhead migrated to the ocean after 1 year in fresh water, 65% after 2 years, and 8% after 3 years. Summer steelhead are recognized as often returning to freshwater precociously after just three or four months in the ocean in a life history known as the "half-pounder." Hopelain (2001) used a length criteria of 24-44mm for half-pounders and found that, while only 50% of Trinity River tributary summer steelhead exhibited this life history, nearly 90% of Klamath River tributary stocks did so. This may have implications for survival to adulthood (see Limiting Factors below). Summer steelhead spawn timing and location is not documented and represents a data gap.

Klamath River steelhead are known to feed on the continental shelf between the Rogue and Klamath Rivers (Kier Assoc., 1991) and the recent rebound suggests strong ties between summer steelhead populations trends in the Salmon River and the Pacific Decadal Oscillation cycle (Hare, 1998; Hare et al., 1999), which has been favorable since 1995. The PDO is also associated with wetter climatic cycles on land that favor enhanced carrying capacity for juvenile steelhead.

Fall-Winter Steelhead: The run timing of adult steelhead entry into the Salmon River should be noted as September through April, not ending in December as noted in Appendix A. There are no data to support the statement that "steelhead trout populations appear more resilient than chinook" and "appear to be more tolerant of rearing conditions." Rather steelhead juvenile life history makes them more vulnerable to such factors as poor water quality in the mainstem Klamath River (Kier Assoc., 1999) (see Limiting Factors).

7.5.4 Coho Salmon

The discussion of Salmon River coho salmon should describe the known range and cite more recent literature about wild coho salmon in the Klamath River basin (Maurer, 2002; Chesney, 2002; Hampton, 2003). The statement that there is only one metapopulation of coho salmon, owing to spreading of hatchery stocks of Columbia River origin (Barnhart, 1994), should be dropped because it is not supported by data.

Juvenile Life History: Chesney (2002) found that peak out migration of Shasta River juvenile coho salmon smolts and young of the year started as early as February, peaked in early April and continued through June in 2001. Scott River downstream migrant trapping in the same year showed peak coho migration in later April. Length frequency of downstream migrants was bi-modal on both the Shasta and Scott Rivers, indicating both young of the year and yearling parr in the catch, however, the Shasta catch had more yearlings while the Scott catch was mostly young of the year.

Adult Life History: Hampton (2003) reported results from the CDFG Shasta River counting facility in Fall 2002 and noted that adults migrated upstream from October 19 through December 17 when increasing flows made trap operation impossible. Run pulses were in response to storm events and the largest number entered the Shasta in December. Hampton (2003) stated that Shasta River coho salmon run and spawn timing likely extends into early January. Salmon River fall and early winter flows do not allow operation of weirs for salmon counting, which prevents any attempt at enumeration adult coho.

Adult Population Trends: Although there are no reliable trend data for coho salmon, there is a clear indication that there are strong and weak year classes (Hampton, 2003). Weak year classes are a sign of extinction risk (Rieman et al., 1993). Recent relatively large returns of adult chinook salmon to tributaries like the Scott River (Maurer, 2002) are likely the result of positive PDO cycles (Hare et al., 1999).

7.5.5 Limiting Factors for Salmonids

Although the Salmon River TMDL needs to stay focused on temperature, Appendix A also needs to acknowledge periodic problems posed by sediment that compromise habitat for all salmonid species at all life stages (Kier Associates, 1991; 1999). Fires and land use have elevated risk of sediment yield well over background and sediment evulsions from tributaries have been documented after the 1987 fires and January 1997 flood (de la Fuente and Haessig, 1994; Kier Assoc., 1999; de la Fuente, 1998).

While mainstem Salmon River temperature regimes may take additional decades to recover, the *Salmon River TMDL* and Appendix A need to make more explicit reference to the fact that restoring sub-basins can establish or maintain refugia at the mouths or in lower reaches of streams as recommended by U.S. EPA (2003). It is likely that hyporheic function of cold water feeds from gravel bars provided disbursed refugia for all salmon species and life histories prior to disturbance. Early mining used water cannons to mine alluvial deposits and would have disrupted hyporheic function (see Monitoring).

Massive hydraulic mining in the mid- to late 1800s flattened stream channels and mobilized tons of sediment that likely took fifty years or more to flush from the Salmon River (de la Fuente and Haessig, 1994), but the legacy of stream channel simplification remains. Large woody debris would have been dislodged by this early land use history, and then further depleted by logging and subsequent flood damage and fire since 1900. Complex stream channels with large wood tend to have increased pool frequency and to sorted pockets of sediment of different size classes. This sorting would have resulted in more abundant smaller gravel suitable for coho and steelhead spawning whereas today's Salmon River channels tend to be cobble dominated, which favors chinook. Reeves et al. (1993) documented the relationship between loss of habitat complexity and salmonid species diversity. The low numbers of Salmon River coho is likely linked to diminished habitat complexity and, therefore, multi-species carrying capacity. Poole and Berman (2001) point out that large wood can force local upwelling from the hyporheic zone increase local cold water refugia.

Mainstem spawning species, such as fall and spring chinook may be more vulnerable to bed scour than those fish spawning in headwater reaches. Montgomery and Buffington (1993) point out that human caused watershed disturbance can increase peak flows and bed shear stress, which in turn triggers increased bed load mobility. The Salmon River TMDL should acknowledge potential elevated rain-on-snow risk because "even minor increases in the depth of scour could significantly reduce embryo survival" (Montgomery et al, 1996).

The Salmon River is one of the healthier tributaries of the Klamath River, but anadromous salmonids must migrate through the Lower Klamath in order to reach the ocean. Chesney (2000) noted mortality of juvenile salmonids from the Shasta and Scott River basins during their Klamath River downstream migration may be high. Kier Associates (1999) used data showing divergent population trends of Trinity River and Klamath River tributary summer steelhead populations as indicative of poor water quality in the mainstem Klamath River limiting the latter. They also asserted that the high occurrence of the half-pounder life history in Klamath summer steelhead stocks would be a selective disadvantage because these fish return during periods of very poor water quality and may be subjected to stress from angling.

The Salmon River TMDL needs to recognize the existence of now well recognized cycles of ocean productivity and favorability of on-land climatic regimes attendant with the PDO (Collison et al., 2003; Hare et al., 1999). This recognition would promote a greater sense of urgency to improve freshwater habitat in the Salmon River and other Klamath TMDL basins before the switch to less favorable conditions for salmon and steelhead some time from 2015-2025 (Collison et al., 2003).

Appendix A failed to note progress on what was formerly a major limiting factor for Salmon River spring chinook. Poaching problems in the Salmon River were recognized as a significant potential limiting factor for spring chinook (Kier Associates, 1991), but educational efforts, community outreach and neighborhood watch programs by SRRC and residents have helped substantially end this threat (Kier Associates, 1999).

7.6 Monitoring and Managing Data for Adaptive Management

The *Salmon River TMDL* defers monitoring to the implementation phase, but needs to give some guidance on standard monitoring methods that might be applied to gauge trends. The draft document acknowledges sediment and channel scour as contributing to warming; therefore, sediment monitoring could be included.

Temperature Monitoring: Routine placement of automated temperature probes in various locales should continue so that long term trends and variability in response to climate can be measured. Not all locations would need annual monitoring, but locations could be re-checked periodically, especially after storm events, fire or other events that could trigger shifts in the temperature regime.

Aerial surveys using forward-looking infra-red radar, similar to ones conducted in the Shasta and Scott River basins for TMDL (Watershed Sciences, 2004), could be used to identify refugia and potential areas of hyporheic influence. Areas of cold water not directly resulting from tributary inflow could be the target of hyporheic studies to discern if there are connections to cold water aquifers proximate to undisturbed gravel bars.

Long term studies regarding hydrology and water temperature regimes might focus on differences in Wooley Creek and the North Fork Salmon River, which have much different land use histories.

Sediment/Channel Monitoring: The Salmon River TMDL recognizes the benefit of sediment reduction in helping restore water temperature regimes and channel conditions for salmonids. Recognized monitoring tools that would help gauge trends in sediment and channel conditions include:

- V-Star, which measures the relative volume of sediment in pools (Lisle and Hilton, 1992; Knopp, 1993),
- Large woody debris frequency,
- Cross sections and longitudinal profiles, and
- Changes in riparian width in response to sediment (Grant, 1988)

Data Management: All three partners likely to be involved in the Salmon River TMDL Implementation Plan have contributed data and/or helped build the Klamath Resource Information System (KRIS). The Salmon River TMDL should mention the active use of this custom computer program and its value for adaptive management.

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8 Sari Sommarstrom, Ph.D., Sari Sommarstrom and Associates

Thanks for this opportunity to comment on your proposed TMDL. I appreciate all of the work that staff has put into this effort so far. Most of my comments relate to the "big picture" of what the Regional Board's intent may be regarding this & future TMDLs, and how to make the TMDL report clear to the average reader.

8.1 Overall

- The public needs to be able to see how a TMDL came about, and where it is going. The Salmon River may be your 'easy' one compared to the other Klamath Basin ones, but the message still needs to be clear to the reader.
- State at the beginning when the Salmon River became 303(d) listed as temperature impaired, and what date were used for the original listing.
- Clearly state how the Salmon River and its tributaries exceed water quality standards at the beginning. The reader is left to figure that out for herself through various tables, without a clear expectation established of—THIS is the standard we expect, and THIS is what the Salmon River (& tribs) current temperatures are. One table could do this?
- Graphs need to be understandable to the lay reader. Figure 3.2 is very confusing yet its data are key to understanding what the temperature trends are. Please display the trend data for each subwatershed separately, and discuss in the text. For example, Wooley Creek is almost all within the wilderness area. What factors may have caused its temperature to exceed your desired MWATs? Is it and other tribs improving or not since the 1987 fires and 1997 flood? Please tell the story more clearly.
- Stream temperature dynamics are something that scientists are still trying to understand (see Johnson 2003 article I faxed to you). Please put your temperature modeling into context with the uncertainty that still exists with this topic. Much remains to be learned about what influences stream temperatures, and the Board's TMDLs on temperature should not give the impression that temperature modeling is a precise science based on solid evidence of cause & effect, when it's still a relatively young science. Inexpensive temperature sensors over the past decade have helped a lot in collecting data – but the analysis of all of the data is still lagging.

8.2 Watershed Characteristics

- This setting is critical to understanding how the impairment has occurred – both natural and human-caused factors. You've made a good start at capturing these conditions, but there are several important factors missing:
- Hydrology – please graph the ave ann discharge through 2003 (since you've listed water temps through that date; use USGS preliminary data if that's all that's available now). It's important to depict the relative magnitude of the floods listed and the relative impacts on riparian vegetation and channel scour. The floods listed were not all equal in severity. It is also very important to mention the droughts and their frequency, since low flows can certainly influence temperature.
- Fire history: both 1977 and 1987, major fire years, were also drought years. There does seem to be a correlation. The USFS has maps from the 1987 fire that indicate the relative intensity of the burning, to indicate potential recovery of riparian vegetation.
- Timber Harvest: Please update for the years 2000-2004, and include USFS plans for future

harvesting.

8.3 Problem Statement:

- Again, you need to restate clearly how the Salmon River's current temperatures exceed the Basin Plan's water quality objectives. Having the reader try to figure it out from Fig 3.2 is too confusing and indirect. Provide a narrative description of what the trend data for each sub-watershed is telling.
- Current Temperatures: State the methods used to collect data since 1990 and who collected the samples where – a table would be helpful, at least in the appendix. Were the temperature probes at the bottom of pools or in riffles? What was the frequency of the temp recordings?
- Explain about temperature stratification in pools – add a diagram from some text? We all know that the spring chinook and summer steelhead adults summer over in the deeper pools due to cooler temperatures on the bottom – they avoid the warmer sites.
- Historic Temperatures: An excellent reference is: *Taft & Shapovalov (1935). A Biological Survey of Streams and Lakes in the Klamath and Shasta National Forests of California. US Bureau of Fisheries.* I'll mail you the excerpts for the Salmon River. They recorded max temps of 77.5 F in the North Fork Salmon, 78.5 F in the South Fork, and 74 in the mainstem during the summer of 1934.
- I thought that TMDLs were supposed to estimate how much of an impairment is "natural" versus "human-caused". I don't see that estimate made here for the Salmon's temperatures?

8.4 Temperature TMDL

- Please clarify how the model addresses potential riparian vegetation along those reaches of the Salmon River with gorges with rock bluffs. Why was the 10 percent selected as the natural effects of reduction rate? Based on what?
- Tables 4.1 & 4.2 appear to indicate that your model's simulated temperatures are almost always overestimating the temperature, compared to the actual temperature. Clarify the "alternative date" used for Table 4.2 in the table heading. Discuss the implications of these tables better in the text, as they seem key to your conclusions and recommendations.

8.5 Implementation Strategy

- Suggest some draft Goals and Objectives for your proposed Implementation Plan. This is where the public can see the intent of this TMDL. Examples: Goal: *Restore the Salmon River's impaired temperature to levels that will protect cold water fisheries. Seek delisting under 303(d) list of impaired waterbodies when deemed recovered. Objective: Restore and maintain riparian corridors.*
- Relate strategy to the WMI Chapter and to the SWRCB Strategic Plan
- Relate implementation to other pertinent programs: Klamath River Basin Fisheries Task Force / new Klamath Basin Conservation Implementation Program (CIP) / CDFG's Fish Restoration Grant Program / etc.
- What is the timeline estimated to get riparian vegetation heights to the levels you anticipate? 50 Years? 100 years? Will the river need to remain listed for this time period?

8.6 References:

- Missing are several references cited in the text: Brungs & Jones 1977; Elliot 1981; Jobling 1981; Ligon et al 1999; USFS 1995a & b; USFS 1997; USFS 2002.
- Please check that all cited references are listed.