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July 2, 2007

Gail Louis
U.S. Environmental Protection Agency
75 Hawthorne Street (WTR-3)
San Francisco, CA 94105

Dear Gail,

Please find the attached comments from the Karuk Tribe of California regarding the Lost River Total Maximum Daily Load (TMDL). Improving water quality in the Lost River is critical to solving water quality issues in the Klamath Basin. Please contact Susan Corum, Water Resources Coordinator for the Karuk Tribe at scorum@karuk.us or (530) 469-3456 if you have any further questions.

Yootva,

Sandi Tripp

Director
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SUMMARY OF COMMENTS

The Public Draft Lost TMDL is critically flawed. Many of the legitimate requests made by the Work Group (Yurok Tribe, 2006) for improvements to earlier versions have been ignored. As a result, the TMDL does not characterize water quality problems adequately and will not likely contribute to water quality remediation. Specific deficiencies include:

- A near-total failure to use existing water quality field data from the Lower Lost River sub-basin
- The model used for supporting the technical TMDL suffers from unmet assumptions and uncertainties, and does not incorporate important processes such as nitrogen fixation by blue-green algae, ground water influence, and natural riverine denitrification.
- Its failure to recognize the need to restore ecosystem function to reduce nutrient pollution (i.e. restoring riparian areas, wetlands and lakes).
- It fails to define the steps needed to restore ESA-listed sucker species; there are no clear monitoring recommendations, and there is no timetable with which to assure that the numbers of this species are recovered.
- Its failure to recognize the present impacts of Lost River water quality on the Klamath River downstream and to determine the amount by which nutrients from the Lost River and Straits Drain must be reduced to prevent degradation of Klamath River water quality.
- The selection of a special interest group, the Klamath Basin Water Users, to serve as technical lead for *Lost TMDL* implementation while, at the same time, ignoring totally the existence and legitimate interest of the Tribes and other river protection-interested communities.

The water bodies included in the *Lost TMDL* are so profoundly altered from their original state that the use of models to analyze existing patterns in data provide little insight into what needs to be done to restore ecological function.

The revised *Lost TMDL* ignores extensive recent, relevant research conducted in the Lost River sub-basin, bearing on water pollution abatement and sucker recovery. There is little evidence (e.g. citations or a literature review) to indicate that this substantial body of scientific knowledge was put to any use whatsoever in developing the TMDL, other than to configure and calibrate the water quality model.

The *Lost TMDL* recommends 50% reductions in dissolved nitrogen and organic matter loads yet it does not consider whether that reduction is what is necessary to prevent violation of water quality standards at the Klamath Straits Drain's terminus in Keno Reservoir, nor in downstream reaches of the Klamath River. The Lost River's substantial contribution to Klamath River nutrient loads confounds water quality restoration and Pacific salmon recovery in the Klamath River.

In its current condition the *Lost TMDL* is so seriously flawed we would request that the U.S. EPA approve it only for the limited purpose of returning responsibility directly to the North

Coast Regional Water Quality Control Board (NCRWQCB) for the purpose of completing the necessary technical analyses and for developing a more effective plan of implementation.

As reflected clearly in this inadequate TMDL, U.S. EPA lacks the regulatory position to implement an effective Lower Lost River water quality improvement program. We recommend, therefore, that such implementation is better placed with the State and its North Coast Regional Water Quality Control Board. Without sound implementation, the current version of the *Lost TMDL* will not meet the mandates of the consent decree.

DETAILED COMMENTS

Chapter 1: Introduction

1.2 Lost River TMDL Summary

This section summarizes the technical approach taken with the *Lost TMDL*, and provides background information about the sub-basin. While this Public Review Draft has added a modest amount of information on the long- term loss of habitat in the Lost River, Tule Lake and Lower Klamath Lake, it fails, still, to make any connection whatsoever between these changes and the degradation of the sub-basin's water quality. It states that "riparian and wetland areas historically helped to filter pollutants from runoff to these receiving waters," but nowhere recommends that this natural pollution control capacity be restored. The *Lost TMDL* notes that "the Lost River is highly channelized and includes several impoundments to facilitate water source and support diversion canals and return flow drains," but it fails to recognize the system of man-made channels, canals, and drains severely impairs the river's ability to assimilate nutrients, as we explain below.

The three paragraphs and the single graphic concerning changes from historic conditions do not properly explain the loss of one of the region's most important subsistence fisheries, nor does it provide a framework for understanding how the ecosystem could be restored sufficiently to restore the beneficial uses of water in the sub-basin. The final adopted *Lost TMDL* should provide more information concerning historic hydrology, recent water quality studies, aquatic biodiversity, and historic and recent trends in sucker populations, such as that provided below.

<u>Historic Changes to Hydrology and Land Use:</u> Historic accounts of the Klamath River below Klamath Falls, Oregon establish the connection between the Lost River and Lower Klamath Lake. In high water years the Klamath River would spill over a low divide with the Lost River into Tule Lake, which once had a maximum surface area of 110,000 acres -- making it seasonally larger than Upper Klamath Lake even before the latter was diked and drained.

Upper Klamath Lake was, historically, about 94,000 acres in surface area (Abney, 1964 as cited in USFWS, 1993).

> "A flood in the spring of 1890 gushed Klamath River water down Lost River Slough deep enough to swim a horse for about six months and brought Tule Lake

> to its last historic high water level of 4,064 feet…the Klamath River periodically flooding down the Lost River Slough is the main source of water which caused Tule Lake's historic high levels."
>
> Abney (1964)

The Klamath River also had a seasonal connection with Lower Klamath Lake (LKL) with flows spilling from the river into the lake during spring-time floods (NRC 2004). Flows would reverse in late summer and the level of LKL would fall as the river dropped and LKL's water would flow from the lake through the Straits Drain back into the Klamath River. Steam driven, flat-bottomed paddle wheel boats navigated from Klamath Falls and Lake Ewauna more than 50 miles south through LKL to Lairds Landing, where goods from the railroad could be loaded, until about 1914 (NRC 2004).

Farming interests began diking off the Klamath River from the Lost River basin and draining the area's wetlands, beginning in 1890, before the advent of the federal Klamath (Reclamation) Project:

> "Following the high water of 1890, J. Frank Adams, Jessie D. Carr and a company of Tule Lake ranchers built a mile long dike along the east bank of the Klamath River to stop the flow of Klamath River into Tule Lake via the Lost River Slough and Lost River."
>
> (Abney, 1964)

The Klamath Project completed the works to prevent the spill of the Klamath River into Tule Lake; it built miles of canals and installed pumps to allow the marshes adjacent to Tule Lake to be converted to farmland. Tule Lake ultimately shrank in size from its maximum of 110,000 acres down to 9,400-13,000 acres of shallow water marsh.

Irrigation canals now carry water from Upper Klamath Lake and the Klamath River into the Lost River basin during summer, adding significantly to the Lower Lost River's nutrient burden. Excess streamflow from the Lost River can be pumped in reverse, through the irrigation canals back into the Klamath River, during winter and spring periods of high runoff. This has the potential to transport a great deal of organic matter to the Klamath River's Keno reach, which adds to nutrient pollution and biological oxygen demand (BOD) (Deas and Vaughn, 2006).

The altered condition of the Lost River was summed up by the USFWS (2001) as follows:

> "The Lost River can perhaps be best characterized as an irrigation water conveyance, rather than a river. Flows are completely regulated, it has been channelized in one six- mile reach, its riparian habitats and adjacent wetlands are highly modified, and it receives significant discharges from agricultural drains and sewage effluent. The active floodplain is no longer functioning except in very high water conditions."

U.S. Bureau of Reclamation's (BOR) Klamath Project activities have had an equal or greater impact on the hydrology and aquatic biodiversity of Lower Klamath Lake (LKL), which was originally 94,000 acres or roughly equivalent in size to Upper Klamath Lake. Today LKL has shrunk to about 4,700 acres as a result of diking for railroad development and subsequent draining by the BOR for farming. Figures 1 and 2 compare open water and wetlands in LKL between historic and the present-day conditions, including the percentage of open water and bulrush delineated on the pre-disturbance map (BOR, 2005).

BOR-led studies in the 1920s predicted that draining Lower Klamath Lake would fail to produce productive farmland and that, in fact, the peat below the lake and marshes would likely catch on fire if exposed (Amory 1926, as cited in NRC 2004). A peat fire did, in fact, ensue after the BOR proceeded to drain LKL despite its own prediction of futility. In 1940, the drain between Tule Lake and Lower Klamath Lake was completed, in part to help extinguish the peat fire, but also to more effectively rid Tule Lake "Lease Lands" (i.e., private farming on the National Wildlife Refuge) of excess water.

The government's destruction of open water marshlands has caused a decline in sucker species in Tule Lake and it has destroyed Lower Klamath Lake's ability to support these fish altogether. The loss of wetlands has also created a major negative impact on water quality due to the loss of the natural filtering capacity that they provided for these historic aquatic ecosystems.

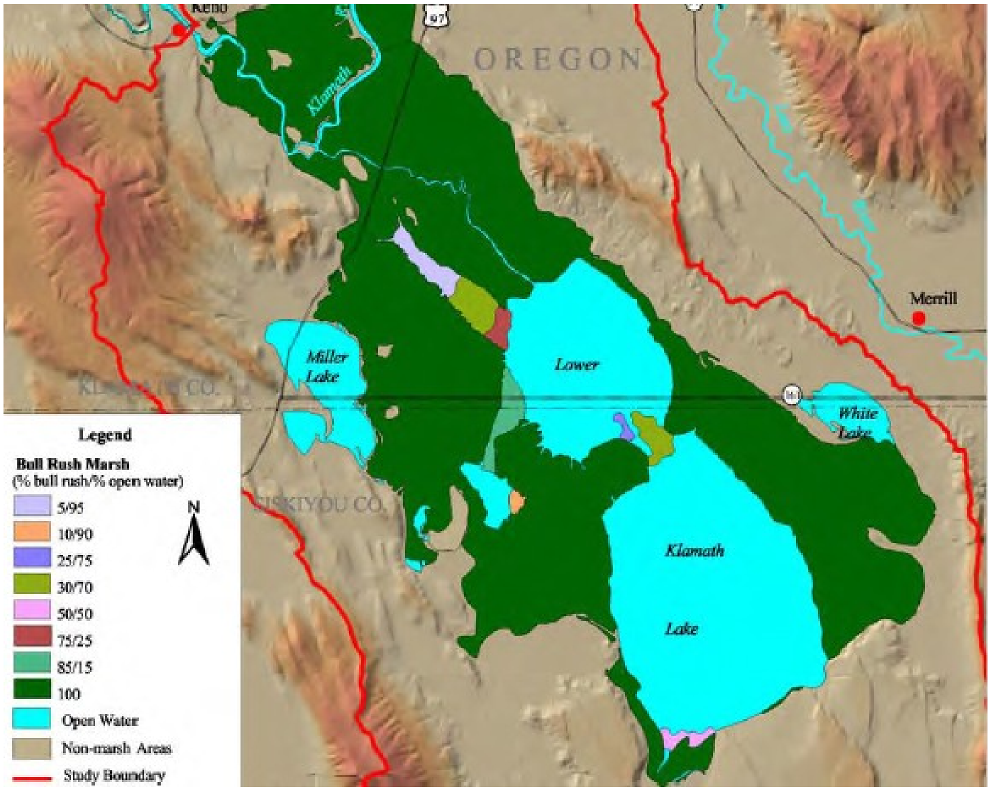

Figure 1. Historic size of Lower Klamath Lake and associated wetlands are shown in the map above, with wetlands broken down by percentage of cover by bulrushes. Map from U.S. BOR (2005).

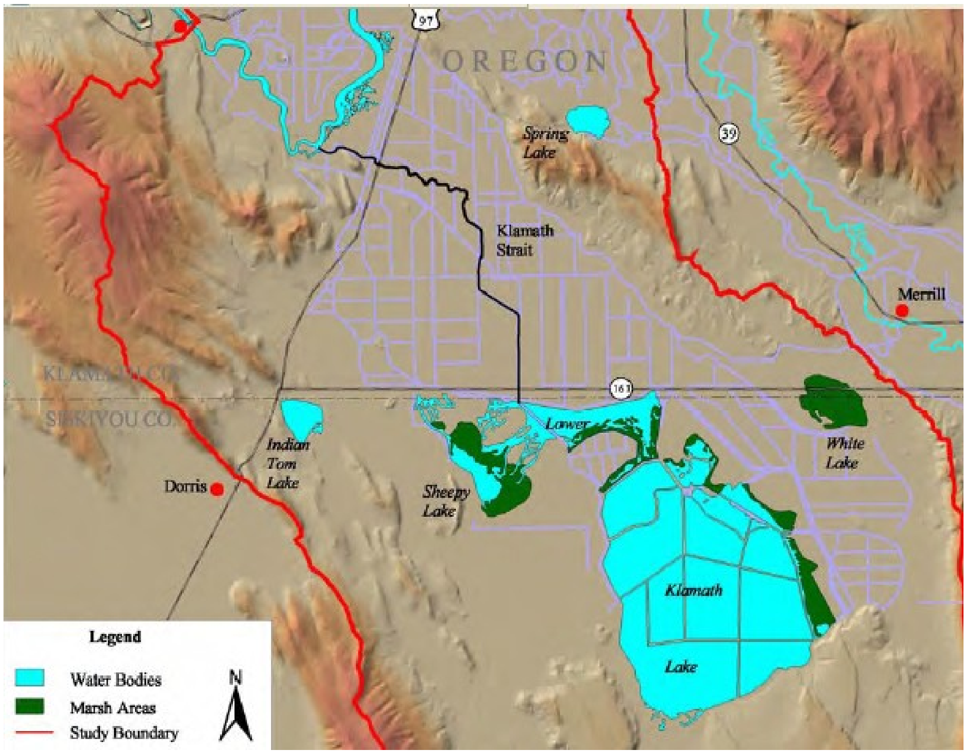

Figure 2. Present size and configuration of Lower Klamath Lake and associated marshes. Map from U.S. BOR (2005). The "Water Bodies" shown in the map include areas of Refuge that are flooded only intermittently.

According to the National Research Council (NRC, 2004): "In Tule and Lower Klamath lakes, original wetlands were estimated at 187,000 acres; about 25,000 acres remain (Gearheart et al. 1995)."

The Klamath Project also extends up the Lost River into Oregon. Its low-gradient reaches once had complex, braided channels (Figure 3) with associated wetlands that would have filtered overland flow, buffered alkalinity and provided some water storage capacity. The channel is largely confined today (Figure 4,5,6) and wetlands are typically severed from the river by levees (Figure 7), so that they cannot act as part of the river's filter and buffering system (Bortleson and Fretwell, 1993).

Bernot and Dodds (2005) point out that channelized rivers have diminished denitrification capacity, a critically important issue nowhere mentioned in the *Lost TMDL*. Channelization and diking impairs natural river processes that retain (strip) nutrients from the water column through denitrification, the growth of attached algae, and the settling of organic matter. The result is higher downstream nutrient concentrations than those that would have occurred prior to channelization, resulting in impaired water quality. As described by Bernot and Dodds (2005):

> "Several additional management methods that have not been regularly employed may prove to be useful in maximizing N retention and removal in lotic ecosystems. These include: 1) Maximizing substrata heterogeneity within the stream channel and creating backwaters where high rates of N flux can

> occur (for example, encouraging both nitrification and denitrification). … 3) Restoring channelized lotic ecosystems that inherently decrease the ability of the system to handle increased N loads. *This restoration should include reversion to historical sinuosity, channel complexity, and connectivity to riparian wetlands as well as decreasing mean depth of the water column in the river channel.*" (emphasis added)

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

The Lost River channel was mapped in detail in 1905 by the U.S. BOR just prior to the completion of the Klamath Project. Figure 5 shows an enlarged view of the Langell Valley reach, not far below Clear Lake. In this reach the Lost River flowed into a vast wetland that made its channel indiscernible. A more recent BOR map, however, shows this reach almost entirely confined by levees (Figure 4). Recent aerial photos of the Lost River just above its convergence with Tule Lake (Figure 5) show that the channel is separated from its old oxbows, which would have had wetlands connecting them to the main channel before wetlands "reclamation".

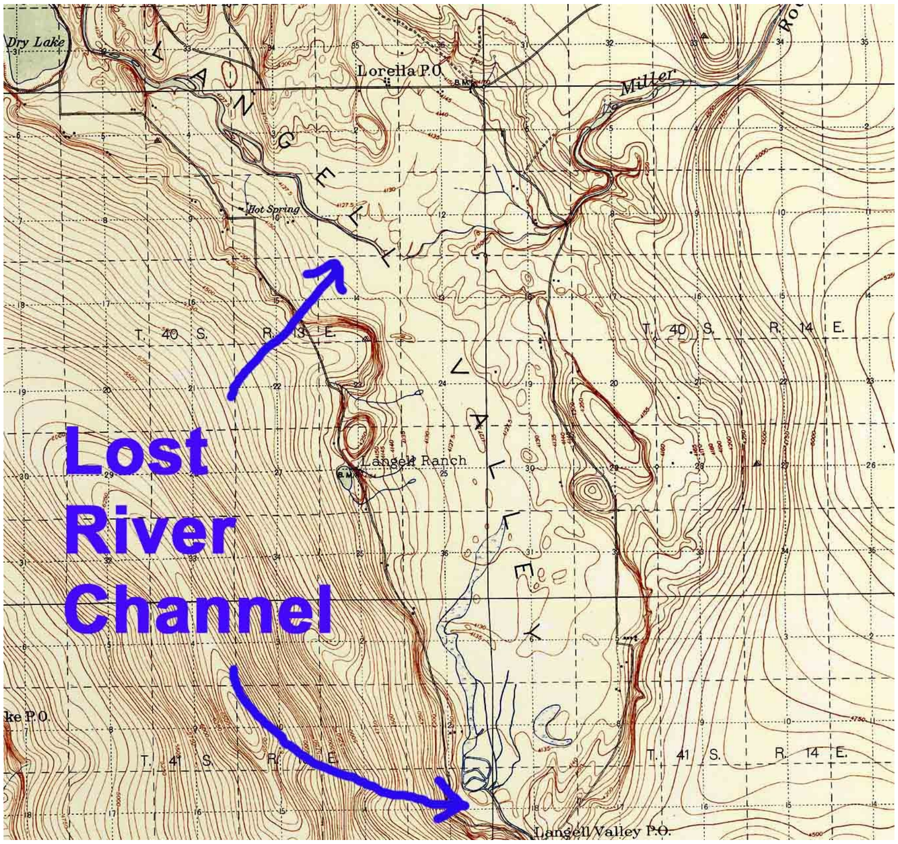

Figure 3. The Lost River in Langell Valley on the U.S. BOR 1905 topographic map appears as a vast wetland with an undefined channel at its juncture with Miller Creek (upper right). The arrows show defined channel reaches above and below the marsh. Figure adapted from U.S. Reclamation Service (1905).

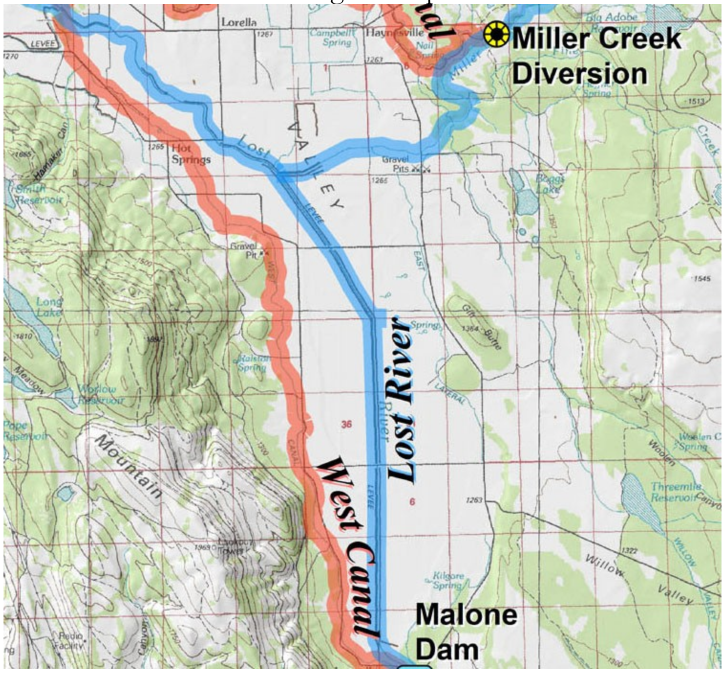

Figure 4. Map of the current Klamath Reclamation Project shows levees along the straightened channel of the Lost River in Langell Valley above its convergence with Miller Creek. This is the same river reach shown in Figure 3. Figure adapted from Neuman (2005).

Figure 5. Lost River above Merrill, Oregon with a simplified channel lacking any riparian zone or any connection to wetlands. Old oxbow (above center) isolated by filling. From Google Earth.

A ground photo by North Coast Regional Water Quality Control Board staff of the Lost River at Johnson Road (Figure 6) shows a different view of the channel with levees and no riparian trees nor buffer. Forward looking infrared radar (FLIR) imagery of the Lost River (Watershed Sciences, 2002, Figure 7) shows wetlands cut off from the river by levees.

Recent Water Quality Assessments: The North Coast Regional Water Quality Control Board staff sampled the Lost River to determine levels of the pesticide acrolein (Winchester et al., 1994) and for general water quality monitoring purposes (Winchester et al., 1995). The staff of the U.S. BOR has sampled seventeen stations along the Lost River in Oregon and California since 1993. The U.S. Geologic Survey (Dileanis et al., 1996; Shively et al., 2000) also sampled Lost River water quality and biological diversity in 1992-93 and 1999.

Winchester et al. (1994) found no trace of acrolein in the Lost River or Klamath Project canals despite its heavy use in the A Canal, which comes from Upper Klamath Lake. The herbicide is used to break down algae in order to keep water moving in the irrigation canals.

Shively et al. (2000) placed fathead minnows, a pollution-tolerant fish species, in live cages downstream of acrolein applications and found delayed mortality up to 48 hours after exposure to Lower Lost River water. Dileanis et al. (1996) also found measurable quantities of other pesticides. The *Lost TMDL* does not address pesticides and herbicides, but its recommendation for manual algae removal from canals could conceivably help with the herbicide problem.

Figure 6. Lost River at Johnson Road with agricultural tailwater pouring in from the culvert at left. Photo by Bill Hobson of the NCRWQCB.

Figure 7. The images above are paired video (left) and FLIR data from the convergence of Miller Creek and the Lost River showing dikes on both sides of the river and the creek and isolated wetlands outside the levees. The colors indicate temperatures: light blue = 20 C, darker blues = 21-22 C and the green shades = 23-24 C. From Watershed Sciences (2002).

Samples taken by NCRWQCB staff (Winchester et al., 1995) in the Lost River, Tule Lake and Klamath Straits Drain show water quality indicative of nutrient pollution and eutrophication, with high pHs (Figure 8), water temperatures, high dissolved ammonia (Figure 9), and low dissolved oxygen (Figure 10) levels.

The NCRWQCB also sampled Klamath River water quality, including dissolved ammonia, in the Lost River and the Klamath Straits Drain, during a Clean Water Act Section 104(b)-funded study in the summers of 1996 and 1997 (Figure 11). Although the conductivity values in the Lost River and Tule Lake did not exceed *Basin Plan* standards, Winchester et al. (1995) found that water quality in the Straits Drain was sometimes out of compliance.

Conductivity reached 1500 micromohs at the Straits Drain while the *Basin Plan* limit for LKL, of which the drain is considered a part, is 1150 micromohs (Figure 12). Winchester et al. (1995) found it difficult to identify the component of California-only derived non-point source pollution to the Lost River because of its connection with Upper Klamath Lake through the A Canal and its pollution from the Oregon reaches of the river. The authors recommended that the relationship between flows in the Klamath Project and Lost River pollution be investigated.

Data collected by the U.S. BOR on the Lost River are consistent with those of the NCRWQCB, showing nutrient enrichment and eutrophication. Continuous data from the A Canal, which supplies Klamath Project lands, show the extremely high pH which is characteristic of Upper Klamath Lake (Figure 14). The high pH is a consequence of entrained algae. Shively et al. (2000) point out that water from the A Canal provides a major source of nutrient enrichment to Klamath Project lands and, ultimately, to the Lost River.

Other findings by Shively et al. (2000) were:

- Dissolved-oxygen concentrations and pH tended to fluctuate each day in response to diurnal patterns of photosynthesis, and they frequently exceeded the criteria for protection of aquatic organisms,
- Elevated ammonia concentrations were common in the study area, especially downstream of drain inputs. The high pH of the water increased the toxicity of ammonia, and the concentrations exceeded criteria at sites upstream and downstream of irrigated land, and
- Sites with potentially toxic levels of ammonia were located all along the flow path, including water sources, agricultural drains, and receiving waters. The sites with the highest percentage of values that exceeded the criteria were sites 10 and 11 in the Tule Lake Sump.

Existing water quality data for the Lost River basin show an increasing pattern of concentration downstream, with the highest levels of impairment in the Tule Sump and the Straits Drain.

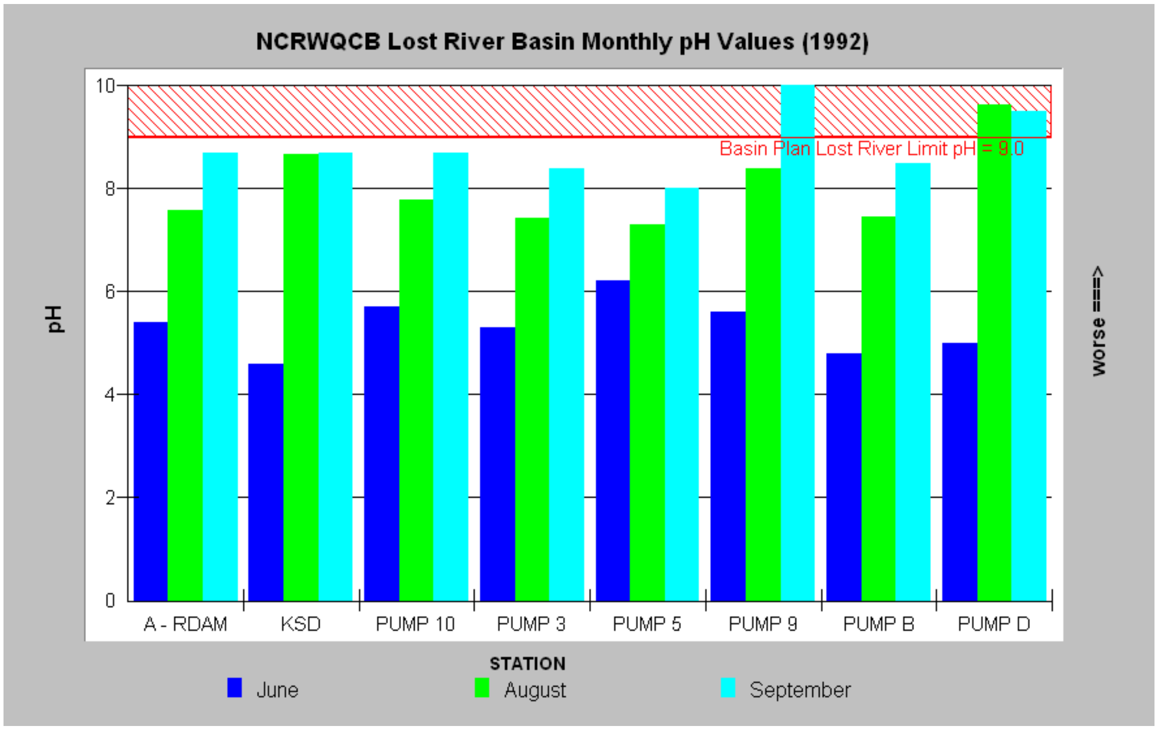

Figure 8. This chart summarizes pH at eight Lost River Basin locations. The NCRWQCB *Basin Plan* standard of 9.0 for pH was exceeded at stations within the Tule Sump in September 1992. Data from Winchester et al. (1995) and chart from KRIS V 3.0.

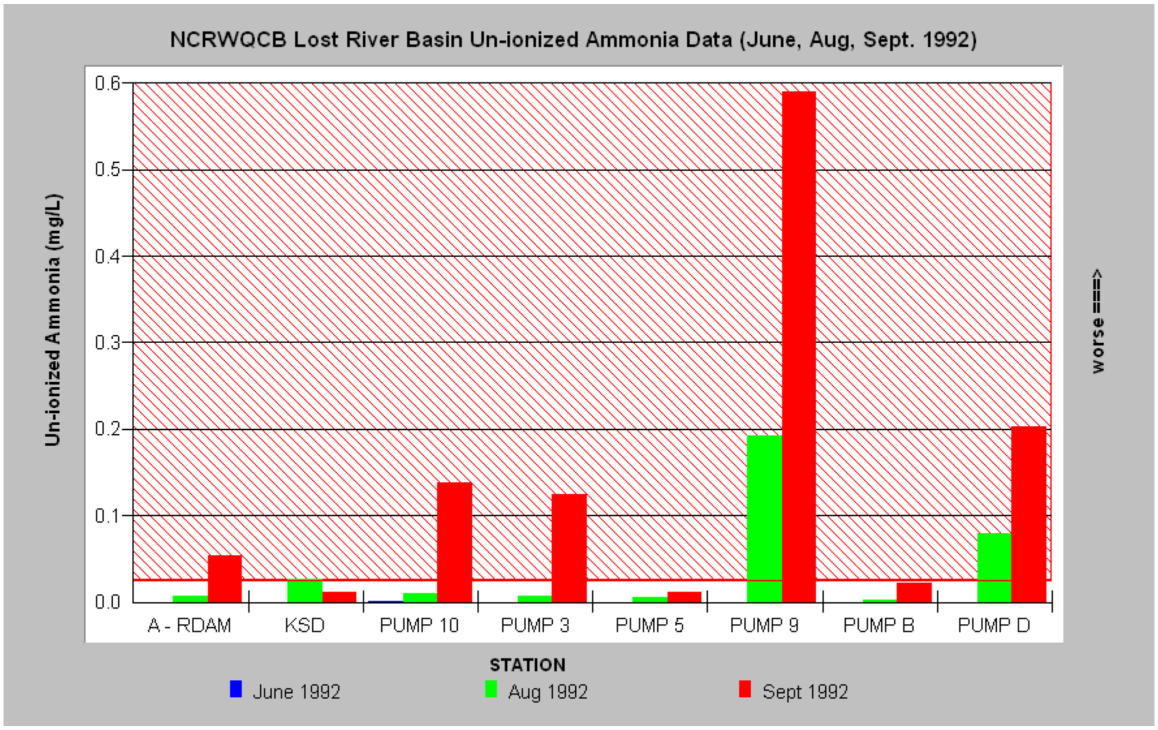

Figure 9. Un-ionized ammonia in the Lost River and Klamath Straits Drain is displayed above with U.S. EPA (1986) maximum objective of 0.025 milligrams per liter (mg/L) for protection of aquatic life. Data from Winchester et al. (1995) and chart from KRIS V 3.0.

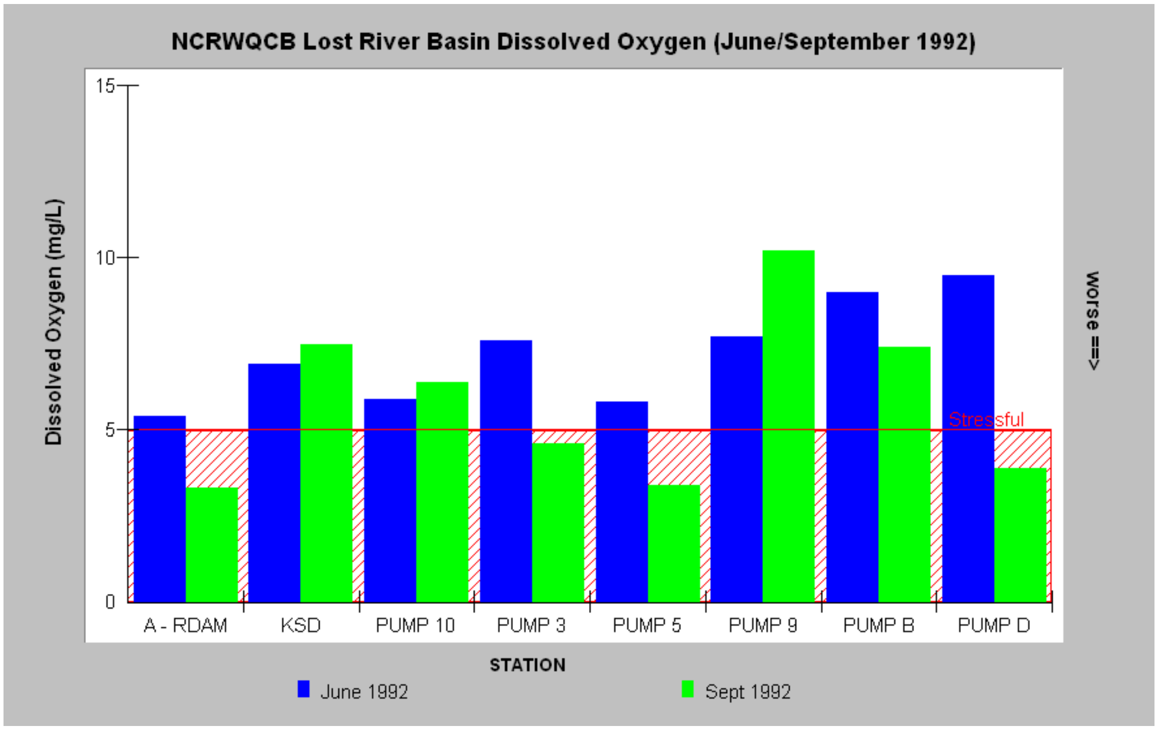

Figure 10. This chart shows dissolved oxygen at eight locations in the Lower Lost River, Tule Lake and the Straits Drain in summer 1992. D.O. fell below North Coast Regional Water Quality Control Board adopted standard of 5 ppm at four sites during September. Data from Winchester et al. (1995) and chart from KRIS V 3.0.

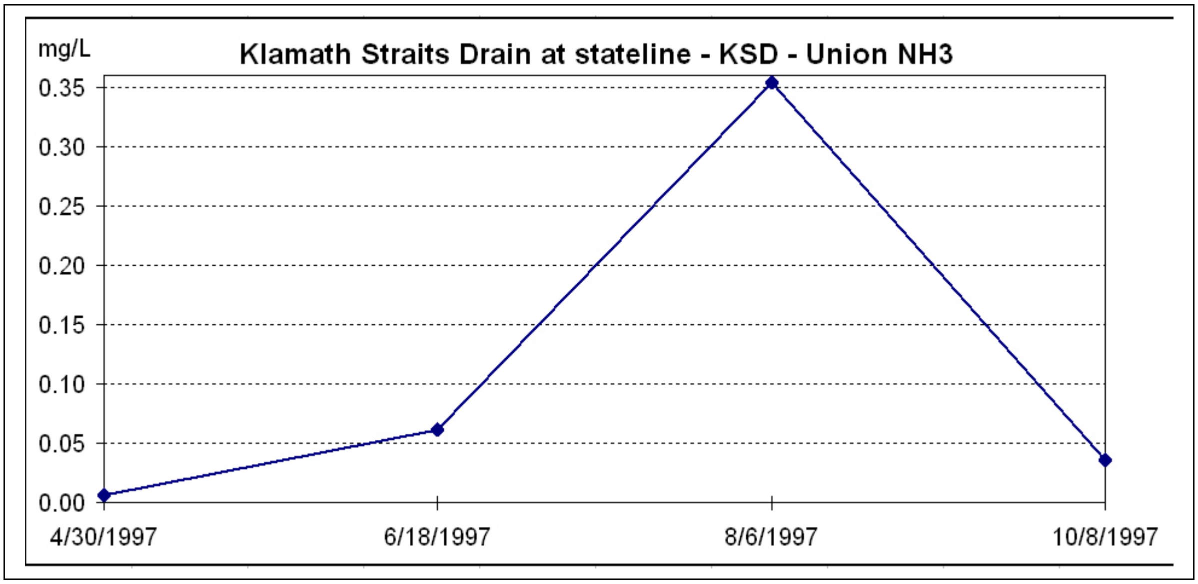

Figure 11. Levels of dissolved, or unionized, ammonia in the Klamath Straits Drain in 1997. NCRWQCB staff data.

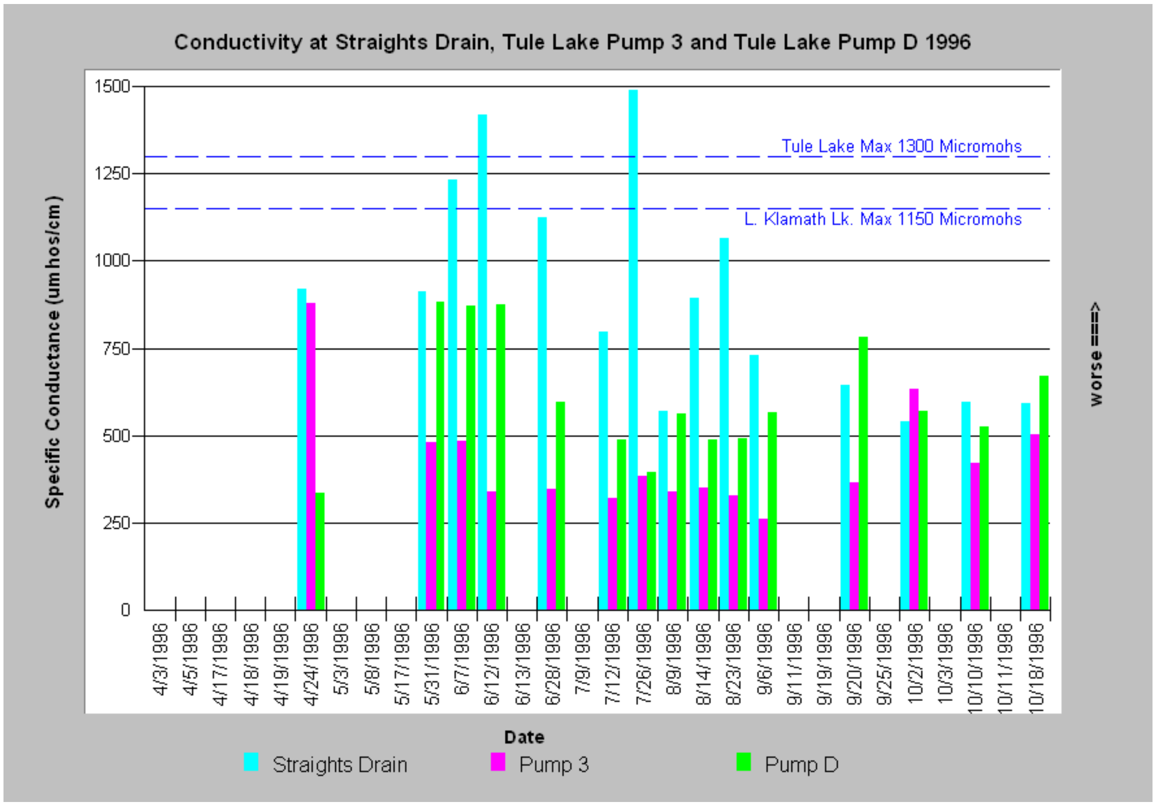

Figure 12. Conductivity measured at the Straits Drain, which is the outlet of Lower Klamath Lake, shows that values exceeded *Basin Plan* standards in June and July 1996. NCRWQCB 104b data.

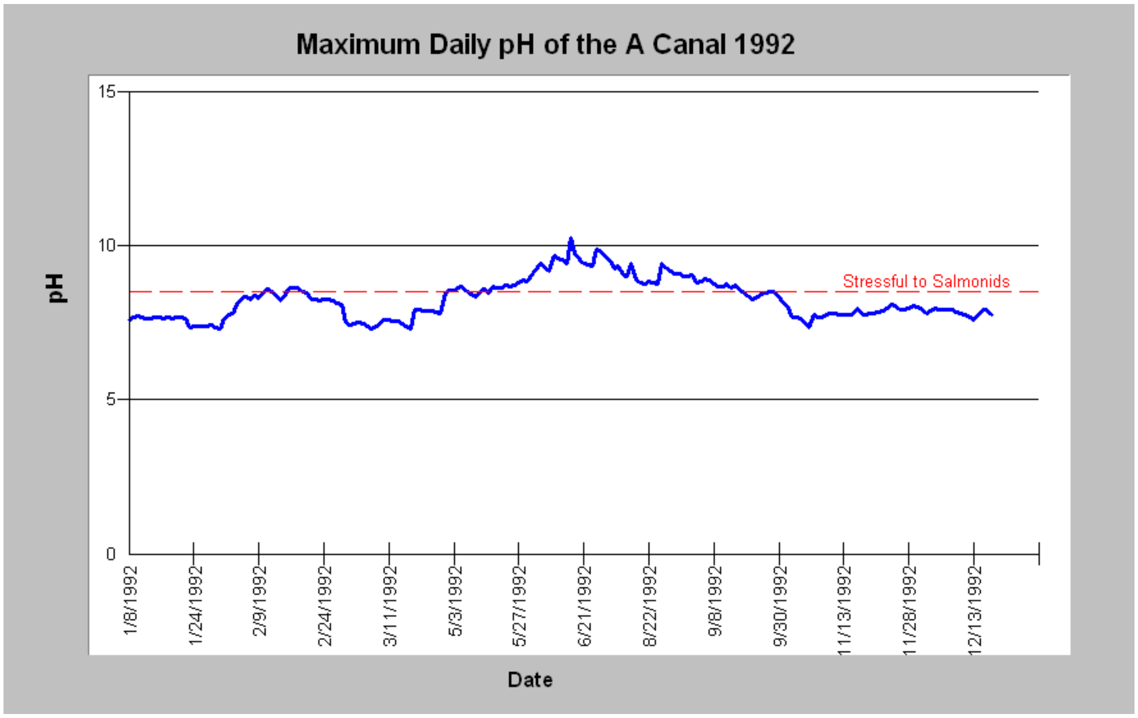

Figure 13. The maximum daily pH of the A Canal in 1992 is shown above. Note that the pH levels fluctuate from about 7.5, which is only slightly basic, to a high of 10.25, which is highly alkaline, in late June. Data from U.S. BOR Klamath Falls, OR. Chart from KRIS V 3.0.

Aquatic Biodiversity Trends: Shively et al. (2000) concluded that the Lost River aquatic communities retained little of their historic ecological structure and that extensive hydrologic modification and hypereutrophic conditions had degraded the quality of aquatic habitat.

The investigators found species diversity to be low, with those species present having a high pollution tolerance. Other specific findings include:

- Historically, the region had many endemic mollusks, but it now supports a reduced mollusk fauna comprised mostly of pulmonate snails and other pollution-tolerant taxa.
- The benthic macroinvertebrate community is now dominated by chironomids and oligochaetes, both of which are tolerant to poor water quality conditions (Figure 15).
- The fish community has become simplified and dominated by short-lived, pollution tolerant species.

Shively et al. (2000) pointed out that there was a major shift in fish community structure of the Lost River between 1973 (Contreras, 1973) and 1999, with non-native species like the fathead minnow and brown bullhead displacing native species like Tui chub, blue chub, and sucker species. Shively et al. (2000) also cautioned that the interaction between Lost River contaminants might make the response by fish and other aquatic life to individual pollutants in a laboratory different than they could be in the Lost River itself. "There was much more mortality in animals tested *in situ,* indicating that environmental conditions (high pH, fluctuating dissolved oxygen, ammonia) presented additional hazards beyond those present in the static laboratory tests." The U.S. Fish and Wildlife Service (1993) made the following statement about water quality in the Lost River: "It can be concluded that water quality in the Lost River limits habitat for all fish, including Lost River suckers and Short-nose suckers, and can be seasonally lethal."

The number of pollution-intolerant aquatic insects of the orders Ephemeroptera (mayflies), Plecoptera (stoneflies), and Trichoptera (caddisflies) from Shively et al. (2000) is shown at Figure 15 and identifies all Lost River locations within California as having values that represent extremely poor ecological conditions. Harrington (1999) recognized streams having more than 19 EPT taxa as healthy, but those having fewer than 12 species as impaired. The values in the Lower Lost River range from only one to no more than six species present.

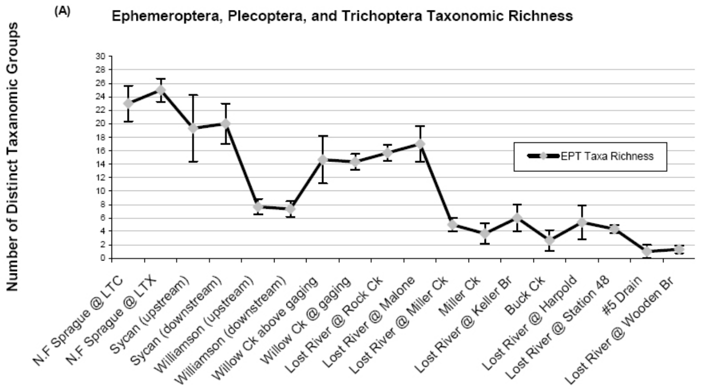

Figure 15. This chart from Shively et al. (2000) shows the number of pollution intolerant species of mayflies, stoneflies and caddisflies present at various Upper Klamath Basin locations, with Lower Lost River scores ranking lowest.

<u>Historic Importance, Status and Trends of Sucker Species:</u> Gilbert's (1898) early reconnaissance of Upper Klamath Basin fisheries had the following to say about the Lost River:

> "The 'Lost River sucker' is the most important food-fish of the Klamath Lake region. It is apparently resident during most of the year in the deeper waters of Upper Klamath and Tule lakes, running up the rivers in incredible numbers in March and April, the height of the run varying from year to year according to the condition of the streams. The Lost River fish are the most highly prized and are said to be much fatter and of finer flavor than those ascending the tributaries of Upper Klamath Lake."

The sucker fish were so abundant that early settlers tried to exploit them commercially:

> "Prior to 1894 an attempt had been made to preserve the meat in cans, but apparently with poor success. Oil had also been extracted from heads and entrails, said to be worth from 60 to 85 cents per gallon."
>
> (Gilbert, 1898)

Fisheries in Lower Klamath Lake are also described by NRC (2004):

> "Before 1924, suckers appear to have been abundant in Lower Klamath Lake, even after its connection to the river was severed in 1917. Suckers migrated into the lake from Sheepy Creek, a spring-fed tributary on the western edge of the lake, in numbers large enough to support a fishery (Coots 1965, cited in USFWS 2001)."

National Research Council (2004) pointed out that Native Americans may have harvested more than 100,000 pounds of adult suckers annually:

> "Lost River suckers in particular were once a staple food of the Modoc and Klamath tribes; they provided important protein in the spring, when food reserves had been depleted (Cope 1879, USFWS 2002)…Stern (1965) estimated an artisanal harvest of 50 tons/yr, which would correspond to 13,000 fish at an average weight of 3 kg."

NRC (2004) describes the co-evolution of these extraordinary fish populations with the lake ecosystems before disturbance:

> "The fluctuation in surface area of Tule Lake afforded by its connections to the Klamath River may have been critical in maintaining the high aquatic productivity of Tule Lake and its wetlands (ILM 2000)...The large fish populations in the lake supported what was probably the largest concentration of nesting osprey in North America (ILM 2000). Much of the historical variability in lake and marsh habitats has been lost as a result of management…After the Klamath Project drained most of

> Tule Lake for agriculture and diversion dams of the project blocked the access of suckers to spawning areas in the Lost River, sucker populations declined substantially (Scoppettone et al. 1995, USBR 2002).

Shively et al. (2000) found few suckers in the Lost River and most were concentrated in reservoirs (Figure 16). While two juvenile suckers were found below Anderson-Rose Dam just above Tule Lake in the USGS survey, there is little recruitment in the lower Lost River (Shively et al., 2000).

This is troubling because the remnant Lost River sucker population in the Tule Sump 1A, which is the remnant deep water of Tule Lake, is considered significant by USFWS (1993; 2001) and NRC (2004).

According to NRC (2004), Lower Klamath Lake has completely lost its ability to support suckers:

> "Lower Klamath Lake has been reduced to a marshy remnant by dewatering. It has occasional connection to the Klamath River through which it appears to receive some recruitment of young suckers, but there is no adult population."

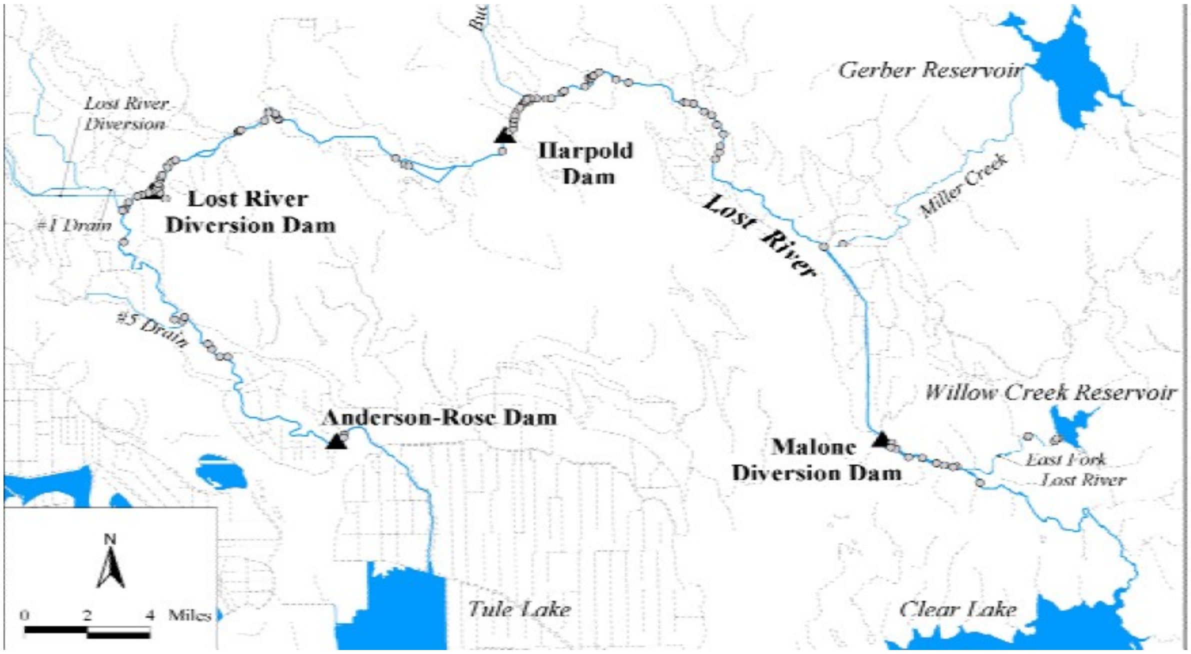

Figure 16. This map shows USGS fisheries survey results with grey dots indicating the locations where individual suckers were captured during USGS' 1999 summer survey. Figure from Shively et al. (2000).

Chapter 2: Problem Statement

2.1 Water Quality Standards

The *Lost TMDL* fails to mention the NCRWQCB Basin Plan standard for specific conductance or conductivity. A discussion of these standards is warranted here because the NCRWQCB (Figure 12) found that these standards are exceeded in the Straits Drain. The Basin Plan standards are: 90% lower limit 1000 micromhos for Lower Lost River, 90% lower limit 1300 micromhos for Tule Lake, and 90% lower limit 1150 micromhos for Lower Klamath Lake.

The 1500 micromohs at the outlet of Lower Klamath Lake likely indicates a highly concentrated nutrient load.

2.2 Discussion of Water Quality Standards Violations

The information presented in figures 4,5,6, and 7 is helpful in understanding Lost River water quality dynamics, but it should be significantly improved. First, although annotation of general locations on nutrient charts were helpful, a table and map of sampling locations should be provided since river kilometers are essentially meaningless to most readers. Second, there is no information identifying the years in which the data were collected, nor who collected the data. We assume the data is from the Lost River Water Quality Database (updated version by Tetra Tech, 2004), but it should be cited as such. A final version of this database should be included as an appendix to the TMDL, so that it can be put to future use and maintained over time.

The lack of any presentation of data from field nutrient samples in a nutrient TMDL is unacceptable. It is difficult, if not impossible, to understand Lower Lost River nutrient and water quality dynamics without any field data. We recommend, therefore, that figures be added showing longitudinal variation in the major forms of nitrogen (ammonia, nitrate, organic). Preferably, phosphorus and chlorophyll data should also be presented.

It is also disappointing that the TMDL apparently makes only very slight use of data from continuous multi-parameter water quality probes that have been deployed at various sites in the Lost River sub-basin over recent years. Given the highly variable nature of water quality in the Lost River, continuous data offer a means for understanding pH and D.O. far superior to that from grab samples. The Work Group recently received a copy of a February 17, 2005 version of the Lost River Water Quality Database (updated version of Tetra Tech, 2004) from the NCRWQCB. It includes approximately 40,000 records of continuous multi-parameter data for the years 2000-2004. It appears that little use was made of this data in the development of the TMDL or its supporting documents (e.g. Tetra Tech, 2005), save for data concerning a brief period in 2004 used for model calibration.

Chapter 3: Numeric Targets

3.1 Overview of nutrient and organic matter processes and effects

Nutrients

This section asserts that "Modeling analysis conducted for these TMDLs found that reductions in phosphorus loads would have little, if any, effect on algal growth rates or

dissolved oxygen deficits; in contrast, reductions in nitrogen loads were found to be effective in reducing excess algal growth and maintaining acceptable dissolved oxygen levels." We suggest the following addition: "If TMDL implementation is successful and nitrogen concentrations are reduced, phosphorus may become a limiting, or co-limiting, factor in the future."
After the statement "The growth of attached algae can also be limited by available suitable substrate, light, and temperature", we suggest the following addition: "In addition, phytoplankton (free-floating algae) can also be limited by light and temperature"

After "…due to the low levels of oxygen remaining in the water" we suggest the following addition: "Oxygen concentrations higher than lethal minimums can also cause chronic problems (stress, reduced growth, reduced fecundity, etc.) for aquatic organisms."

The paragraph regarding nitrogen fixation focuses solely on nitrogen fixation in soil, neglecting water. Blue green algae (cyanobacteria) nitrogen fixing is a well-recognized problem in Upper Klamath Lake. This species can be expected to thrive in nearby nitrogen-limited water with low-turbulence (e.g. lakes and impoundments). In fact *Aphanizomenon flos-aquae* was a dominant species in phytoplankton samples collected by Eilers (2005) in the Lost River at East-West Road, just upstream of Tule Lake. In a prior study, Scoppettone et al. (1995) found *A. flos-aquae* in Tule Lake, Sheepy Lake, Lower Klamath Lake, ADY canal, and Klamath Straits drain, which are all within the *Lost TMDL* geographic area.

The *Lost TMDL* section on denitrification is inadequate. It fails to note that this process occurs in the hyporheic zones beneath healthy rivers (Holmes 1996), especially in alluvial rivers with braided channels (Sjodin et al. 1997). Channelization and diking of the Lost River sub-basin has decreased the amount of the river's denitrification potential because it has reduced its channel sinuosity and eliminated its connecting wetlands (see discussion above regarding Historic Changes to Hydrology and Land Use). The *Lost TMDL* does not address this matter.

The *Lost TMDL* notes that "Although particulate forms of nitrogen and phosphorous are believed to be far less important influences on growth of aquatic plans, these TMDLs indirectly account for particulate nutrients by also targeting excess loads of organic materials that may contain particulate nutrients"

The foregoing does not correctly characterize the role of inorganic nutrients. We would suggest that the following be included in the final *Lost TMDL*:

> "Typically, most of the nitrogen in the Lost River and its tributaries is in organic (particulate) form. For example, averaging together all U.S. BOR samples from the year 1999 in the Lost River Water Quality Database shows that 65% of the nitrogen is in organic form, while only 35% is inorganic (ammonia and nitrate). It should also be noted that organic matter containing nitrogen decomposes to release dissolved inorganic nitrogen that is then available for uptake by algae and aquatic plants. As such, the EPA recognizes that reduced loads of all forms of nitrogen will benefit water quality.

> Further, it should be noted here that the impact of the Lost River on the Klamath River downstream is primarily the total nitrogen load flowing from the Lost River sub-basin to the Klamath. As water flows down the Klamath River's miles of river and reservoirs, nitrogen will cycle (spiral) between organic and inorganic forms. The form of nitrogen discharged from the Lost River into the Klamath River is less important, therefore, than is its total amount."

Dominant Aquatic Plants and Algae Species

A brief summary of information regarding phytoplankton surveys from Eilers (2005) should be added here, including the presence of *A. flos-aquae*..

3.2 Numeric Targets

Due to the format of the model, the TMDL selects dissolved inorganic nitrogen (DIN) and Carbonaceous Biochemical Oxygen Demand (CBOD) as the nutrients to be targeted for reduction despite the fact that it is total nitrogen (TN = organic nitrogen + inorganic nitrogen) that matters most to the Klamath River downstream. CBOD does contain an organic nitrogen component, so organic nitrogen is indirectly slated for reduction, but CBOD is measured in units of mg/L of oxygen consumption, not in units of nitrogen, so it is a less direct and less precise way to specify nitrogen load reductions.

This section of the *Lost TMDL* closes with the statement:

> "While it would be desirable to specify maximum DIN and CBOD targets to supplement the dissolved oxygen and pH targets, it was infeasible to do so for these TMDLs as there is substantial spatial and temporal variability in the manner in which oxygen and pH levels are affected by nitrogen and organic matter loads."

This justification for failing to provide numeric targets for DIN and CBOD concentrations seems to lack logical consistency. If EPA believes that the model is accurate enough to determine confidently that a 50% reduction in external DIN and CBOD loads will result in the achievement of water quality standards, then why not present the DIN and CBOD concentrations predicted by the model as numeric targets? One way to provide numeric targets would be to add figures showing DIN and CBOD concentrations for the "Scenario 1D", similar to the *Lost TMDL* Figures 12-15 that show pH and D.O.

Targets for DIN and CBOD should be attempted. As noted in the quote above, the relationships between the parameters are spatially and temporally variable; thus, it is perhaps appropriate that targets would not have to be identical for all sites and time periods. For instance, unique targets could be set for a few key locations such as the Lost River at East/West Bridge (inflow to Tule Lake), Pump Station D (the outflow from Tule Lake), and the Klamath Straights Drain at the California/Oregon border. Targets could be also be temporally variable as well (e.g. with a different target for each day, week, or month).

Having numeric DIN and CBOD targets at a few key locations would make monitoring meaningful. Many of the input loads in the TMDL model were calculated by taking the difference in loads between two monitoring stations. It is challenging to measure all the input loads given the number of canals and drains, but it should be practical to measure concentrations/loads at a few key locations.

Chapter 4: Source Analysis

4.1 Overview of Source Categories

Table 4 shows nitrogen and CBOD loading estimates, with section 4.2 describing the methods by which the various loads for each segment were calculated. We could be mistaken, but the magnitudes of the nitrogen and CBOD loadings in Table 4 do not appear to correspond with those described in section 4.2.

In Table 4, the sum of all the loads listed for segment 1 (Lost River) equals the background load for segment 2 (Tule Lake). This would make sense because, as described in section 4.2, agricultural drain loads to Lost River between Stateline Road and Tule Lake were calculated by taking the difference between the loads at the California/Oregon border and the loads at Tule Lake.

In contrast, the sum of all loads listed in segment 2 (Tule Lake) does not equal the background load for segment 3 (Lower Klamath Lake and Wildlife Refuge), despite a purported similar methodology of assigning agricultural and refuge drainage loads to Tule Lake by calculating the difference between Tule Lake inflow loads and outflow loads. As for segment 2, the sum of all the loads in segment 3 does not equal the background load for segment 4 (Klamath Straits Drain). These apparent contradictions need to be explained or corrected.

There is not enough information provided in Table 4 and section 4.2 to be able to quantitatively confirm the loading estimates. This could be remedied substantially by providing additional information (columns) to Table 4. For each row, the following information should be added: average flow (in units of cfs or cms), flow-weighted DIN concentration (in units of mg/L), and flow-weighted CBOD concentration (in units of mg/L). Also, adding rows for segment totals would also help readers to understand the table.

Although the U.S. EPA (2000b) appears not to recognize flow depletion as a source of pollution, per se, it does recognize that flow depletion increases concentrations of pollutants. Groundwater extraction has roughly tripled in BOR's Klamath Project area since 2001, driven largely by the BOR's Water Bank program (Gannet et al., 2007). The impact of this increased pumping on water quality is not addressed in the *Lost TMDL*.

The USGS (2005) study entitled *Assessment of the Klamath Project Pilot Water Bank: a Review from a Hydrologic Perspective* provides a clear picture of the potential for major problems with groundwater depletion as a result of increased well capacity following the 2001 drought and water supply crisis. The authors found an "eight-fold increase in ground-water pumpage in the lower Lost River sub-basin" and "seasonal declines of 10 to 20 feet near pumping centers, and year to year declines of 2 to 8 feet over broad areas surrounding large pumping centers."

USGS (2005) found that groundwater levels surrounding Tule Lake in 2004 were lower than in 2001, despite 2004 being a much wetter year. They concluded that "In the long term, the rate of ground-water pumping in 2004 may be difficult to maintain indefinitely." The failure of the Lost TMDL to address this issue is a substantial shortcoming. The TMDL should be revised to include a discussion of the interaction between groundwater and surface flow, and the implications for water quality and attainment of beneficial uses.

4.2 Description of Source Categories

Agricultural Drainage Discharges to Lost River, Oregon Border to Tule Lake

The Lost TMDL contends that assumptions regarding "pollutant levels are conservative." This is likely not the case considering the substantial biological productivity of the system. Phytoplankton and aquatic plants take up nutrients as they grow and they release them as they die, changing the temporal dynamics of nutrient availability. Nitrogen fixation (in reservoirs) and denitrification (in wetlands and hyporheic zones) are likely occurring in the Lower Lost River sub-basin as well.

Agricultural and Refuge Drainage Discharges to Tule Lake and Tule Sump

The *Lost TMDL* states:

> "Internal nutrient loadings to Tule Lake were not quantified in this analysis. Over the long run, however, internal loading rates will likely decrease as the amount of excessive nutrient loadings from external sources are decreased."

This assumption is not likely because of the role of the blue-green algae *A. flos-aquae* in nitrogen fixation. Nitrogen loads exiting Upper Klamath Lake are 3.5 times higher than are incoming loads (ODEQ 2002) due to internal loading, including nitrogen fixation. The Lost TMDL provides no evidence that nitrogen fixing is not occurring in Lost River, Tule Lake, Lower Klamath Lake and the Straits Drain.

As noted above, *Aphanizomenon flos-aquae* was a dominant species in phytoplankton samples collected by Eilers (2005) in the Lost River at East-West Road, just upstream of Tule Lake. The low nitrogen**:** phosphorus ratios in the Lost River shown in the TMDLs' Figure 7 would provide a competitive advantage to nitrogen-fixing species. Because wetlands produce humic acids, decrease pH, and inhibit the production of *A. flos-aquae* (Geiger et al. 2005), nitrogen fixation in the entire *Lost TMDL* area could doubtlessly be addressed by expanding riparian wetlands and lakes, including an intact perimeter of functioning marshes and wetlands surrounding them.

Agricultural and Refuge Loadings to Lower Klamath Lake/Refuge

Mayer (2005) constructed nutrient budgets for the Lower Klamath National Wildlife Refuge for the April-November period in 1999-2000 and found that the refuge was a net sink for both nitrogen and phosphorus. For 2000, 75-77 percent of the incoming nitrate, 56 percent of incoming ammonia, and 63 percent of the incoming TKN (Total Kjeldahl Nitrogen) was retained. Although Mayer (2005) is listed in the reference section of the *Lost TMDL*, there is no discussion whatsoever of his work or findings, another critical omission of the TMDL.

Mayer's (2005) retention results should be compared to the TMDL model's predictions to determine if the model predicts the same patterns. Because of the issues that we point out in section 4.1, users of the *Lost TMDL* are unable to make such a determination. Instead the model continues to characterize refuge areas as sources of nutrients when, if they were flooded, they would become nutrient sinks.

Chapter 5: Loading Capacity and Linkage Analysis

This section of the *Lost TMDL* states that Tetra Tech (2005) contains "complete documentation of modeling configuration, model input, and calibration."

While Tetra Tech (2005) provides abundant comparisons of model and field data, it does so only for single sites -- there are no longitudinal comparisons. Thus, it is not possible to determine whether the TMDL's water quality model adequately characterizes the spatial trends in nutrient concentrations in the Lost River system. As noted above in our comments on section 2.2, the TMDL does not even present longitudinal patterns in nutrient field data, let alone compare them with model outputs. Without such comparisons, the TMDL is a black box that asks reviewers to take it on faith.

We are disappointed that the TMDL provides no insight into basic questions such as:

- Do nutrient concentrations in the Lost River generally increase or decrease as water flows downstream?
- Do sites with lower nutrient concentrations have better pH and D.O. conditions than sites with higher nutrient concentrations?

5.1.3 Modeling Assumptions

The key assumptions outlined in this section are potentially problematic, though we recognize that given data limitations these assumptions were necessary absent a delay in the TMDL's completion to collect the additional data.

Assigning ambient Lost River water quality to distributed inflows

A review of Lost River literature (Dileanis et al. 1996) shows that this is not a correct procedure. Relevant key findings of Dileanis et al. (1996) are:

- Elevated ammonia concentrations were common in the study area, especially downstream of drain inputs.
- Concentrations of ammonia in samples from small drains on the Tule Lake refuge lease lands were higher than those measured in the larger, integrating drains at primary monitoring sites.
- The mean ammonia concentration in leaseland drains [1.21 milligrams per liter (mg/L)] was significantly higher than the mean concentration in canals delivering

water to the leaseland fields (0.065 mg/L) and higher than concentrations reported to be lethal to *Daphnia magna* (median lethal concentration of 0.66 mg/L).
- Dissolved-oxygen concentrations also were lower, and *Daphnia* survivability measured during in situ bioassays was correspondingly lower in the leaseland drains than in water delivery canals.

The potential effects of assigning all distributed inflows similar water quality to ambient Lost River water quality could be determined fairly easily by calculating the distributed inflow as a percent of total flow (summed over some period of time, and with each segment perhaps listed separately).

Tule Lake as a single mixed segment

The model's representation of Tule Lake as a single mixed segment is incorrect and it is clearly problematic from a biological perspective.

Water quality in Tule Lake is not homogeneous. There is a well recognized area at the southern end of Tule Sump 1A known as the "donut hole" (USFWS 1993), where the last viable population of Lower Lost River suckers reside from June through September. The "donut hole" is approximately 250 acres in size with a mean depth of 3 feet (USFWS 1993), it contains relatively little rooted aquatic plant material, the water is frequently turbid, and the bottom substrate is firmer and low in peat. One possible explanation for this anomaly is that the suckers are swimming in circles which scours a deep spot and counters deposition, which prevents aquatic plants from growing, and which creates turbidity that inhibits phytoplankton activity.

Examination of a high-resolution color aerial photo (Figure 17) shows substantial heterogeneity in Tule Sump 1A.

Additionally, as noted in Tetra Tech (2005), the model's assumption of instant mixing of inflows leads to inaccurate predictions for the P Canal downstream of Tule Lake.

Additional assumption not mentioned in the TMDL

Given documented changes such as reduced water tables in the vicinity of Tule Lake due to the increased groundwater extraction in the intervening years (USGS, 2005)(See 4.1 above), the model's reliance on data from 1999 also raises the question of whether current water quality conditions are the same as those found in 1999.

5.2 Evaluation of load reduction scenarios

We recommend that figures be added (for the same locations as existing figures) showing CBOD and DIN. Justification for this request is included in our comments on Chapter 3 above.

[minor note: on page 29, this section is numbered 5.3, it should be 5.2]

The TDML contains no quantitative analysis of the relative contribution of the Lost River , through its terminus at the Klamath Straits Drain, to Klamath River nutrient loads, as was conducted by Mayer (2001). Nor are the impacts of this contribution anywhere discussed in the *Lost TMDL*. Mayer (2001) found that the Straits Drain contributed "a significant percentage of the nitrate (25-75%) and soluble reactive P (25-50%) load" in the Keno reach of the Klamath River."

Deas and Vaughn (2006) point out that there is substantial flow from the Lost River to the Keno reach of the Klamath River occurring in winter and spring via the Lost River Canal that has the potential to deliver inorganic nutrients. This organic load may be inert at the time of delivery, but can contribute substantially to BOD and SOD in subsequent periods of warmer water and associated biological activity. An acceptable final *Lost TMDL* must have a target for reducing nutrient contributions sufficient enough to allow water quality recovery in the Keno reach of the Klamath River.

5.3 Estimation of Loading Capacity

See comments on section 3.1 above regarding the importance of total nitrogen, rather than just DIN.

Figure 17. This high resolution 2005 color aerial photo shows a circular area of higher turbidity that meets the description of the "donut hole", an anomalous area of higher water quality. One

hypothesis is that this is sustained by Lost River suckers swimming in circles. Much of the rest of the sump is covered with algae blooms that likely adversely affect water quality. Image from National Agriculture Imagery Program (NAIP)[1].

Chapter 6: TMDLs, Allocations, and Margin of Safety

6.1 TMDLs and Allocations

We agree that the setting of the TMDLs on both a daily and annual basis is a good idea.

Also, see comments on section 3.1 above regarding the importance of total nitrogen, rather than just DIN.

6.2 Margin of Safety Analysis

The following sentence should either be removed or clarified: "Third, the TMDL source analysis does not give 'credit' for biological consumption of DIN and CBOD following discharge for purposes of estimating loading capacity."

This is not a valid margin of safety. Biological consumption of DIN and CBOD *is incorporated* into the model. Breakdown of CBOD releases ammonia (increasing DIN) and consumes oxygen. DIN could either be taken up by aquatic plants or algae, or nitrate (a component of DIN) could be permanently removed from the system through denitrification.

It would be improper to "give credit" (e.g. subtract internal consumption from external loads) to biological consumption since the fundamental purpose of the TMDL is to determine what level of external nutrient loads the river is able to accept without the pH and D.O. standards being violated. Violation of pH and D.O. standards is not caused directly by the nitrogen and organic matter; it is caused by the effects of the biological consumption of the nitrogen and organic matter. Hence, it is unclear why giving credit to biological consumption represents a "margin of safety".

Chapter 7: Implementation and Monitoring Recommendations

7.1 Recommended Implementation Actions

The TDML should lay out an effective vision of how to restore Lost River water quality. We recommend an approach that focuses on restoring natural hydrologic and ecological processes, and of protecting refugia.

U.S. EPA (2000b) called for "a focused effort to identify polluted waters and enlist all those who enjoy, use, or depend on them in the restoration effort." The *Lost TMDL* implementation steps do not meet that standard because it does not include downstream Tribes, who are dependent on a healthy Klamath River.

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[1] NAIP images can be browsed at http://gdw.apfo.usda.gov/naip/viewer/viewer.htm

The U.S. EPA's recommendation that the Klamath Water Users Association (KWUA) play a leading role in defining restoration measures and in writing the *Lost TMDL* implementation plan makes success problematic. Regardless of their good intentions, it not reasonable to expect any group of people with a vested economic interest in the status quo to voluntarily make the significant changes in land- and water use necessary to restore the water quality of the Lost River. The KWUA and landowners will need to be active participants in TMDL implementation, but they should not be allowed to take the lead role in setting goals, priorities, and benchmarks.

In previous comments on other Klamath River Basin TMDLs, member Tribes of the Work Group have recommended that implementation be tied to existing, science-based restoration plans that also target fish recovery (i.e. Elder et al., 2001). The closest thing of that nature for the Lost River, Tule Lake, LKL and the Straits Drain are the available sucker recovery plans (USFWS, 1993; 2001) and the NRC (2004) report.

The Lost River and short-nose suckers are indicator species and are specifically designated as beneficial uses by the Lost TMDL. Yet there is no mention of sucker recovery in the implementation section and key recovery recommendations of the USFWS (1993; 2001) and NRC (2004) are missing from the *Lost TMDL*.

NRC (2004) noted that Lower Klamath Lake has completely lost its ability to support suckers adult suckers:

> "Lower Klamath Lake has been reduced to a marshy remnant by dewatering… Development of an adult population is unlikely unless the depth of water can be increased, which would involve incursion of the boundaries of the lake onto lands that are used for agriculture. If the lake were deepened, water quality might be adequate for support of suckers."

Suckers cannot be recovered without expanding the system's natural filtration capacity by restoring riparian zones, lakes of substantial depth, and surrounding open water marshes.

Similarly, pH and D.O. problems cannot be solved without the same such actions.

While the *Lost TMDL* suggests restoring Lower Klamath Lake marshes be explored, it makes no such recommendation with regard to Tule Lake. Dileanis et al. (1996) pointed out that water quality coming off the lease lands surrounding Tule Sump were much worse than ambient water quality within the sump. This suggests that these public lands should be a high priority target for restoring to marsh or lake habitat.

We strongly support the use of wetlands to reduce nutrient loads in Lost River water before it is delivered into the Klamath. As described above, the Lower Klamath Wildlife Refuge is a substantial net sink for both nitrogen and phosphorus Mayer (2005). We agree with the TMDL's recommendation that USFWS explore how the refuges might be used as treatment wetlands. Using the existing wetlands on the refuges as treatment wetlands offers some substantial advantages over constructing new wetlands.

As described above, the Lower Klamath Wildlife Refuge is a substantial net sink for both nitrogen and phosphorus Mayer (2005). Currently, the refuges receive only enough water to keep them wet. If the refuges were to be used as treatment wetlands, an increased amount of water would be diverted from the Klamath River, through the Lost River diversion channel or Ady Canal, cycled through the refuges and returned to the Klamath River.

It is highly likely that such operations would decrease nutrient loads to, and improve water quality in, the Klamath River.

Deas and Vaughn (2006) suggest that new wetland areas be constructed along Keno Reservoir to reduce organic matter load and improve dissolved oxygen levels in the reservoir. This approach is attractive because constructed wetlands can be specifically designed to maximize desirable processes such as settling organic matter and denitrification, resulting in higher nutrient reductions per unit area than typical natural systems (U.S. EPA, 1993; 1999, 2000a).

It is critically important, however, to note that while using constructed wetlands to treat Straits Drain and Link River, water could improve water quality in the Keno Reservoir and the Klamath River downstream, it would do little to improve Lost River water quality or assist endangered Lost River suckers. For this reason, we strongly support both 1) the use of wetlands (either newly constructed or in LKL refuges) to treat Straits Drain effluent, and 2) restoration actions within the Lost River system such as riparian restoration, lake expansion, and wetland restoration.

Remedying the complex and acute water quality problems in the Lost River, Lower Klamath Lake and Klamath Straits Drain will require major changes in land and water management. These are obviously difficult social issues, but they are a legitimate and necessary component of anything that purports to be a Lost River water quality improvement plan.

7.2 Monitoring

The *Lost TMDL*'s discussion of monitoring is vague. As noted in our comments on section 3.2 above, we are disappointed that the TMDL does not provide numeric targets for DIN and CBOD. If they were in place, such targets would provide the means for practical monitoring, evaluation, and adaptive management of the TMDL's implementation.

There is a wealth of baseline data that has been collected in the *Lost TMDL* area. In addition to recommending monitoring of water quality, the final technical report should also recommend continued monitoring of aquatic invertebrates and fish species as indicators of restored water quality and attainment of beneficial uses.

The trends in sucker numbers should also be regarded as an indicator of pollution abatement and the U.S. EPA should more directly acknowledge these fish as indicators of success. If the Lost River and short-nose suckers thrived in a restored Lower Klamath Lake, it is likely that there would be no problem with nutrient pollution at the Straits Drain.

7.3 Adaptive Management

The U.S. EPA (2000) recognized that the "ultimate success in achieving water quality standards for non-point sources may depend upon an iterative approach" or adaptive management. National Research Council (2004) pointed out, however, that USFWS, the U.S. BOR and other cooperating entities had failed to implement adaptive management in sucker recovery efforts in the Upper Klamath Basin. NRC was, therefore, unable to determine whether tens of million of dollars in restoration money spent over the last decade had any ecosystem benefit.

The use of the wildlife refuges as treatment wetlands is an excellent opportunity for adaptive management. For a year, more water should be cycled through the refuges, with intensive monitoring. The data can then be evaluated to determine the program's effectiveness, and adjustments may be made as necessary. If use of the existing refuge wetlands does not result in sufficient water quality improvements, then additional wetlands should be created.

Concluding comments

The Tribes of the Lower and Mid-Klamath River have harmony-based cultures, in which the people are inseparable from the natural environment. If the environment is treated well people will thrive.

The condition of the Lower Lost River, Tule Lake and Lower Klamath Lake are profoundly altered from their natural state, with the latter two water bodies comprising only 8 percent of their former area. It is not surprising to Tribes therefore that water quality in the sub-basin is abysmal and that almost nothing can live in these water bodies.

The *Lost TMDL* is an artificial construct that is over-reliant on an obviously flawed modeling approach and is lacking totally in historical context. It simply will not work. It will not control pollution within the Lost River system, nor will it reduce nutrient contributions to Keno Reservoir and the Klamath River downstream sufficiently.

The U.S. EPA should do whatever its needs to do legally with the *Lost TMDL*, but it should be prepared to assist the State of California and its North Coast Regional Water Quality Control Board to do the substantial amount of work remaining to complete the necessary technical analyses, using the abundant available data missing from EPA's effort, and to craft an effective implementation plan.

The Lost TMDL, as its text makes clear, drew upon the interests of local land- and water users. There are many more communities affected by the quality of water of the Lost River and the Klamath River downstream. Further work to accomplish an adequate TMDL for the Lost River and an effective implementation plan for that TMDL must open up its process to recognize and include the larger Lost River stakeholder community.

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