Quartz Valley Indian Reservation
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August 29, 2010

Jeffery Shu
State Water Resources Control Board
Division of Water Quality
P.O.Box 100
Sacramento, CA 95812-0100

RE: 303 D Listing for Scott River Basin and tributaries

Dear Mr. Shu,

The Quartz Valley Indian Reservation (QVIR) would like to submit the following data and water quality impairments for consideration of CWA 303 D listing.

Tribal cultural resources are diminishing in the Scott Valley and tributaries. Water quality information indicates severe impairments to the federally and state listed coho salmon. Flow impairment is also greatly impacting **all** cultural significant flora and fauna to the tribe.

Please contact myself or my staff at 530-468-5907 if there are any further questions regarding this data submittal.

Sincerely,

Crystal Bowman
Environmental Director
Quartz Valley Indian Reservation

PART I

Comments requesting the State Water Resources Control Board to list the Scott River and Shackleford Creek as impaired by flow alteration

INTRODUCTION/SUMMARY

California's State Water Resources Control Board (SWRCB) issued the *Notice Of Public Solicitation Of Water Quality Data And Information For 2012 California Integrated Report – Surface Water Quality Assessment And List Of Impaired Waters [Clean Water Act Sections 305(B) And 303(D)]* (SWRCB 2010) in January 2010. That document invites interested entities to submit information regarding the listing of California waterbodies as impaired. At the request of Quartz Valley Indian Reservation, Kier Associates has prepared the following comments regarding the listing of the Scott River and its tributaries as impaired by flow alteration.

The comments below are organized into the following sections
- Other U.S. waterbodies have been listed as impaired by flow-alteration
- The effects of flow alteration on Scott River water temperatures
- The effects of flow alteration on Shackleford Creek water quality
- Estimates of unimpaired flows in the Scott River
- Long-term trends in the Scott River flows
- Dry reaches of the Scott River and tributaries
- Effects of flow alteration on beneficial uses
- Recommendations for listing

COMMENTS

Other U.S. waterbodies have been listed as impaired by flow-alteration

While no waterbodies in the North Coast region (Region 1) have yet been listed as impaired by flow alteration, many waterbodies in other areas of the United States have been listed as being impaired by flow alteration (Table 1). Listings in California include two reaches of the Ventura River for "Water Diversion" and "Pumping" (SWRCB 2006).

Table 1. Specific state causes of impairment that make up the national flow alteration(s) cause of impairment group. From:
http://iaspub.epa.gov/tmdl_waters10/attains_nation_cy.cause_detail_303d?p_cause_group_id=545

Cause of Impairment	Number of Waterbodies Listed as Impaired
Flow Alteration(s)	101
Hydromodification	2
Pumping	2
Water Diversion	2
Reduced Tidal Flushing	1
Low Flow Alterations	1

The information presented here demonstrates that the beneficial uses designated by the State, those which are to be attained in the Scott River Hydrologic Area, are not being attained.

The effects of flow alteration on Scott River water temperature

The North Coast Regional Water Quality Control Board (NCRWCB) has conducted extensive research, monitoring, and modeling of the Scott River and its tributaries as part of developing the Scott River TMDL. The staff report for the Scott River TMDL (NCRWQCB 2005) provides solid evidence that flow depletions, caused by a combination of surface water diversions and groundwater pumping, have resulted in impaired water temperatures.

The following summarizes the TMDL's findings regarding how human activities have increased Scott River water temperatures:

- " The primary human-caused factor affecting stream temperatures in the Scott River watershed is increased solar radiation resulting from reductions of shade provided by riparian vegetation.
- Groundwater inflows are also a primary driver of stream temperatures in Scott Valley. The temperature of the Scott River is affected by groundwater in two ways. First, groundwater accretion directly affects stream temperature by direct addition of cold water, changes in volume, and transit time. Second, the elevation of groundwater affects the ability of riparian tree species to thrive and reproduce, which indirectly affects stream temperatures by increasing exposure to solar radiation.
- Diversions of surface water lead to relatively small temperature impacts in the mainstem Scott River, but have the potential to affect temperatures in smaller tributaries, where the volume diverted is large relative to the total flow. Effects of surface diversions on stream temperatures may be significant when effects of human activities are considered cumulatively." (pages 4-1 to 4-2)

The TMDL model indicates that Scott River water temperatures are highly affected by groundwater accretions (Figure 1). A doubling of groundwater accretion (labeled as 200% accretion in graph) would substantially decrease water temperatures, and a 50% reduction in accretion would substantially increase water temperatures (Figure 2). The TMDL model also indicates that surface water diversions affect water temperatures, although the magnitude of that effect is less than for groundwater accretions.

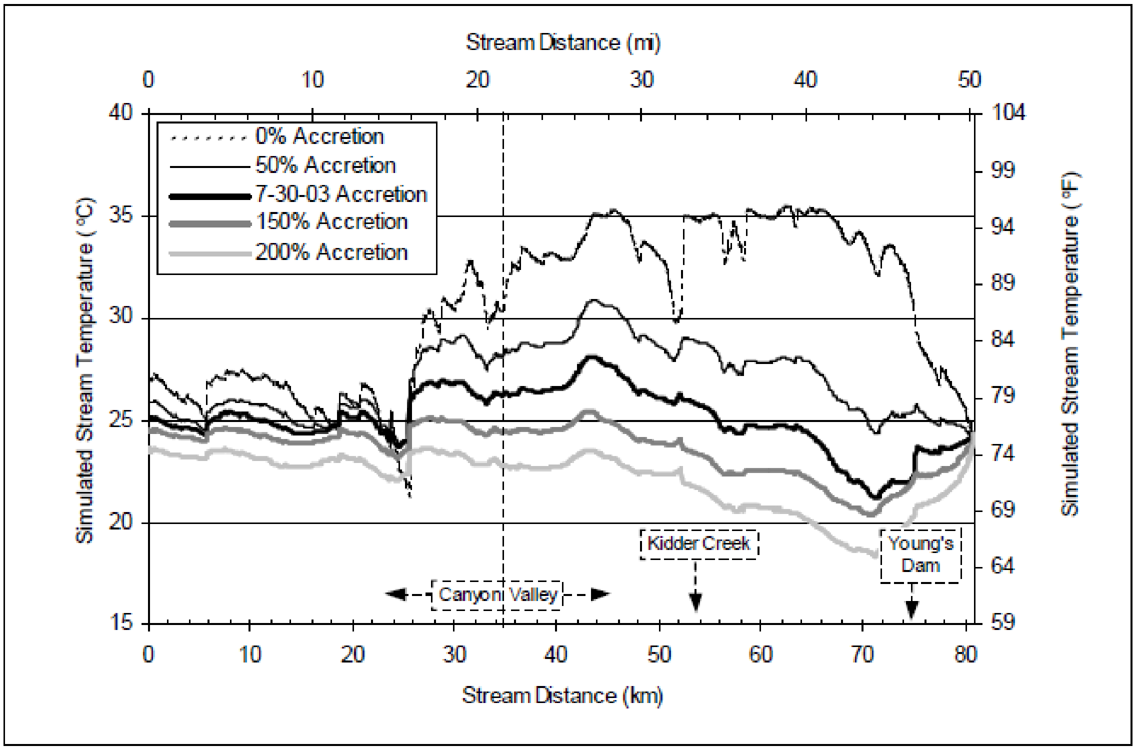

Figure 1. Longitudinal profiles of TMDL temperature modeling results quantifying effects of groundwater accretion, Scott River mainstem at 3:00pm, July 30, 2003. Figure 4.13 from the NCRWQCB (2005).

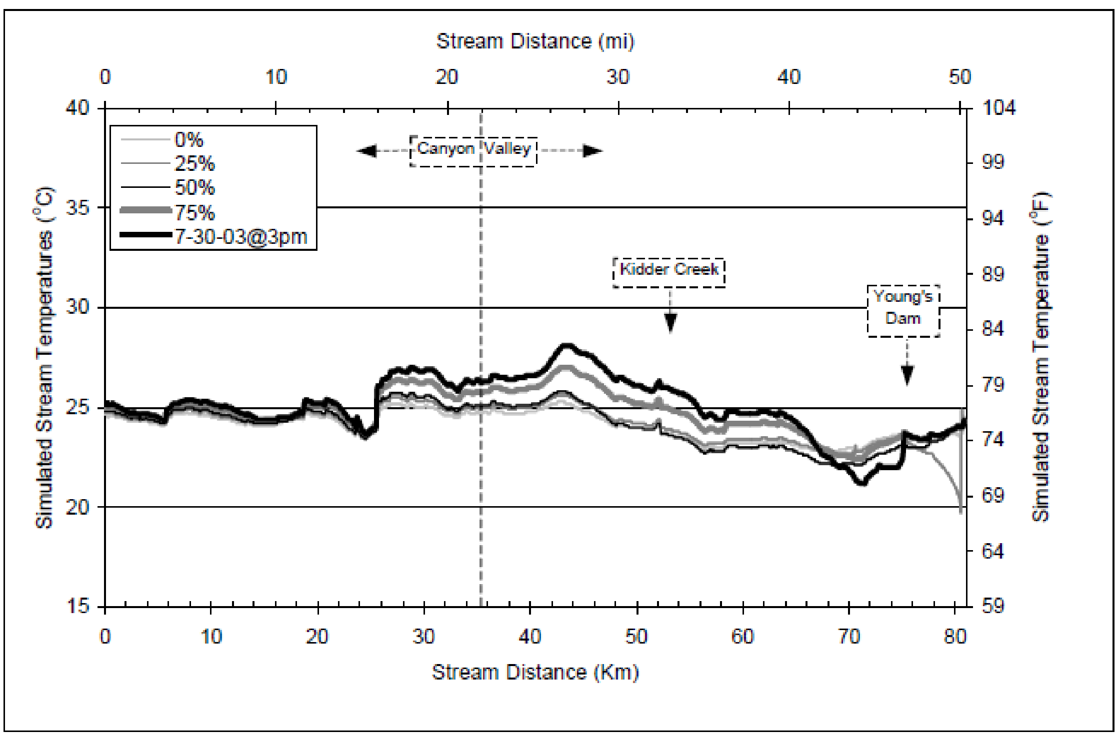

Figure 2. Longitudinal profiles of TMDL temperature modeling results quantifying effects of changes in surface water diversions in the Scott River mainstem at 3:00pm, July 30, 2003. Figure 4.17 from the NCRWQCB (2005).

The effects of flow alteration on Shackleford Creek water quality

The Quartz Valley Indian Reservation has been monitoring water quality in Shackleford Creek since 2007. An automated multi-parameter probe was installed in 2008 in Shackleford Creek on the Reservation. These data show the progressive degradation of water quality that occurs as first the flow declines and then the creek goes dry on July 22, 2008 (Figure 3). Water temperature (pink line) increases as the flow declines because smaller masses of water are subject to greater warming. Specific conductance (dark blue line) also increases as the stream dries up.

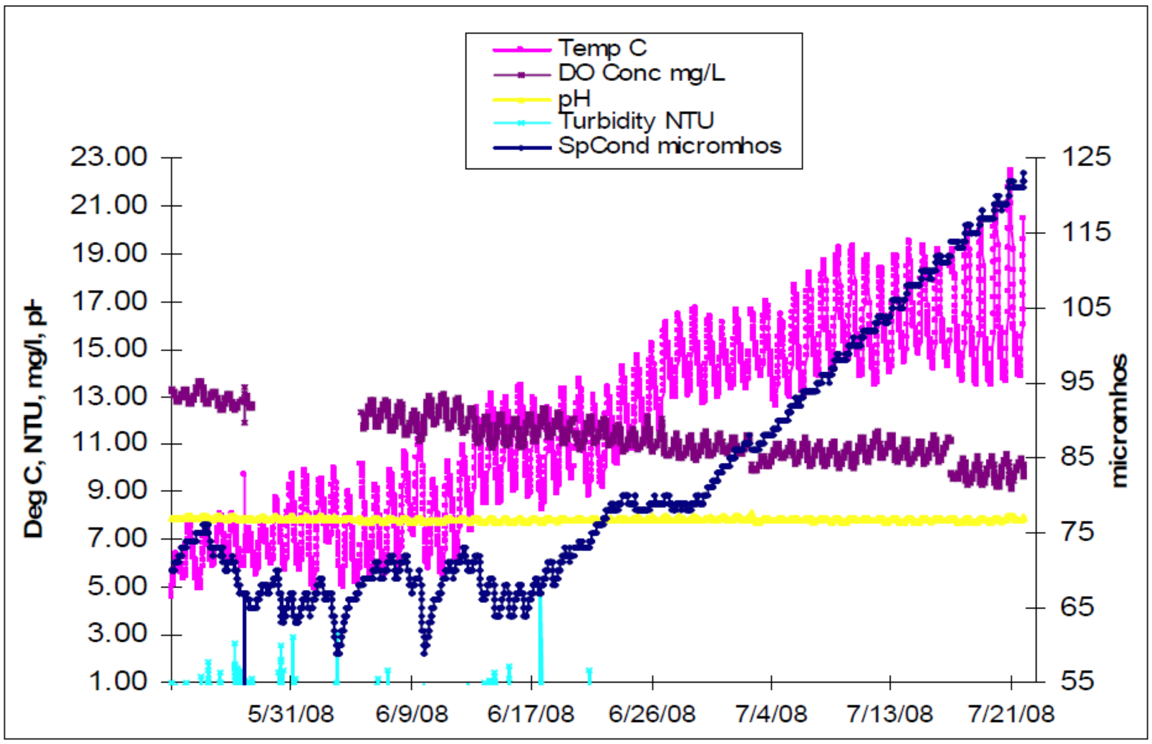

Figure 3. Shackleford Creek datasonde at Quartz Valley Reservation (site code SRES) for May through July 2008 (until the creek dried up). Figure from QVIC (2009) water quality report.

Estimates of unimpaired flows in the Scott River

The Klamath River TMDL (NCRWQCB 2010) contains an informative discussion of methods for estimating the unimpaired flow (i.e. streamflow absent diversions and groundwater pumping) of the Scott River. The discussion concludes that the Regional Board's estimate of unimpaired flows August (154 cfs) and September (100 cfs) are 4 to 6 times higher than flows measured in 2000 and approximately double the measured flows between 1942-1976 (Table 2). For reasons described by NCRWQCB (2010), the USBR estimates in Table 2 (top line) are likely unrealistically high.

Table 2. Estimated and measured flows at USGS' "Scott River near Fort Jones" gauge, located at the downstream end of Scott Valley. Table modified from Table A-1 of Appendix 7 to NCRWQCB (2010)

Source	Monthly average flow estimate, **August (cfs)**	Monthly average flow estimate, **September (cfs)**
USBR estimated unimpaired flow, 2000	253	193
NCRWQCB estimated unimpaired flow, 2000	154	100
Mean of measured monthly average, 1942-1976	77	62
Measured monthly average, 2000	19	24

Long-term trends in the Scott River flows

There is a long history of flow alteration in the Scott Valley, but the problem has become increasingly more acute over time. The number of days per year when Scott River flows (at the USGS Fort Jones gage) are below 20 cfs is a powerful illustration of the long-term trend of the increasing severity of flow depletion (Figure 4). USGS flow data shows that many of the river's hydrologic metrics are getting worse over time, including: annual minimum daily flow (Figure 4, top panel); annual minimum monthly flow (Figure 4, top panel); and the number of days per years with flows less than 10, 20, and 40 cfs (Figure 4, middle panel). Annual precipitation does not appear to have changed over the period of record (Figure 4, bottom panel). Even in years with low (i.e. <15 inches) precipitation, flow never dropped below 20 cfs until 1977. Now flow drops below 20 cfs for many months during most years, even in years with moderate and high precipitation (Figure 5). The annual minimum of average monthly discharge of the Scott River also appears to be decreasing over time, even when precipitation is taken into account (Figure 6).

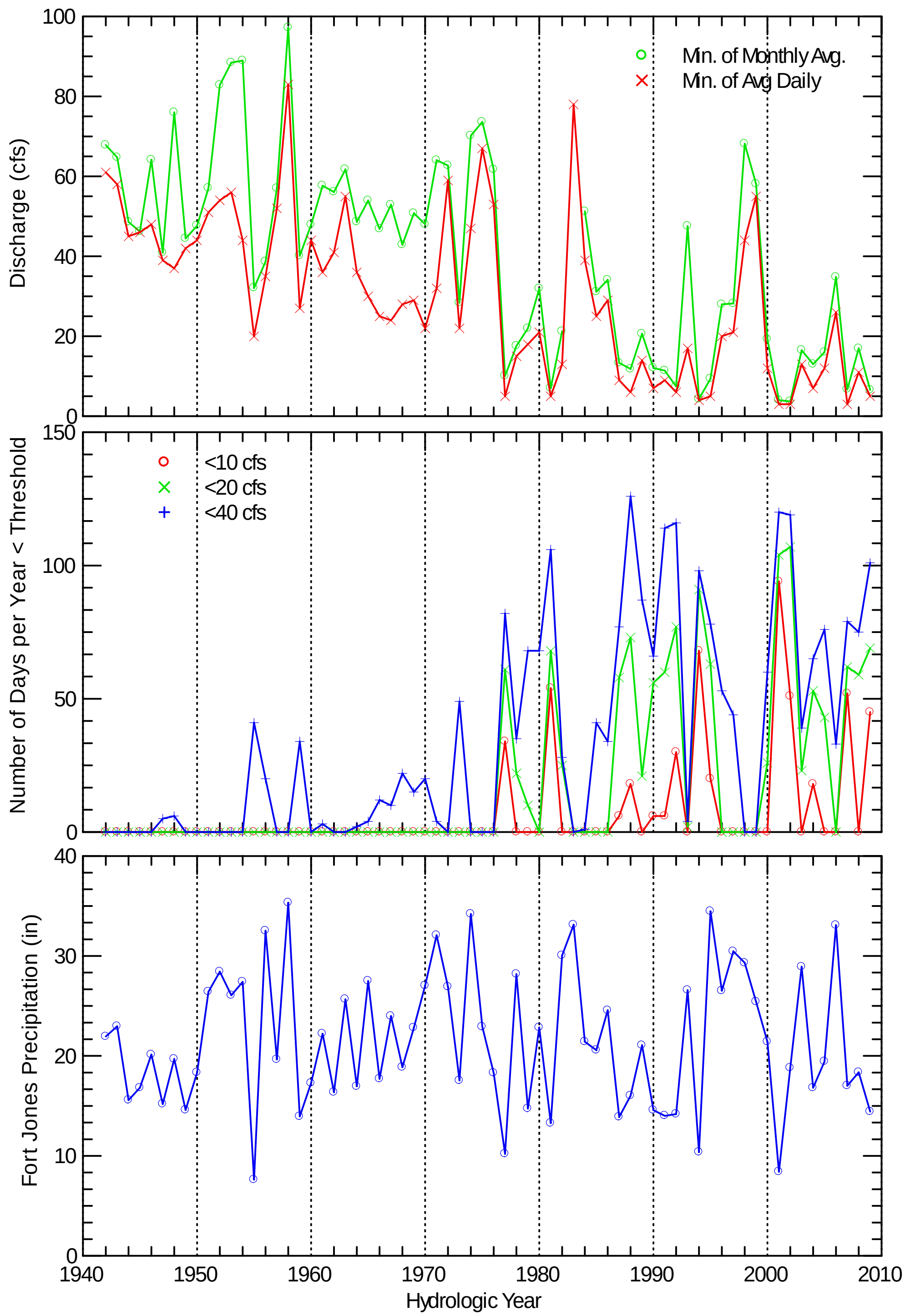

Figure 4. Precipitation and various metrics of Scott River flow for each hydrologic year from 1941 to 2009. The top panel shows minimum daily and minimum monthly flow. The middle panel shows the number of days each year in which Scott River flow was below 10, 20, and 40 cubic feet per second (cfs). The bottom panel shows the annual precipitation at the California Data Exchange Center (CDEC) Fort Jones (FJN) gage. Flow data are from the USGS "Scott River near Fort Jones" gage (http://waterdata.usgs.gov/nwis/dv/?site_no=11519500&agency_cd=USGS&referred_module=sw)

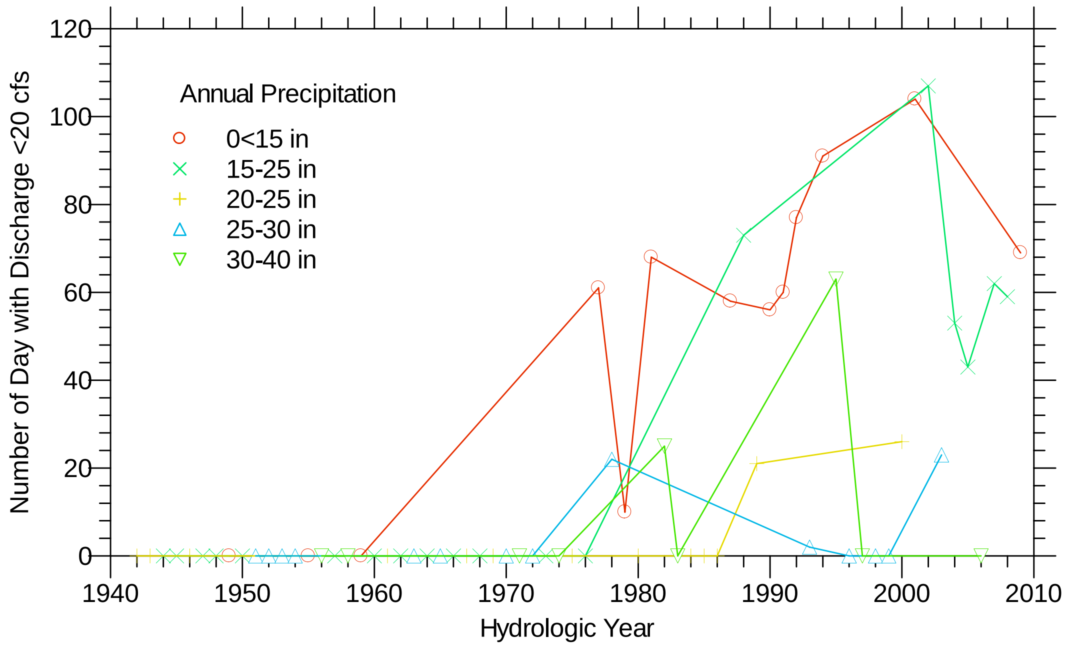

Figure 5. The number of days each year in which Scott River flow was below 20 cfs. The data are stratified into five groups according to annual Fort Jones precipitation.

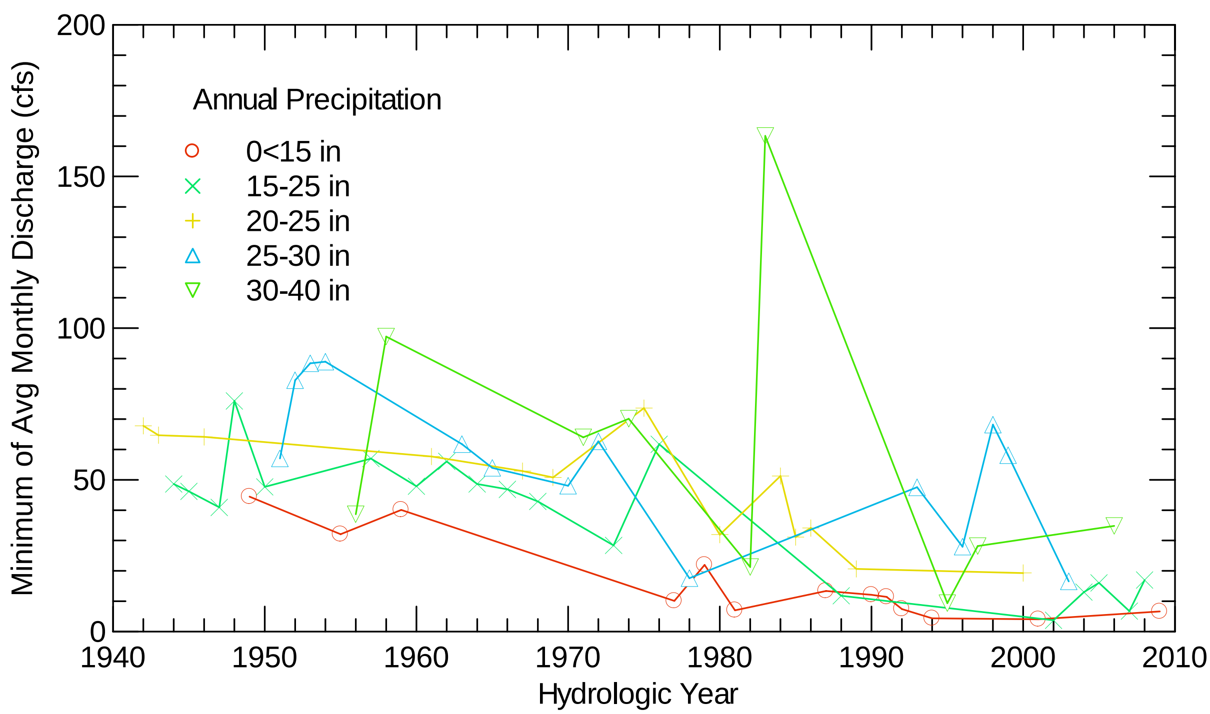

Figure 6. The annual minimum of average monthly Scott River flow, 1941-2009. The data are stratified into five groups according to annual Fort Jones precipitation.

Van Kirk and Naman (2008) conducted a comparative-basin hydrologic analysis of Lower Klamath Basin streams. The authors conclude that while climate (reduction in snowpack) has contributed to decreased flows in the Scott River in recent decades, increased use of water for irrigation has had a larger effect:

> "Irrigation withdrawal in the Scott watershed has increased from about 48 Mm^3 per year to over 100 Mm^3 since the 1950s, and the amount of ground water withdrawn for irrigation has increased from about 1 Mm^3 per year to about 50 Mm^3. We estimate that 39% of the observed 10 Mm^3 decline in July 1-October 22 discharge in the Scott River has been caused by regional-scale climatic factors and that the remaining 61% is attributable to local factors, which include increases in irrigation withdrawal and consumptive use."

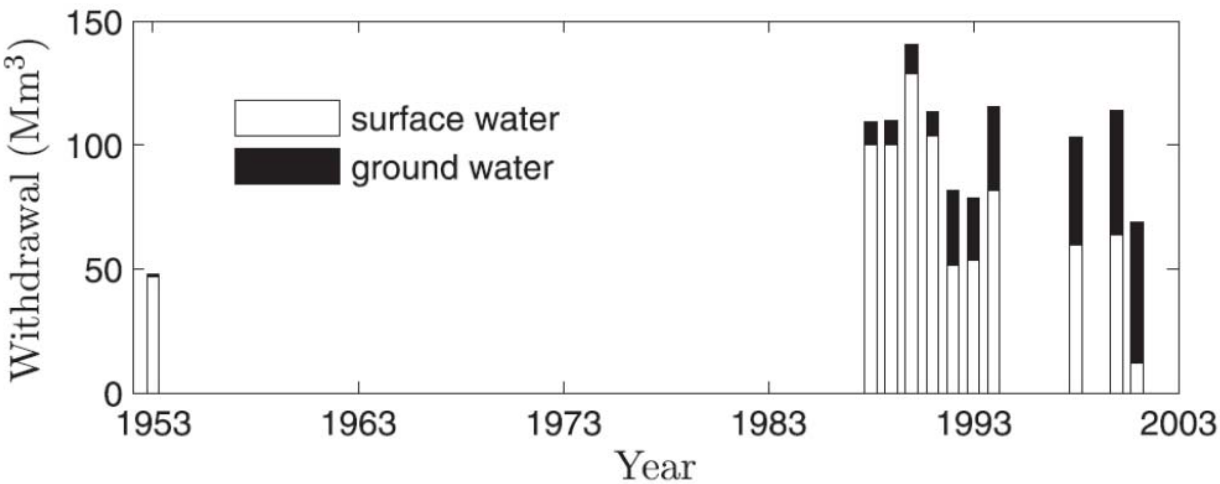

Figure 7. Groundwater and surface water use in the Scott River valley in millions of cubic meters showing a dramatic increase in overall water use, but especially in groundwater use. (This is Figure 7 from Van Kirk and Naman [2008]).

Despite the fact that the SWRCB recognized many reaches of the Scott River to be fully allocated, the installation of groundwater wells has continued to the present time. California Department of Water Resources (CDWR) well completion report data (Figure 8) suggest that the greatest number of wells were installed from 1971-1980 and that installations decreased between 1981 and 1990. Prolonged drought caused an increase in well installations in the 1990s, but installations continued, albeit at a lower level, after 2000. CDWR estimates that their record may be 30-50% low as a result of under-reporting.

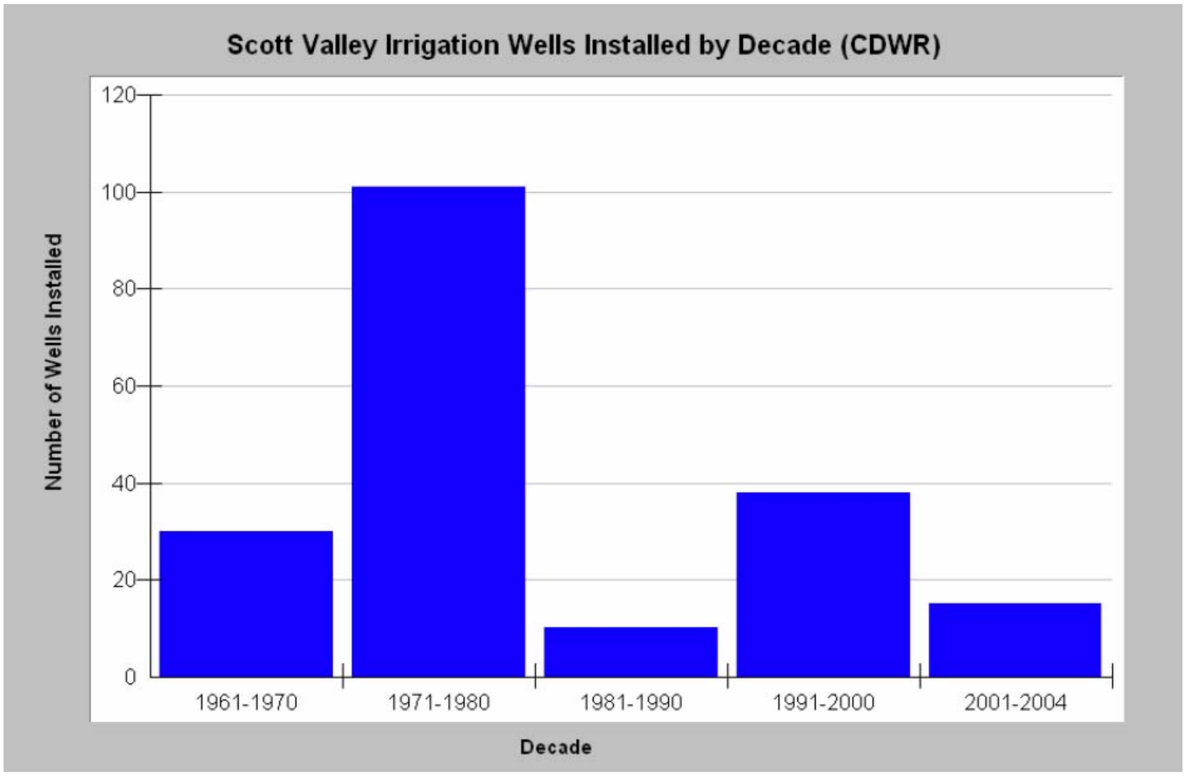

Figure 8. The number of irrigation wells installed, by decade, according to California Department of Water Resources records. Not all parties installing wells file with DWR.

Dry reaches of the Scott River and its tributaries

The most acute expression of flow impairment on aquatic habitats is the complete dewatering of the stream channel. Each summer, reaches of the Scott River and its tributaries go dry due to diversion and groundwater pumping.

<u>Shackleford Creek</u>
The Watershed Sciences (2004) thermal infrared aerial imagery of the Scott River and its tributaries from July 25-26, 2003 shows the effects of water diversions on water temperature in Shackleford Creek (Figure 9). Temperatures were initially optimal for salmonids in the Shackleford Creek canyon, but then diversions caused the water to warm rapidly. Eventually, all surface flow disappeared and Shackleford Creek was dry for approximately 1.5 miles above its confluence with Mill Creek (Figure 9). Below Mill Creek, there was surface flow again except for another dry reach for the last mile Shackleford above its confluence with the Scott River.

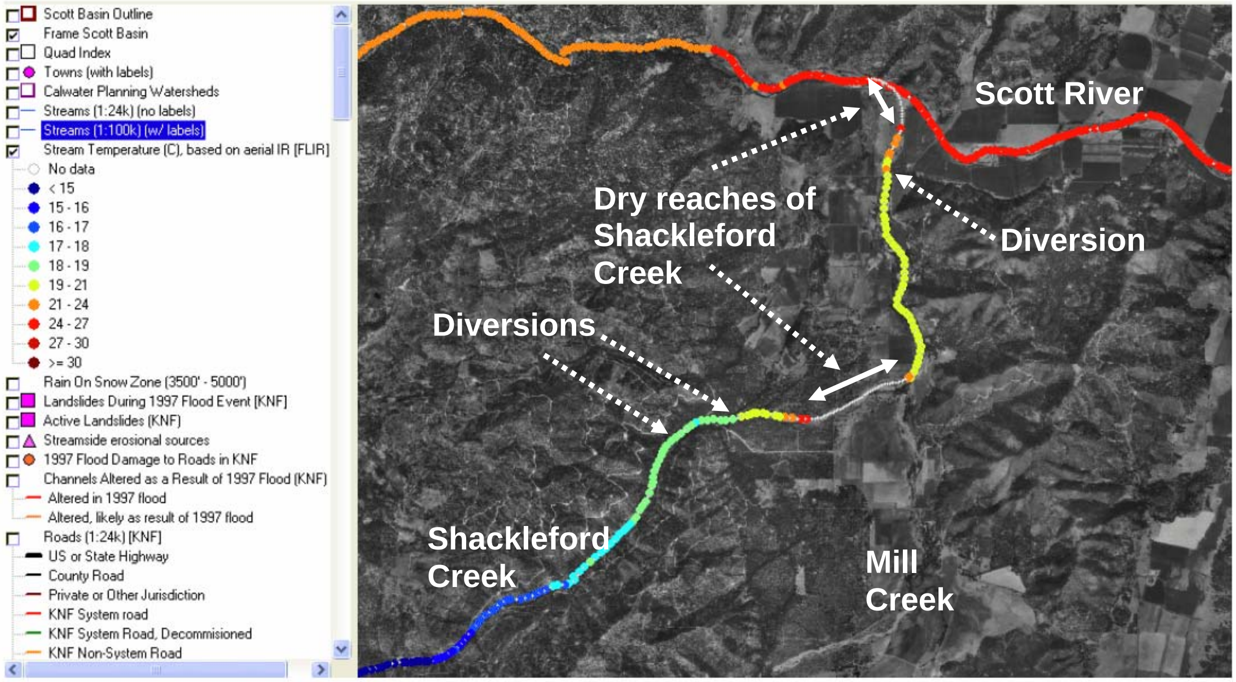

Figure 9. This map shows summary data of Scott River Thermal Infrared Radar (TIR) surveys for Shackleford Creek, with an aerial photograph as background. Shackelford Creek flows northeast, then north to meet up with the mainstem Scott at the top of the figure. Note that temperature increases as flow is depleted. Missing temperatures (shown as grey reaches) indicate that the stream is dry. Major diversions marked on USGS topographic maps (http://mapper.acme.com/?ll=41.59301,-122.99164&z=15&t=T&marker0=41.57347%2C-122.95170%2Cmugginsville\%2C%20ca) are also labeled on the map.

Information available from other years indicates the drying up of Shackleford Creek is a long-standing annual event. An infrared survey on July 2006 also found Shackleford Creek to be dry for 1.5 miles above Mill Creek and 1 mile above the Scott River (Watershed Sciences 2007)(Figure 10). Water quality monitoring by the Quartz Valley Indian Reservation indicates that Shackleford Creek went dry on July 16, 2007 and July 22, 2008 (QVIR 2008).

The problem of flow depletion on Shackleford Creek is a long-standing issue. In 1934 surveys for the U.S. Bureau of Fisheries, Taft and Shapovalov (1935) list seven diversions totaling 34 cfs on Shackleford Creek and state that these diversions caused the complete dewatering of the mouth of the creek: "No surface water from Shackleford Creek was reaching the Scott River on June 9, all of it being tapped to irrigation ditches. Some surface water should be allowed to flow to the Scott River at all times of the year." (p. 69). Decades later, CDFG (1974) noted "Sniktaw and Shackleford. Creeks are dried annually near their mouths an the Scott River. The mouth of Shackleford Creek often is still dry during the major portion of the king salmon runs which prevent their entrance and utilization of the spawning gravels in this stream."

Figure 10. Comparison of median radiant water temperatures from airborne thermal infrared surveys conducted in 2003 and 2006. Figure from Watershed Sciences (2007).

Etna Creek (see photos, next page)

A single diversion on Etna Creek diverts almost the entire flow of creek (Figure 11).

Figure 11. Jenner's diversion on Etna Creek: top photo–looking upstream of diversion, middle photos – at point of the diversion, and bottom photo – looking downstream of the diversion. August 2003. Lat/long coordinates: 41.43948, -122.89865. Photo by Bryan McFadin, NCRWQCB staff.

Mainstem Scott River

In discussions regarding the effect of aquifer drawdown on the Scott River, the Scott River TMDL (NCRWQCB 2005) noted that "In dry years the water table is lower than the bottom of the river channel and consequently the river water percolates into the aquifer to the point that there is no continuous flow. The Scott River went dry for long stretches in 1924, 1977, 1991, 1994, 2001, 2002, and 2004." (p 4-7, 4-8). The Scott River TMDL also noted that the river was dry in 2003: "The tailings reach was not included [in the 2003 water temperature model] because the river goes dry for a large stretch of the tailings reach as river water infiltrates into the subsurface…" (page 4-18).

The 2003 and 2006 thermal infrared (TIR) surveys (Watershed Sciences 2004, 2007) were conducted during the two years with the highest August flows of any two years in the past 10 years (Table 3). No dry reaches of the mainstem Scott River were detected during 2003 TIR survey. In 2006, in spite of having the second-highest August flow in the past 10 years, there was a stretch of dry river approximately one mile long in the mine tailings reach of the upper mainstem. According to Watershed Sciences (2007), "At mile 53.3, the Scott River went sub-surface with very little water visible in the river channel."

Available photographic evidence documents the drying up of the Scott River channel in 2002 (Figure 12), 2007 (Figure 13), and in 2009 across large stretches of the Scott Valley (Figures 14, 15, 16).

The cause of these dry river reaches is not difficult to discern; it is diversion and groundwater pumping for agriculture in the Scott Valley. For example, the Scott River TMDL (NCRWQCB 2005) notes that the Scott Valley Irrigation District (SVID) has a water right that allows diversion of 42 cfs, and in the TMDL model the SVID diversion was set at 90% of the Scott River's flow.

Table 3. Mean August flows for the years 2000-2009 at USGS' "Scott River near Fort Jones" gauge and notes regarding documented instances of the mainstem Scott River channel becoming dry. Note that this is not a comprehensive list of years in which portions of the stream channel dried up, it is only to provide a summary outline of information documented in these documents.

Year	**Mean August Flow (cfs)**	**Notes regarding channel de-watering**
2000	19	
2001	5	Portions of Scott River dried up (NCRWQCB 2005)
2002	15	Portions of Scott River dried up (Figure 12 and NCRWQCB 2005)
2003	88	Dry river in tailings reach (NCRWQCB 2005)
2004	13	Portions of Scott River dried up (NCRWQCB 2005)
2005	22	
2006	52	Thermal infrared survey, dry river in tailings reach.
2007	8	Portions of Scott River dried up (Figure 13)
2008	23	
2009	11	Portions of Scott River dried up (Figures 14,15,16)

Figure 12. Summer 2002 photo of the dry Scott River bed looking off a bridge south of Fort Jones, not far north of the airport. Bridge is likely Island Road (lat/long coordinates: 41.57045, -122.84664). Photo by Michael Hentz, downloaded from KRIS (http://www.krisweb.com/krisklamathtrinity/krisdb/sc/scott_river_brnofairportup.jpg)

Figure 13. Photo of dry Scott River at Eller Lane, approximately halfway between Fort Jones and Etna. Lat/long coordinates: 41.51933, -122.8508. Photo by Bryan McFadin, NCRWQCB staff, August 30, 2007.

Figure 14. Mainstem Scott River at Highway 3 Bridge southwest of Fort Jones, August 23, 2009. Lat/long coordinates: 41.595474, -122.851547. Photo from Klamath Riverkeeper (http://picasaweb.google.com/klamathriverkeeper/ScottAndShastaRivers2009FlowEmergency#5395238901042667954)

Figure 15. Mainstem Scott River at Quartz Valley Road, August 21, 2009. Lat/long coordinates: 41.629040, - 122.956978. Photo from Klamath Riverkeeper (http://picasaweb.google.com/klamathriverkeeper/ScottAndShastaRivers2009FlowEmergency#5395238925999748034)

Figure 16. Dewatered Scott River, full irrigation ditches, and irrigated fields in central Scott Valley, Sept. 2, 2009. Lat/long coordinates: 41.496438, - 122.844658. Photo from Klamath Riverkeeper (http://picasaweb.google.com/klamathriverkeeper/ScottAndShastaRivers2009FlowEmergency#5395238959214867394).

Effects of flow alteration on beneficial uses

According to the Scott River TMDL (NCRWCB 2005), the beneficial uses designated by the State which are to be attained in the Scott River Hydrologic Area are:

1. Municipal Water Supply (MUN)
2. Agricultural Supply (AGR)
3. Industrial Service Supply (IND)
4. Groundwater Recharge (GWR)
5. Freshwater Replenishment (FRSH)
6. Navigation (NAV)
7. Hydropower Generation (POW)
8. Water Contact Recreation (REC-1)
9. Non-Contact Water Recreation (REC-2)
10. Commercial or Sport Fishing (COMM)
11. Cold Freshwater Habitat (COLD)
12. Wildlife Habitat (WILD)
13. Rare Threatened or Endangered Species (RARE)
14. Migration of Aquatic Organisms (MIGR)
15. Spawning, Reproduction, and/or Early Development (SPWN)
16. Aquaculture (AQUA) (Scott Valley Hydrologic Subarea)

When the river is dried up none of these beneficial uses can be attained.

Recommendations for listing

Based on the information we have reviewed and presented here, we recommend that the Scott River and Shackleford Creek be added to the Clean Water Act section 303(d) list as impaired by flow alteration.

PART II

Comments requesting the State Water Resources Control Board to list the Scott River and Shackleford Creek as impaired by nutrients and bacteria

INTRODUCTION

The QVIR Environmental Protection Department has been monitoring Scott River and the tributaries of Quartz Valley, sub-basin to the Scott River, since 2007. Quartz Valley tributaries monitored include Shackleford Creek, Mill Creek and Sniktaw Creek. All tributaries cross through the boundaries of the Quartz Valley Indian Reservation. Datasonde 's were deployed each year beginning in the summer of 2007 and continuously monitoring temperature, dissolved oxygen, pH and turbidity year-round. Bi-weekly grab samples were collected May through October each year. Grab samples were collected and analyzed for total nitrogen, total phosphorus, total coliform and *E.coli*.

Datasonde data values were compared to the North Coast Basin Plan water quality objectives for dissolved oxygen and pH. Scott River objectives were not met in any of the sampled years, 2007-2009 during a large portion of the summer base-flow. The following Figures depict the results from the past three years.

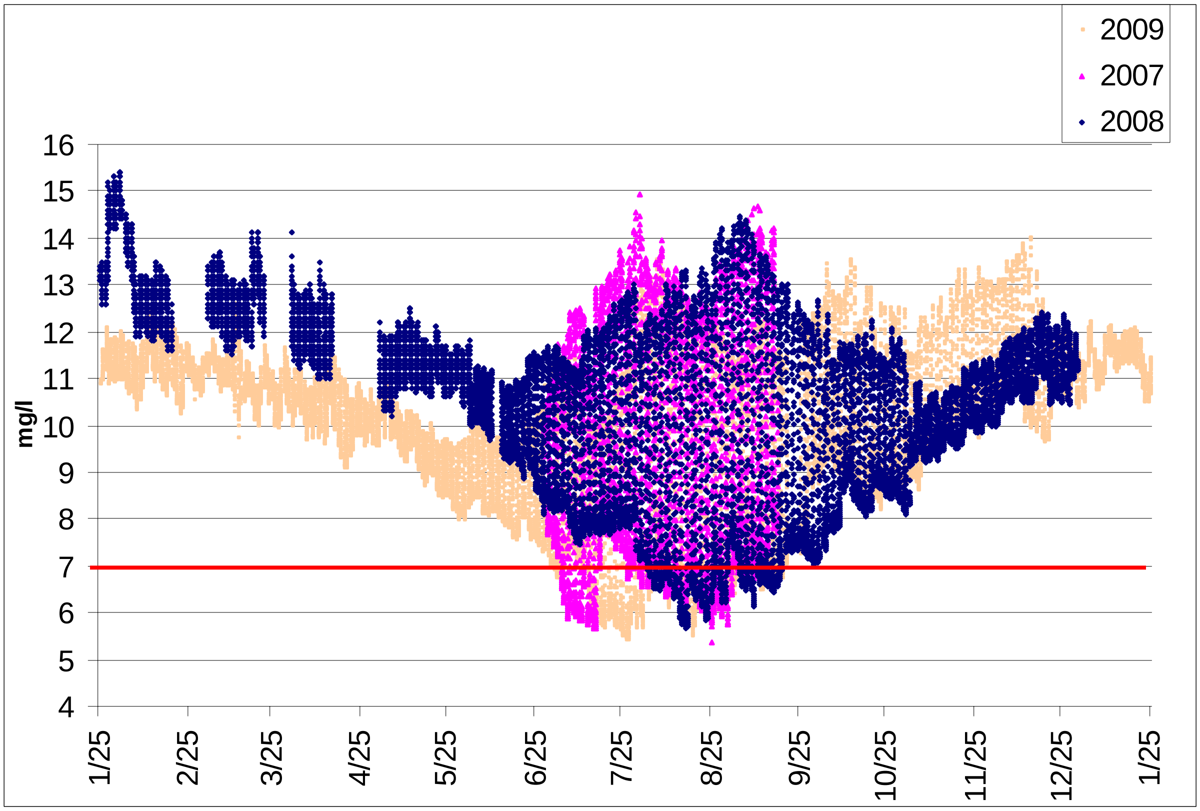

Figure 17: Datasonde dissolved oxygen data @ Scott River USGS Gauging Station from 2007-2009.

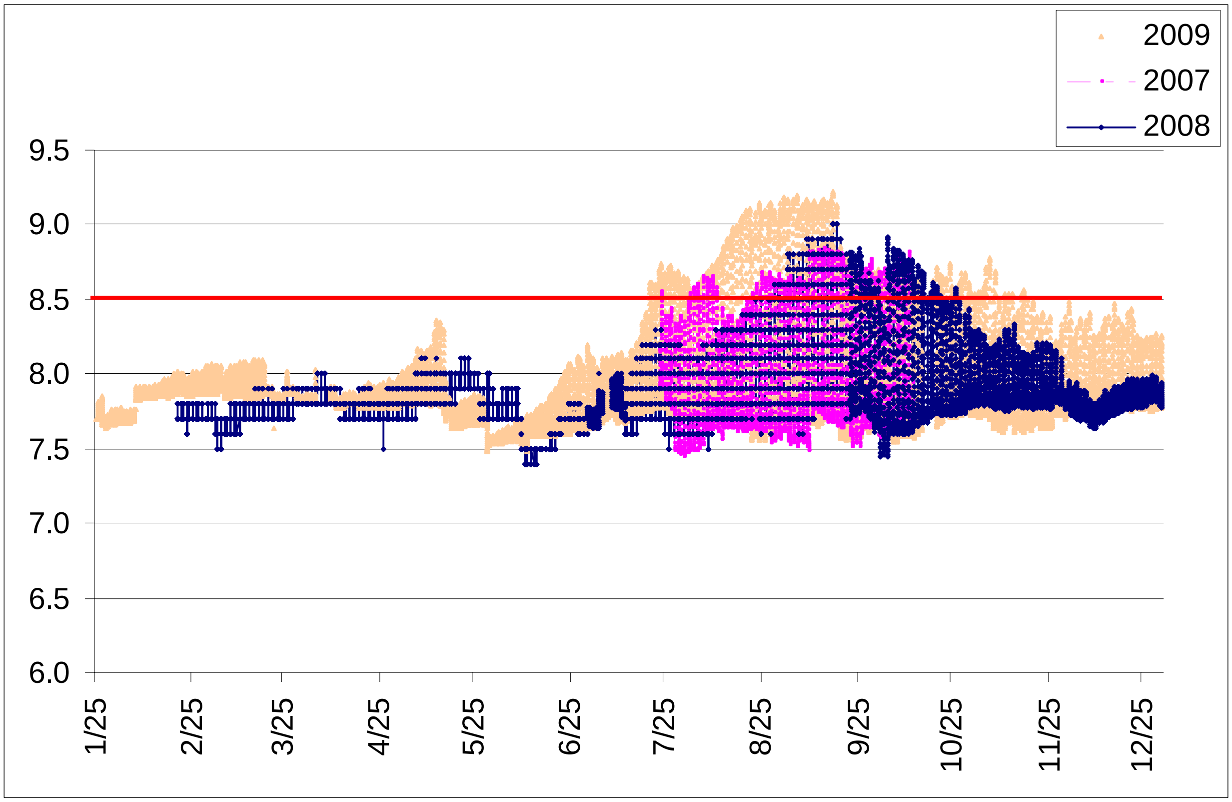

Figure 18: Datasonde pH data @ Scott River USGS Gauging Station from 2007-2009.

Nutrients do not directly affect salmonids, but can impact them indirectly by stimulating the growth of algae and aquatic macrophytes to nuisance levels that can adversely impact water quality (diurnal swings in dissolved oxygen and pH as seen during base flow in the Scott). The concentration of nutrients required to cause nuisance levels of periphyton varies widely from one stream to another (U.S. EPA, 2000b; Tetra Tech, 2004, 2006), and detailed data analyses are required to determine relationships. In the absence of such analyses for the Scott River, we use the U.S. EPA's (2000a) *Ambient Water Quality Criteria Recommendations for Rivers and Streams in Nutrient Ecoregion II*. U.S. EPA provided the document as general guidance, but did not intend for these values to be directly translated into standards. The U.S. EPA's recommendations of 0.12 mg/L total nitrogen (TN) and 10 µg/L total phosphorus (TP) were used as preliminary reference values to compare our data with, understanding that these values are subject to uncertainty. The following figures depict the grab sampling results for TN and TP collected at the Scott River Gauging Station site from 2007-2009.

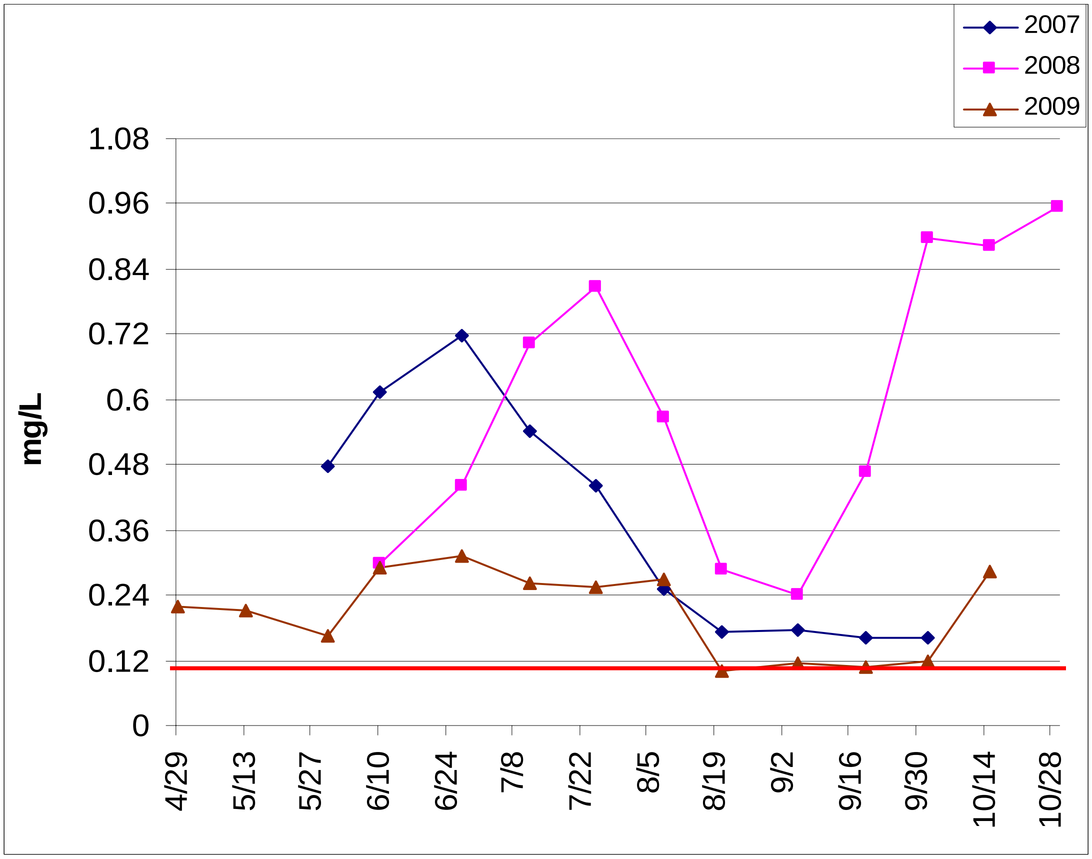

Figure 19: Total Nitrogen (TN) at the Scott River USGS Gauging Station 2007, 2008 and 2009 compared to the EPA water quality recommendation, 0.12 mg/L (red line). Results from 2007 and 2008 are very similar; while 2009 follows the same trend but does not reach the same magnitude at its peak.

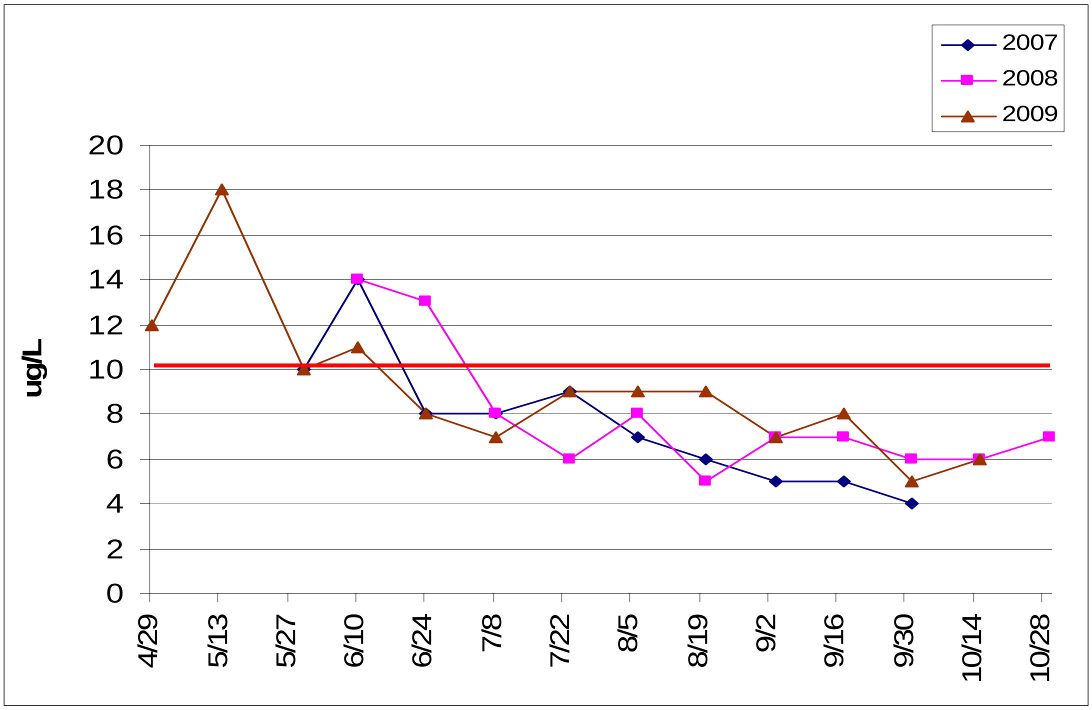

Figure 20: Total Phosphorus (TP) at the Scott River USGS Gauging Station 2007, 2008 and 2009 compared to the EPA water quality recommendation, 10 µg/L (red line). A similar trend exists for 2007-2009 data at the Scott Gauge; 2009 had the highest sample collected in 3 years.

Although these graphs do not depict all the collected data, we are submitting data on TP and TN for Mill Creek, Sniktaw Creek and longitudinally on Shackleford as well as these locations.

Bacteria data has been collected since 2007 at the Scott River Gauging Station, Shackleford Creek from the wilderness to the confluence with the Scott, Mill & Sniktaw Creeks. The following Figures depict the results and trends.

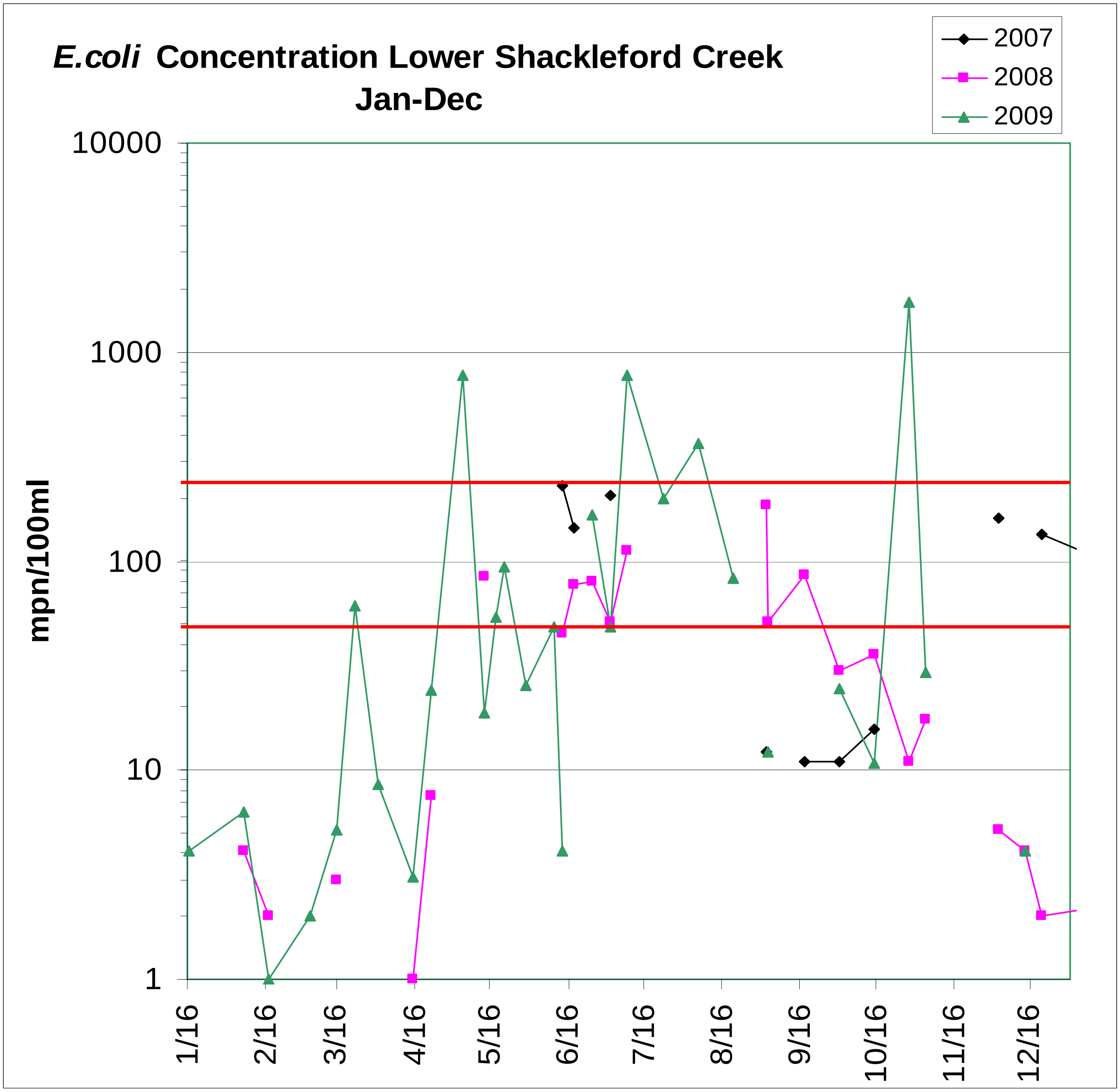

Figure 21: Lower Shackleford Creek (site code CHTH) *E.coli* concentration, January –December 2007, 2008 and 2009 compared to the *Basin Plan* water quality objective (<50 MPN/100 ml over a 30-day period, lower red line) and EPA objective (<235 single sample maximum, upper red line). *Note – logarithmic scale*

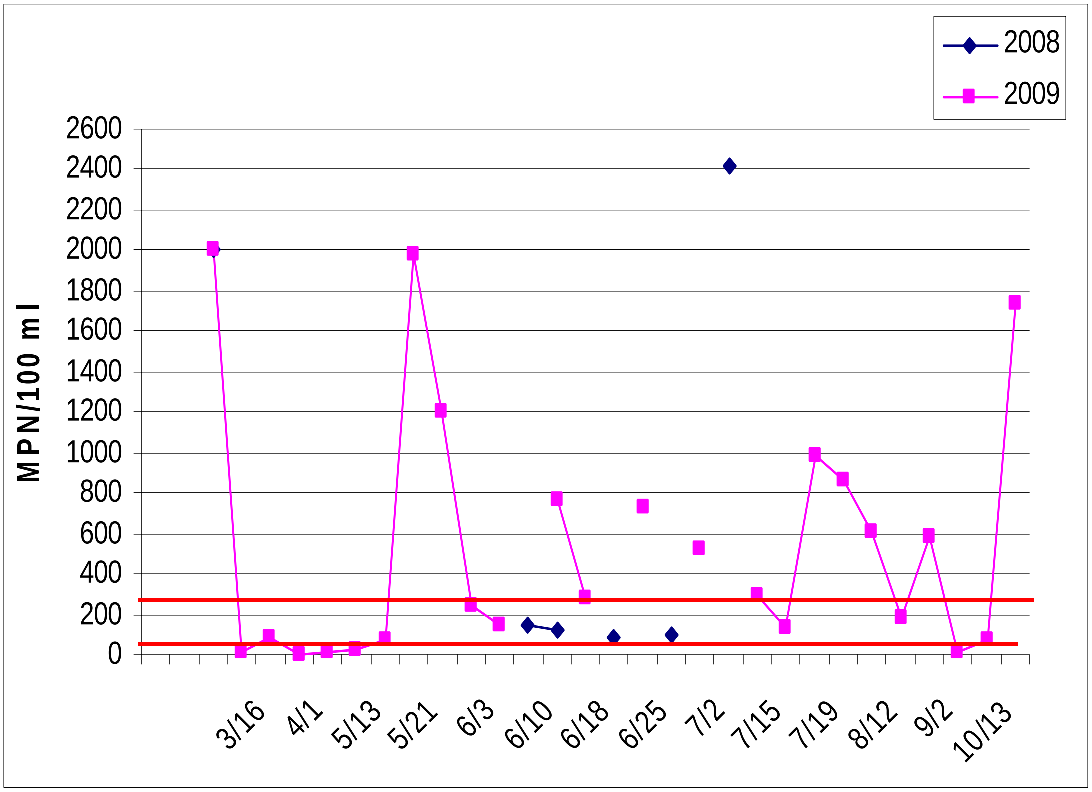

Figure 22 Lower Sniktaw Creek @ QVIR, *E.coli* concentration, January –December 2008 and 2009 compared to the *Basin Plan* water quality objective (<50 MPN/100 ml over a 30-day period, lower red line) and EPA objective (<235 single sample maximum, upper red line). *Note – logarithmic scale*

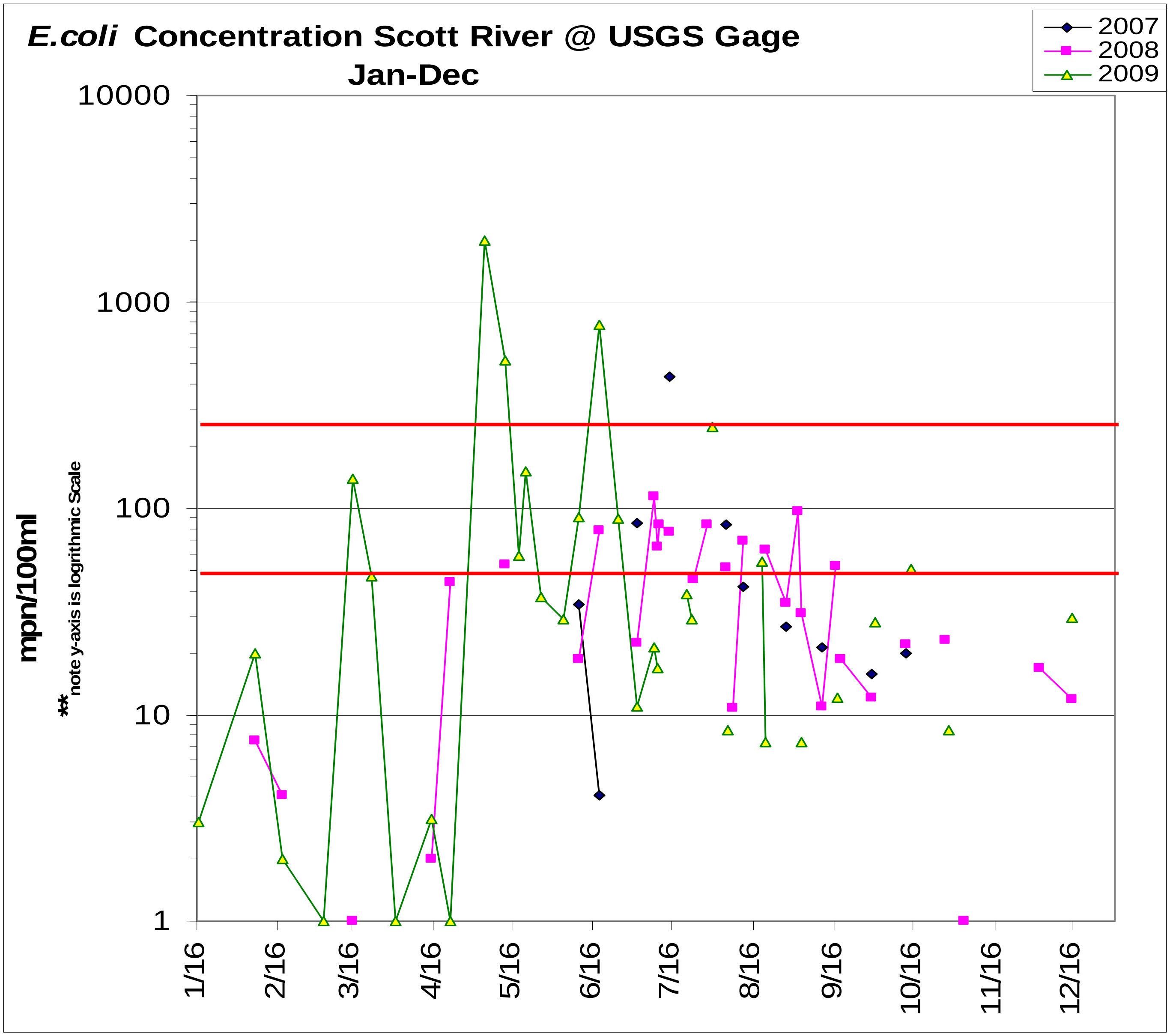

Figure 23: Scott River at USGS Gauging Station *E.coli* concentration, January –December 2007, 2008 and 2009 compared to the *Basin Plan* water quality objective (<50 MPN/100 ml over a 30-day period, lower red line) and EPA objective (<235 single sample maximum, upper red line). *Note – logarithmic scale*

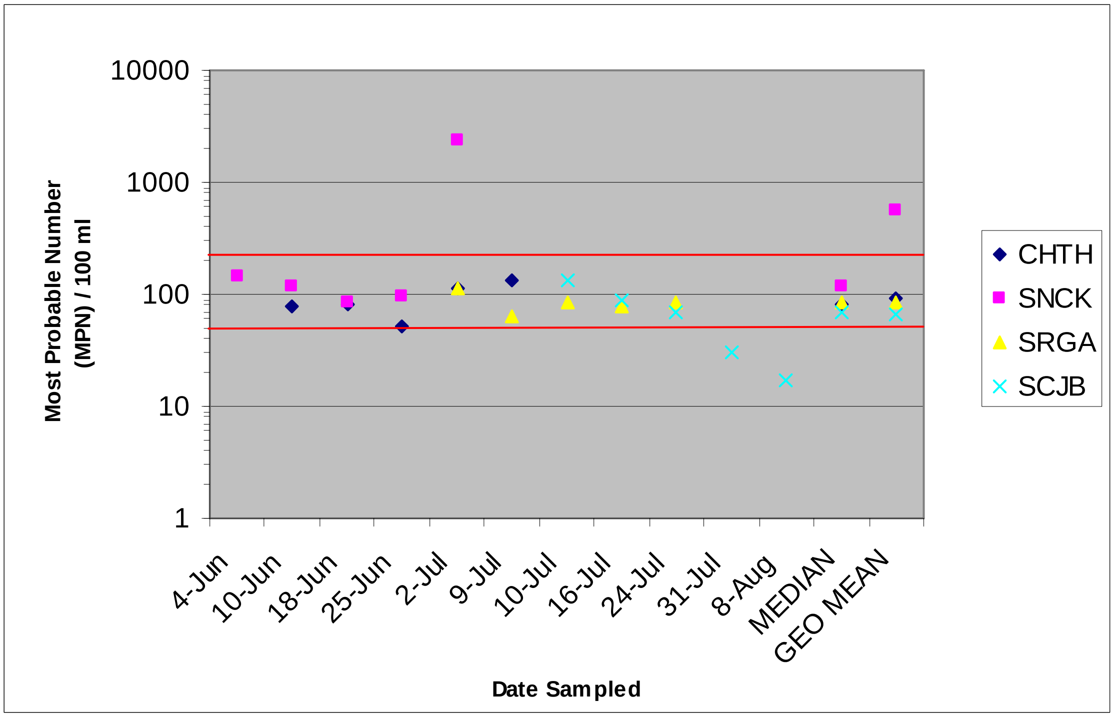

Figure 24: 2008 *E.coli* results from five equally spaced samples taken within 30 days, to compare to state, federal and tribal objectives (lower red line – limit for state and tribe, upper red line – federal limit) on lower Shackleford (CHTH), lower Sniktaw (SNCK), Scott River @ USGS Gauge (SRGA), Scott River @ Jones Beach (SRJB). *Note – Median and geometric mean values are graphed on the far right and scale is logarithmic.*

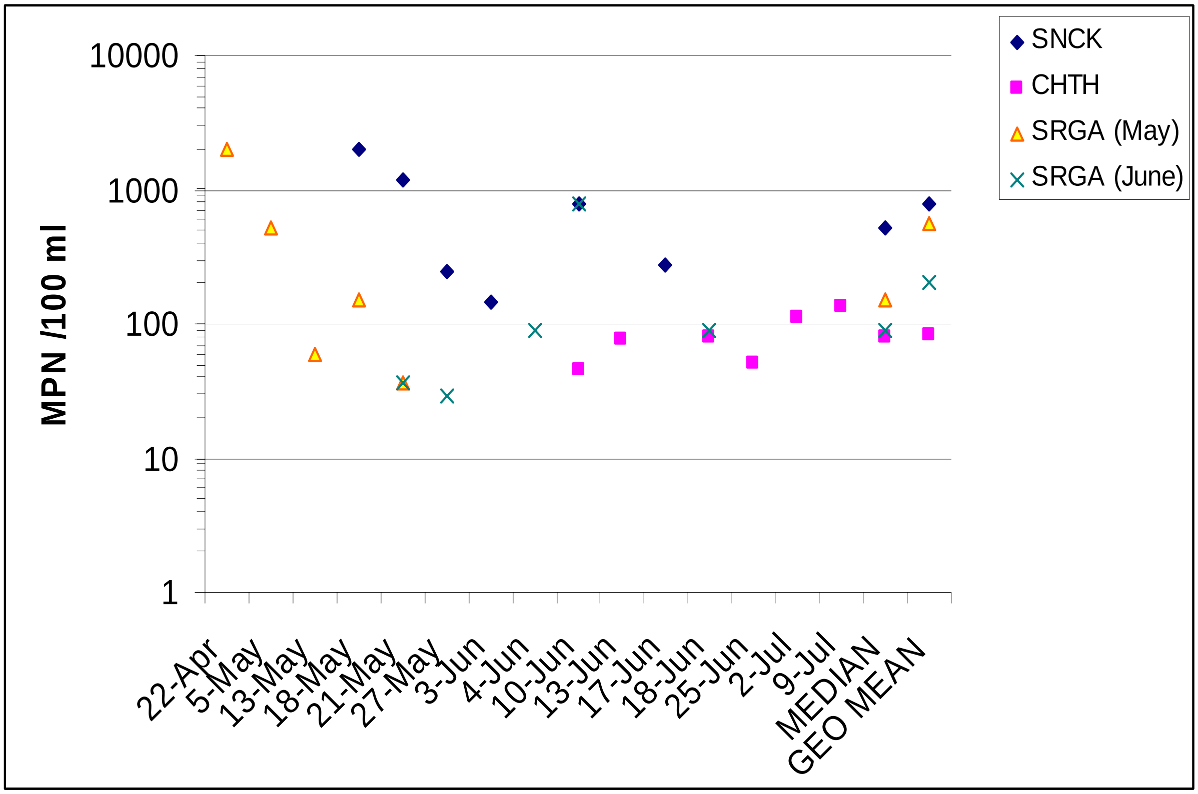

Figure 25**:** 2009 *E.coli* results from five equally spaced samples taken within 30 days, to compare to state, federal and tribal objectives (lower red line – limit for state and tribe) on lower Shackleford (CHTH), lower Sniktaw (SNCK), Scott River @ USGS Gauge (SRGA). *Note – Median and geometric mean values are graphed on the far right and scale is logarithmic.*

This data, along with longitudinal comparisons on Shackleford Creek, are submitted herein for *E.coli* and total coliform.

COMMENTS

A significant amount of data exists for nutrient and bacteria in the Scott River Basin. Trends observed over time indicate an annual problem exists during base flow in this system. Comments above discuss the issues surrounding flow alterations that coincide with impairments to dissolved oxygen and pH.

Recommendations for listing

Based on the information we have reviewed and presented here, we recommend that the Scott River, Shackleford and Sniktaw Creek be added to the Clean Water Act section 303(d) list as impaired by nutrients and bacteria.

REFERENCES

Note: all documents listed here except those by NCRWQCB and SWRCB are submitted as PDF attachments to these comments. The files are named by the convention: year_author_subject.pdf

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