Final Report

Preliminary Water Quality Assessment of Cow Creek Tributaries

Morgan J. Hannaford
and
North State Institute for
Sustainable Communities

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report submitted to

Patricia Parker
US Fish and Wildlife Service
10950 Tyler Road
Red Bluff, CA 96080

Morgan J. Hannaford
Shasta College - Biology
11555 Old Oregon Tr.
Redding, CA 96049

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OVERVIEW

Basin Geography

The Cow Creek watershed encompasses approximately 430 square miles and drains the base and foothills of Mt. Lassen in a southwest direction into the Sacramento River. The basin area is roughly bordered by Highway 299 to the north, Highway 44 to the south, and Highway 89 to the east. Cow Creek is a dendritic (tree like) stream system and can be divided into five main sub-basins (see relief map, Figure 1), including Little Cow Creek, Oak Run Creek, Clover Creek, Old Cow Creek and South Cow Creek.

According to area maps and historical naming convention the Main Stem of Cow Creek begins at the confluence of South Cow and Old Cow Creeks. From there it flows west for seven miles where it joins with Clover Creek, and then within one more mile joins with Oak Run Creek. The Main Stem of Cow Creek and Little Cow Creek converge further downstream, at the Highway 44 bridge crossing. The Main Stem of Cow Creek continues south for approximately 7.5 miles where it empties into the Sacramento River, 23 miles downstream of Shasta Dam and 4 miles east of the town of Anderson.

Little Cow Creek (also known as North Cow Creek) drains a 148 square mile basin. The headwaters (Cedar Creek, North Fork, and Mill Creek) originate at an elevation of roughly 5900 feet on the west slopes of Tolladay Peak, Snow Mtn. and Clover Mtn. Little Cow Creek flows for 36 miles southwesterly along Hwy 299 and then southerly along Deschutes Rd. before it joins with the Main Stem Cow Creek at Hwy 44.

Oak Run Creek, the smallest of the five main tributaries, drains a 42 square mile basin and originates at approximately 3200 feet elevation. Oak Run Creek flows 23.5 miles southwesterly, past the town of Oak Run and along Oak Run Road, to its confluence with the Main Stem of Cow Creek in Palo Cedro.

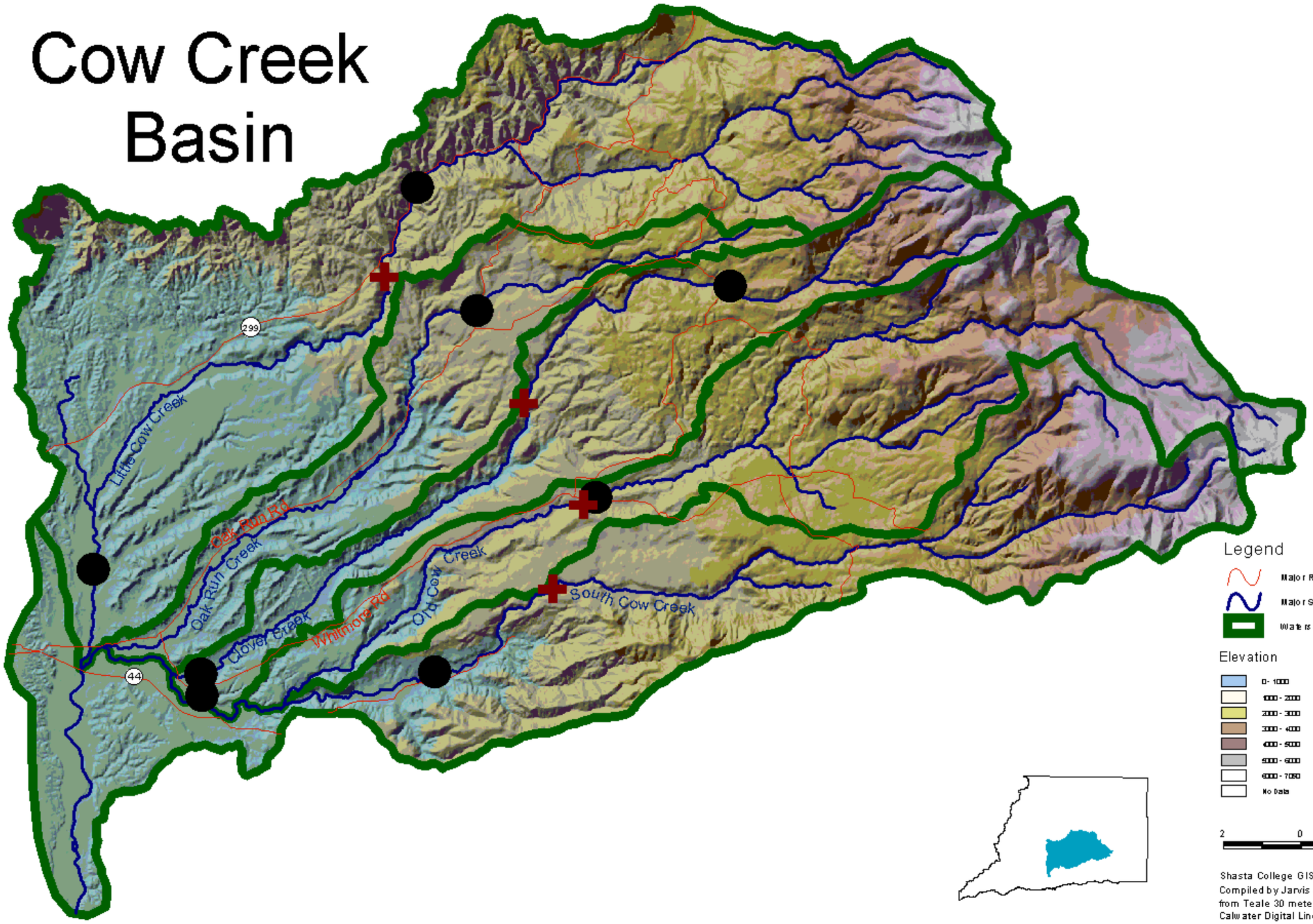
Clover Creek drains a 54 square mile basin and originates at approximately 5500 feet elevation on the south slope of Clover Mountain. Clover creek flows 27.5 miles from the headwaters to its confluence with the Main Stem of Cow Creek.

Old Cow Creek drains an 80 square mile basin and originates at 6500 feet elevation in the Latour Demonstration State Forest. Old Cow Creek flows 32 miles and conjoins with Hunt Creek, Glendenning Creek (east of Whitmore), Canyon Creek and Coal Gulch before its confluence with South Cow Creek three miles east of Millville.

South Cow Creek drains a 78 square mile basin and originates at 5800 feet elevation in the Latour Demonstration State Forest. South Cow Creek flows 28.5 miles to its confluence with Old Cow Creek near Hwy 44. Its larger tributary streams include Atkins Creek, Beal Creek, Hamp Creek, and Mill Creek.

Figure 1. Relief map of the Cow Creek Basin and its drainage network. Shading identifies elevation in 1000 foot increments. Note how the 2000 foot transition coincides with a dramatic change in stream gradient, see Figure 2.

Cow Creek Basin



Legend

- Major Roads
- Major Streams
- Watershed Boundries

Elevation

- 0 - 1000
- 1000 - 2000
- 2000 - 3000
- 3000 - 4000
- 4000 - 5000
- 5000 - 6000
- 6000 - 7050
- No Data

N
W
E
S

2 0 2 Miles

Shasta College GIS Center
Compiled by Jarvis Jones
from Teale 30 meter Digital Elevation Models,
Calwater Digital Line Graphs,
and data modified by the Shasta College GIS Center

Table 1. Summary data for tributaries of the Cow Creek Basin.

Stream Name	Basin Area (sq. mi.)	Stream Length (mi.)
Little Cow Creek	148	36
Oak Run Creek	42	23.5
Clover Creek	54	27.5
Old Cow Creek	80	32.9
South Cow Creek	78	28.5
Main Stem Cow Creek	29	15
Total to Sacramento River	430	47.8

Basin Geologic History

Cow Creek and its tributaries carve into diverse layers of geologic features. The eastern high elevation reaches are the result of relatively recent volcanic activity, ranging from 12 million years ago to the present; the last eruption series occurred from 1915-1917 (Alt and Hyndman 1975). Encrusted lava rocks along with loose volcanic debris were deposited over more ancient (Cretaceous) marine sandstone and shale formations. Over time the Cow Creek tributaries have sliced through the blanket of volcanic deposits and eroded into the underlying sandstone and shale producing extensive alluvial deposits (Alt and Hyndman 1975). Gradient-transition points (i.e., head-cuts or knick-points) are evident in all 5 tributaries at approximately 1000 feet elevation, forming spectacular waterfalls. These erosional deposits are the source of rich, well-draining soils that support lush forests and more recent agricultural development.

Cultural History

The Cow Creek Basin has a rich cultural history. The region was used extensively by indigenous peoples, most recently the Yana tribes, up to the late 1880s (Allen 1979, 1984). European-American settlers, attracted by the gold extraction activities based in various parts of Shasta County, established the first community in the Millville area of Cow Creek in 1853. The mid-elevation reaches of South Cow Creek were settled as early as 1855 (SWRB 1965). By 1863 the settlement called Tamarack (now called Whitmore in honor of one of its founders) was established and steadily grew into a small trade center.

Land Use History

Irrigation in the Cow Creek basin began soon after its settlement and continues today with a complex series of diversions and lift-pumps in all tributaries. Stream diversions and pumps carry water to fields, pasturelands and residences in the upper and lower elevation areas. The lowland area primarily supports livestock ranches. Private and public timberlands dominate the eastern upland parts of the basin, above 2000 ft. Mining activity was limited to the northern portion of the basin, along Little Cow Creek, where the Afterthought Mine near Ingot (Hwy 299) was a source for gold and copper ore from 1862 to 1952 (Albers and Robertson 1961). Hydro-power plants were established on Old Cow Creek (Kilarc Reservoir and Powerplant) and South Cow Creek (Olsen Diversion) in the early 1900s to provide electricity for copper smelting, businesses and residents (Allen 1979).

WATER AND HABITAT QUALITY CONCERNS

Background

A primary goal of the Anadromous Fish Restoration Plan of the Central Valley Project Improvement Act [section 3406(b)(1)] is to double natural production of anadromous fish populations in Central Valley Rivers by 2002. Pursuant to this goal, the U.S. Fish and Wildlife Service (USFWS) and California Department of Fish and Game (CDFG) are examining opportunities to increase chinook salmon and steelhead populations throughout the northern Sacramento River valley. According to the California Department of Fish and Game the Cow Creek basin has the potential to support 5,000 to 10,000 fall-run chinook salmon, and a minimal number of steelhead. Although accurate counts are not available, it is believed that current populations are far below historic numbers (see appendix B). Water quality, physical habitat degradation and barriers to fish migration are major factors suspected of contributing to limited salmon populations in the Main Stem Cow Creek and its tributaries.

The Central Valley Regional Water Quality Control Board (CVRWQCB) is responsible for assuring that water quality is adequate for the protection of all beneficial uses, including water supplies, aquatic life and recreation. Past water quality data and reports from water users in the basin have raised concerns regarding deteriorating water quality for all of the above uses. Fecal coliform, from defective septic systems and livestock, threaten drinking water and recreational-contact users. In conjunction with warm summer water temperatures, heavy microbial oxygen demand could effect aquatic species by decreasing the available dissolved oxygen. Additionally, excessive soil erosion and bank failure in some tributaries is believed to contribute to increase stream turbidity.

The Western Shasta County Resource Conservation District's (WSRCD) mission is to work with willing landowners, government agencies and other organizations to facilitate the conservation or restoration of Shasta County's natural resources. With the successful formation of stakeholder-based watershed groups on Battle Creek and Clear Creek the WSRCD's primary interest was to incorporate landowner education and participation in all management decisions that effect the Cow Creek Basin.

Shasta College and the McConnell Foundation established the North State Institute for Sustainable Communities (NSISC) to conduct research on issues related to the sustainability of the Northern Sacramento River Watershed. This Preliminary Water Quality Assessment Project is intended to strengthen the linkage between State and Federal agencies, conservation groups, the community and education. The NSISC, as the grant recipient, coordinated activities and sub-contracted with Shasta College Biology Instructor, Morgan Hannaford Ph.D., to collect data, train students in water quality monitoring techniques and develop this report.

Barriers to Fish Migration

Both natural and man-made channel features limit anadromous fish access to Cow Creek tributaries. Habitat surveys conducted by California Department of Fish and Game identified a number of unscreened permanent (approximately 14) and temporary water diversions in the reaches of the Main Stem of Cow Creek that are accessible to salmon and steelhead (CDFG 1992). Water diversion normally extends from April through October, during which time juvenile salmon may still be present. The concern here is that water diversions may draw juvenile fish out of the stream channel and strand them in ditches or fields. Furthermore, some of the diversion structures may be potential barriers to adult fish migrating upstream to spawn.

Prominent natural barriers exist that restrict chinook salmon to the low elevation portions of the Cow Creek Basin. Each of the 5 main Cow Creek tributaries has a significant change in stream gradient (slope) accompanied by a waterfall at the transition point (Figure 2, see also Table 2). The waterfalls result from a head-cut (knick-point) as the tributaries erode through the sandstone deposits mentioned above. This natural stream channel evolution has probably occurred over millions of years. A geologic fault (rift) may also contribute to the sudden change in gradient in all the tributaries, all occurring at a similar elevation and distance from the Cow Creek outlet to the Sacramento River.

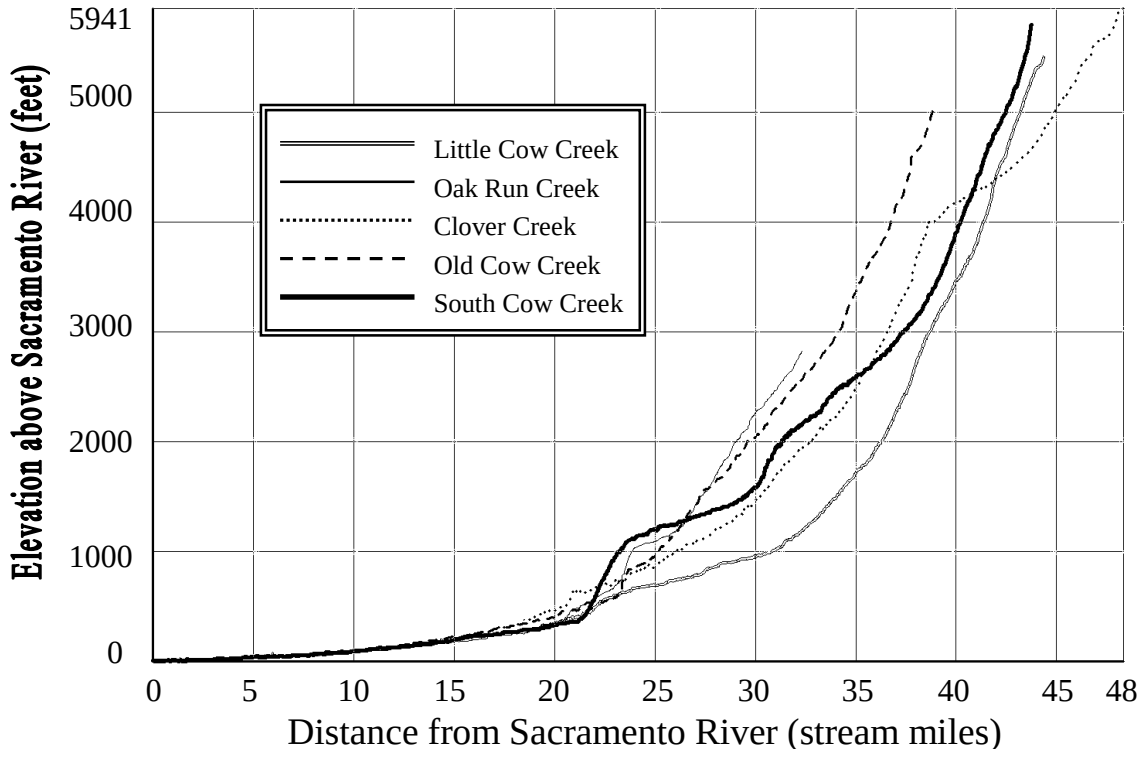


Figure 2. Stream gradient profile for Cow Creek tributaries. Elevation units can be adjusted to sea level by adding 372 feet. Prominent shifts in gradient occurring at 20-25 miles limit chinook salmon to the lower elevation reaches (i.e., below 1000 ft. above sea level).

Table 2. Summary of natural barriers to anadromous fish migration. Based on information from Colleen Harvey (CDFG; personal communication) and field observations.

Stream Name	Barrier Location	Description
Little Cow Creek	Diddy Wells Falls	15' bedrock falls - Partial barrier to upstream migrants during normal flows.
Oak Run Creek	Unknown waterfall	Report of bedrock falls downstream from the town of Oak Run.
Clover Creek	Clover Creek Falls	>100' bedrock falls - Impassable barrier to all upstream migrants.
Old Cow Creek	Whitmore Falls	>12' bedrock falls - Partial barrier to upstream migrants during normal flows.
South Cow Creek	Wagner Canyon	Boulder cascades - Steep gradient.

Water Quality Data Sources

The U.S. Geological Survey maintains a gauging station on the Main Stem of Cow Creek, near Palo Cedro (gage basin area of 425 square miles). This gauge has a 40 year continuous record (1950-current; station number 11374000). Additionally, flow records exist for Little Cow Creek (1957-1965; station number 11373300), Oak Run Creek (1957-1966; station number 11373200), Clover Creek (1957-1959; station number 11372700) and South Cow Creek (1956-1972; station number 11372200).

The Department of Water Resources (DWR) Northern District office in Red Bluff maintains a monitoring program on the Main Stem of Cow Creek, downstream of the Hwy 44 bridge. This data, usually collected quarterly (4 times per year), is the only comprehensive record of water quality for the lower elevation portion of the Cow Creek Basin (Table 3). Macroinvertebrate samples were collected periodically throughout the basin over the past 25 years.

Table 3. Water quality parameters measured by the Department of Water Resources. Sample dates range from 1/92 - 2/00. All parameters were not measured on all dates. An asterisk indicates parameters with peaks notably higher than background levels.

Parameter	
Metals	As, Cd, Cr, Cu, *Fe, Pb, Mn, Hg, Mo, Se, Zn
Nutrients	Total N, Nitrate, Nitrite, Ammonia, Total P, Orthophosphate, Ca, Mg, Na, K, SO_4, Cl, B
Physical	Hardness, *Temperature, Dissolved Oxygen, pH, Conductivity, Alkalinity, *Turbidity
Biological	Macroinvertebrates

Most chemical parameter measurements in Table 3 (above) were below measurable concentrations, or well within surface water background limits (RWQCB 1998). Iron concentrations were notably high on most sample dates (range: 0.1 - 0.88 mg/L); however, based on the lithography and mining history of the area this may be within the natural background level, or contributed mostly by the Little Cow Creek drainage (see mining effects on water quality below). Summer water temperatures and turbidity associated with spring runoff were identified as other physical factors that deserved further attention.

Monitoring Sites

All data collected during the course of this study were from repeat visits to 9 stream reaches (see Appendix A for approximate locations). Sampling sites were selected based on available landowner permission, public access easements, and proximity to passable roads (for ease of sampling access). The overall monitoring plan was designed to identify differences between the major tributaries and between the lower (<1000 feet) and middle (1000 - 2000 feet) elevation reaches within each tributary.

Sampling dates range from early June 1999 to April 2000. Summer sampling occurred weekly to biweekly, depending on the parameters being measured. Winter and spring sampling coincided with peak rainfall events and are thus sporadic. Specific monitoring methods are outlined below.

Temperature and Dissolved Oxygen

Temperature is a primary limiting factor for all aquatic biota (Allen, 1995). Excessive temperatures can induce high metabolic rates and oxygen-debt stress in fish and invertebrates. In addition to the temperature effect on oxygen demand, the physical capacity for water to hold oxygen decreases as water gets warmer (Wetzel, 1983). Thus, many aquatic species have specific temperature requirements to successfully complete their life cycles. Although different salmon species and even populations within a species are known to have varying temperature requirements, as a whole salmonids are considered stenotherms (i.e., tolerating a narrow range of temperatures). Table 4 outlines estimated temperature requirements for specific developmental stages of chinook salmon (Armour 1991). These temperatures are too warm to support steelhead trout.

Table 4. Preferred temperature ranges for chinook salmon. These are estimates based on field and laboratory studies. Actual site-specific values may vary.

Species/Life Stages	Temperature Range Requirements*
Chinook Salmon	
Adult migration	3.3-14.4°C (38-58°F)
Spawning	4.4-13.9°C (40-57°F)
Egg incubation / fry emergence	5.0-14.4°C (41-58°F)
Juvenile rearing	5.0-14.4°C (41-58°F)

Adapted from Armour 1991.

*0.1°C precision is an artifact of translating temperatures from Fahrenheit, as reported in the literature.

Water Termperature Monitoring

Temperature probes, programmed to record every 15 minutes, were deployed at each monitoring site in June 1999. The probes (Onset Optic Stowaway™ and Hobo™ temperature loggers) were anchored to the stream bottom in the channel flow and in the shade to prevent edge-warming effects (Stevens et al. 1975). All probes were calibrated to a laboratory-grade reference thermometer to within ±0.5°C. Records from the Main Stem of Cow Creek, downstream of all tributaries, are from the DWR.

Based on the temperature records for Cow Creek (continuous records from 1995-2000, and current field measurements) the water temperature in the Main Stem of Cow Creek exceeds preferred developmental thresholds for chinook salmon approximately 6 months each year (roughly May - October). Furthermore, maximum peak temperatures frequently exceed lethal thresholds (~25°C) for juvenile and adult fish in summer months (Figure 3). The upstream tributary input can account for the bulk of this warm water during the hot summer months (Figure 4a & 4b). Because the flow in the Main Stem of Cow Creek is dominated by Old Cow Creek and South Cow Creek throughout the summer, temperatures are actually mediated; upstream average and maximum temperature in Little Cow Creek and Oak Run Creek exceeded those of the Main Stem downstream (Figure 4a).

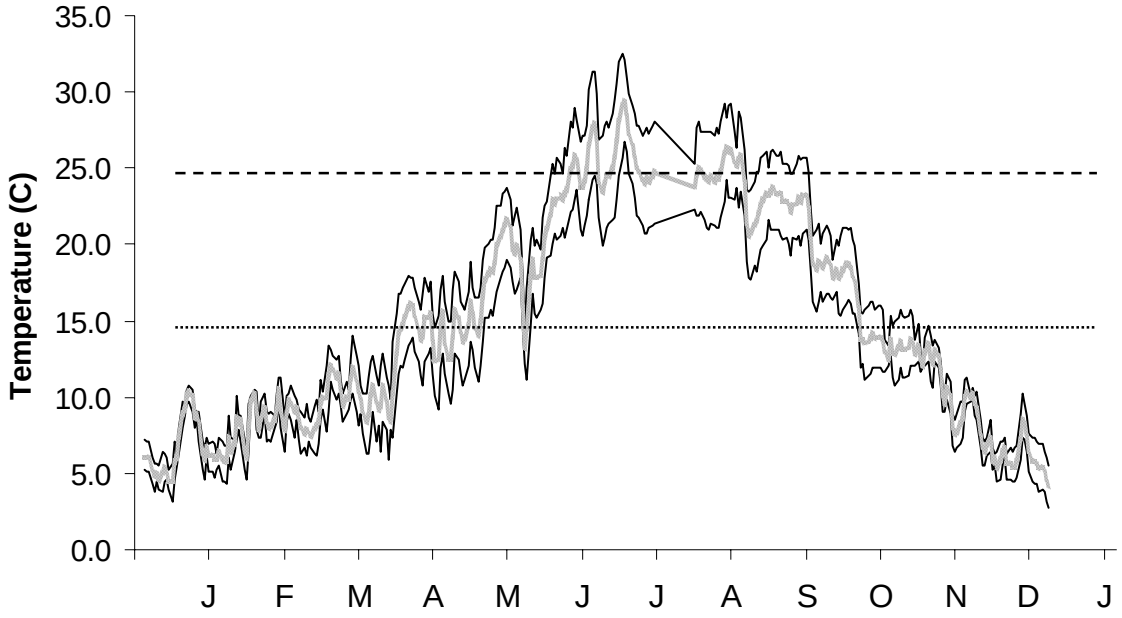
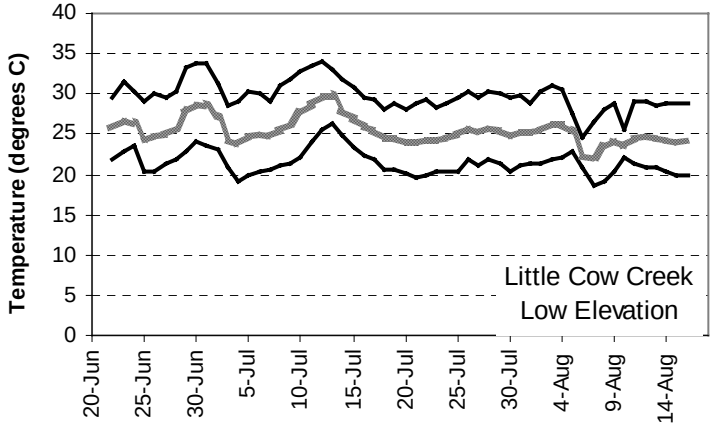
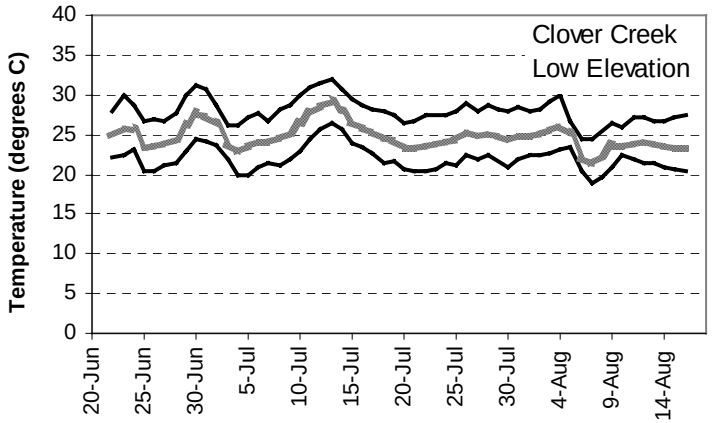
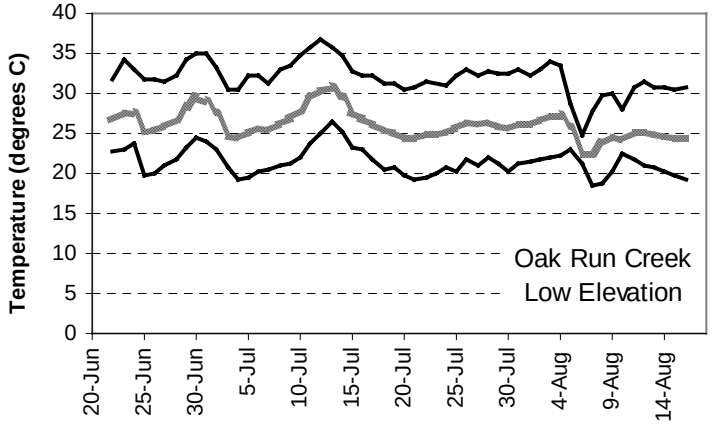
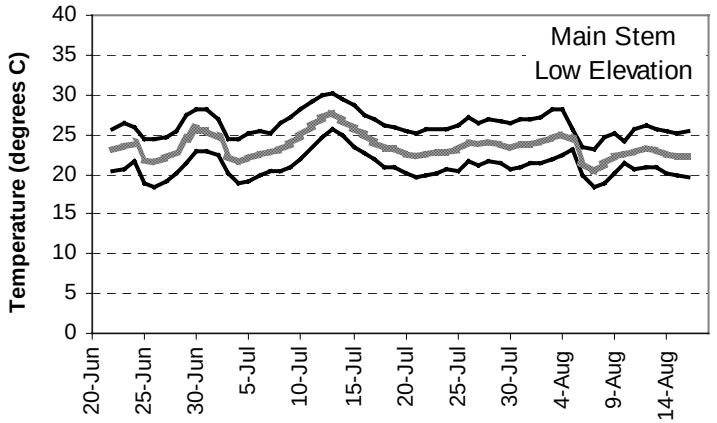


Figure 3. Daily range (maximum/minimum) and average water temperatures in 1999 for the Main Stem Cow Creek, near Palo Cedro. The dotted line is preferred developmental temperature, and the dashed line is lethal temperature thresholds for juvenile chinook salmon (based on published data, see text). Data for Jun 26 - Aug 9 are estimated because of sensor failure. Data source DWR.









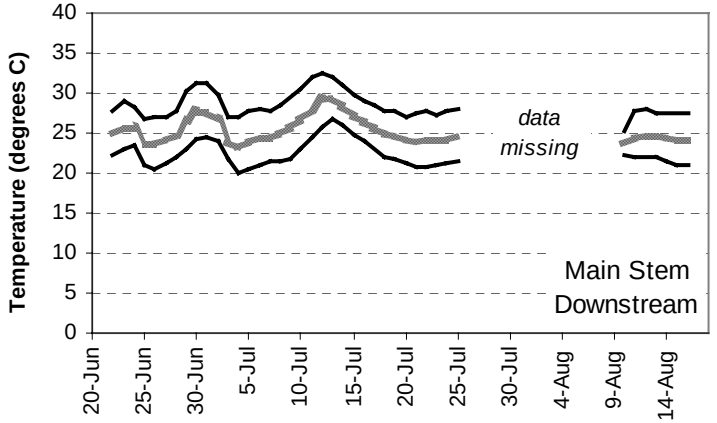
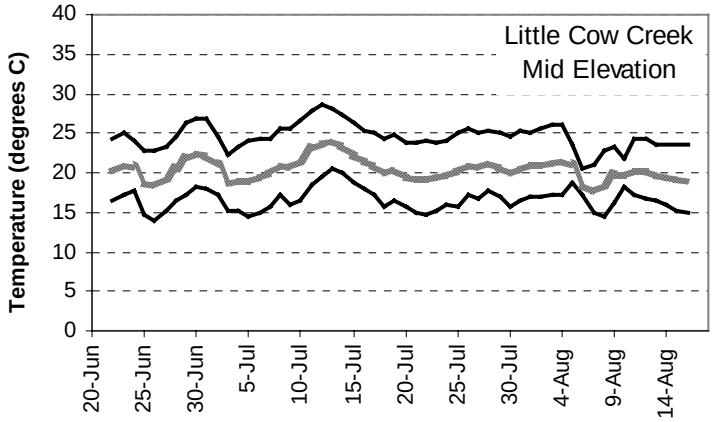
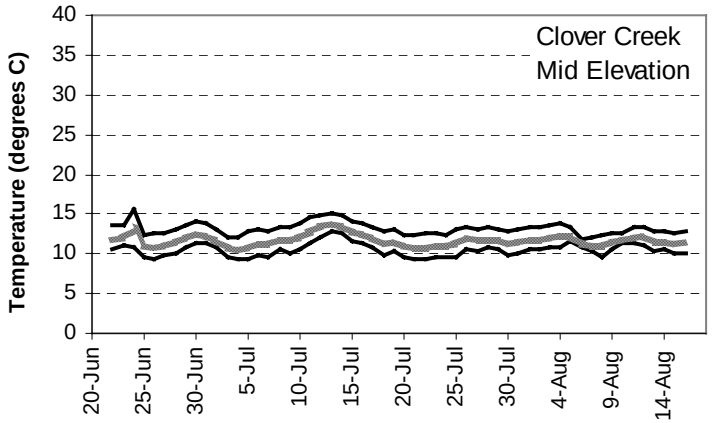
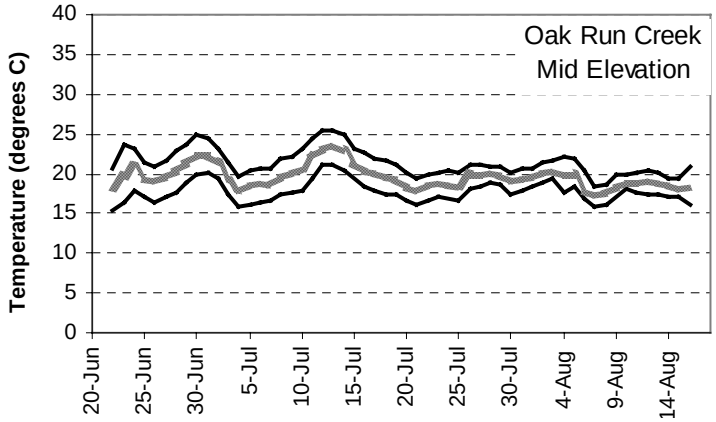
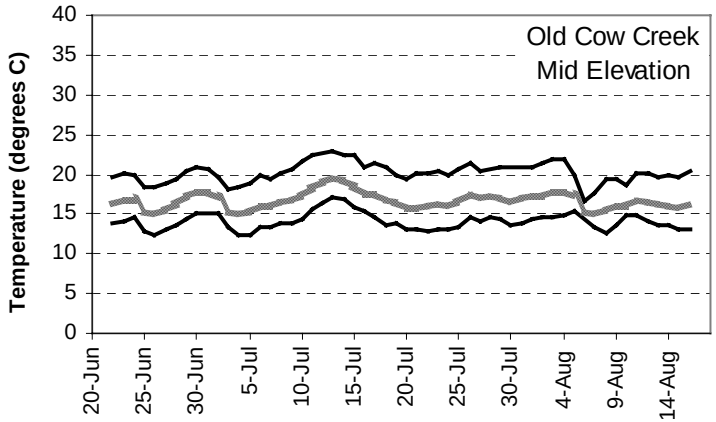


Figure 4a. Daily range (maximum/minimum) and average water temperatures in 1999 for the Cow Creek tributaries at low elevation (elev. < 1000 feet).









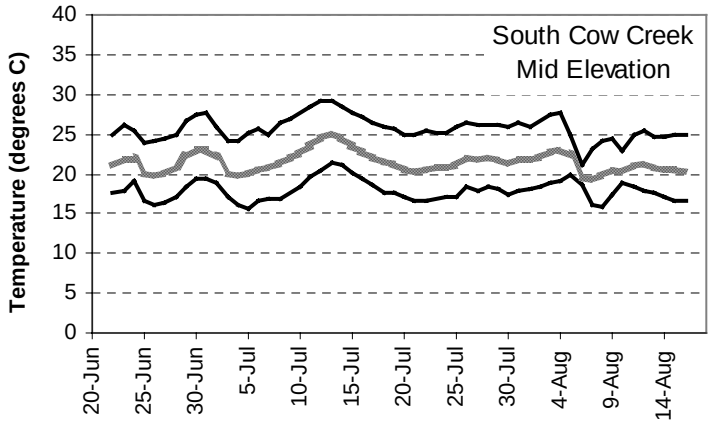


Figure 4b. Daily range (maximum/minimum) and average water temperatures in 1999 for Cow Creek tributaries at mid elevations (elev. > 1000 feet).

Within each tributary average and maximum temperatures recorded in mid elevation reaches were notably lower than downstream reaches (Figure 4b, see also Table 5). Downstream water temperature increases are a natural occurence and are expected in stream systems (Allen 1995), however the increase in temperatures can be exacerbated by a number of human induced factors. Degradation of riparian vegetation (i.e, reduced channel shading) and water diversion (i.e., decreased water volume) are specific factors that may apply to Cow Creek tributaries.

Table 5. Differences in average and maximum daily summer temperatures from mid-elevation to low-elevation reaches in Cow Creek tributaries.

		Mid-Elev.	Low-Elev.	Difference
Little Cow Creek	Avg.	20.5 °C	25.5 °C	+5.0 °C
	Max	24.6 °C	29.9 °C	+5.3 °C
Oak Run Creek	Avg.	17.2 °C	26.2 °C	+9.0 °C
	Max	20.8 °C	32.1 °C	+11.3 °C
Clover Creek	Avg.	12.5 °C	24.8 °C	+12.3 °C
	Max	14.2 °C	28.0 °C	+13.8 °C
Old Cow Creek	Avg.	17.2 °C	23.6 °C	+5.4 °C*
	Max	20.8 °C	26.3 °C	+5.5 °C*
So. Cow Creek	Avg.	21.7 °C	--	+1.9 °C*
	Max	25.9 °C	--	+0.4 °C*

*indicates a comparison between Old Cow Cr. and So. Cow Cr. to their downstream confluence site.

Dissolved Oxygen

As mentioned above an increase in water temperature and associated increases in metabolic demand can reduce dissolved oxygen levels significantly. This effect is especially apparent when dissolved nutrients are supporting the growth of algae and microbes. The oxygen content in stream water comes from two primary sources: 1) oxygen gas dissolving into the water at the surface and during turbulent flows (e.g., riffles); and 2) oxygen production during photosynthesis by algae and macrophytes. The CVRWQCB guidelines state "…the monthly median of the mean daily dissolved oxygen (DO) concentration shall not fall below 85% of saturation…" EPA's water quality criteria states that DO concentrations should be at a minimum of 8.0 mg/L to protect early life stages of cold water aquatic life (i.e., anadromous fish). Existing data on DO levels in the Main Stem of Cow Creek were consistently at or near saturation (Figure 5). It should be noted that all samples were collected during the day, when stream DO concentrations peak. In the absence of light, aquatic algae respire and consume oxygen. Thus the lowest DO concentrations typically occur just before dawn.

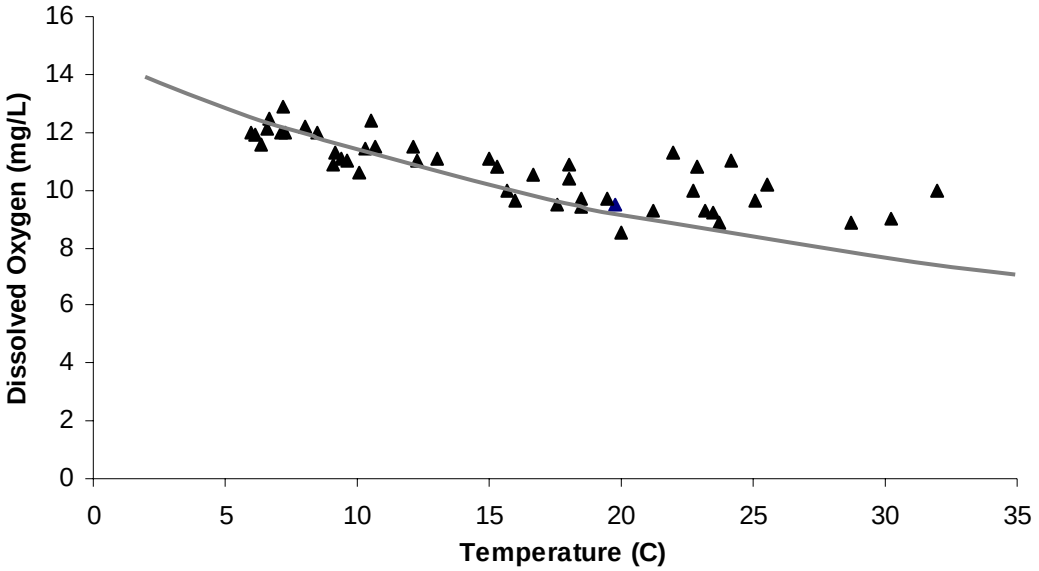


Figure 5. Relationship of dissolved oxygen and temperature measured from point samples on the Main Stem of Cow Creek, near Palo Cedro from 1992-2000. The line represents an approximate 100% oxygen saturation curve (after Wetzel 1983).

Data points at the extreme high end of the scale in Figure 5 may be the result of oxygen "super saturation" by stream turbulence or high daytime photosynthetic productivity. The latter can potentially cause diel oxygen "crashes" and subsequent fish mortality (Allen 1995).

Although chinook salmon adults and juveniles have access to the reaches that are under 1000 feet in elevation, much of this area has an unsuitable temperature range during the warm summer months of May - October (see Appendix A-1). In fact, salmon adults were observed migrating into the Main Stem of Cow Creek just after the first rainfall events in October. These rainfall events coincided with a sudden decrease in stream temperatures at all sites (field temperature measurements were less than 20°C following Oct. 1st). Reaches above 1000 feet, although observed to have significantly lower temperatures throughout the summer, are effectively blocked to most salmon adults and juveniles by the sharp gradient change caused by geologic features.

Turbidity

Turbidity is a measure of the suspended solids and visible particulates that give water a cloudy appearance. A turbidimeter directs a beam of light at a water sample and measures the amount of light scattered by suspended particles. This measurement is reported as Nephelometric Turbidity Units (NTUs). The main problem with turbidity analysis is that because samples can only be collected periodically (i.e., not on a continuous basis) so pulse events that are associated with intense storms, bank failure, channel changes or surface runoff are often missed. Thus, existing data can only be reported as a range.

1999 - 2000 Turbidity Measurements

Water samples from each site were measured for field turbidity during the low flow summer (1999) and several winter and spring (2000) storm flow events. Cow Creek and its tributaries generally fell within 3 categories during this study: 1) summer low flow turbidity was consistently less than 1 NTU; 2) after minor rain events turbidity ranged from 1 - 5 NTU; and 3) during spring storm events turbidity ranged from 5 - 20 NTU (Figure 6). No obvious differences were observed among the tributary streams in this study.

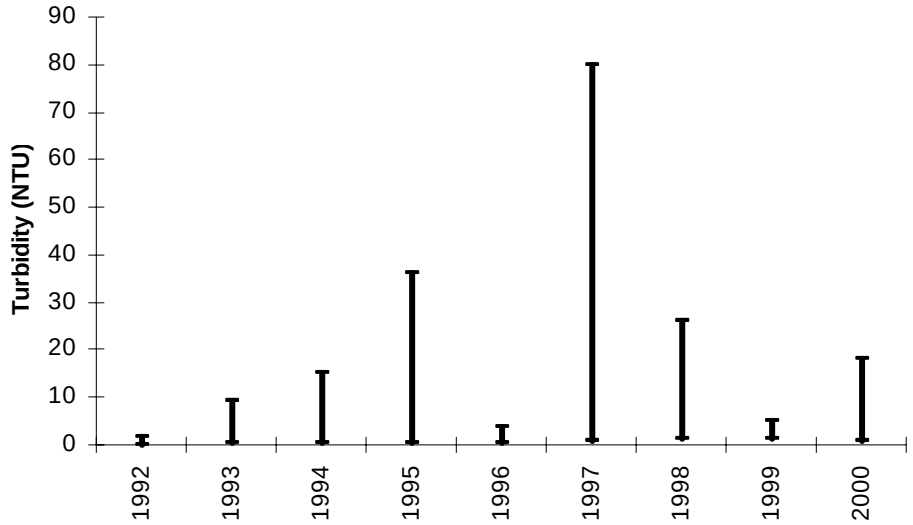


Figure 6. Range of turbidity measurements (Nephelometric Turbidity Units) collected from the Main Stem of Cow Creek, near Palo Cedro. Source: DWR and field data.

Fecal Coliform

Coliform bacteria are a natural element of aquatic food chains. Along with aquatic fungi they constitute the micro-decomposers of aquatic systems (Allen 1995). Fecal coliform (i.e., *E. coli*) in surface and ground water are derived directly from solid wastes of mammals. Although fecal coliform are not considered to be pathogenic, their presence is generally accepted as an indicator of animal waste contamination that may harbor other harmful pathogens. Because of the potential health risks that are associated with animal feces contact, the RWQCB has clearly defined guidelines for fecal coliform levels in drinking water and recreational contact water (RWQCB 1998).

Measurement of coliform and fecal coliform is an estimate of the number of coliform cells in a 100ml water sample. This value is reported as the Most Probable Number (MPN) derived from the coliform testing procedure selected. The threshold for fecal coliform health risk in public drinking water is ≥1 MPN. The recreational contact use (e.g., swimming, fishing etc.) threshold is established as an average of ≥200 MPN calculated from 3 samples collected over a 30 day period; additionally, any one sample that contains 400 MPN or greater is not recommended for recreational contact use (RWQCB 1998).

Fecal Coliform Methods

The Colilert®-18 test from IDEXX Laboratories, Inc. is a simultaneous detector of total coliform and fecal coliform (*E. coli*) for marine and fresh waters. The measurement procedure allows for the calculation of 0 - 2419.2 MPN without dilution with sterile water. Samples are collected in sterile 100ml sample bottles in the field. In the laboratory an incubation reagent is added to each bottle and the sample is heat-sealed into an incubation-well pack (Quanti-Tray/2000®). The samples are then incubated at 35°C for 18 hours. The presence of total coliform is identified by the formation of a yellow metabolic product. Fecal coliform (*E. coli*) presence is identified by a fluorescent metabolic product, observed by illuminating with ultraviolet light.

The precision of this method was tested by collecting replicate samples at a single site (Main Stem of Cow Creek) and from a drinking water source (city of Redding tap water) as a control. All samples were processed simultaneously. The coefficient of variation (CV = standard deviation/mean) of the field samples was between 8 - 10% for representative low (25.4 MPN for fecal coliform) and high (1556.5 MPN for total coliform) measurements, respectively. All the drinking water control samples showed 0 MPN, indicating that false positives were not likely derived from the lab handling procedures.

Water samples for fecal coliform analysis were collected from June 25, 1999 through October 19, 1999. Water was collected in the mid-channel region by immersing the sterile sample bottle completely underwater, opening the container to flood the bottle and then resealing the sample under water. This was done to prevent surface water (which has been observed to contain higher coliform levels; R. Heinrichs personal communication) from entering the sample bottle. Sample bottles were placed on ice and incubated the same day they were collected.

Among the 9 sites sampled throughout this study, 3 sites had consistently high fecal coliform concentrations (Figure 7). Clover Creek in the low elevation reach, and South Cow Creek and Oak Run Creek in the middle elevation reaches had fecal coliform concentrations that exceeded recommended recreational contact standards. The other 6 sites were consistently low in fecal coliform concentration, well within the recreational contact standards.

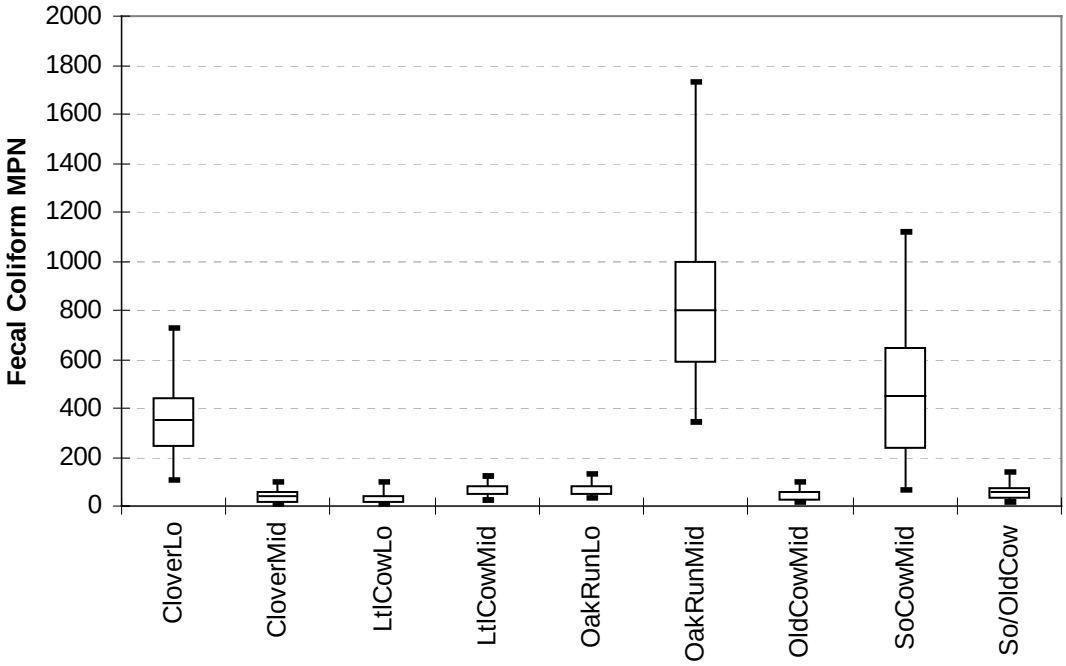


Figure 7. Fecal coliform concentrations from the Cow Creek tributaries. Boxes represent average (midline) and standard error (±1 SE). Bars represent the range (maximum and minimum) of measured values from a total of 6 samples collected from 6/25/99 to 10/19/99. 200 MPN and 400 MPN are the recreational use standards - see text for explanation. "Lo" and "Mid" refers to lower and middle elevation reaches.

The actual source of fecal coliform in Cow Creek is unknown. Possible sources include wildlife defecating near streams, livestock waste entering the streams, or human septic systems or sewage lines leeching into the streams. We can assume that the study sites with low coliform levels (less than 50 MPN in most cases) represent at least the wildlife input. Acknowledging that this represents a background level of fecal coliform, the high fecal coliform levels measured in this study probably originated from livestock or human sources.

Water Chemistry and Mine Drainage

Historical hard rock mining for metals is limited to Little Cow Creek, namely the Afterthought Mine near Ingot. The Afterthought Mine is the easternmost exposure of the "Shasta Crescent", a band of metal ore deposits that fed the Shasta County gold rush in the 1850s. The Afterthough Mine produced approximately 166,500 tons of ore from 1862 to 1952 (Albers and Robertson, 1961). The mine was worked primarily for copper, zinc, silver, and gold. An on-site smelter operated from 1901 to 1908; after which the ore was transported by cable car to a smelter near Keswick (powered by the Kilarc Power Plant on Old Cow Creek).

A summary of water quality assessments on the Afterthought Mine tailings and portal outflow (Gaggini and Croyle, 1994 and references cited therein) identified high levels of mercury, total zinc, lead, arsenic, and iron concentrations. Acid mine drainage is also a concern where readings as low as pH 2.6 have been taken from a creek that drains the tailings into Little Cow Creek. Water quality measurements downstream of the Afterthought Mine show that the mine drainage water is significantly diluted by Little Cow Creek. Dissolved iron concentrations ranged from 0.05mg/L downstream of the mine to 1.75mg/L at the mine portal. Acid mine drainage effects were also diluted by Little Cow Creek as reported acidity readings fall within a range of pH 6.2 to 8.1 downstream of the mine.

Acid waters were not identified as a water quality concern based on the results of this study (Figure 8). Measurements taken immediately downstream of the Afterthough Mine (pH 8.6) did not differ appreciably from pH measurements taken upstream of the mine at the Little Cow Creek middle elevation site. The lower elevation Little Cow Creek reach had a slightly lower pH range (i.e., more acidic) than the upstream sites, however this cannot be attributed to the mine drainage exclusively.

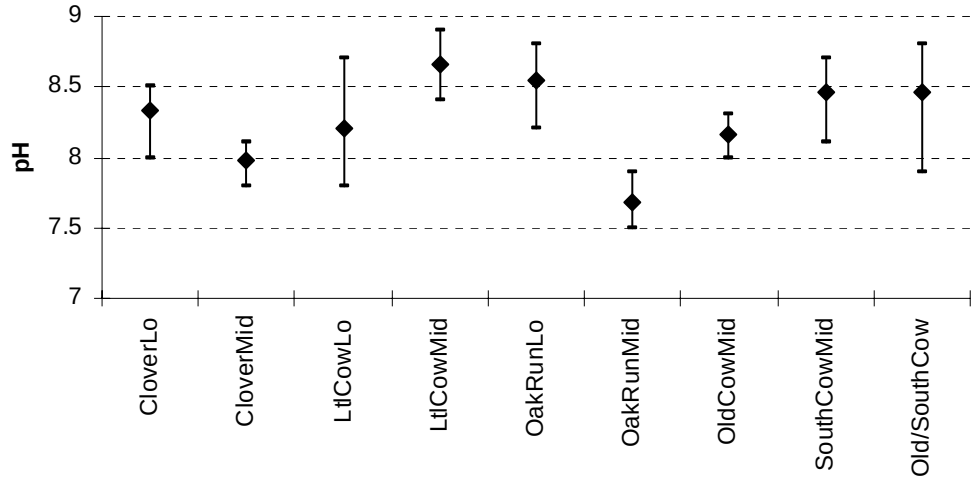


Figure 8. Range (maximum and minimum, bars) and average (diamonds) field pH measurements from the Cow Creek tributaries. Measurements were taken from 6/25/99 to 10/19/99.

Specific conductivity (i.e., an estimate of dissolved ions in water) measurements were within a natural background range (Figure 9). It is interesting to note the increase in conductivity from upstream to downstream sites. This increase in dissolved solids can most easily be explained by the underlying litholoy that changes from volcanic rock in mid elevation reaches to ancient marine (saline) deposits in the lower elevations.

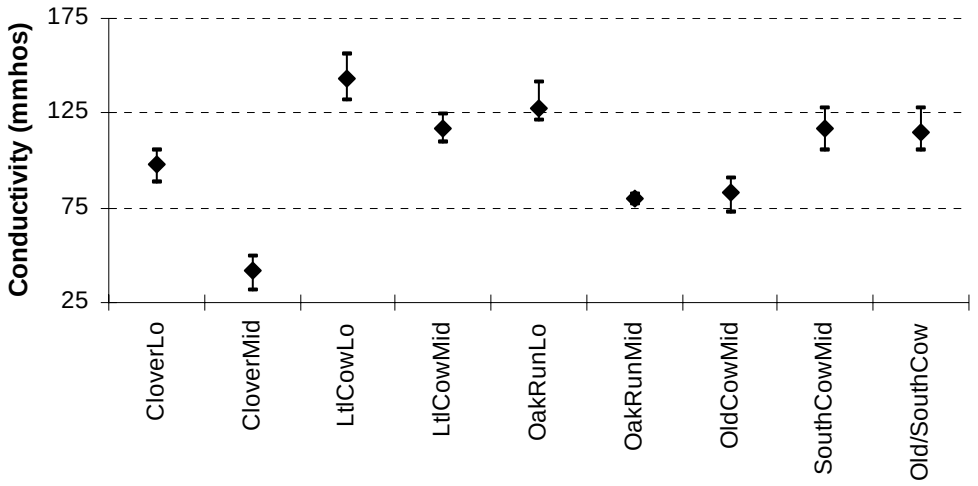


Figure 9. Range (maximum and minimum, bars) and average (diamonds) field conductivity measurements from the Cow Creek tributaries. Measurements were taken from 6/25/99 to 10/19/99.

SUMMARY AND RECOMMENDATIONS

The Cow Creek Basin currently supports extensive timber production, livestock production, recreational uses and wildlife habitat. The potential problems identified in this report need to be investigated further to identify specific solutions that support all beneficial uses.

Temperature

High summer temperatures are likely limiting chinook salmon juvenile rearing habitat. Although barriers to downstream juvenile migration were not specifically identified in this study, a survey of all lower elevation diversions needs to be documented to identify those that are accessible to migrating juveniles. A survey of this kind would benefit greatly from landowner cooperation through the developing Cow Creek group, and technical support for screen design by CDFG and USFW.

An estimate of lost riparian vegetation that may have functioned to buffer nutrients and sediment, shade the channel and provide instream cover in the lower elevation reaches needs to be completed to evaluate the potential benefits of riparian restoration.

Fecal Coliform

Tests that determine the source of fecal coliform bacteria (e.g., human vs. cattle *E. coli* strains) in surface water can be done to identify possible pollution reduction actions in Oak Run Creek, Clover Creek and South Cow Creek. Additionally, detailed surveys at these 3 reaches can identify specific sources. In the meantime, tests of biochemical oxygen demand (BOD) and diel field oxygen concentrations should be done to determine if this pollution is detrimental to aquatic life. Benthic macroinvertebrate communities, which are widely used as indicators of organic pollution stress in aquatic systems (Resh et. al. 1995), can be utilized in a field bioassay to evaluate the real effects of long term water quality problems.

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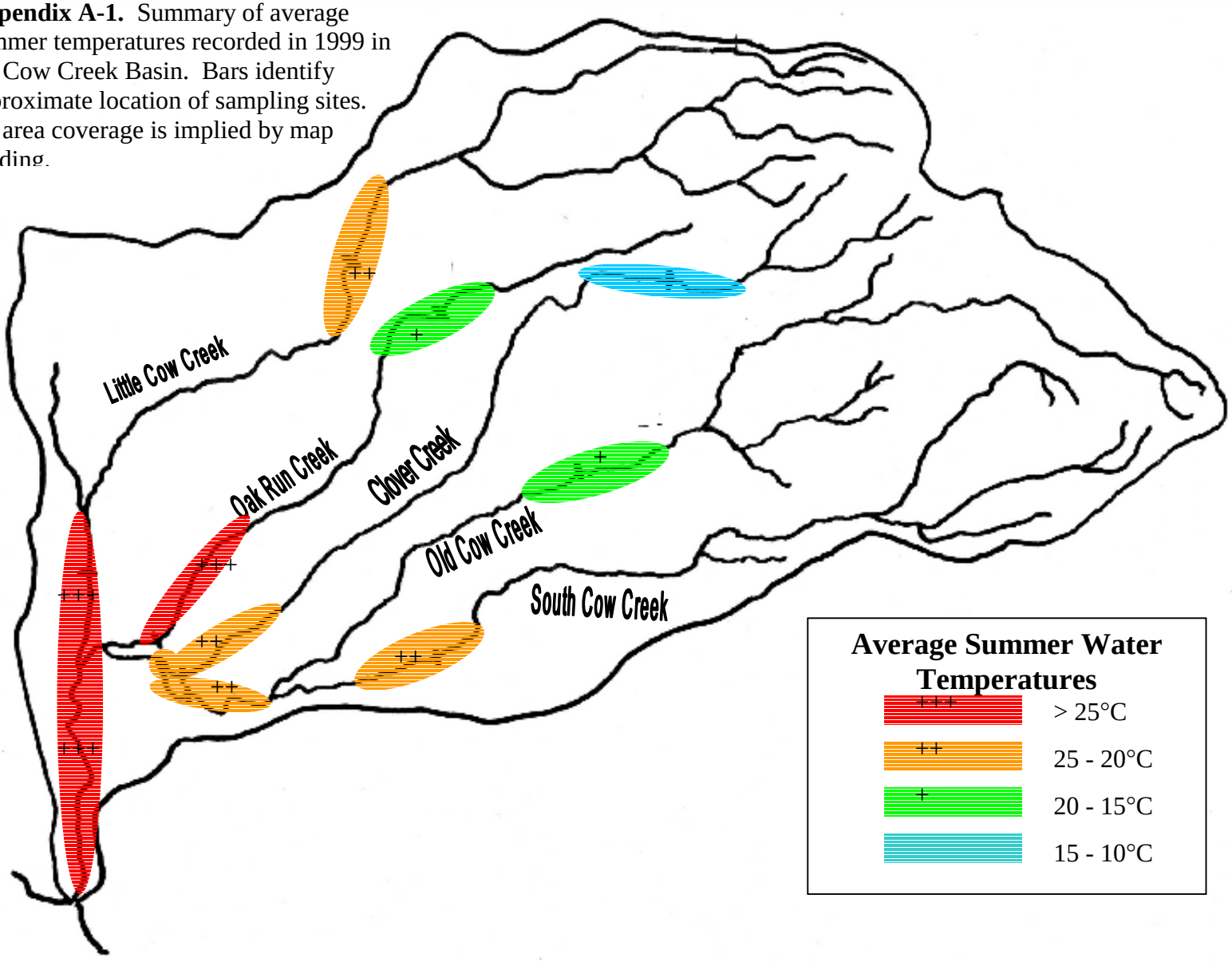
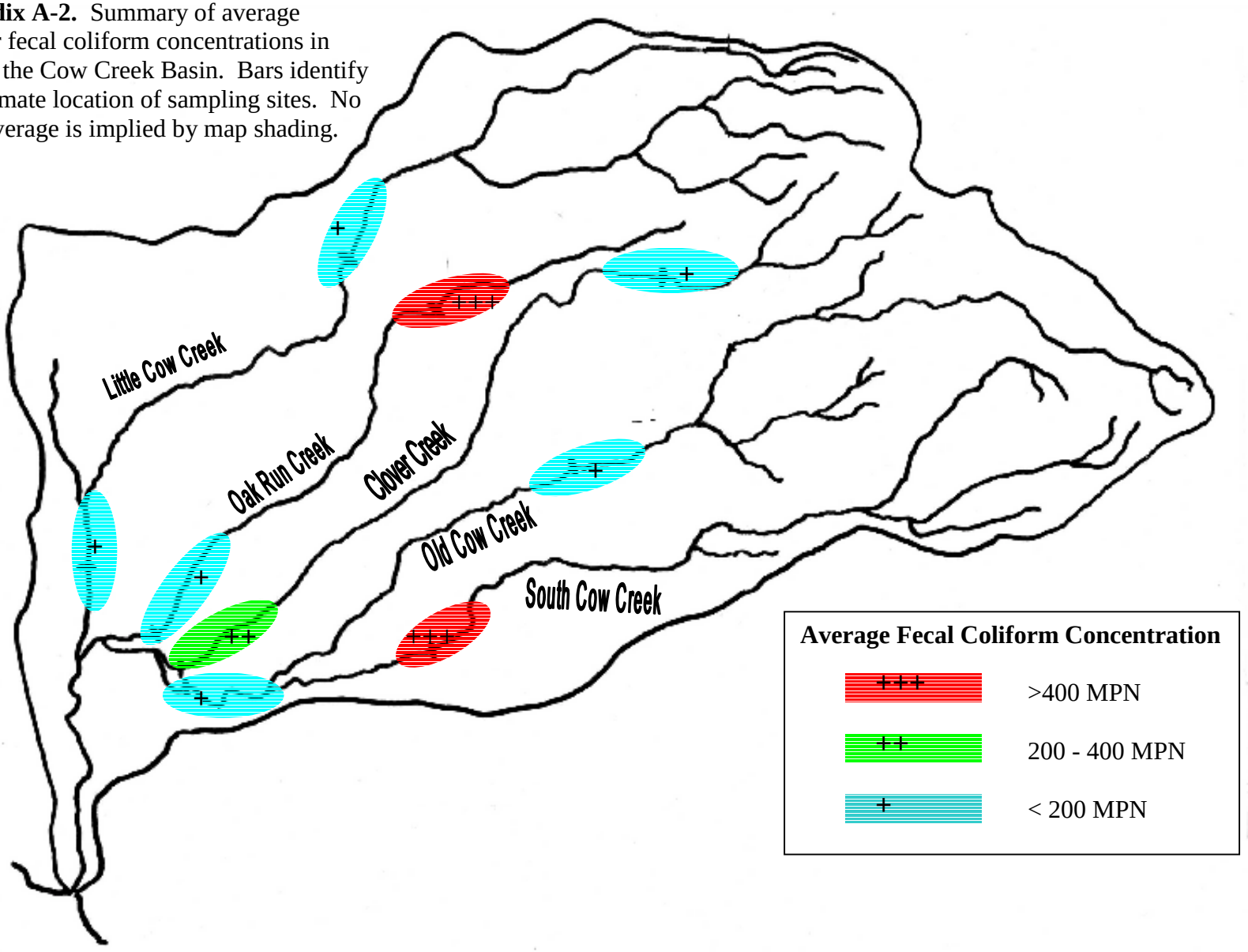
APPENDIX A
BASIN MAP SUMMARY OF DATA

Appendix A-1. Summary of average summer temperatures recorded in 1999 in the Cow Creek Basin. Bars identify approximate location of sampling sites. No area coverage is implied by map shading.



Appendix A-2. Summary of average summer fecal coliform concentrations in 1999 in the Cow Creek Basin. Bars identify approximate location of sampling sites. No area coverage is implied by map shading.



APPENDIX B
RECORD OF STAKEHOLDER MEETINGS

"COW CREEK WATERSHED"
PUBLIC MEETING NOTICE

MEETING: January 26, 1999
TIME: 7:00 P.M. - 9:00 P.M.
LOCATION: ----------

NOTE: This meeting will be repeated on February 25, 1999.

The Institute for Sustainable Communities is hosting a "Cow Creek Watershed Information Gathering Session". The purpose of this meeting is to identify resource concerns relating to the Cow Creek Watershed.

The Institute received a grant from the U.S. Fish & Wildlife Service to initiate a process of collaboration among landowners, resource agencies and educational institutions including; The Western Resource Conservation District, U.S. Fish & Wildlife Service, The California Department of Fish & Game, The Regional Water Quality Control Board and Shasta College - Center for Science Industry and Natural Resources.

The major objectives of this grant are to gather information regarding resource concerns relating to the watershed, identify landowner cooperators, initiate a data collection survey related to water quantity and quality and to assess the level of community acceptance for future projects. The predicted biological benefits of this project are to make some informed decisions based on existing conditions and future potential restoration activities of the streams.

Cow Creek Watershed landowners and others are encouraged to attend. Your input is important.

Institute for Sustainable Communities

☆ COW CREEK WATERSHED ☆

" Information Gathering Session"
January 26, 1999

~ A G E N D A ~

1. Introductions:

Francis Duchi, ISC Executive Director

2. Institute for Sustainable Communities:
Who are We?

3. Grant Overview:

4. Brief Agency Presentations:

- Jeff Souza ~ Western Shasta Resource Conservation District
- Tricia Parker ~ U.S. Fish & Wildlife Service
- Harry Rectenwald ~ Department of Fish & Game
- Carole Crowe ~ Regional Water Quality Control Board

5. Resource Identification:

Issues & Concerns ~

INSTITUTE FOR SUSTAINABLE COMMUNITIES

COW CREEK WATERSHED

Public Meeting Minutes
January 26, 1999

The Institute for Sustainable Communities held a APublic Information Gathering Session@ at the Junction School Gym in Palo Cedro on January 26, 1999 from 7:00 pm to approximately 9:30 pm. The purpose of the meeting was to identify issues and concerns about the Cow Creek Watershed. Landowners and others were encouraged to attend.

There were approximately 85+ landowners and others who attended.

Francis Duchi, Executive Director for *the Institute for Sustainable Communities* (ISC) started the meeting by giving a brief overview of ISC & its goals and purposes. He defined the $15,000 Grant & it objectives and explained how Shasta College students would be involved.

Jeff Souza, Project Manager for Western Shasta Resource Conservation District (WSRCD) gave an introduction about WSRCD and talked about Clear Creek & Battle Creek projects and explained how the Alocals@ (Cow Creek Watershed Landowners) could get involved & decide how things should be done in their local watersheds. He addressed the Clean Water Act, (205j) Grant & how there was an application for funds. The proposal was not approved. ISC submitted a proposal to US FWS with hopes to help jump-start the data collection process in Cow Creek and gather information that will contribute to the data needs of the assessment plan until the Clean Water Act Grant can be resubmitted.

Tricia Parker from U.S. Fish & Wildlife Service (US FWS) discussed her role as being part of US FWS & how she has worked with watershed groups for approximately 10 years. She also discussed the Anadromous Fish Restoration Act and how the groups can get started.

Harry Rectenwald from U.S. Fish & Game (USFG) discussed salmon & steel head and fish barriers. He showed pictures and handed out graphs indicating the salmon population in Cow Creek. He also addressed Water Rights and how important they are.

Carol Crowe, Central Valley Regional Water Quality Control Board (CVRWQCB) gave the background on WQCB and addressed the importance of water quality. She also addressed Point Source pollution, sediment, and stream temperatures.

The meeting was opened to participants for input regarding issues and concerns of the watershed and the data collection project.

INSTITUTE FOR SUSTAINABLE COMMUNITIES

SUMMARY OF QUESTIONS FROM PALO CEDRO WATERSHED MEETING JANUARY 26, 1999

1) Questions regarding the data collection.

Need more information on the study design and statistical validity.
Why is Cow Creek so important?
What is being collected and why?
What are the time limitations related to access?
What agencies will be on landowners' property?
Is this baseline data that's being collected?
Has baseline data been collected?
Will it affect water rights?
What about liability on someone's property?
Is there a sunset clause?
Will this lead to more studies?
Will this be used in litigation?
There is a general concern about how the data is applied or misused, (i.e. affecting drainage from livestock, stream fencing, loss of land, and who pays?) and concerns about gaps in the project if there are gaps in the data.

What about wildlife and a written guarantee that we won't be regulated.

2) Questions about WSRCD, USFWS, and ISC.

Have we talked to other agencies such as the USGS?
Need more information about the WSRCD, and the ISC.
Does the USFWS already know what they want to do?
Why were government agencies only involved in putting the meeting together?
What does USDA have to do with this?

3) Questions about Water Rights?

Will this affect future water rights?
Doesn't Bella Vista Water District have water rights information?

4) Questions about funding?
Is the funding to fix problems or the landowners problems?

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PO Box 992807 ☿ Redding ☿ CA ☿ 96099-2807 ☿ Phone: (530) 226-6238 ☿ Fax: (530) 226-6230 ☿
fduchi@shastain.org

5) Questions relating to landowner issues?
What are the negative impacts to landowners in Cow Creek or in other watersheds?
Fencing of cattle from streams?
Checking drainage from livestock operations?
What's the cost to landowner to help fish and water quality?
Possible loss of land, equity, restriction in land uses, who pays?
Will there be future restrictions to logging and livestock?
Landowners have a lot of information related to the overall watershed health, water quantity, and water quality. What are the implications of the Endangered Species Act?
There are no anadramous fish in my area! Landowners have been here a long time and there was plenty of water and fish.

6) Other comments and concerns.

There is a loss of land due to erosion and a need to prevent deterioration in water quality and wildlife habitat.
There are increasing conflicts between older and newer residents.
There is a need to control brush in the watershed as it relates to losing bridges.
There is a need for road improvements/paving.
Will this create another government agency and increase our taxes?
Would like information on the track record in other watersheds.
Cow Creek. is in the best shape this year, flows are at peak due to Fountain Fire.
Why are fish being killed at Coleman Fish Hatchery?
Bass and perch are eating salmon and trout.
What permission does BLM give for access?
Leaves in creek cause discoloration.
Not everyone on the creek is paranoid of the government.

☆ **Please attend** ☆

THE FIRST

COW CREEK WATERSHED

INFORMATION GATHERING SESSION

Thursday, February 25, 1999
7:00 - 9:00 p.m.

Held at:
Whitmore Elementary School
in the Gym

☞ WE WANT TO HEAR FROM YOU! ☜

✓Help us gather information about resource concerns and issues relating to Cow Creek Watershed.

✓Information will be presented about Cow Creek and its fisheries.

✓Agency representatives will be available to answer your questions.

✓Cow Creek Watershed Landowners & Others encouraged to attend.

☎ For more information please contact:
INSTITUTE FOR SUSTAINABLE COMMUNITIES
@ 226-6238 or
email: fduchi@shastain.org

INSTITUTE FOR SUSTAINABLE COMMUNITIES

COW CREEK WATERSHED

Public Meeting Minutes
February 25, 1999

The second "Public Information Gathering Session" was held at the Whitmore Elementary School on February 25, 1999 at 7:00 p.m. Approximately 25 residents, landowners and interested participants attended.

Francis Duchi, Executive Director of the Institute of Sustainable Communities welcomed everyone, gave a brief overview of the Institute and its goal of identifying willing landowner participants to assist with the US Fish and Wildlife Service funded Data Collection Grant.

Agencies including the U.S. Fish and Wildlife Service, California Dept of Fish and Game, and the Regional Water Quality Control Board, working with the Western Resource Conservation District and Shasta Community College are interested in collecting additional data in the five main tributaries and main stem of Cow Creek. Data includes water temperature, sedimentation, water quantity, and fecal coliform.

A second goal of the meeting was to acquire information and concerns from landowners regarding the future formation of local watershed groups.

Harry Rectenwald, Fisheries Biologist explained the interest that California Fish and Game had regarding Cow Creek's salmon and steelhead numbers, the need for additional data collection, and the need for the development of cost-effective methods to improve spawning habitat. Mr. Rectenwald stressed the agency's efforts were to work collaboratively with landowners.

Carol Crowe representing the Central Valley Regional Water Quality Control Board explained her role in the project as wanting additional water quality samples in order to monitor fecal coliform and other water quality issues. Since the Board is responsible for assuring that water quality is adequate for the protection of all beneficial uses, past studies and reports from water users have raised some water quality concerns with regard to accelerated erosion and sediment discharge, elevated temperatures and fecal coliform.

Jeff Souza discussed the role of the Western Resource Conservation District, its work with watershed groups and funding available to support watershed restoration.

continued.

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Discussion with landowners raised the following questions:

- How can data collected be compared if there is no previous data?
- The creeks have completely dried up in past years.
- We are concerned about government regulation of water rights and uses.
- Use good science in the data collection study.
- How long has it been since steelhead have disappeared? What is the cause?
- What kind of projects would be involved?
- How will turbidity be determined since it is variable? Dependent on drought and floods.
- It is very complicated and expensive to show trends.
- Who defines the problem?
- What are solutions to temperature and bacteria problems other than restricting land use?
- All surface water, including springs, have coliform.
- What role does CVPIA and AFRP play in this?
- What guarantees are there that the landowner won't be held liable if fish are restored and listed?
- The program being presented is too narrow.
- If CalFed gives us dollars they may expect to take our water later.
- Need a better defined study plan.
- The Clean Water Act has the ability to shut down all ranching.
- How can we get better agency people?
- We have been lied to by government in the past.

Hank Pritchard, a representative of the Battle Creek Watershed, addressed the group as one who had similar concerns approximately two years ago. After getting involved he has lessened his fears of water loss and feels like progress has been made on Battle Creek. He has not lost any water or land. He encouragement the landowners to get involved.

Steve Fitch, Representative for Assemblymen Dickerson, and Glenn Hawes, Shasta County Supervisor and watershed landowner, also offered words of encouragement.

The meeting was adjourned at 9 p.m.

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COW CREEK WATERSHED INFORMATION

1. COW CREEK ISSUES AND CONCERNS:

The 425 square mile Cow Creek watershed is comprised of five major tributaries, North Cow, Oak Run, Clover, Old Cow, and South Cow creeks. Principal uses include water for ranch and other agricultural operations, habitat for fish and other aquatic life, and water for recreational uses, (swimming, rafting, wildlife viewing, etc.). Established land use activities are; Timber harvest, livestock grazing, hydro power production, and rural residential development in the lower watershed. The vision shared by most Cow Creek Watershed landowners and resource users would be to protect and preserve the agricultural/rural lifestyle, enhance fish and wildlife populations, and protect water quality for all beneficial uses.

The California Dept of Fish and Game and the U.S. Fish and Wildlife Service are looking for opportunities to increase salmon and steelhead populations throughout the Sacramento River and tributary streams. The agencies estimate that Cow Creek has the potential for 5,000 to 10,000 fall-run salmon and an undetermined number of steelhead. Though accurate counts are not available,(see attached) it is believed that current populations are below potential levels.

Habitat surveys conducted early this decade (1992), identified a number of permanent, (approximately 14) and temporary diversions in the reaches of Cow Creek that are accessible to salmon and steelhead. The diversions lacked fish screens giving rise to concerns of young fish being taken out of the stream along with the irrigation water. The diversion season normally extends April through October when there are still some young fish in the watershed. In addition, some of the irrigation diversion structures may be potential barriers to adult fish migrating upstream to spawn. Some reaches of the stream have banks that appear to have abnormal amounts of erosion and/or minimal vegetation coverage along the stream. Sediment arising from eroding banks could interfere with successful spawning of fish that lay their eggs in the stream gravel. Reduced shading of the stream where vegetation is abnormally sparse can increase the heat gain of the water as it travels downstream.

The California Regional Water Quality Control Board is responsible for assuring that water quality is adequate for the protection of all beneficial uses (i.e. water supplies, aquatic life, and recreational uses). Past studies and reports from water users have raised some water quality concerns with regard to accelerated erosion and sediment discharge, elevated water temperatures and fecal coliform bacteria concentrations.

The potential resource issues and concerns for Cow Creek are summarized as follows:

- Current Salmon and Steelhead populations which are below potential levels
- Accelerated erosion that causes property loss and impacts aquatic habitat
- Water quality levels that may not fully protect all beneficial uses
- Riparian and aquatic habitat conditions which may be below optimal levels

Other watershed issues could include fire management, illegal trespass, poaching, and the desire to maintain local control of watershed management.

2. EXISTING DATA BASE:

The existing information on Cow Creek watershed conditions is derived from the following studies and reports:

- 1992 DFG Cow Creek Stream Survey Report
- Habitat Restoration Actions to Double Natural Production of Anadromous Fish in the Central Valley of California - A working plan on Restoration Needs, Volume 3
- California Dept of Water Resources, Water Quality Monitoring data on Cow Creek Near Palo Cedro
- RWQCB Cow Creek Water Quality Survey, Summer 1996

The data search is still underway.

3. THE EXISTING GRANT AND PROPOSED MONITORING PROGRAM:

The Institute of Sustainable Communities, ISC, (a public non profit whose mission is to promote the development of Healthy Sustainable Communities through education, research, and public service), has received a $15,000 grant from the US Fish and Wildlife Service to summarize existing data and initiate additional data collection and monitoring on the lower reaches of each tributary and main branch of Cow Creek. Shasta College would like to link environmental education and water resource techniques training to real world situations. Money provided to Shasta College for a portion of this monitoring will pay for equipment, vehicle mileage, and hourly stipends for students interested in water resources issues in order to gain practical hands-on experience. The two main goals of the study are to:

- Compile and summarize past data on the Cow Creek Drainage in order to assess historical conditions.
- To supplement the current Department of Water Resources data from the Palo Cedro main branch station (see attached) with data from the lower reaches of each tributary. Data emphasis will initially be on turbidity, water temperatures, water quantity, and water quality. (Coliform counts)

4. LANDOWNER CONCERNS:

A great deal of concern regarding potential government regulation was evident at the Palo Cedro meeting on 1/26/99. Several of the questions related to the new data collection and monitoring effort. In response to those concerns, several conditions have been established for the proposed water quality survey:

1. **No regulatory agency personnel will collect the data.** The data will be collected by Shasta College students and staff.
2. **Data will not be collected in a regulatory fashion.** Certain procedures must be followed in order for data to be used for regulatory purposes. These procedures will not be followed for this survey.
3. **Landowners will have an opportunity to review the data prior to release.**

Appropriate hold harmless/permission forms will be developed and signed prior to any data collection.
In general, concern over regulated changes in land use from endangered species and water use issues is increasing. Many of the resource agencies have indicated that they would prefer to work with the local landowners to solve resource concerns through **voluntary** actions as opposed to **regulatory** measures. The local landowners know the land and its history better than anyone. For this reason it is critical that the landowners are involved in any efforts to restore, enhance, and manage the watershed.

There are many programs that are currently available for willing landowners to help fund projects to solve resource problems. It is premature to talk about what possible solutions might be used to restore salmon and steelhead populations. The water quality data collection and monitoring survey would be a first step to gather information about the watershed in order to arrive at some possible solutions that could be implemented on a **voluntary** basis. **High priority solutions would be those that benefit both the landowner and the resource while at the same time emphasizing those solutions that have little or no negative impacts to the landowner.**

5. WATERSHED PROGRAMS OBJECTIVES:

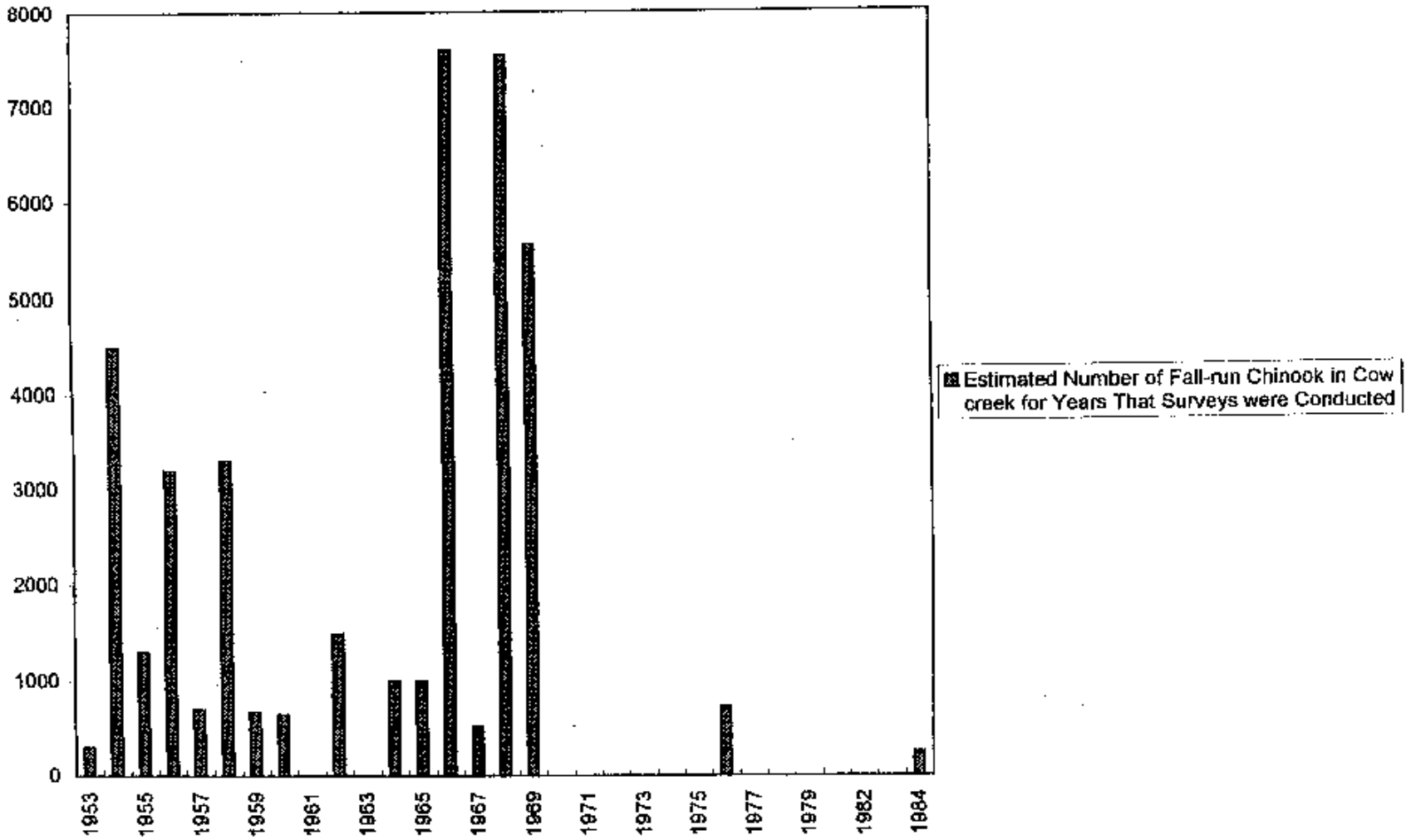
The short-term objectives of the ISC and resource agencies is to collect information to better understand and define the issues discussed in No. 1 above. In addition, throughout the Sacramento River basin, watershed management groups have formed to address local issues, (see attached map) Typically these local watershed programs are supported by public and private grants to assess watershed conditions, conduct education, implement projects and monitor long-term watershed trends. ISC and the agencies would support this type of a program for Cow Creek, however it is imperative that the motivation and leadership come from the watershed residents. As a possible next step, representatives of nearby local watershed programs could be invited to discuss their program experiences and accomplishments.

Table 2. Seasonal occurrence of selected life stages of anadromous salmonids in the Upper Sacramento River, California, based on Schafter (1980) and Vogel and Marine (1991).

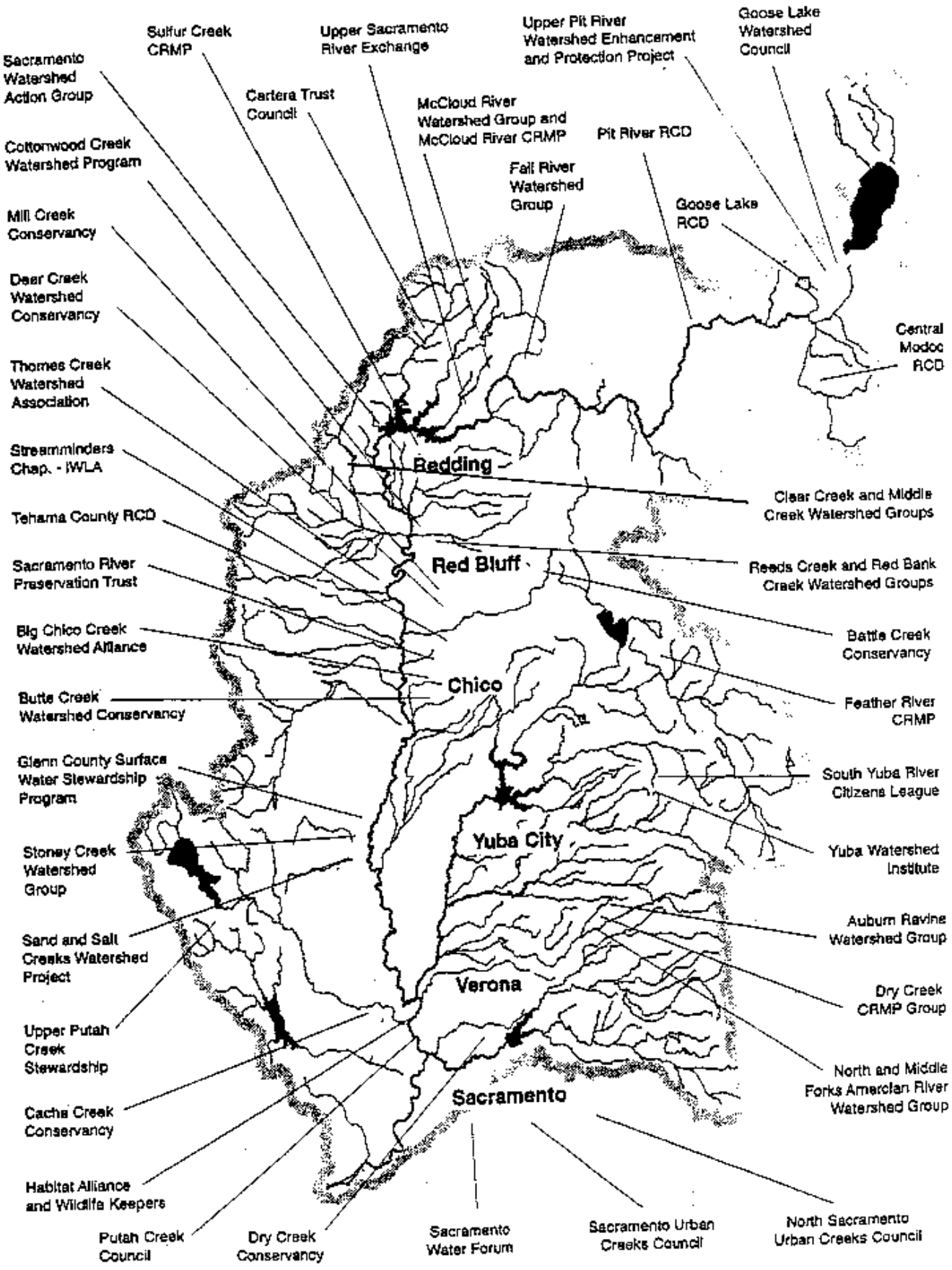
Life Stage	Species	Month											
		Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.
Adult Migration	Winter Chinook				X								
	Spring Chinook					X							
	Fall Chinook										X		
	Late-Fall Chinook	X											
	Steelhead												
Spawning	Winter Chinook						X						
	Spring Chinook									X			
	Fall Chinook											X	
	Late-Fall Chinook	X											
	Steelhead												
Juvenile Residence	Winter Chinook												
	Spring Chinook												
	Fall Chinook												
	Late-Fall Chinook												
	Steelhead												

X = Denotes approximate peak of life stage if a significant peak occurs.

Estimated Number of Fall-run Chinook in Cow creek for Years That Surveys were Conducted



Watershed Groups and Conservancies on the Sacramento River Watershed Program Distribution List



COW CREEK WATERSHED
~~ AGENDA ~~

TUESDAY, MAY 18, 1999 • 7:00 – 9:15 P.M.
MILLVILLE GRANGE HALL, PALO CEDRO, CA
22031 Old Highway 44 Drive

7:00 **INTRODUCTIONS:**
Francis Duchi, Executive Director of the Institute for Sustainable Communities will briefly review the purposes of the Cow Creek Watershed Data Collection and resident watershed interest project.

7:10 **CALIFORNIA COORDINATED RESOURCE MANAGEMENT AND PLANNING (CRMP):**
Bob Bailey, District Conservationist will present a 20-minute slide program on the following topic: The CRMP Watershed Process of Managing Areas with Multiple Use Ownership.

7:30 **PANEL PRESENTATION:**
7:30 **Diane Gaumer / Deer Creek Conservancy**
7:40 **Keri Burke / Mill Creek Conservancy**
7:50 **Irwin Fust, Shasta County Supervisor / Cow Creek**
8:00 **Al Carter / Landowner / Clear Creek**
The above Watershed Representatives will review the organizational structure of their respective watershed groups and discuss why and how their group formed.

8:10 **AB-730:**
Steve Fitch, Legislative Assistant to Assemblyman Dickerson
Will discuss the Proposed scope for the AB-730 bill.
The California Watershed Management and rehabilitation Act.

8:20 ***Opportunity to address your questions to the above Presenters…***

8:40 **DATA COLLECTION PROJECT:**
Morgan Hannaford with Shasta College and Phil Warner with California Department of Fish and Game will review the Data Collection portion of the project.

8:55 **CLEAN WATER ACT FUNDING:**
Jeff Souza, Projects Manager of the Western Shasta Resource Conservation District will review potential future funding, and discuss how the group may wish to proceed.

9:15 **Adjourn**

Attachments: Cow Creek Watershed Information and Data Collection Project 1999

INSTITUTE FOR SUSTAINABLE COMMUNITIES
PO Box 992807 • Redding • CA • 96099-2807 • Phone: (530) 226-6238 • Fax: (530) 226-6230 • fduchi@shastain.org

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COW CREEK WATERSHED

Public Meeting Minutes # 3

May 18, 1999

The third "Public Information-Gathering Session" was held at the Millville Grange Hall in Palo Cedro on March 18, 1999 at 7:00 p.m. Approximately 50 residents, landowners and interested participants attended.

Francis Duchi, Executive Director of the Institute of Sustainable Communities welcomed everyone, gave a brief overview of the Institute and its goal of identifying willing landowner participants to assist with the US Fish and Wildlife Service funded Data Collection Grant.

Francis introduced Bob Bailey of The Natural Resources Conservation Service, who gave a slide presentation on the California Coordinated Resource Management watershed process of managing areas with multiple use ownership. A copy of a handbook regarding the CRMP process was offered to those who might be interested.

Diane Gaumer with the Deer Creek Conservancy was introduced at 7:35 p.m. Diane gave a brief history regarding the formation of the Deer Creek Conservancy watershed group, which was started in 1994. Diane's presentation included a step-by-step description of all the issues involved in the planning and formation of the Conservancy, which included the positives, as well as the negatives, grant applications, funding sources, and the many agencies involved, as well as many individuals. Diane's presentation was very informative and well received by those present.

Keri Burke with the Mill Creek Conservancy was introduced at 8:00 p.m. This Conservancy encompasses 132 sq. miles from Lake Helen to Los Molinos. There are only 16 landowners owning a 100 acres or more and 65 smaller landowners, most of whom live in the rural, residential subdivision areas located at lower levels. Keri's presentation included many of the issues encountered in the planning and formation of the Mill Creek Conservancy, and some of the current projects they were working on.

Shasta County Supervisor Irwin Fust was scheduled to speak; however, he was not able to attend.

Al Carter gave a very positive talk regarding his involvement with local, as well as government agencies, as a landowner in the Clear Creek watershed. Al explained some of his problems as a landowner, i.e., under-grazing, over grazing, erosion, and star thistle. He then talked about many of the benefits he had received in becoming involved in cooperating with different environmental programs. He shared how these groups/agencies have given him assistance in introducing native grasses, which helped to choke out the star thistle and that he should rotate his grazing areas. Al encouraged those present to become involved in the formation of a watershed group.

At 8:25, Steve Fitch, Legislative Assistant to Assemblyman Dickerson, spoke about the Proposed Scope of the AB-730 Bill, The Watershed Management and Rehabilitation Act. Steve shared with landowners, the many Grants that were available and that there were numerous funding programs available north of Sacramento. He discussed the need for coordination and the long-term implications of continuing the local watershed groups.

Diane Gaumer stated that there were 29 Granting sources available, all of which have something to do with watershed groups. She asked Steve if Dickerson's office was working with local watershed/landowner groups so that they were not hindered in their endeavors. Steve answered with a "yes."

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At 8:35, Morgan Hannaford described the present Data Collection process, as well as the involvement of Shasta College students who would be collecting the data. Morgan encouraged interested landowners to contact him if they were interested in participating. The question was asked, "will we (landowners) be able to see a copy of the final report/findings of this project?" Morgan stated that this information would be available to the landowners.

At 8:55, Phil Warner of the California Department of Fish Game gave a talk regarding the Department of Fish and Game and their interest and willingness to work with landowners. Phil discussed some of the issues the DF&G were working on, regarding stream erosion and sedimentation, anadromous fish, etc. He stated that if anyone had an interest in fish screen diversions, they should contact him at the DF&G, Redding office.

At 9:10, Dennis Heiman with the Regional Water Quality Control Board filled in for Jeff Souza of the WSRCD. Dennis distributed a copy of the 205j Grant. The scope of this Grant is to conduct watershed assessment focusing on (1) potential for anadromous fish enhancement and (2) evaluation of any water quality problems. Dennis stated that if anyone had concerns or issues of what may or may not be included in the study, that they were to contact Jeff Souza at WSRCD. Dennis commented that the motivation of the WSRCD is to work with the landowners. He also pointed out that without the landowner's cooperation, many of these agencies would not be able to complete and carryout the projects of their offices.

Francis informed the group, that this project was funded through a $15,000 Grant received from the U.S. Fish and Wildlife Service and that the Institute of Sustainable Communities became involved in the Clear Creek Data Collection project in collaboration with Shasta College. The purpose of the three information-gathering meetings was to inform the landowners of the project and to find willing participants who would allow students on their land so that the data-collection could take place. Francis then informed the group that the WSRCD would be taking over the Institute's roll regarding the formation of a watershed work group. All landowners that are interested in any future endeavors and wish to be involved in the formation of a watershed group should contact Jeff Souza at the WSRCD.

Francis thanked the group for showing their continued interest by attending tonight's meeting.

The meeting was adjourned at 9:20 p.m.

/bjc

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