AQUATIC MONITORING PROGRAM

2002-2003 REPORT

APPLEGATE RIVER WATERSHED COUNCIL

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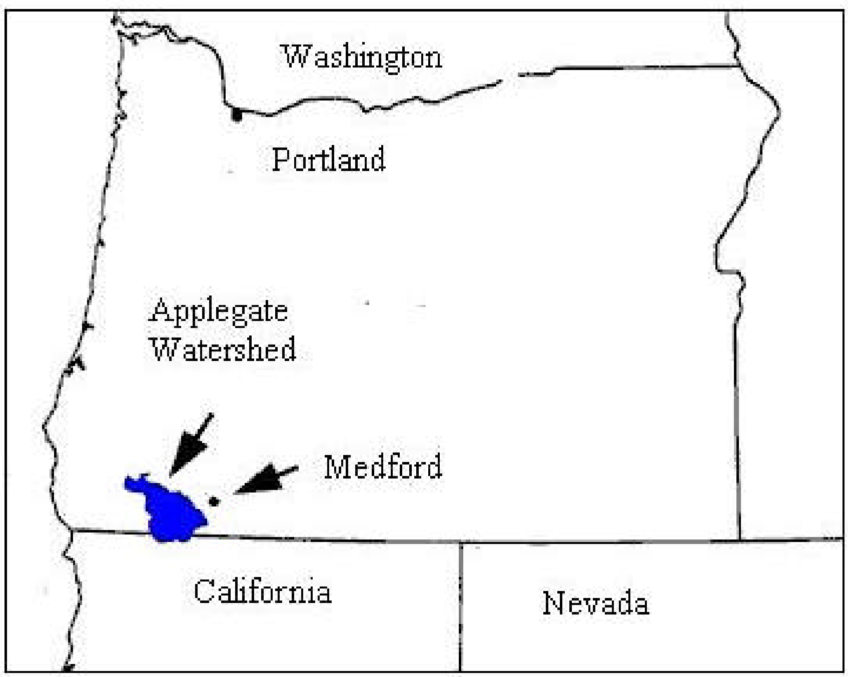
THE APPLEGATE RIVER WATERSHED



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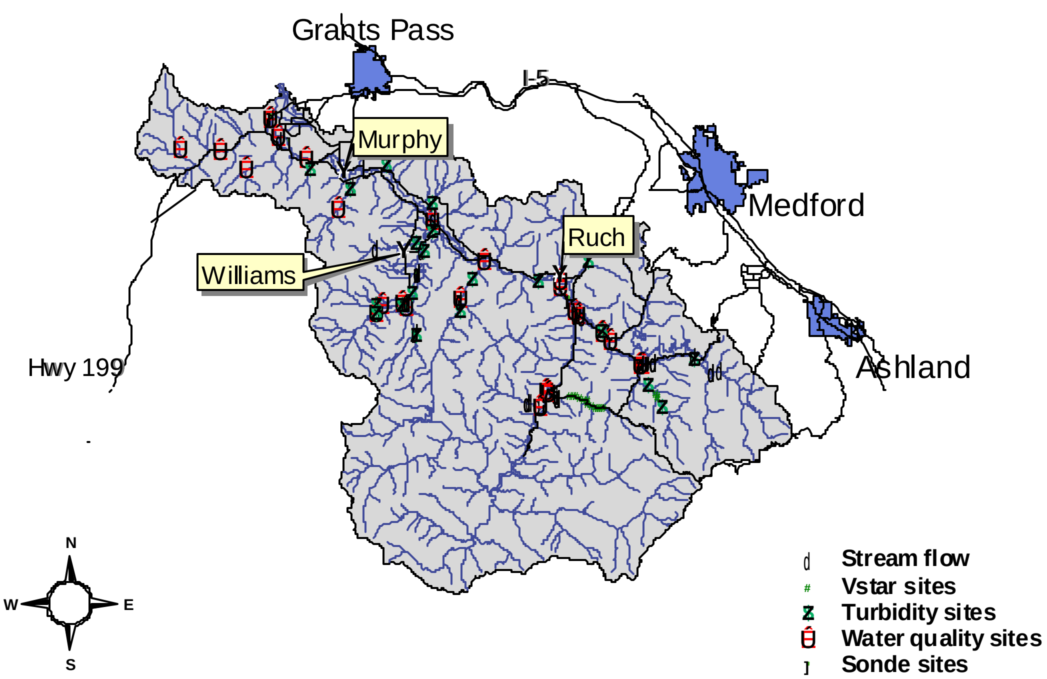
1.0 INTRODUCTION

The Applegate River Watershed Council (ARWC), a non-profit, 501(c)3 organization located in southern Oregon has been monitoring water quality, temperature, biological and physical aspects in the Applegate since 1997 (Fig. 1, Appendix A). The data collected by ARWC staff has established baseline conditions and allowed for water quality trend analysis in the 493,000-acre Applegate watershed located in the Rogue River Basin.

Figure 1. Applegate River Watershed Council Monitoring Sites (1997-2003)



Much of the monitoring data collected by ARWC has been integrated with data collected by the Oregon Department of Environmental Quality (ODEQ) in determining Total Maximum Daily Loads (TMDLs) for the Applegate subbasin. The Environmental Protection Agency (EPA) defines TMDL as "the greatest amount of loading that a water can receive without violating water quality standards" (40 CFR 130.2(f)). In accordance with provisions of the Clean Water Act of 1986, the State of Oregon has imposed TMDLs on reaches designated "water-quality limited."

Oregon Administrative Rules (OAR 340-041-0362) adopted water quality standards to protect "beneficial uses" as defined by the EPA. Beneficial uses include domestic and agricultural water supply, recreational use, and salmonid habitat. The water quality standards are set at a level to protect the most sensitive beneficial uses. Cold-water aquatic life is the most sensitive beneficial use in the Applegate subbasin (ODEQ, 1995). Monitoring by ARWC has helped to identify TMDLs applicable for the basin and areas that do not meet specified criteria.

The ODEQ reports in the *Applegate Subbasin Total Maximum Daily Load (TMDL;* 2003), "Of the 700 miles of streams and creeks in the Applegate subbasin, approximately 126 miles of streams are known to exceed the 64°F summer rearing temperature criteria, 2 miles of streams exceed the 55°F spawning temperature criteria, 9 miles exceed the sedimentation criteria, 9 miles exceed the biological criteria, 14 miles are listed for habitat modification, and 64 miles are listed for flow modification." In the Applegate subbasin, the following streams are on the EPA's Clean Water Act Section 303(d) list of water-quality limited streams for temperature:

- Applegate River
- Beaver Creek
- Humbug Creek
- Little Applegate River
- Palmer Creek
- Powell Creek
- Slate Creek
- Star Gulch
- Sterling Creek
- Thompson Creek
- Waters Creek
- Williams Creek
- Yale Creek

In addition to temperature, Beaver Creek is listed on the 303(d) list for sedimentation, biological criteria, habitat modification and flow modification. The Applegate River and Palmer Creek are listed for flow modification. Palmer Creek is listed for habitat modification. Although flow and habitat modification affect beneficial uses, the DEQ has not established TMDLs for these parameters as they are not the direct result of a pollutant.

The DEQ must update the list of water quality limited waters every two years. ARWC monitoring data is critical to maintaining accurate water quality information in the basin. In addition to determining baseline conditions and assisting with TMDL development, ARWC monitoring data provides information on the Applegate watershed conditions and processes in order to develop restoration projects and monitor the effectiveness of projects already in place. As trend monitoring continues, specific pre- and post-project monitoring will continue to be conducted to assess the success of the projects. As the watershed undergoes development and change, the availability of monitoring data allows decision makers to analyze water quality trends and identify areas of concern and potential restoration sites. ARWC continued collecting data on numerous water quality and stream habitat parameters in 2002 and 2003 (Table 1).

Table 1. ARWC Monitoring Conducted in 2002 and 2003

Monitoring Parameter	Number of 2002 Sites	Number of 2003 Sites
Water Quality Grab Samples	25	24
Stream Flow	18	15
Continuous Temperature	25	31
Sonde (pH, conductivity, and temperature)	15	14
Cross Sections	13	13
Longitudinal Profiles	4	2
Turbidity (winter)	31	11
Snorkel Surveys	1	1
Spawning Surveys	4	4
Habitat Surveys	1	2
Suspended and Bed load Sediment Samples	2	--

ARWC's goal continues to be the identification of causal mechanisms responsible for water quality degradation. This, then, becomes the list of potential restoration opportunities. Ultimately the goal of the restoration projects will result in eliminating streams from the EPA's 303(d) water-quality limited list.

2.0 WATER QUALITY MONITORING

2.1 Water Temperature

Water temperatures in the Applegate subbasin are influenced by geology, topography, flow regime, land use, and riparian vegetation. Because of the history of elevated temperatures in parts of the Applegate subbasin, high water temperatures are an important concern. Elevated water temperatures can have detrimental effects on salmonid populations by causing changes in the food resources and by direct effects on the metabolism, development, and activity of the fish (Bjornn and Reiser, 1991). Temperatures between 21°C and 26°C reduce the ability to fight disease and the water has less dissolved oxygen for respiration and food conversion. In addition, water temperature is an important regulator of migration and spawning timing. The optimal temperature range for steelhead is 10-13°C (50-55°F), and temperatures below 10°C are most desirable for spawning (Bjornn and Reiser, 1991).

Oregon adopted the seven-day moving average of daily maximums as the statistical measure of the stream temperature standard (Oregon Administrative Rule [OAR] 340-041-0028). The seven-day moving average of the daily maximum temperature should not exceed 64°F (17.8°C) during rearing of juvenile and adult salmonids (June 1 through September 30). During the duration of spawning to fry emergence (October 1 through May 31), the seven-day average of the daily maximum temperature should not exceed 55°F (12.8°C).

In 2002 and 2003, ARWC continued an extensive continuous temperature monitoring program to track trends within the system and identify areas that do not meet temperature standards (Appendix B). Data was submitted to ODEQ to assist with the Applegate

TMDL report. Information from past temperature monitoring (1997 – present) has been utilized to identify project priorities (i.e. riparian tree planting), effectiveness monitoring for our Riparian Enhancement Restoration Program, as well as the DEQ-funded *Estimated Heat Budget for the Applegate Basin Project*.

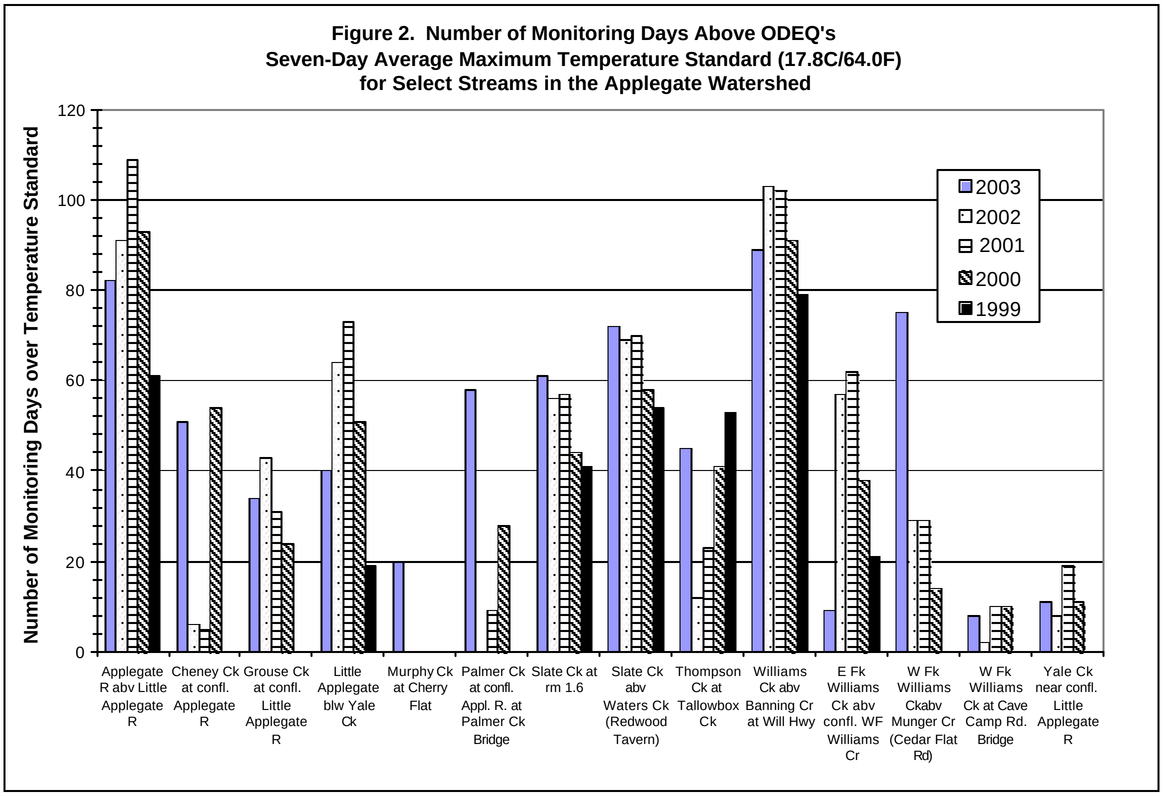
<u>Continuous Water Temperature Monitoring Methods</u>

Continuous temperature monitoring assists in identifying warm and cool water reaches and the factors influencing temperature. ARWC monitoring data was essential for the development of TMDLs for the Applegate subbasin. Stream temperatures were continuously recorded at 25 sites in 2002 and 31 sites in 2003 from June to mid-September. *Onset Optic StowAway Temp* thermo-loggers were placed in a well-mixed shaded area of the water column to minimize heating by solar radiation and were set to record temperature every 30 minutes. The data was downloaded and formatted to ODEQ specifications and submitted to the ODEQ.

<u>Continuous Water Temperature Monitoring Results</u>

Water temperature data submitted to the ODEQ contributed to the TMDL report for the Applegate basin. The following streams have been listed on the 303(d) list for temperature exceedances in the Applegate Subbasin TMDL: Applegate River, Star Gulch, Little Applegate River, Beaver, Humbug, Palmer, Powell, Slate, Thompson, Sterling, Waters, Williams, and Yale Creeks. A total of 126.3 stream miles are listed for summer temperature criteria exceedances (June 1 through September 30) and 2.0 stream miles in Powell Creek are listed for spawning temperature criteria exceedances (October 1 through May 31).

In 2002, all of the sites monitored by ARWC except Cheney Creek at the 37-3-13 Bridge, Murphy Creek and Palmer Creek near the confluence with the Applegate River exceeded the seven-day moving average maximum temperature of $17.8^{o}C/64.0^{o}F$ (Figure 2). The Applegate River above the Little Applegate River, the Little Applegate River below Yale Creek, Slate Creek above Waters Creek, and the East Fork of Williams Creek above the confluence with the West Fork of Williams and Williams Creek above Banning Creek exceeded the seven-day moving average over 50% of the monitoring period (Appendix B). In 2003, all of the sites monitored by ARWC, with the exception of Goodwin Creek (monitoring began in 2003) exceeded the temperature standard. Thompson Creek and Williams Creek exceeded the temperature standard the greatest number of monitoring days. Little Applegate River, Palmer Creek, Williams Creek and Slate Creek showed the highest seven-day average maximum temperatures.



2.2 Water Chemistry

The ARWC collected water chemistry data using two methods – grab sampling and continuous sampling. The following water chemistry parameters were analyzed using the grab sample technique: temperature, pH, DO, conductivity, turbidity and nitrates. Samples were typically collected at the same time of the day for each sampling period. The samples represent conditions at one point in time and do not show variation due to such variables as photosynthesis, respiration, solar radiation, and land use.

The ARWC collected continuous water chemistry data in 2002 and 2003 to document the spatial extent and diurnal variability of DO concentrations, pH levels and water temperature in selected reaches of streams in the Applegate through the summer months. The July and August periods are of interest relative to streamflow, sunlight, and water temperature, which affect photosynthetic activity and water quality. July and August are typically the warmest and driest months in the Applegate Valley. Although streamflow is augmented by releases from the Applegate Dam, discharge in the Applegate River and tributaries tends to be a minimum and relatively stable over these 2 months, maximizing the adverse effects of nutrient loading. These conditions also promote maximum photosynthetic activity and algal abundance.

Water Chemistry Monitoring Methods

Grab samples were collected two times per month at 25 sites in 2002 and 24 sites in 2003. Grab samples were tested by ARWC staff for nitrate, phosphate, DO, pH, temperature, conductivity and turbidity. Sampling protocol followed methods defined in the Oregon Plan for Salmon and Watersheds Water Quality Monitoring Technical Guide Book (1999). Temperature was measured with a DEQ-calibrated audit thermometer. A hand-held portable HACH EC10 pH meter was used to measure pH. The meter was calibrated to pH 7 and pH 10 prior to each field measurement. DO concentrations were measured by Winkler titration.

Continuous monitoring was conducted through the deployment of two sondes. YSI model 600XLM records DO, pH, conductivity and temperature. YSI model 6920 collects turbidity in addition to DO, pH, conductivity and temperature. Both sondes collect data at 30-minute intervals. Monitoring sites were selected above and below significant tributaries and downstream of locations determined to be a substantial contributor of nutrients. In 2002, ARWC staff deployed 2 sondes in 15 stream locations for approximately one week throughout the summer. In 2003, the sondes were deployed in 14 sites. Field measurements of temperature, pH, and DO were made at each site during initial deployment and retrieval of sondes. Site locations where field measurements and sonde measurements were not in agreement within two tenths for each parameter were not incorporated in final analysis. When possible, sondes were positioned near the centroid of flow; otherwise, sondes were placed at the river's edge. The sondes were rotated every 4 to 7 days. Recorded data was downloaded to an ARWC database.

Water Chemistry Monitoring Results

Nitrates and Phosphates

Excessive phosphorous and nitrogen in the system can result in eutrophication and increases in aquatic plant growth and plant distribution. Excess plant growth can affect dissolved oxygen, pH and temperature. In the Applegate basin, common sources of nutrient inputs to streams are failing septic systems, livestock manure and fertilizer runoff.

The EPA set a maximum value for phosphorous at 0.1 mg/l in freshwater streams as a goal for prevention of nuisance plant growth (1996). No water quality standard currently exists for the protection of aquatic life for nitrate (ODEQ, 1995). The EPA's human health standard for nitrogen in drinking water is less than 10 mg/l as levels above this can be toxic to warm-blooded animals as it may result in hypoxia, low levels of dissolved oxygen. Oregon DEQ adopted the 10 mg/l drinking water standard in 1992.

Phosphate levels measured at select sites in the summer of 2002 were consistently within the normal range in the Applegate watershed. In 2003, ARWC discontinued phosphate testing at the recommendation of former ARWC Water Quality Chemist, Hans Rilling, PhD. As nitrates dissolve in water more readily than phosphates, nitrate values serve as a better indicator of the possibility of a source of sewage or manure pollution during dry weather (EPA, 1997). In 2002, nitrate levels at all sites were below the EPA's 10 mg/l drinking water standard. In 2003, nitrates were tested at 24 sites. All nutrient testing showed levels well below the EPA standard of 10 mg/l. Forest Creek showed the highest nitrate levels in July 2003 with a value of 2.22 mg/l. All other values were less than 1 mg/l.

Conductivity

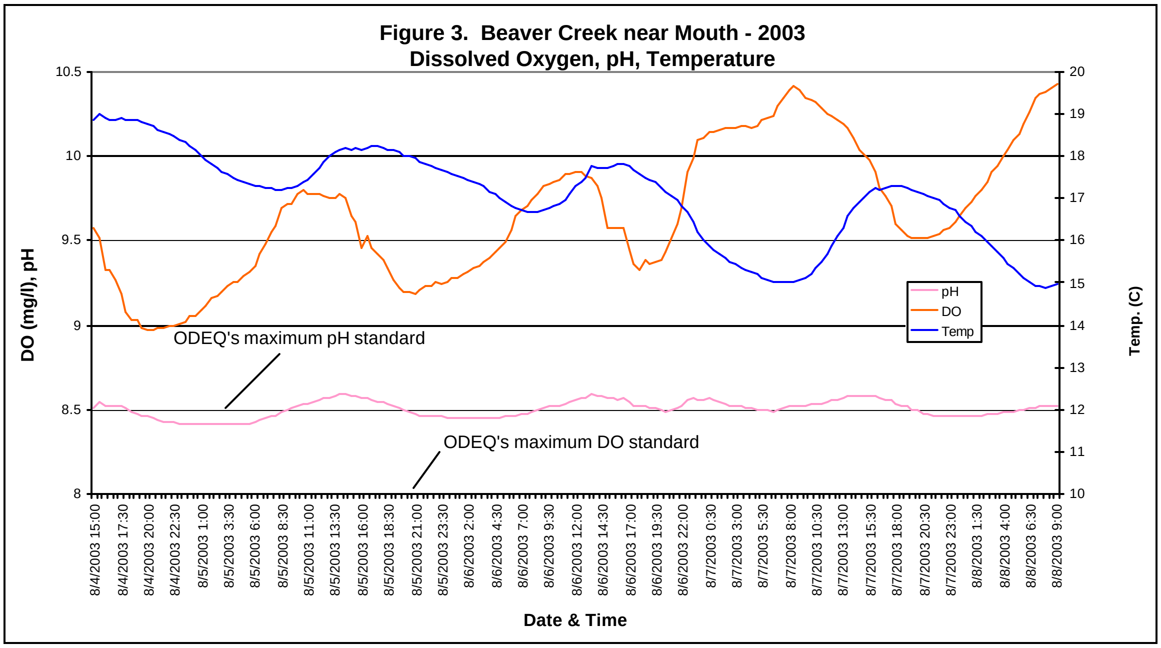
Conductivity is a measure of the water's ability to conduct an electrical current. Conductivity is dependent on the level of dissolved salts and minerals in the water, the size of the watershed, and other influences such as point sources and non-point sources of pollution, including agricultural runoff. The EPA has not set a conductivity standard, however, fresh waters in Oregon typically have ranges between 20 to 500 micromhos per centimeter (umhos/cm). All conductivity levels measured in 2002 and 2003 were within this range with the exception of Cheney Creek at the second bridge. On July 28, 2003, conductivity was measured at 570.1. This value is not characteristic of the other values at the same location during the summer, therefore, the data may be suspect or unknown factors contributed to this higher level of conductivity.

pH

The pH of water is a measure of the hydrogen ion concentration. A value of seven is neutral. The pH standard for the Rogue basin is 6.5 to 8.5 to protect beneficial uses such as cold-water fisheries (OAR 340-041-0021).

In 2003, grab samples showed no exceedances of the pH, however, continuous monitoring with the sonde showed exceedances above the standard in Beaver Creek in August and September and Slate Creek at two sites during August and the Little Applegate River in August and September.

Although the pH in Beaver Creek rose above 8.5, it remained below 8.6 during the continuous monitoring period between August 4 and August 8, 2003 (Fig. 3). The high was 8.59 on 8/5/03 at 14:00. The pH at Slate Creek at Jacob's property exceeded Oregon's standard when it rose above 8.5 on 8/28/03 at 08:00 and continued rising to a high of 8.7 at 15:00. On this day, the pH exceeded the standard at this site for 12 hours. On the same day at the Sampsel property on Slate Creek, pH exceeded the criteria for 6 hours in the late afternoon. The maximum value was 8.59, just slightly above the 8.5 standard. The Little Applegate River had the most extensive continuous monitoring data. During the 8/5 through 8/8/03 period, only two one-half hour exceedances of the pH value were recorded. The sonde captured six events between 9/5 and 9/11/03 in which the pH exceeded the standard. All of the events were captured between noon and 19:00 with the highest value at 8.74 on 9/8/03 at 16:30.



Dissolved Oxygen and pH

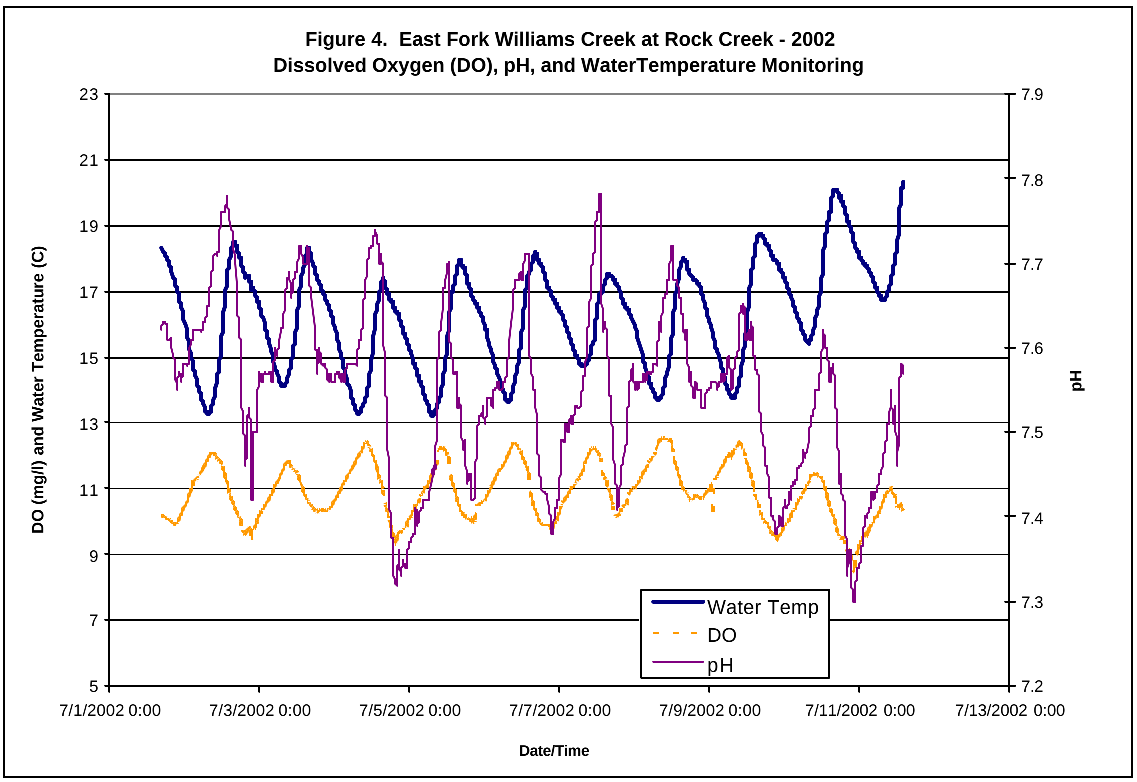
The water quality criteria for DO in streams that provide cold-water aquatic life shall not be less than 8.0 mg/l as an absolute minimum (OAR 340-041-0016(2)). For the summer months, the 90% saturation standard applies.

Two driving mechanisms for DO levels exist in the Applegate subbasin (Mathews, 2002). Oxygen is more soluble on cold water, therefore, as water temperature drops, DO increases. Conversely, as water temperature increases, DO decreases. This concept is termed gas exchange. The second driver of DO is primary productivity. Solar radiation during the day causes aquatic plants to transpire and produce oxygen. Respiration occurs at night and plants consume oxygen.

Temporal and spatial patterns of DO and pH are seen in the monitoring data between 1999 through 2003. All of the sites monitored in the Applegate basin exhibit diel fluctuation, although the synchrony of the dissolved oxygen and temperature vary spatially (Mathews and Stanford, 2002). In the lower reaches of the basin, the synchronism of the DO and temperature mirror each other. In general, progressing upstream, the diel cycles become offset and agreeance between diel fluctuation decreases. Simultaneous diel fluctuation of DO saturation and pH are indicative of the photosynthetic activity of aquatic biota (Odum, 1956; Pogue and Anderson, 1995). As algae photosynthesize during the day, carbon dioxide is taken up, resulting in a reduction in free hydrogen ions and an increase in pH. At night, respiration produces CO_2, reducing pH. During the day, photosynthetic activity is highest in the lower reaches of the basin due to channel widening and decreased riparian shading. These physical properties have been observed by ARWC during stream surveys and cross-sectional analysis. For example, in the upper reaches of the Little Applegate River, the cyclical variation of DO and pH has a DO minimum occurring at approximately 10:00 p.m. and a maximum occurring around 12:30 p.m. Temperature reached a maximum around 3:00 p.m. and reached a minimum around 7:30 a.m. In the lowest reach near the mouth of the Little Applegate River, the DO minimum occurred around 10:00 p.m. and reached maximum around 3:00 p.m., at the same time as the temperature was maximized.

Although the minimum DO concentration in percent saturation is relatively similar, the maximum DO concentrations are approaching similar cycles to the maximum water temperature cycles downstream. In systems where photosynthesis is driving the DO, the pH and DO diel cycles are simultaneous indicating that there is a higher correlation between pH and DO in these systems. In systems where DO is primarily gas exchange, the pH and DO are not so closely related (Mathews, 2002).

The temperature and DO relationship is also exhibited in the western part of the Applegate basin in Williams (Fig. 4). At the uppermost site in the watershed near the headwaters of the East Fork of Williams Creek near Rock Creek, the DO saturation is highest when the water is the coolest during the night, and decreasing as the water temperatures warm. Near the mouth of Williams Creek at Highway 238, the DO, pH and water temperature have corresponding highs during the middle of the day when the water is the warmest, and lows at night where the water temperature is the coldest.



ARWC monitoring data indicates that the average change in DO is increasing each year. The average maximum DO levels are not necessarily increasing nor are the average minimums decreasing, the overall change between the two is increasing. This indicates that an alternate variable is affecting DO that is not affecting pH or temperature. It is hypothesized that this variable is flow.

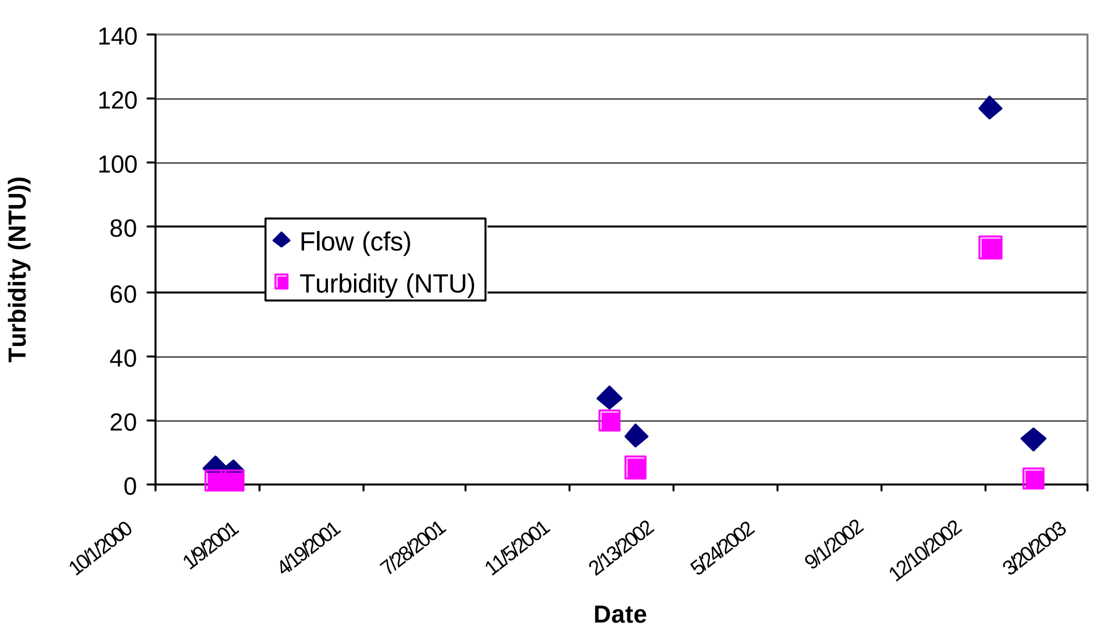
DO is the most sensitive water quality variable being monitored in the Applegate watershed. DO is affected by many factors. The relative change in DO is an important indicator of aquatic health and continued monitoring of DO, pH, temperature and flow is essential to identifying restoration needs.

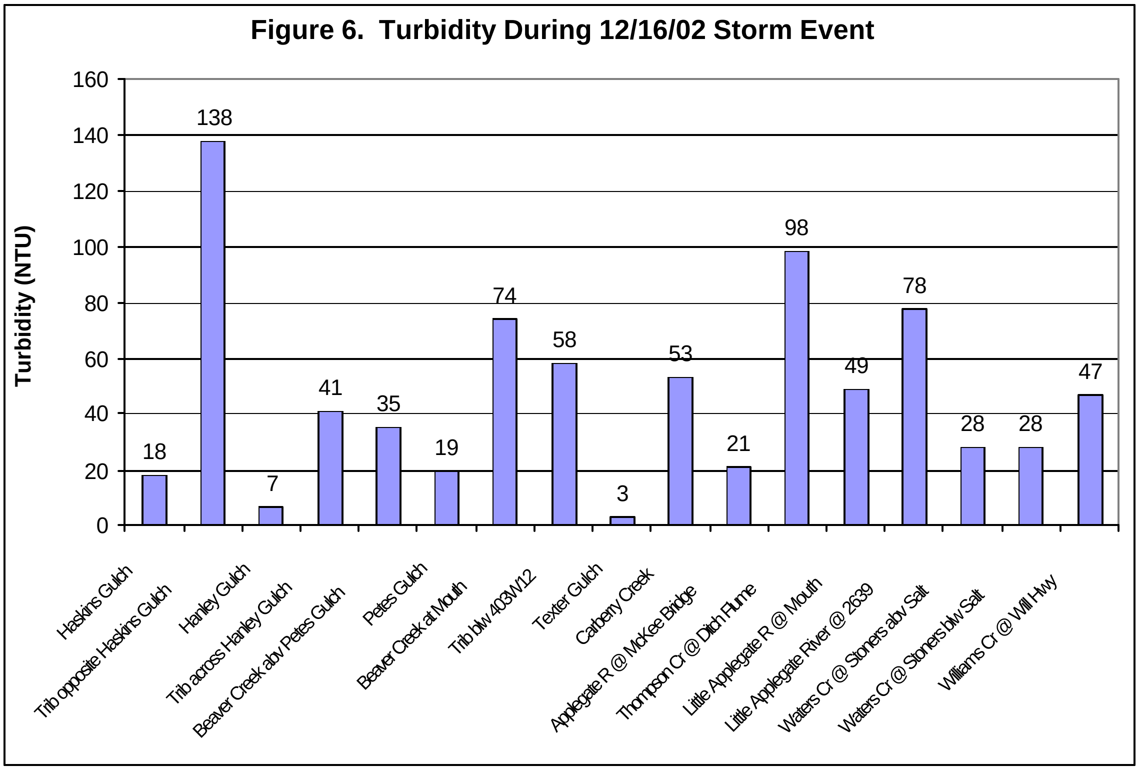
Turbidity

Turbidity is defined as the optical property of a sample that causes light to be scattered and absorbed. In other words, turbidity is the measurement of the amount of suspended solids, or fine sediment in the water column. Increases in turbidity reduce visibility, affecting aquatic organisms by reducing foraging ability. In addition, high levels of sedimentation can increase streambed scour, thereby removing essential food sources for higher-level organisms. Increased fine sediment can also abrade organs in aquatic organisms and irritate fish gills. Turbidity levels greater than 25 nephlometric turbidity units (NTUs) adversely affect salmonids and other fish species (EPA, 1991).

With the help of volunteers from the community, turbidity was monitored at 31 sites in the Applegate basin in 2002 (Appendix C). Turbidity in many of the streams monitored was very high after several heavy rain storms in the winter of 2002. The National Weather Service web site reported that the Medford Airport received 0.75 inches of rain on 12/16/02. Between 12/10/2 and 12/16/02, a total of 2.15 inches were recorded. This storm event resulted in flows at Beaver Creek of 117 cubic feet per second (cfs) and turbidity of 74 NTUs (Fig. 5). A total of 17 sites were sampled for turbidity during this storm event and 12 sites had levels above 25 NTUs (Fig. 6).

Figure 5. Beaver Creek- Turbidity vs Flow 2002





It is important to note that Beaver Creek is currently the only stream in the Applegate subbasin that is on the 303(d) list of water quality impairments for sediment. In 2002 and 2003, ARWC completed a multi-year DEQ-funded evaluation of the sources of sediment and heat in the Beaver Creek subbasin. The project, *Sediment and Major Heat Sources in the Upper Applegate Basin,* is discussed in Section 5.2. The evaluation of the change in sediment supply, particle size and effects on spawning was designed to establish potential restoration plans.

3.0 STREAM FLOW MONITORING

The Oregon Plan for Salmon and Watersheds has prioritized the restoration of stream flows to benefit critical fish runs (Oregon Watershed Enhancement Board [OWEB], 2003). Since most alternatives to restoring flows rely on voluntary actions by private landowners, the ARWC is in a key position to pursue these alternatives.

Low summer flows characterize most of the tributaries in the Applegate watershed. Low flows can cause elevated stream temperatures, excessive aquatic plant and bacteria growth, increased dissolved oxygen levels and fish passage problems. The Oregon Department of Water Resources publishes water availability and allocation on their web site. Many streams in the Applegate were historically over allocated and irrigation withdrawals exacerbate summer low flow periods.

Monitoring stream flows in the Applegate watershed is an important component of ARWC's monitoring program. ARWC has been collecting stream flow data regularly since 1999. Flow data was collected at 18 sites in 2002 and 15 sites in 2003 approximately two times per month. Flows at Waters and Slate Creeks were measured as part of the Slate Creek Instream Habitat Enhancement pre-project monitoring (see Section 3.4.1). Winter flows were conducted at 8 sites on Haskins, Hanley, and Beaver Creeks as part of the Upper Applegate River Sediment and Major Heat Source study (see Section 3.4.2). Flows are measured in the Little Applegate River as part of pre-project monitoring for the Little Applegate River Streamflow and Habitat Enhancement Project (LASHEP).

Stream Flow Monitoring Methods

Stream discharge measurements were conducted using U.S. Geological Survey (USGS) protocol. Pygmy/AA and Swoffer flow meters were used to determine velocity measurements. Discharge was calculated by multiplying cross sectional area by velocity. Staff gauges are in place at 14 stations throughout the basin. A staff plate calibration, or rating curve, was developed using several discharge-water surface elevation pairs. A rating curve is used to estimate the discharge of a stream by reading gauge height and using the rating curve to convert it to discharge. Flow measurements included a full range of flows. Discharge and associated water surface elevation were statistically evaluated to determine correlation.

ARWC maintained continuous recorders at the following sites in 2002: Little Applegate River at Grouse Creek; Little Applegate River at mouth; McDonald Creek; Williams Creek at Williams Highway; and Beaver Creek. In 2003, continuous recorders were placed in the Little Applegate River, Beaver Creek and Williams Creek.

Stream Flow Monitoring Results

The stream flow data collected in 2002 and 2003 has been compiled into a table with all flow measurements conducted by ARWC (Appendix D). Discharges were higher in 2003 compared with 2002 at most of the sites monitored. It is interesting to compare flow data to 2001 in which a State of Drought Emergency was issued. Although stream flows are influenced by several variables including precipitation, snow pack, groundwater storage, and irrigation withdrawals, it is difficult to determine their individual effects.

The Little Applegate River's discharge at the mouth was measured at 2 cfs on 8/21/02 and at 8 cfs on 8/21/03 representing a 75% increase in flow (Fig. 7). Flows in the Little Applegate River below Grouse Creek were measured and compared during similar periods in 2002 and 2003 (Fig. 9). For the four sampling events shown below, flows at this site were between 63 and 150% higher in 2003 compared with flows in 2002.

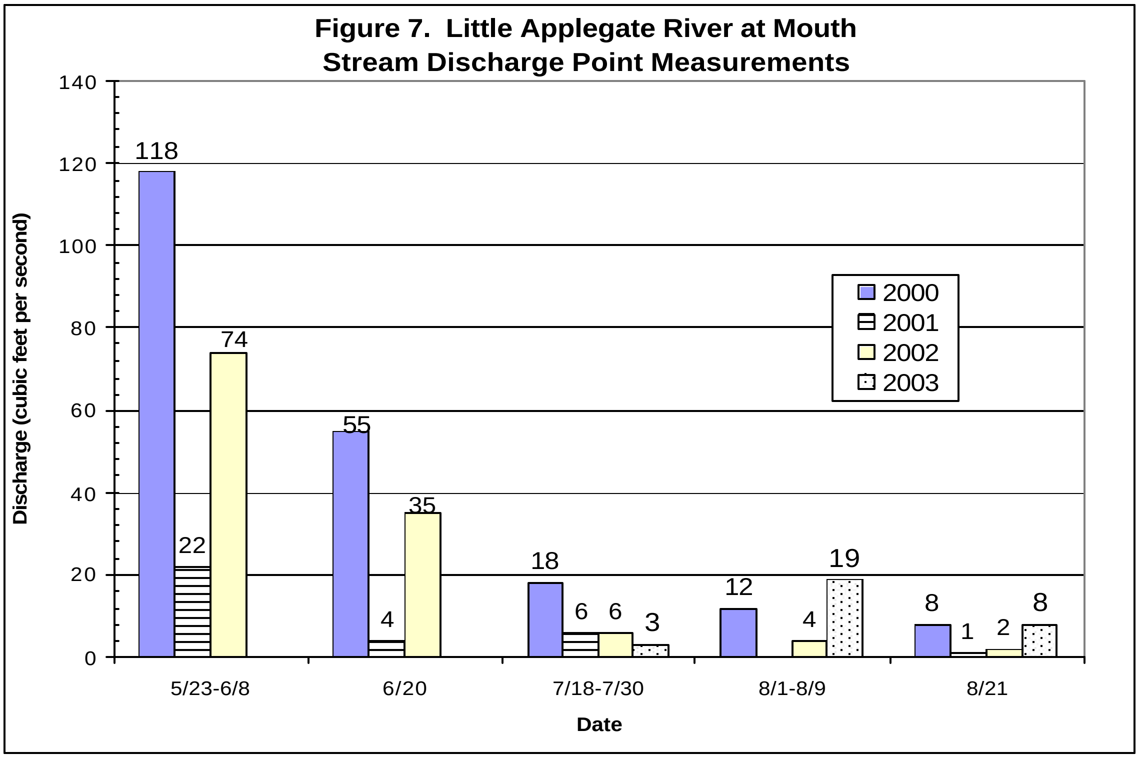


Figure 7. Little Applegate River at Mouth
Stream Discharge Point Measurements
Discharge (cubic feet per second)
140
120
100
80
60
40
20
0
118
22
74
55
4
35
18
6
6
3
12
4
19
8
1
2
8
2000
2001
2002
2003
5/23-6/8
6/20
7/18-7/30
8/1-8/9
8/21
Date

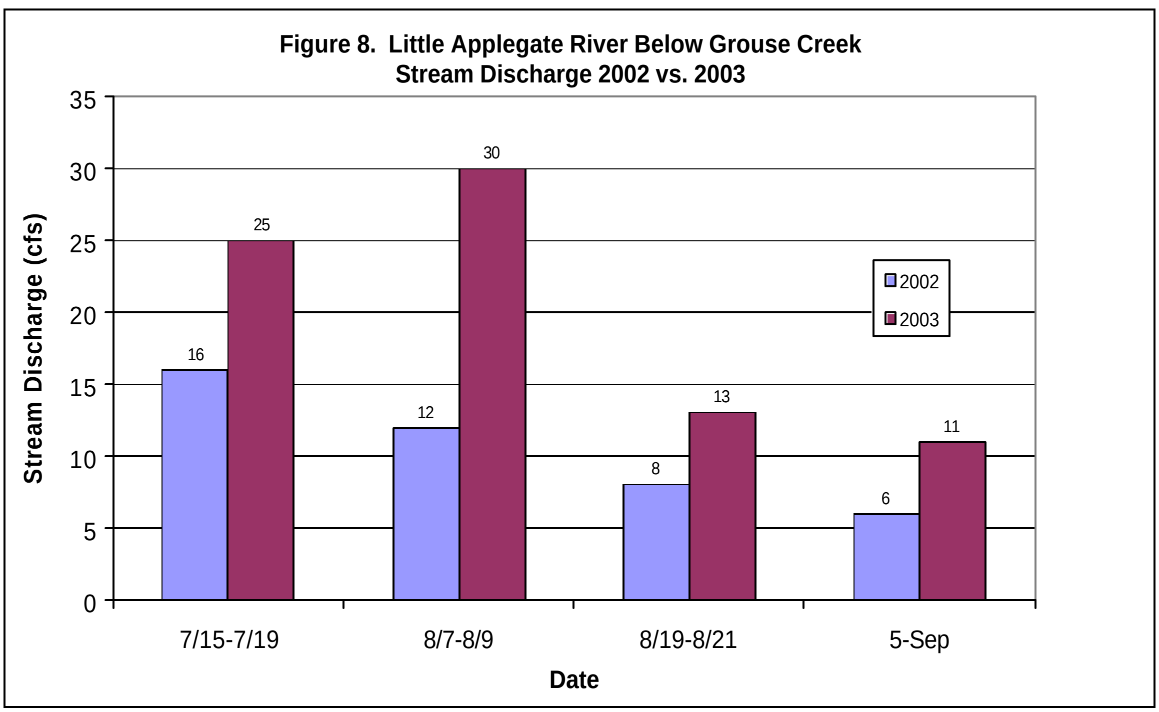
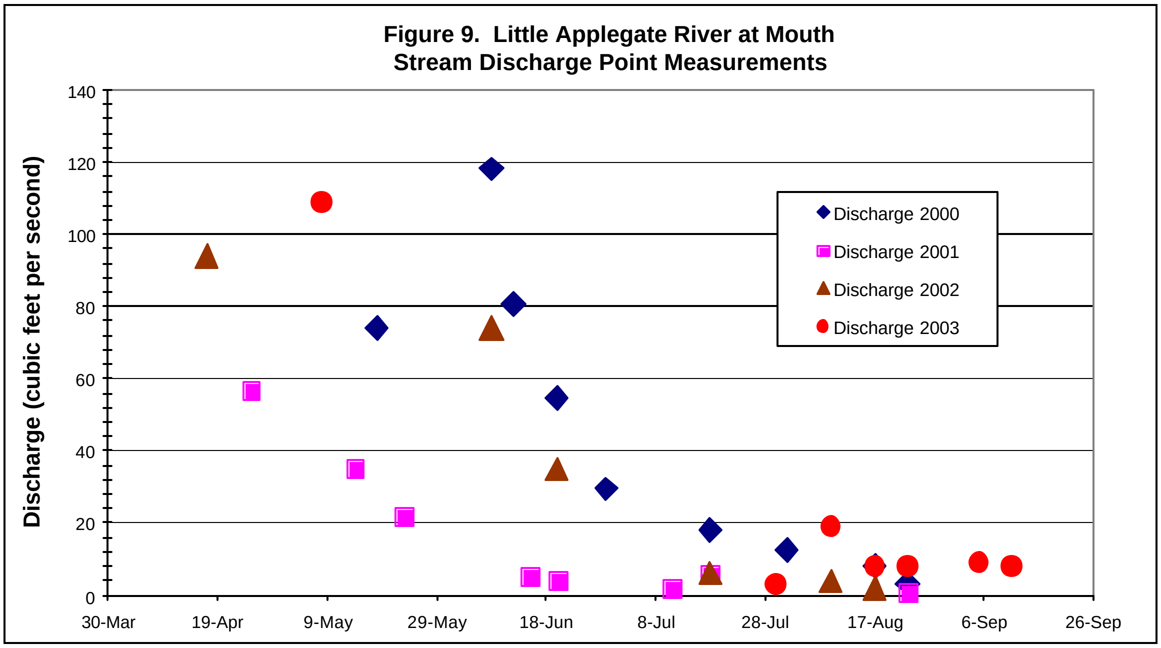
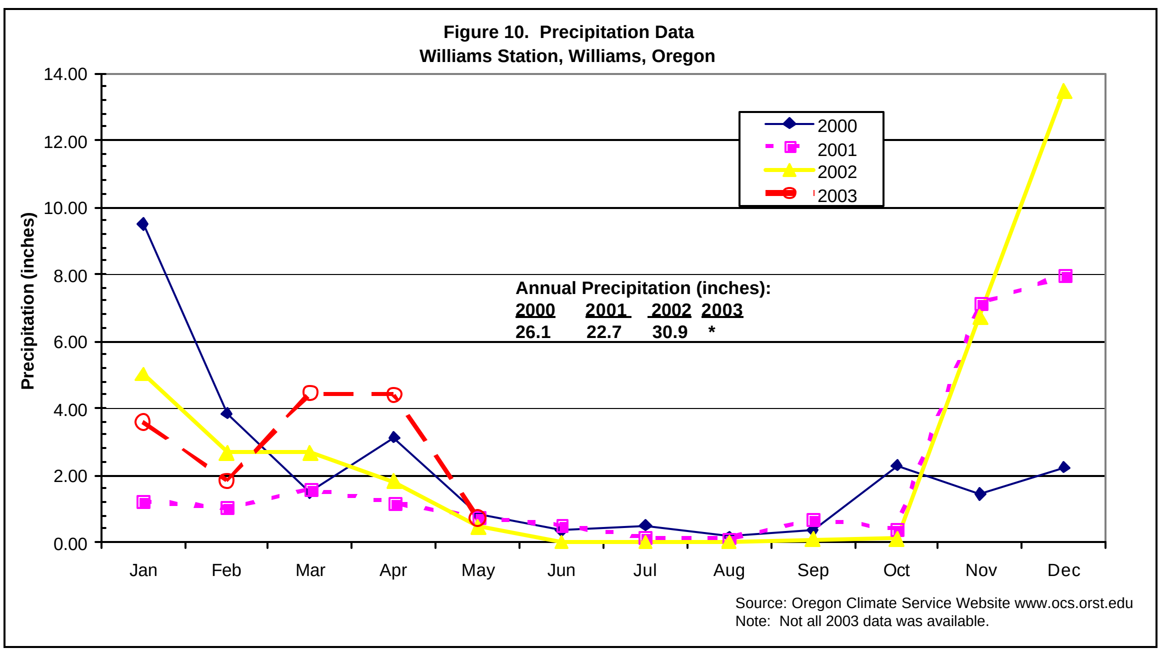


Figure 8. Little Applegate River Below Grouse Creek
Stream Discharge 2002 vs. 2003
Stream Discharge (cfs)
35
30
25
20
15
10
5
0
16
25
12
30
8
13
6
11
2002
2003
7/15-7/19
8/7-8/9
8/19-8/21
5-Sep
Date



For context, precipitation reported on the Oregon Climate Service's web site at the Williams, Oregon station shows 2003 spring rainfall (March to May) was 48% higher than the 2002 spring rainfall (Fig. 10). Summer rainfall in the valley is typically low, with May through July precipitation levels between 0 and 1 inch for every year from 2000 to 2003.



4.0 BIOLOGICAL MONITORING

4.1 Pre-Project Monitoring: Little Applegate Stream Habitat and Enhancement Program

The Buck and Jones Dam on the Little Applegate River.

The Little Applegate River supports populations of coho salmon (*Oncorhynchus kisutch)*, fall Chinook salmon (*O. tshawytscha*) and summer and winter steelhead trout (*O. mykiss*) and is designated as high value steelhead habitat. The river is listed on the Clean Water Act's 303(d) list as water quality limited due to temperature exceedances.

Two irrigation dams in the Little Applegate River, Farmers and Buck and Jones, are scheduled to be removed as part of the Little Applegate Stream Habitat and Enhancement Program (LASHEP). The dam removals will increase summer instream flows by approximately 13 cfs and will improve steelhead access to approximately 40 miles of habitat. ARWC will continue to monitor the Little Applegate River using the same survey methodology during pre- and post-project implementation. The purpose of monitoring is to quantify and compare pre- and post-dam removal conditions in fish habitat, fish populations, instream flow and fine sediment amounts under low flow hydrologic regime.

Annual snorkeling and spawning surveys have been conducted to identify fish species present and provide information on habitat use. Follow up surveys will continue after dam removal. Riparian vegetation has been inventoried and will be monitored for dam removal impacts. Stream flow and stream temperature have been and will continue to be monitored during summer months.

4.2 Pre-Project Monitoring: Snorkel Surveys

Tracking and measuring salmonid populations is important for determining trends in the fish populations. The Applegate subbasin maintains anadromous populations of coho salmon, Chinook salmon, and steelhead trout. Coho are listed as threatened under the Endangered Species Act (ESA). Monitoring of anadromous fish populations is an important component of the Little Applegate Stream Habitat and Enhancement Project (LASHEP) dam removal project. Chinook and coho have not been observed above Little Applegate Falls (river mile 1.6), which is considered a barrier to coho and Chinook by Oregon Department of Fish and Wildlife (ODFW).

Snorkel surveys were conducted in the Little Applegate River in 2002 and 2003. Approximately 6.5 miles of the Little Applegate River were snorkeled using Hankin and Reeves protocol (1988). Snorkel surveys collected data on species and age class by reach. Reach 1 covers the area between the mouth of the Little Applegate River and Farmer's Ditch Dam; reach 2 is from Farmer's Ditch Dam to the Buck and Jones Ditch Dam; reach 3 is from the Buck and Jones Ditch Dam to Sterling Creek; reach 4 is from Sterling Creek to Grouse Creek; and reach 5 is from Grouse Creek to Yale Creek.

The pre- and post-project surveys will help to determine the effectiveness of the dam removals on anadromous fish passage. Survey information is shared with the U.S. Bureau of Land Management (BLM), U.S. Forest Service (USFS), ODFW and other interested parties on anadromous fish distributions, abundance, and habitat use in the Applegate watershed.

<u>2002 Snorkel Survey Results</u>

A total of 3,343 fish were observed during the 2002 snorkel surveys (Table 2). The most prevalent age classes observed were 0+ and 1+. Reach 1 had 243 coho. Reach 3 had the lowest percentage of fish observed (Fig. 11). The number of fish per mile was highest in reach 5 (Fig. 13).

Table 2. 2002 Little Applegate River Snorkel Survey Data

Reach	Total # Fish	Reach Length (miles)	# Fish per Mile
1	1070	2	535
2	437	1	437
3	133	1	133
4	162	1	162
5	1541	1.25	1233

<u>2003 Snorkel Survey Results</u>

A total of 3,252 fish were observed during the 2003 snorkel surveys (Table 3). Chinook, coho and steelhead/rainbow trout were observed in reach 1 in 2003, however, no Chinook nor coho were found above the Little Applegate Falls (river mile 1.6) within reach 1. Only steelhead/rainbow trout were observed in reaches 2 through 5. The lowest percentage of fish observed was in reach 3 (Fig. 12), which may be a result of only one habitat unit being sampled. Age 0+ and 1+ were the age classes observed most frequently. One age 0+ Chinook and three 1+ coho were observed in Reach 1. Reaches 2 and 5 had the greatest number of fish observed per mile (Fig. 13).

Table 3. 2003 Little Applegate River Snorkel Survey Data

Reach	Total # Fish	Reach Length (miles)	# Fish per Mile
1	968	2	484
2	849	1	849
3	46	1	46
4	338	1	338
5	1051	1.25	841

Figure 11. Distribution of Fish Observed in the Little Applegate River - 2003

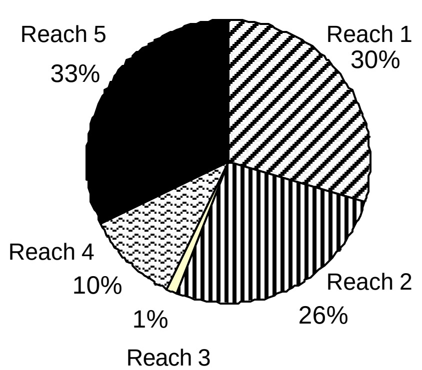
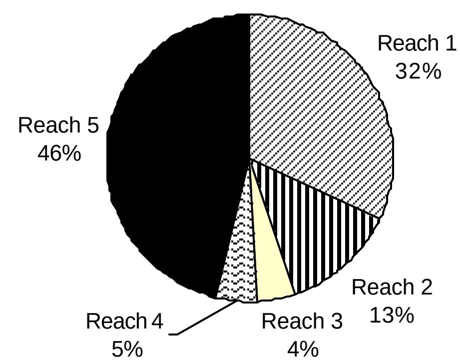
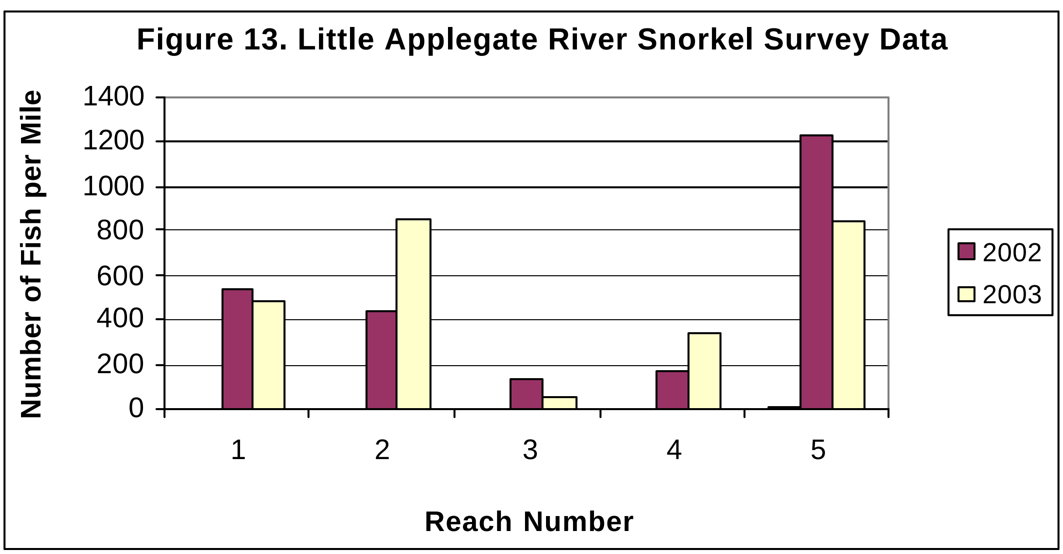
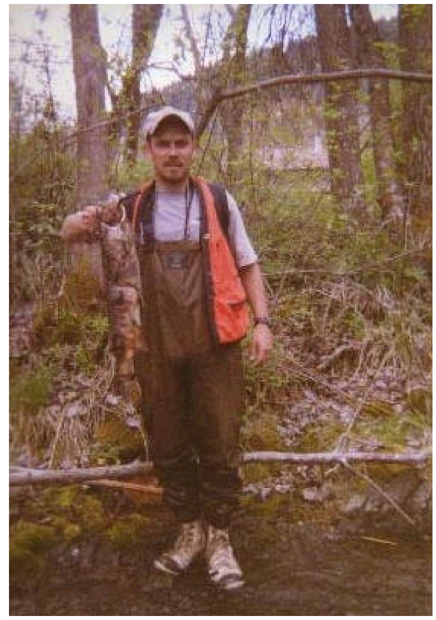


Figure 12. Distribution of Fish Observed in the Little Applegate River – 2002





4.3 Steelhead Spawning Surveys



Chris Vogel with steelhead carcass.

Steelhead spawning surveys were conducted each year from 2001 to 2003 as a component of the LASHEP pre-project monitoring program. Spawning surveys consist of counting redds and returning adults within a given stream reach. Monitoring was conducted using ODFW's *Coastal Steelhead Spawning Survey Procedures Manual* (2000).

ARWC conducted spawning surveys in Yale Creek and Little Applegate River to monitor the abundance of steelhead returning to spawn (Figs. 14 and 15). The Little Applegate River was divided into three reaches: Reach 1 covers the area from Farmers Ditch dam to Buck and Jones dam; Reach 2 covers the area from Buck and Jones dam to Grouse Creek; and Reach 3 is from the Forest Service boundary at river mile 14.2 to Waters Gulch. Yale Creek was surveyed at the confluence of the Little Applegate River to First Waters Gulch. Spawning surveys will continue to be conducted after the Farmer's and Buck and Jones Dams on the Little Applegate River are removed. Data will be compared with previous year's data to determine impact of dam removal. It is important to note that spawning surveys are subject to changing environmental conditions such as precipitation, flow, and turbidity.

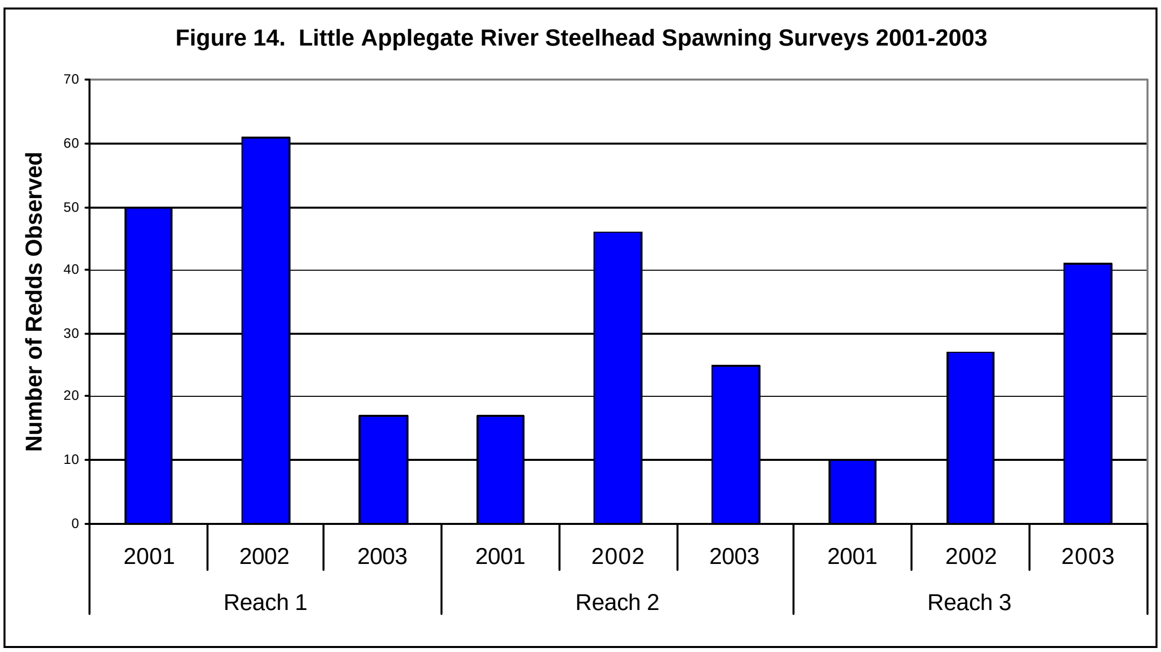
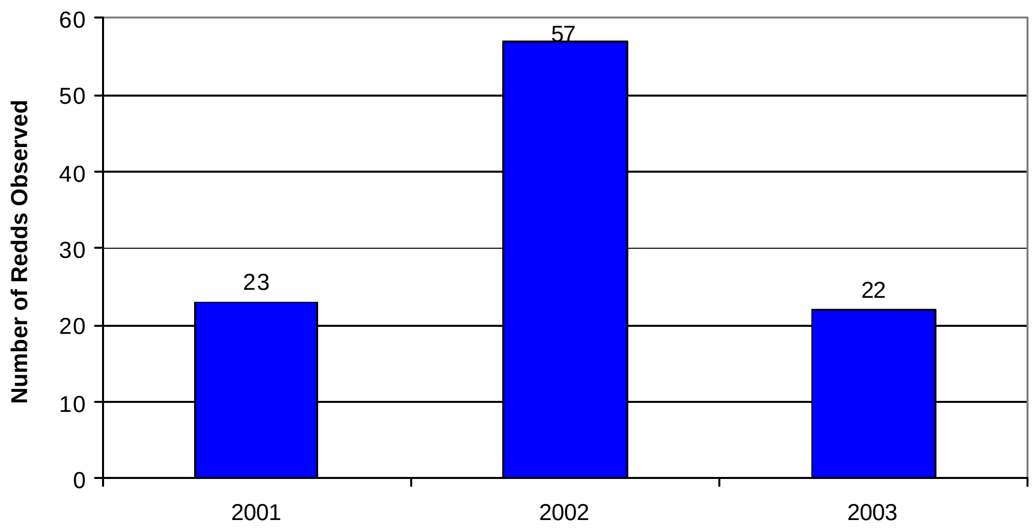


Figure 15. Yale Creek Steelhead Spawning Surveys 2001-2003



4.4 Lamprey Study

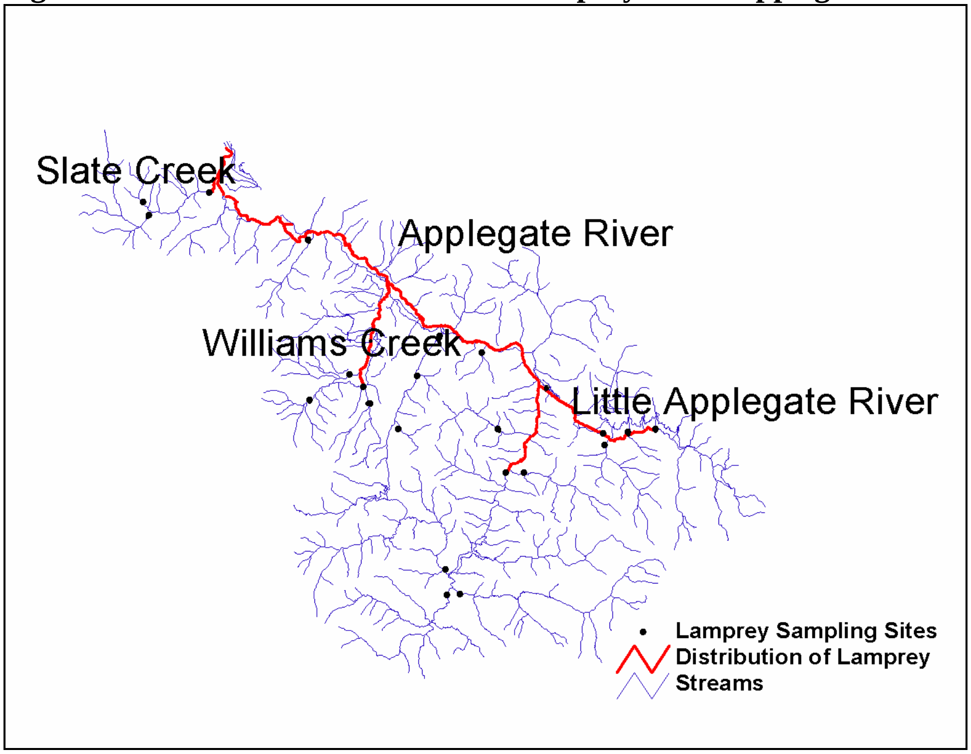
The Applegate River Watershed Council collaborated with the Medford District of the Bureau of Land Management to study lamprey (*Lampetra spp.*) populations in the Applegate River Watershed. The objectives of the study included: identifying species composition; determining the distribution of lamprey species; and relating the distribution of lamprey ammocoetes (juveniles or larvae) to physical stream characteristics. Eight low gradient and slow water habitat sites within the Applegate basin were sampled using hand held scoop nets (Table 2). ODFW Level II stream habitat surveys were conducted using stream channel and valley type characteristics to evaluate large-scale fluvial geomorphic features in relation to ammocoete distribution.

Table 4. Lamprey Monitoring Sites

Sample Site	River Mile	Valley Type	Channel Type	Reach Slope %	Lowest Upstream Gradient %	Habitat Unit	Substrate
Applegate River							
Jackson Campground	42	Open V-Shape	Constrained	0.4	0.4	Pool & Riffle	Medium-Coarse Sand & Organics
Little Applegate River							
Confluence with Applegate R.	0.1	Broad Constrained	Terrace	1	1.3	Pool & Riffle	Silt & Organics
Confluence with Yale Cr.	6.6	Broad Constrained	Terrace	1.5	2	Pool	Medium-Coarse Sand & Organics
Tunnel Ridge Trailhead	9.8	Narrow; Open V-Shape	Constrained	2.4	1.6	Pool & Glide	Medium-Coarse Sand & Organics
Confluence with Rush Cr.	11.6	Narrow; Open V-Shape	Constrained	2.5	2	Riffle	Silt & Organics
Williams Creek							
Williams Cr. @ Highway Bridge	5.8	Broad; Multiple Terraces	Constrained	1.5	1.3	Pool & Riffle	Medium Sand & Organics
East Fork Williams Cr. at Brown's Rd.	.02	Broad Constrained	Constrained	3.8	3	Pool	Fine Sand & Silt
Slate Creek							
Confluence with Applegate R.	.01	Broad; Multiple Terraces	Terrace	1.1	1	Pool	Fine Sand & Organics

Lampetra Tridentata, commonly referred to as the Pacific lamprey, is currently the only known lamprey species identified in the Applegate basin (*Lamprey Composition and Distribution in the Applegate Basin, Oregon*, 2003). Lamprey ammocoetes were identified in the following streams within the Applegate basin: Applegate River; Little Applegate River; Slate Creek; East Fork of Williams Creek; and Williams Creek (Fig. 15).

Figure 16. Minimum Distribution of Lamprey in the Applegate Basin



The study found that ammocoetes distribution is partially correlated to physical stream attributes. All ammocoetes were found in low gradient streams (less than 3%) and depositional habitats composed of silt and/or sand. All juveniles were found within depositional material. Larger-scale fluvial geomorphic features did not appear to influence ammocoete presence.

Although no other lamprey species were identified during the sampling period, the presence of Western Brook and River Lamprey are feasible in the Applegate basin. Current lamprey collection methods need to be modified to provide more confidence in species identification. The lamprey study recommends that additional studies with more sophisticated techniques are warranted to determine if a unique subpopulation exists and to better understand lamprey life history patterns and population trends. The ARWC, in partnership with the ODFW, are currently studying adult lamprey in the Little Applegate River by trapping adults during spawning migration.

5.0 PHYSICAL MONITORING

5.1 Pre-Project Monitoring: Slate and Waters Creeks Cross Sections

The Slate Creek Instream Habitat Enhancement project seeks to improve aquatic habitat by placing large wood and boulders in key coho and steelhead rearing reaches in the Slate Creek watershed. Due to channel modification and large wood removal, this watershed provides very little spawning gravel retention and pool habitat for rearing coho and steelhead juveniles.

The goal of the project is to improve instream and spawning habitat and channel complexity by placing large wood structures and boulder clusters at several sites in Slate and Waters Creeks. This project was implemented upon the recommendations of the *Slate Creek Watershed Assessment* (2002). ARWC pre-project cross sections were conducted in 2002 at four sites on Waters Creek and eight sites on Slate Creek (Appendix E). A longitudinal profile was conducted at 3 sites on Waters Creek and 2 sites on Slate Creek. Staff also completed a USDA Forest Service Level III habitat survey on Slate Creek prior to project implementation. The survey was developed by the Rogue National Forest and is a hybrid of survey procedures developed on the Gifford Pinchot, Mount Hood, Siuslaw National Forests, and procedures outlined by Hankin and Reeves (1988). The survey provides a high-resolution description of stream channel microhabitat, riparian character and fish distribution. Surveys will be repeated the summer following project completion and again in year three and five following project completion. The surveys will quantify changes in channel character and fish use.

Mandy Lewis monitoring Slate Creek after large wood placement.

5.2 Sediment and Heat Source Study in the Upper Applegate Basin

In 2003, ARWC completed a multi-year evaluation of the sources of sediment and heat in the Beaver Creek subbasin. Quantifying these values and interactions facilitates an understanding of channel processes. An accurate assessment of channel processes is crucial for long-term aquatic restoration success. An evaluation of the change in sediment supply, particle size and effects on spawning was designed to establish potential restoration plans. Activities performed for this project included flow measurements, temperature recording, and sediment analysis for Beaver Creek. In addition, Palmer Creek and Star Gulch were monitored for temperature and winter turbidity.

Staff gauges were installed and stream flows taken to calibrate the gauges to discharge. Temperature recording devices were deployed. Bedload samples were evaluated following World Meteorological Organization (1981) protocol. Suspended sediment and turbidity were measured at each of the sites in winter and spring during high flows and substrate composition evaluated by Wolman pebble counts. Several cross-section transects were established to track changes in channel geometry.

The V* method is a useful tool for evaluating sediment supply and substrate habitat. V* is a direct and quantifiable measure of sediment volume in pools; therefore, the results are repeatable and comparable. The method samples a subset of pools in a reach, providing a cost-effective measure of sediment loading (Hilton and Lisle, 1993). The average calculated value for the sampled pools represents the value for the entire reach.

Suspended sediment was collected using a DH-48 depth integrated suspended sediment sampler. Sampling procedure followed USGS protocols and entailed sampling the water column at 10-20 verticals along an established cross section. Samples were taken to the lab, filtered, dried and weighed. Integrating discharge information with measured suspended sediment generated sediment expressed in tons per day. Sediment samples were collected and measured in January and February 2000 and in December 2002.

The study enabled baseline data on sediment, turbidity, temperature and discharge to be collected on Beaver Creek, Palmer Creek and Star Gulch. ARWC will continue to monitor summer discharge on Beaver and Palmer Creeks and future monitoring efforts will aid in the assessment of the Beaver Creek sedimentation 303(d) listing.

5.3 Thompson Creek Habitat Survey

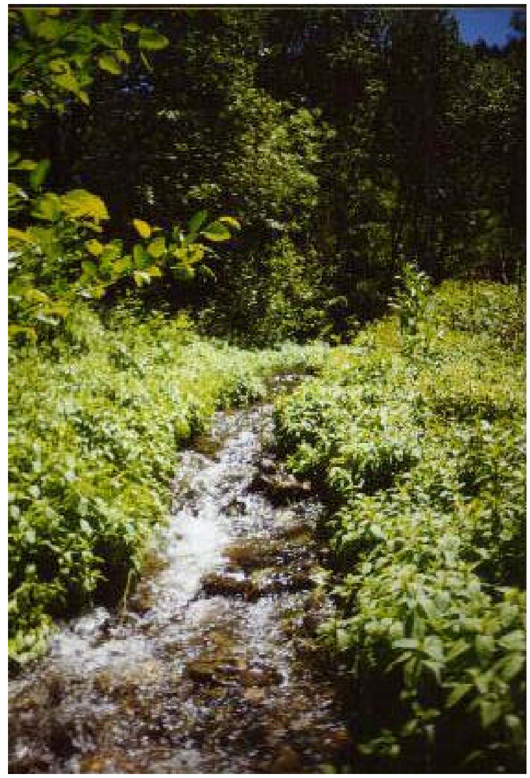
Thompson Creek is a significant tributary to the Applegate River, containing populations of fall Chinook and coho salmon, steelhead, cutthroat and rainbow trout. Thompson Creek also supports multiple agricultural uses, backyard gardens, and a diversity of wildlife. The ARWC completed a stream survey and water quality analysis of Thompson Creek in 2002 and 2003.

Stream surveys provide a detailed examination of a stream from the mouth to the headwaters. Using methods outlined in the ODFW Aquatic Inventory Project (Moore, Jones, Dambacher, 1999), the survey quantified stream substrate, pools, riffles, bank stability and riparian vegetation. The data provides a picture of the physical aquatic conditions within Thompson Creek.

ODFW completed a stream survey of Thompson Creek in 1996. Data from the 1996 and 2002 surveys were compared to detect changes in stream morphology due to the 1997 flood event. Cross sections were conducted at 4 sites in Thompson Creek in 2002 and three sites in 2003 (Appendix F).

Thompson Creek Survey Results

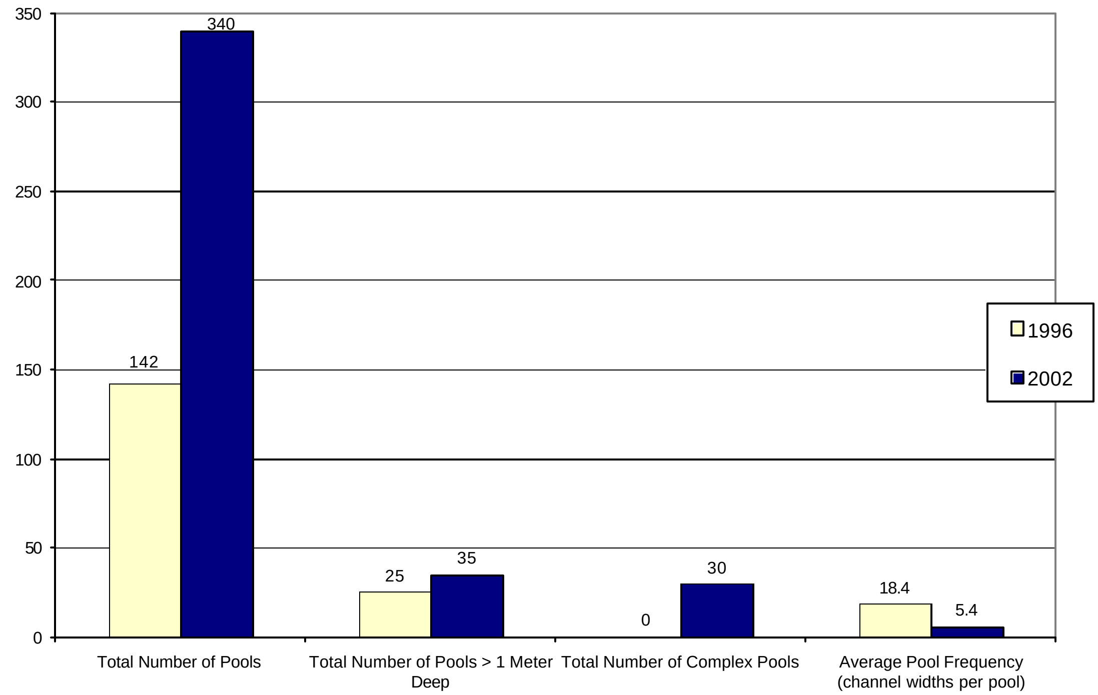
Accelerated stream bank erosion is occurring in Thompson Creek. Actively eroding banks are composed of alluvial sediments that are not stabilized by vegetation. Unstable banks contribute sediment slowly to the stream or collapse in large chunks under the force of gravity. Although bank erosion is a natural process, past mining, removal of streamside vegetation, and changes in stream geometry have increased the occurrence of bank erosion.



Thompson Creek

Comparing the 2002 stream survey data to the 1996 ODFW stream survey indicates improvement in fish habitat. Specifically, the number of pools has increased in frequency from a pool every 18 channel widths in 1996 to every 5 channel widths in 2002 (Figure 17). Pools, particularly deep pools, are important habitat for juvenile and adult fish during low water periods as they provide refuge from high temperatures, protection from predators and refugia from high velocity stream flows. Pools were created by large wood input and scouring as a result of the 1997 flood.

Figure 17. Thompson Creek ODFW Stream Survey Data



ODFW has established desirable habitat benchmarks for salmonids. Habitat conditions in Thompson Creek were quantified and compared with ODFW's benchmarks. Many reaches in Thompson Creek lack complex pools and large instream wood. While many reaches do not fall into the "undesirable" category, only one reach (reach 3) qualifies as desirable for pool habitat and no reaches qualify as desirable for large instream wood. Only reaches 1 and 9 qualify as "desirable" for number of complex pools.

Water temperature monitoring in Thompson Creek found that temperatures downstream of Tallowbox Creek (approximate road mile 3.5) routinely exceeded 64° F, and occasionally rose above 70° F. Water temperature increased nearly 5° F from Tallowbox Creek downstream to the mouth. ODFW (1994) found water temperatures highest during July, approaching 70° F at river mile 6. The lack of mature riparian vegetation along the creek and low stream flows contribute to these high temperature values.

The ARWC presented the findings of the Thompson Creek survey to landowners and solicited their involvement to assist in improving fish habitat and watershed conditions.

6.0 MONITORING PROGRAM SUMMARY

The *Water Quality and Stream Habitat Monitoring Program* has provided crucial data regarding watershed functions so that enhancement opportunities within the Applegate watershed can be identified. This program is the primary source of information on the chemical, physical and biological conditions on private lands in the Applegate. ARWC collaborates with federal and state agencies to integrate data across the watershed and involves partnerships between these agencies, private organizations and landowners.

Information gathered in the monitoring program has led to the development and implementation of stream restoration projects on the Little Applegate River, Slate Creek and Thompson Creek. In addition, data collected by ARWC contributed to the draft TMDL report prepared by ODEQ as required by the Clean Water Act. The TMDL report identifies streams exceeding water quality standards set by the EPA and adopted by the State of Oregon. Water Quality Management Plans will be implemented by designated to restore streams to proper functioning. ARWC monitoring data will provide information regarding the effectiveness of the WQMPs in restoring load allocations to TMDL levels.

The ARWC is dedicated to assisting landowners improve fish habitat and watershed conditions. The council contributes native vegetation and labor to restore streamside vegetation for shade and stream bank stabilization and noxious weed eradication. ARWC sponsors workshops to landowners to provide tools and ideas for reducing agricultural runoff and nutrient input. The council assists with projects to place large wood and structures in the stream to create more complex pools and improve fish habitat. The outreach work by the ARWC ensures that we raise awareness within the community regarding watershed health in addition to providing the tools to improve habitat.

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APPENDIX A

Aquatic Tracking Report

Rogue River Basin/Applegate Subbasin
Applegate River Watershed Council
Aquatic Tracking

H2O quality = temp, pH, conductivity, turbidity, DO & nitrates. **alkalinity and phosphates during 1997-2001

Turbidity = This is winter turbidity and is in addition to any H2O Quality sampling.

Type of Activity	5th Field Watershed	Stream Name	Number of Sites Visited					
			1999	2000	2001	2002	2003	2004
H2O Quality**		Applegate R	4	4	4	4	4	4
H2O Quality**	Slate/Cheney	Cheney Cr	2	2	1	1	1	1
H2O Quality**	Slate/Cheney	Slate Cr	3	3	3	3	3	3
H2O Quality**	Lower Applegate	Murphy Cr	1	1	1	1	1	1
H2O Quality**	Williams Cr	Williams Cr	3	2	2	2	2	2
H2O Quality**	Williams Cr	E.Fk.Williams Cr	1	1	1	1	1	1
H2O Quality**	Williams Cr	W.Fk. Williams Cr	2	2	2	2	1	1
H2O Quality**	Williams Cr	Munger Cr	1	1		1	1	1
H2O Quality**	Middle Applegate	Forest Cr	1	1	1	1	1	1
H2O Quality**	Middle Applegate	Humbug Cr	1					
H2O Quality**	Middle Applegate	Jackson Cr	1					
H2O Quality**	Middle Applegate	Thompson Cr	2	2	2	2	2	6
H2O Quality**	Little Applegate R	Little Applegate R.	4	3	3	3	3	3
H2O Quality**	Little Applegate R	Sterling Cr	1	1				
H2O Quality**	Little Applegate R	Yale Cr	1	1	1	1	1	1
H2O Quality**	Little Applegate R	Grouse Cr	1	1		1	1	1

			Number of Sites Visited					
Type of Activity	5th Field Watershed	Stream Name	1999	2000	2001	2002	2003	2004
H2O Quality**	Star/Beaver/Palmer	Beaver Cr	1	1	1	1	1	1
H2O Quality**	Star/Beaver/Palmer	Palmer Cr	1	1	1	1	1	1

Continuous Temp		Applegate R	1	1	1	2	1	1
Continuous Temp	Slate/Cheney	Slate Cr	3	3	3	3	3	3
Continuous Temp	Slate/Cheney	Cheney Cr	1	1	1	1	1	1
Continuous Temp	Lower Applegate	Murphy Cr	1	1	1	1	1	1
Continuous Temp	Williams Cr	Williams Cr	1	1	1	2	2	2
Continuous Temp	Williams Cr	E.Fk.Williams Cr	1	2	1	1	2	2
Continuous Temp	Williams Cr	W.Fk. Williams Cr	2	3	3	4	2	2
Continuous Temp	Williams Cr	Munger Cr	1	1		1		
Continuous Temp	Williams Cr	Rock Cr					1	
Continuous Temp	Williams Cr	Goodwin Cr					1	
Continuous Temp	Middle Applegate	Forest Cr	1	1	1	1		
Continuous Temp	Middle Applegate	Thompson Cr	1	1	1	1	4	6
Continuous Temp	Little Applegate R	Little Applegate R	3	3	2	3	3	3
Continuous Temp	Little Applegate R	Yale Cr	1	1	1	1	1	1
Continuous Temp	Little Applegate R	Grouse Cr	1	1	1	1	1	1
Continuous Temp	Little Applegate R	Sterling Cr	1			1		
Continuous Temp	Star/Beaver/Palmer	Palmer Cr	1	1	1	1	1	1
Continuous Temp	Star/Beaver/Palmer	Beaver Cr	1	1	1	1	1	1

Type of Activity	5th Field Watershed	Stream Name	Number of Sites Visited 1999	2000	2001	2002	2003	2004
Sonde data		Applegate R			4	2	2	
Sonde data	Slate/Cheney	Slate Cr			3	3	3	
Sonde data	Slate/Cheney	Cheney Cr			2			
Sonde data	Lower Applegate	Murphy Cr			1			
Sonde data	Williams Cr	Williams Cr			2	1	1	
Sonde data	Williams Cr	W.Fk. Williams Cr			2	1	1	
Sonde data	Williams Cr	E.Fk. Williams Cr				2	2	
Sonde data	Williams Cr	Munger Cr			1			
Sonde data	Middle Applegate	Thompson Cr			2	1	1	
Sonde data	Little Applegate R	Little Applegate R			3	4	2	
Sonde data	Little Applegate R	Little Applegate R						
Sonde data	Little Applegate R	Yale Cr			1	1	1	
Sonde data	Little Applegate R	Grouse Cr			1			
Sonde data	Star/Beaver/Palmer	Beaver Cr			1		1	
Sonde data	Star/Beaver/Palmer	Palmer Cr			1			
Turbidity		Applegate		1	1	1	2	
Turbidity	Lower Applegate	Jackson Cr	1	1				
Turbidity	Lower Applegate	Slagle Cr	1	1				
Turbidity	Slate/Cheney	Slate Cr				1	1	
Turbidity	Slate/Cheney	Waters Cr				3	3	

Type of Activity	5th Field Watershed	Stream Name	Number of Sites Visited 1999	2000	2001	2002	2003	2004
Turbidity	Slate/Cheney	Elliott Cr		1				
Turbidity	Williams Cr	Williams Cr		1	1	1	1	
Turbidity	Williams Cr	W.Fk. Williams Cr		1	1			
Turbidity	Williams Cr	E.Fk. Williams Cr		1	1			
Turbidity	Williams Cr	Rock Cr	1	1	1			
Turbidity	Williams Cr	Bluejay Cr	1	1				
Turbidity	Williams Cr	China Cr	1	1				
Turbidity	Middle Applegate	Thompson Cr				2	1	
Turbidity	Middle Applegate	Humbug	1	1			1	
Turbidity	Middle Applegate	Caris Cr	1	1				
Turbidity	Little Applegate R			3	5			
Turbidity	Little Applegate R	Crapsey Gulch	1	1				
Turbidity	Little Applegate R	Dog Fork	1	1				
Turbidity	Little Applegate R	1st Waters Gulch		1				
Turbidity	Little Applegate R	Glade Cr	1	1				
Turbidity	Star/Beaver/Palmer	Beaver		3	4	11	8	
Turbidity	Upper Applegate	Carberry Cr	1	1				
Turbidity		Long Gulch		1				
Turbidity		Miller Cr	1	1				
Suspended Sediment		Applegate R.		1				

Aquatic Tracking Summary

Type of Activity	5th Field Watershed	Stream Name	Number of Sites Visited 1999	2000	2001	2002	2003	2004
Suspended Sediment	Little Applegate R	Crapsey Gulch		1				
Suspended Sediment	Little Applegate R	Dog Fork		1	1			
Suspended Sediment	Little Applegate R	Glade Cr		1				
Suspended Sediment	Little Applegate R	Grouse Cr		1				
Suspended Sediment	Little Applegate R	Little Applegate R		1				
Suspended Sediment	Little Applegate R	Sterling Cr		1				
Suspended Sediment	Little Applegate R	Waters Gulch		1				
Suspended Sediment	Little Applegate R	Yale Cr		1	1			
Suspended Sediment	Star/Beaver/Palmer	Beaver Cr		1	1		2	
Suspended Sediment	Star/Beaver/Palmer	Palmer Cr		1				
Limited Bedload Sampling	Williams Cr	Williams Cr		1				
Limited Bedload Sampling	Star/Beaver/Palmer	Beaver Cr		1			2	
Limited Bedload Sampling	Little Applegate R	Yale Cr		1				
Limited Bedload Sampling	Little Applegate R	Crapsey Gulch		1				
Limited Bedload Sampling	Little Applegate R	Dog Fork		1				
Limited Bedload Sampling	Little Applegate R	Glade Cr		1				
Limited Bedload Sampling	Little Applegate R	Little Applegate R		1				
Limited Bedload Sampling	Star/Beaver/Palmer	Palmer Cr		1				
V*	Little Applegate R	Little Applegate R			1			

Type of Activity	5th Field Watershed	Stream Name	Number of Sites Visited 1999	2000	2001	2002	2003	2004
V*	Little Applegate R	Yale Cr		1			1	
V*	Star/Beaver/Palmer	Beaver Cr		1			1	
V*	Star/Beaver/Palmer	Palmer Cr		1				
Cross-section		Applegate		1	2	5	1	
Cross-section (pebble count in '99)	Slate/Cheney	Slate Cr	1			4		2
Cross-section	Slate/Cheney	Waters Cr				5	2	2
Cross-section	Slate/Cheney	Cheney Cr	1					
Cross-section (pebble count in '99)	Williams Cr	Williams Cr	1	4		1		
Cross-section	Williams Cr	E.Fk. Williams Cr		1				
Cross-section	Williams Cr	West Fork Williams Cr		1				
Cross-section	Williams Cr	Munger Cr		1				
Cross-section	Middle Applegate	Thompson Cr				4	6	2
Cross-section	Middle Applegate	Bishop Cr		1				
Cross-section	Middle Applegate	Forest Cr		1	1			1
Cross-section (pebble count in '99)	Little Applegate R	Little Applegate R	3	2				1
Cross-section (pebble count)	Little Applegate R	Yale Cr	1					
Cross-section	Star/Beaver/Palmer	Palmer Cr		1				
Cross-section	Star/Beaver/Palmer	Beaver Cr		1				
Cross-section	Upper Applegate	Applegate		3			5	2
Cross-section (scour chains)	Williams Cr	Williams Cr		2		1		

Type of Activity	5th Field Watershed	Stream Name	Number of Sites Visited 1999	2000	2001	2002	2003	2004
Cross-section (scour chains)	Williams Cr	Williams Cr				1		
Cross-section (scour chains)	Little Applegate R	Little Applegate R		2				
Cross-section (scour chains)	Upper Applegate	Applegate		1				1
Cross-section (pebble count)	Little Applegate R	Yale Cr	1					1
Longitudinal Profile	Slate/Cheney	Cheney Cr	1					
Longitudinal Profile	Star/Beaver/Palmer	Palmer Cr		1				
Longitudinal Profile	Slate/Cheney	Slate Cr				2		1
Longitudinal Profile	Slate/Cheney	Waters Cr				2	1	2
Longitudinal Profile	Middle Applegate	Thompson Cr					1	2
Longitudinal Profile	Little Applegate R	Little Applegate R		2				2
Longitudinal Profile	Star/Beaver/Palmer	Beaver Cr		1				
Flow	Slate/Cheney	Slate Cr	3	3		3	3	
Flow	Slate/Cheney	Cheney Cr	1	1			1	2
Flow	Slate/Cheney	Waters Cr				1		
Flow	Slate/Cheney	Ramsey Cr				1		
Flow	Williams Cr	Williams Cr	2	2	2	3	3	
Flow	Williams Cr	W.Fk. Williams Cr		2	2			
Flow	Williams Cr	E. Fk. Williams Cr	1	1	2	2		
Flow	Williams Cr	Powell Cr					1	

			Number of Sites Visited					
Type of Activity	**5th Field Watershed**	**Stream Name**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**
Flow	Middle Applegate	Thompson Cr	2	2		2	2	5
Flow	Little Applegate R	Little Applegate R.	3	3	1		3	2
Flow	Little Applegate R	Yale Cr	1	1	1	1	1	1
Flow	Little Applegate R	Glade Cr	1	1	1	1		
Flow	Little Applegate R	Grouse Cr	1			1		
Flow	Little Applegate R	Sterling Cr	1					
Flow	Little Applegate R	McDonald Cr			1	1		
Flow	Star/Beaver/Palmer	Beaver Cr		2	2	2	2	
Flow	Star/Beaver/Palmer	Palmer Cr		1			2	2
Flow	Star/Beaver/Palmer	Hanley Gulch				1		
Flow	Star/Beaver/Palmer	Haskins Gulch				1		
Flow		Armstrong Gulch		1				
Stream Survey - Level II	Williams Cr	Munger Cr	1					
Stream Survey - Level II	Little Applegate R	Little Applegate R		1				
Stream Survey - Level II	Little Applegate R	Thompson Cr				1		
Stream Survey - Level II		Upper Applegate R			1			
Stream Survey - Level III	Slate/Cheney	Slate Cr					1	
Stream Survey - Level III	Slate/Cheney	Waters Cr					1	1
Fish Survey: Snorkel		Applegate R			2			

Type of Activity	5th Field Watershed	Stream Name	Number of Sites Visited 1999	2000	2001	2002	2003	2004
Fish Survey: Snorkel	Little Applegate R	Little Applegate R		1	1	1	1	
Fish Survey: Snorkel	Williams Cr	Munger Cr			1			
Fish Survey: Snorkel	Williams Cr	Williams Cr			1			
Fish Survey: Snorkel	Little Applegate R	Yale Cr			1			
Fish Survey: Spawning	Little Applegate R	Little Applegate R		1	1	1	1	
Fish Survey: Spawning	Little Applegate R	Yale Cr			1	1		
Macroinvertebrate Survey		Applegate R	2	1	1			
Macroinvertebrate Survey	Slate/Cheney	Slate Cr						
Macroinvertebrate Survey	Slate/Cheney	Waters Cr	1	1	1			
Macroinvertebrate Survey	Slate/Cheney	Cheney Cr	1					
Macroinvertebrate Survey	Lower Applegate	Murphy Cr						
Macroinvertebrate Survey	Williams Cr	Williams Cr		1	1			
Macroinvertebrate Survey	Williams Cr	E.Fk. Williams Cr	1	1	1			
Macroinvertebrate Survey	Williams Cr	W.Fk. Williams Cr	1	1	1			
Macroinvertebrate Survey	Little Applegate R	Little Applegate R	1	1	2			
Macroinvertebrate Survey	Little Applegate R	Yale Cr	1	1	1			
Macroinvertebrate Survey	Little Applegate R	Glade						1
Macroinvertebrate Survey	Upper Applegate	Steves Fk						1
Macroinvertebrate Survey	Upper Applegate	Left Hand Fk Steves Fk						1
Macroinvertebrate Survey	Upper Applegate	Squaw Cr						1

APPENDIX B

Water Temperature Data

Applegate Watershed Temperature Summary Data - 2003

Temperature Monitoring Site	Start Date	Stop Date	Seasonal Max		Seasonal Min		Seasonal Max ΔT		7-Day average Temp C			
			Date	Value	Date	Value	Date	Value	Date	Max	Min	ΔT
Cheney Cr @ confl. Applegate R	06/07/03	09/01/03	07/30/03	20.6	06/24/03	11.9	08/30/03	5.4	07/30/03	20.1	17.6	2.5
Williams Ck 0.2rm abv Powell Ck (Granthums)*	06/11/03	09/01/03	07/29/03	22.6	06/24/03	13.3	06/26/03	5.4	07/28/03	22.1	18.9	3.2
West Fk Wms @ 2455 Cedar Flat	06/07/03	10/02/03	07/30/03	19.8	09/18/03	9.7	07/09/03	3.6	07/30/03	19.1	16.4	2.7
Thompson Cr below Tallowbox Ck (JD's)	06/07/03	10/05/03	07/30/03	19.5	06/24/03	11.5	06/28/03	4.6	07/29/03	19.1	16.4	2.7
West Fk Williams at Caves Camp Rd Bridge	06/07/03	10/02/03	07/30/03	19.2	09/18/03	9.9	08/17/03	3.3	07/30/03	18.5	16.1	2.4
Little Applegate R at road mile 2.6	06/07/03	10/05/03	07/22/03	24.9	06/24/03	9.5	07/04/03	8.1	07/20/03	23.2	16.2	7.1
Little Applegate R @ confl. Applegate R	06/07/03	10/07/03	07/30/03	26.5	06/24/03	9.7	07/29/03	8.7	07/28/03	25.5	17.6	7.9
Grouse Ck at mouth	06/24/03	10/05/03	07/21/03	20.7	06/24/03	9.5	07/17/03	4.6	07/21/03	20.0	16.4	3.6
Thompson Cr at 4625 Thompson Ck Rd*	06/26/03	10/05/03	07/30/03	21.0	09/18/03	11.4	08/17/03	4.8	07/29/03	20.3	16.3	4.0
Thompson Cr at 6285 Thompson Ck Rd*	06/11/03	10/05/03	07/30/03	19.2	06/24/03	11.0	06/25/03	3.7	07/29/03	18.7	16.2	2.5
Slate Ck @ road mile 1.6 (Jacob's)	06/07/03	10/02/03	07/30/03	22.0	09/18/03	9.6	06/26/03	4.6	07/30/03	21.1	17.5	3.6
Yale Ck at mouth	06/07/03	10/05/03	07/30/03	19.2	06/24/03	8.3	06/26/03	3.9	07/29/03	18.5	15.2	3.3
Williams at Williams HWY Bridge	06/07/03	10/02/03	08/04/03	21.6	06/24/03	11.9	06/25/03	5.5	07/28/03	20.9	17.3	3.6
Rock Cr @ confl. E Fk Williams Ck*	06/16/03	10/02/03	07/30/03	19.8	06/24/03	8.2	08/15/03	7.3	07/29/03	18.9	13.5	5.4
East Fk Williams Ck blw Rock Cr	06/07/03	10/02/03	07/30/03	18.5	06/24/03	9.0	06/25/03	3.0	07/30/03	17.8	15.7	2.2
Slate Ck abv Waters Ck @ Redwood Tavern	06/07/03	10/02/03	07/30/03	23.7	09/18/03	9.5	07/28/03	5.4	07/29/03	22.7	18.0	4.7
Beaver Ck at Mouth	06/07/03	10/05/03	07/30/03	20.5	09/18/03	9.4	06/25/03	3.7	07/30/03	20.0	17.6	2.4
Murphy Creek	06/07/03	10/02/03	07/30/03	20.5	09/18/03	9.4	06/25/03	3.7	07/30/03	20.0	17.6	2.4
Goodwin Ck @ 591 Cedar Flat Rd*	06/07/03	10/02/03	07/31/03	16.5	06/24/03	10.3	06/16/03	3.1	07/30/03	16.1	14.8	1.3
West Fk Williams Ck @ 1375 Cedar Flat Rd	06/13/03	10/02/03	07/30/03	23.6	06/24/03	10.9	07/11/03	5.9	07/29/03	22.7	17.4	5.4
Thompson Cr at 1095 Thompson Cr Rd*	06/07/03	10/01/03	07/30/03	25.4	09/18/03	13.3	09/01/03	7.4	07/29/03	24.6	19.2	5.4
Palmer Cr	06/07/03	10/05/03	07/31/03	29.4	09/30/03	10.9	09/02/03	15.2	09/02/03	25.7	13.7	12.0
East Fk Williams Ck abv Rock Cr (Chas's)*	06/07/03	10/02/03	07/30/03	19.0	06/24/03	9.3	08/17/03	3.4	07/29/03	18.4	15.5	2.9
Little Applegate R @ Yale Ck	06/07/03	09/02/03	07/30/03	20.7	06/24/03	9.0	06/26/03	4.2	07/28/03	20.2	16.5	3.7
Applegate R above mouth of Little App R	06/07/03	10/05/03	07/22/03	21.4	10/03/03	11.7	07/04/03	7.0	07/20/03	20.9	14.7	6.2

Notes: * - Seven new temperature monitoring sites in 2003

Applegate Watershed Temperature Summary Data - 2003 *page 2*

Temperature Monitoring Site	Days > 12.8 C	Days > 17.8 C	Days > 21.1 C	Hours > 12.8 C	Hours > 17.8 C	Hours > 21.1 C	Warmest day of 7-day max Date	Max	Min
Cheney Cr @ confl. Applegate R	87	51	0	2054.5	530.0	0.0	07/30/03	20.6	17.9
Williams Ck 0.2rm abv Powell Ck (Granthums)*	83	82	23	1991.5	1440.0	79.0	07/29/03	22.6	19.3
West Fk Wms @ 2455 Cedar Flat	114	20	0	2314.5	150.0	0.0	07/30/03	19.8	16.7
Thompson Cr below Tallowbox Ck (JD's)	121	45	0	2840.5	296.0	0.0	07/30/03	19.5	16.8
West Fk Williams at Caves Camp Rd Bridge	115	8	0	2351.0	69.0	0.0	07/30/03	19.2	16.5
Little Applegate R at road mile 2.6	120	73	24	2602.0	864.0	121.5	07/22/03	24.9	17.9
Little Applegate R @ confl. Applegate R	123	87	55	2704.5	1115.5	320.0	07/30/03	26.5	18.1
Grouse Ck at mouth	103	34	0	2226.5	259.0	0.0	07/21/03	20.7	16.2
Thompson Cr at 4625 Thompson Ck Rd*	102	45	0	2331.5	302.0	0.0	07/30/03	21.0	16.8
Thompson Cr at 6285 Thompson Ck Rd*	117	13	0	2638.0	102.5	0.0	07/30/03	19.2	16.6
Slate Ck @ road mile 1.6 (Jacob's)	117	61	5	2574.0	704.5	37.5	07/30/03	22.0	17.9
Yale Ck at mouth	109	11	0	2068.0	71.5	0.0	07/30/03	19.2	15.6
Williams at Williams HWY Bridge	118	89	3	2808.5	1036.5	4.5	07/30/03	21.4	17.4
Rock Cr @ confl. E Fk Williams Ck*	93	13	0	1563.5	94.0	0.0	07/30/03	19.8	14.2
East Fk Williams Ck blw Rock Cr	104	4	0	1994.5	24.0	0.0	07/30/03	18.5	16.0
Slate Ck abv Waters Ck @ Redwood Tavern	118	72	15	2638.0	898.5	83.0	07/30/03	23.7	18.7
Beaver Ck at Mouth	113	20	0	2368.0	320.0	0.0	07/30/03	20.5	17.8
Murphy Creek	110	20	0	2335.0	320.0	0.0	07/30/03	20.5	17.8
Goodwin Ck @ 591 Cedar Flat Rd*	112	0	0	2210.5	0.0	0.0	07/30/03	16.5	14.9
West Fk Williams Ck @ 1375 Cedar Flat Rd	112	75	20	2546.5	866.0	95.5	07/30/03	23.6	17.9
Thompson Cr at 1095 Thompson Cr Rd*	117	112	63	2807.5	1619.0	384.5	07/30/03	25.4	19.5
Palmer Cr	121	58	25	2856.0	631.5	170.5	09/02/03	28.7	13.5
East Fk Williams Ck abv Rock Cr (Chas's)*	113	9	0	2186.0	61.0	0.0	07/30/03	19.0	16.0
Little Applegate R @ Yale Ck	87	40	0	1811.0	265.5	0.0	07/30/03	20.7	16.8
Applegate R above mouth of Little App R	121	82	2	2731.0	655.5	3.0	07/22/03	21.4	15.1

Applegate Subbasin Stream Temperature Data (June 1 through October 31)
1999-2003

ODEQ's 7-Day Avg Max-17.8C/64.0F	2003				2002				2001				2000				1999			
Monitoring Site	Highest 7-Day Avg. Max (F)	No. Days above 7-Day Avg. Max	No. Days of Complete Data	Percent of Days Monitored Above 7-Day Avg.	Highest 7-Day Avg. Max (F)	No. Days above 7-Day Avg. Max	No. Days of Complete Data	Percent of Days Monitored Above 7-Day Avg. Max	Highest 7-Day Avg. Max (F)	No. Days above 7-Day Avg. Max	No. Days of Complete Data	Percent of Days Monitored Above 7-Day Avg.	Highest 7-Day Avg. Max (F)	No. Days above 7-Day Avg. Max	No. Days of Complete Data	Percent of Days Monitored Above 7-Day Avg.	Highest 7-Day Avg. Max (F)	No. Days above 7-Day Avg. Max	No. Days of Complete Data	Percent of Days Monitored Above 7-Day Avg.
Applegate R abv Little Applegate R	69.6	82	127	65	69.9	91	113	81	76.1	109	115	95	71.2	93	104	89	69.1	61	97	63
Cheney Ck at Road 37-7-13 Bridge					56.2	0	35	0	58.4	0	38	0	64.3	11	103	11	63.4	0	118	0
Cheney Ck at confl. Applegate R	68.2	51	93	55	64.5	6	36	17	64.6	5	27	19	69.4	54	103	52				
Grouse Ck at confl. Little Applegate R	68.0	34	107	32	70.0	43	97	44	68.3	31	69	45	68.0	24	104	23	63.8	0	97	0
Little Applegate blw Yale Ck	68.4	40	94	43	69.4	64	113	57	72.7	73	114	64	69.5	51	104	49	66.1	19	96	20
Murphy Creek at Cherry Flat	68.0	20	121	17	61.5	0	114	0	63.2	0	115	0	61.9	0	103	0	63.9	0	118	0
Palmer Ck at confl. Appl. R. at Palmer Ck Bridge	78.3	58	124	47	62.8	0	21	0	73.5	9	15	60	66.6	28	104	27	63.6	0	112	0
Slate Ck at confl. with Applegate R*					73.6	108	114	95	71.9	109	115	95	74.7	97	103	94	72.0	94	118	80
Slate Ck at rm 1.6	70.0	61	124	49	69.2	56	114	49	69.0	57	115	50	69.1	44	103	43	66.9	41	118	35
Slate Ck abv Waters Ck (Redwood Tavern)	72.9	72	121	60	71.1	69	114	61	70.8	70	115	61	70.5	58	122	48	68.6	54	118	46
Thompson Ck at Tallowbox Ck	66.4	45	127	35	65.7	12	89	13	65.7	23	95	24	67.6	41	102	40	67.0	53	119	45
Williams Ck abv Banning Cr at Williams Hwy	69.6	89	121	74	69.7	103	114	90	68.6	102	115	89	72.2	91	97	94	69.0	79	119	66
E Fk Williams Ck abv confl. WF Williams Cr	65.1	9	124	7	69.4	57	115	50	67.5	62	121	51	68.9	38	100	38	65.5	21	119	18
W Fk Williams Ck abv confl. w/ Munger Cr (Cedar Flat Rd)	66.4	75	124	60	65.0	29	133	22	67.5	29	115	25	65.6	14	100	14	62.7	0	119	0
W Fk Williams Ck at Cave Camp Rd. Bridge	65.3	8	124	6	64.2	2	114	2	66.1	10	115	9	64.9	10	100	10	62.5	0	119	0
Yale Ck near confl. Little Applegate R	65.3	11	124	9	64.4	8	113	7	67.4	19	114	17	64.5	11	104	11	62.7	0	96	0

*Data not available, hobo malfunctioned.

APPENDIX C

Turbidity Data

Turbidity Monitoring Results: 2000-2003

Applegate River @ McKee Bridge

Date	Time	NTU	Weather	Comments
12/5/2000		1		
1/3/2001	20:00	1		
2/6/2001	12:00	1		
2/6/2001	12:00	1		
3/6/2001	12:40	1		
4/4/2001	13:00	3		
12/5/2002	14:00	2	cloudy	
12/15/2002	15:00	21	stormy	high water
12/27/2002	10:00	10	hard rain	
12/29/2002	17:00	51	not raining	river full
1/5/2003	11:00	10	clear	
2/15/2003	13:30	1	clear	low
2/16/2003	13:30	2	rain	low/clear
3/6/2003	13:00	1	no rain	low/clear
3/16/2003	17:30	2	after 2 days of rain	
4/3/2003	16:30	0	after snow	

Applegate River below Thompson Creek

Date	Time	NTU	Weather	Comments
1/3/2003	11:20	17		

Thompson Creek @ ditch flume

Date	Time	NTU	Weather	Comments
12/16/2002	15:00	98	drizzle	after high water
1/27/2003		4	clearing	clear

Thompson Creek @ 4127 (Fisher's)

Date	Time	NTU	Weather	Comments
1/8/2003	8:00	2	clear	falling/clear

Little Applegate River @ mouth

Date	Time	NTU	Weather	Comments
12/16/2002	16:00	49	drizzle	after high water

Little Applegate River @ 2639

Date	Time	NTU	Weather	Comments
12/8/2002	10:00	0	clear	Water temp 30's night 21
12/16/2002	13:15	78		water rising/muddy
1/5/2003	10:00	5	clear sky	40degree/ water clearing

Sterling Creek @ Lee's (10021 Sterling Cr.)

Date	Time	NTU	Weather	Comments
1/12/2001		1		
2/5/2001	9:00	0		
4/4/2001		0		
12/4/2002	9:00	0	cloudy	
12/30/2002	10:29	2	lt.rain	water clearing
2/7/2003	8:30	0	clear	
3/10/2003	8:30	1	cloudy	GH=.70

Turbidity Monitoring Results: 2000-2003

Sterling Creek @ Mouth

Date	Time	NTU	Weather	Comments
12/6/2000	16:30	0		
2/5/2001	16:30	0		
3/7/2001	11:30	0		
4/4/2001	17:20	0		
1/3/2001	16:00	0		
12/4/2002	9:00	0		
12/30/2002	10:29	2		

Slate Creek @ Wacker's

Date	Time	NTU	Weather	Comments
12/6/2002	15:15	0	clear	stream falling, 3.7 in of rain in 2 weeks
2/7/2003	13:55	1	clear/cold	
4/4/2003		3	rising	

Waters Creek @ Stoners above Salt

Date	Time	NTU	Weather	Comments
12/5/2002	15:00	0	foggy/calm/45F	stream low and clear/collected at mouth of Salt creek
12/16/2002	10:00	28	major storm/45.5F	
12/30/2002	17:00	104	heavy rainfall	approx. 8.5 in of rain in 4 days
2/7/2003	11:00	1	clear/cold	
3/7/2003	13:00	0	cloudy/showers	52F
3/14/2003	10:00	8	partly cloudy	rising/discolored

Waters Creek @ Stoners below Salt

Date	Time	NTU	Weather	Comments
12/16/2002	10:00	28	major storm/45.5F	
12/30/2002	17:00	88	heavy rainfall	
1/2/2003	13:00	7	showers	
2/7/2003	11:00	1	clear/cold	
3/7/2003	13:00	0		
3/14/2003	10:00	10	cloudy	rising/discolored

Waters Creek @ Elliotts

Date	Time	NTU	Weather	Comments
12/14/2002	7:45	18	rainy	

Williams Creek @ Williams Hwy (old bridge)

Date	Time	NTU	Weather	Comments
12/6/2000	15:00	0		
1/3/2001	15:00	0		
2/6/2001	11:00	4		
12/16/2002	15:30	47	drizzle	after high water
3/14/2003	15:00	8	drizzle	

Turbidity Monitoring Results: 2000-2003

Beaver Creek @ mouth

Date	Time	NTU	Weather	Comments
11/29/2000	15:30	1		
12/14/2000	15:34	1		
1/2/2001	15:00	0		
1/24/2001	16:00	1		
2/6/2001	13:40	0		
4/6/2001	15:13	9		
11/29/2001	10:00	8		
12/14/2001		20		
1/8/2002	15:00	5		
12/16/2002	10:00	74	drizzle	after high water
12/31/2002	11:30	24		
1/27/2003	9:55	2	cloudy/drizzle	clear
2/13/2003	13:00	0		
3/17/2003	13:10	4	after 2 days of rain	clear
3/25/2003	12:50	1	drizzle	
4/1/2003		2		

Haskins Creek

Date	Time	NTU	Weather	Comments
12/14/00	15:50	0		
11/29/2001	9:45	2		
12/14/2001		3		
12/16/2002	13:50	18	drizzle	after high water
12/31/2002		4		
1/27/2003		2		

Hanley Gulch

Date	Time	NTU	Weather	Comments
12/14/2001	10:40	7		
12/16/2002	11:00	7	drizzle	after high water
12/31/2002		9		
1/27/2003		2		

Trib at Beaver-Sulfur Campground

Date	Time	NTU	Weather	Comments
12/14/00	15:45	1		
12/16/2002	10:21	5	drizzle	after high water
12/31/2002		10		

Beaver Creek above Petes Camp Ck

Date	Time	NTU	Weather	Comments
12/16/2002	12:10	35	drizzle	after high water
1/27/2003		25		

Petes Camp Creek

Date	Time	NTU	Weather	Comments
12/14/2001		21		
12/16/2002	12:25	19	drizzle	after high water
1/27/2003		9		

Turbidity Monitoring Results: 2000-2003

Trib across Hanley Gulch

Date	Time	NTU	Weather	Comments
12/16/2002	10:25	41	drizzle	after high water
12/31/2002		21		

Trib at 4.2 miles /FS boundry (opposite Haskins Gulch)

Date	Time	NTU	Weather	Comments
12/16/2002	11:15	138	drizzle	after high water
12/31/2002		42		
1/27/2003		26		

Trib at 5 miles /FS boundry

Date	Time	NTU	Weather	Comments
12/16/2002	11:15	55	drizzle	after high water
1/27/2003		51		

Trib below 40 3W 12

Date	Time	NTU	Weather	Comments
12/16/2002	11:10	58	drizzle	after high water
12/31/2002		36		
1/27/2003		28		

Texter Gulch

Date	Time	NTU	Weather	Comments
12/16/2002	10:20	3	drizzle	after high water
12/31/2002		4		

Palmer Creek

Date	Time	NTU	Weather	Comments
11/29/2001	9:30	1		
12/14/2001	9:00	4		
1/8/2002	14:35	2		
2/13/2003	13:00	1		
3/17/2003	13:15	2	clear/cloudy	
3/25/2003	11:50	1	drizzle	
4/1/2003		1		

Carberry Creek

Date	Time	NTU	Weather	Comments
11/29/00		4		
1/2/2002		5		
1/8/2002		8		
12/13/2002		2		
12/14/2002		53		muddy
12/29/2002		3		storm calming down
3/14/2003		2		after 2 days of rain

Turbidity Monitoring Results: 2000-2003

Poorman's Creek

Date	Time	NTU	Weather	Comments
2/6/2001	10:00	0		
3/5/2001		0		
4/4/2001		0		
1/3/2002	12:00	3		
12/2/2002	11:40	1	partly cloudy	no flow/pools only
1/8/2003	14:00	1	sunny	normal winter flow
2/6/2003	14:00	1	clear	
3/7/2003	10:30	0	cloudy	54F
4/4/2003	9:00	1		after rains

Humbug Creek (Rt Fork) @ 4099 Humbug

Date	Time	NTU	Weather	Comments
2/10/2003		0	clear	

East Fork Williams below Rock Creek

Date	Time	NTU
12/5/2000	8:00	1
1/2/2001	17:00	1
2/6/2001	12:00	1
3/6/2001	15:30	0
4/8/2001	14:30	2

East Fork Williams Creek above Rock Creek

Date	Time	NTU
12/5/2000	8:00	1
1/2/2001	17:00	1
2/6/2001	12:00	1
3/6/2001	15:30	0
4/8/2001	14:30	1

Rock Creek above confluence EF Williams Creek

Date	Time	NTU
12/5/2000	8:00	1
1/2/2001	17:00	0
2/6/2001	12:00	0
3/6/2001	15:30	0
4/8/2001	14:30	1

West Fork Williams Creek @ Marshall's

Date	Time	NTU
12/22/2000	9:00	2
1/7/2001		1
2/6/2001	9:45	1
3/2/2001		1
4/11/2001		1

Yale Creek above Dog Fork

Date	Time	NTU
11/28/2001	16:00	55
11/29/2001	11:35	2
12/14/2001	12:45	6
1/8/2002	16:30	13

4/30/2002		12

Yale Creek Below Dog Fork

Date	Time	NTU
11/28/2001	16:20	105

Yale Creek Below Dog Fork & Shump

Date	Time	NTU
11/28/2001	16:30	241

Yale Creek Below Quartz Gulch

Date	Time	NTU
11/28/2001	16:40	344

Quartz Gulch

Date	Time	NTU
12/14/2001		2
1/8/2002	16:00	2
4/30/2002		5

Dog Fork Creek

Date	Time	NTU
11/28/2001	16:05	130
11/29/2001	11:20	7
12/14/2001		7
1/8/2002	16:30	23
4/30/2002	13:02	10

Yale Creek @ Mouth

Date	Time	NTU
11/28/2001	17:00	129
11/29/2001	8:30	6
11/29/2001	11:00	7
12/14/2001	14:00	13
1/8/2002	16:45	11
4/30/2002	13:53	17

Little Applegate River below Yale Ck

Date	Time	NTU
11/29/2001	10:50	10
12/14/2001	14:00	10
1/8/2002	16:00	7

Little Applegate River above Yale Ck

Date	Time	NTU
11/29/2001	10:50	13
12/14/2001	14:00	9
1/8/2002	16:00	9
4/30/2002		18

APPENDIX D

Stream Flow Monitoring Data

Applegate River Watershed Council Stream Flow Measurements

Location	Date	Discharge (cfs)
Beaver Ck nr Mouth (FS boundary)	2/17/2000	14
Beaver Ck nr Mouth (FS boundary)	2/29/2000	36
Beaver Ck nr Mouth (FS boundary)	6/9/2000	4
Beaver Ck nr Mouth (FS boundary)	6/13/2000	3
Beaver Ck nr Mouth (FS boundary)	6/28/2000	3
Beaver Ck nr Mouth (FS boundary)	7/19/2000	2
Beaver Ck nr Mouth (FS boundary)	8/24/2000	1
Beaver Ck nr Mouth (FS boundary)	11/29/2000	5
Beaver Ck nr Mouth (FS boundary)	12/14/2000	4
Beaver Ck nr Mouth (FS boundary)	12/14/2001	27
Beaver Ck nr Mouth (FS boundary)	1/8/2002	15
Beaver Ck nr Mouth (FS boundary)	4/30/2002	16
Beaver Ck nr Mouth (FS boundary)	5/20/2002	3
Beaver Ck nr Mouth (FS boundary)	12/16/2002	117
Beaver Ck nr Mouth (FS boundary)	1/27/2003	14
Beaver Ck nr Mouth (FS boundary)	7/17/2003	1
Beaver Ck nr Mouth (FS boundary)	7/21/2003	1
Beaver Ck nr Mouth (FS boundary)	7/31/2003	1
Beaver Ck nr Mouth (FS boundary)	8/8/2003	2
Beaver Ck nr Mouth (FS boundary)	8/13/2003	2
Beaver Ck nr Mouth (FS boundary)	8/21/2003	1
Beaver Ck nr Mouth (FS boundary)	9/5/2003	1
Beaver Ck nr Mouth (FS boundary)	9/11/2003	1
Beaver Ck abv Pete's Camp Cr	12/14/2001	3
Beaver Ck abv Pete's Camp Cr	4/30/2002	5
Beaver Ck abv Pete's Camp Cr	12/16/2002	12
Beaver Ck @ Pete's Camp Cr	12/14/2001	3
Beaver Ck @ Pete's Camp Cr	12/16/2002	7
Beaver Ck at Bridge	7/17/2003	1.4
Beaver Ck at Bridge	7/21/2003	0.7
Beaver Ck at Bridge	7/31/2003	0.6
Beaver Ck at Bridge	8/8/2003	1.4
Beaver Ck at Bridge	8/13/2003	1.0
Beaver Ck at Bridge	8/21/2003	0.5
Beaver Ck at Bridge	9/5/2003	0.6
Beaver Ck at Bridge	9/11/2003	0.9
Cheney Ck	5/26/1999	6
Cheney Ck	2/25/2000	36
Cheney Ck	3/3/2000	52
Cheney Ck	6/27/2000	2
Cheney Ck	7/26/2000	1
Glade Ck @ Mouth	7/23/1999	12
Glade Ck @ Mouth	10/14/1999	7
Glade Ck @ Mouth	4/13/2000	66
Glade Ck @ Mouth	6/8/2000	36
Glade Ck @ Mouth	6/20/2000	18
Glade Ck @ Mouth	6/26/2000	11
Glade Ck @ Mouth	7/6/2000	13
Glade Ck @ Mouth	7/17/2000	7
Glade Ck @ Mouth	8/7/2000	4
Glade Ck @ Mouth	8/23/2000	4
Glade Ck @ Mouth	7/17/2001	7
Glade Ck @ Mouth	6/13/2002	11
Grouse Ck @ Mouth	7/31/1999	0.5
Hanley Cr	12/16/2002	8
Hanley Cr	12/31/2002	27
Haskins Gulch	12/16/2002	4
Haskins Gulch	12/31/2002	8

Applegate River Watershed Council Stream Flow Measurements

Location	Date	Discharge (cfs)
Little Applegate @ Brickpile	11/11/1999	10
Little Applegate @ Brickpile	2/29/2000	41
Little Applegate @ Brickpile	6/6/2000	20
Little Applegate @ Brickpile	6/20/2000	23
Little Applegate @ Brickpile	6/26/2000	13
Little Applegate @ Brickpile	7/17/2000	12
Little Applegate @ Brickpile	8/23/2001	7
Little Applegate abv Glade Ck	7/23/1999	15
Little Applegate abv Glade Ck	10/4/1999	8
Little Applegate abv Glade Ck	2/29/2000	24
Little Applegate River @ Mouth	7/30/1999	28
Little Applegate River @ Mouth	5/18/2000	74
Little Applegate River @ Mouth	6/8/2000	118
Little Applegate River @ Mouth	6/12/2000	81
Little Applegate River @ Mouth	6/20/2000	55
Little Applegate River @ Mouth	6/29/2000	30
Little Applegate River @ Mouth	7/18/2000	18
Little Applegate River @ Mouth	8/1/2000	12
Little Applegate River @ Mouth	8/17/2000	8
Little Applegate River @ Mouth	8/23/2000	3
Little Applegate River @ Mouth	4/25/2001	57
Little Applegate River @ Mouth	5/14/2001	35
Little Applegate River @ Mouth	5/23/2001	22
Little Applegate River @ Mouth	6/15/2001	5
Little Applegate River @ Mouth	6/21/2001	4
Little Applegate River @ Mouth	7/11/2001	2
Little Applegate River @ Mouth	7/19/2001	6
Little Applegate River @ Mouth	8/22/2001	1
Little Applegate River @ Mouth	4/17/2002	94
Little Applegate River @ Mouth	6/6/2002	74
Little Applegate River @ Mouth	6/20/2002	35
Little Applegate River @ Mouth	7/19/2002	6
Little Applegate River @ Mouth	8/9/2002	4
Little Applegate River @ Mouth	8/18/2002	2
Little Applegate River @ Mouth	9/5/2002	1
Little Applegate River @ Mouth	10/14/2002	8
Little Applegate River @ Mouth	5/8/2003	109
Little Applegate River @ Mouth	7/30/2003	3
Little Applegate River @ Mouth	8/7/2003	19
Little Applegate River @ Mouth	8/13/2003	8
Little Applegate River @ Mouth	8/21/2003	8
Little Applegate River @ Mouth	8/28/2003	8
Little Applegate River @ Mouth	9/5/2003	9
Little Applegate River @ Mouth	9/11/2003	8
Little Applegate @ Tunnel Ridge	7/30/1999	28
Little Applegate @ Tunnel Ridge	10/13/1999	4
Little Applegate @ Tunnel Ridge	7/17/2000	13
Little Applegate blw Grouse Ck	6/20/2002	37
Little Applegate blw Grouse Ck	6/25/2002	29
Little Applegate blw Grouse Ck	7/5/2002	19
Little Applegate blw Grouse Ck	7/19/2002	16
Little Applegate blw Grouse Ck	8/9/2002	12
Little Applegate blw Grouse Ck	8/19/2003	8
Little Applegate blw Grouse Ck	9/5/2002	6
Little Applegate blw Grouse Ck	10/14/2002	14
Little Applegate blw Grouse Ck	5/8/2003	108
Little Applegate blw Grouse Ck	7/2/2003	36
Little Applegate blw Grouse Ck	7/15/2003	25

Applegate River Watershed Council Stream Flow Measurements

Location	Date	Discharge (cfs)
Little Applegate blw Grouse Ck	7/30/2003	12
Little Applegate blw Grouse Ck	8/7/2003	30
Little Applegate blw Grouse Ck	8/13/2003	14
Little Applegate blw Grouse Ck	8/21/2003	13
Little Applegate blw Grouse Ck	8/28/2003	13
Little Applegate blw Grouse Ck	9/5/2003	11
Little Applegate blw Grouse Ck	9/11/2003	12
Little App abv McDonald Ck	8/23/2001	3
Little Applegate abv Yale Ck	7/1/1999	63
Little Applegate abv Yale Ck	10/13/1999	10
Little Applegate abv Yale Ck	11/3/1999	13
Little Applegate abv Yale Ck	11/16/1999	16
Little Applegate abv Yale Ck	12/1/1999	20
Little Applegate abv Yale Ck	12/9/1999	18
Little Applegate abv Yale Ck	1/11/2000	88
Little Applegate abv Yale Ck	2/14/2000	114
Little Applegate abv Yale Ck	2/29/2000	77
Little Applegate abv Yale Ck	6/8/2000	114
Little Applegate abv Yale Ck	6/12/2000	64
Little Applegate abv Yale Ck	6/20/2000	44
Little Applegate abv Yale Ck	6/26/2000	35
Little Applegate abv Yale Ck	7/7/2000	24
Little Applegate abv Yale Ck	7/17/2000	19
Little Applegate abv Yale Ck	8/2/2000	16
Little Applegate abv Yale Ck	8/23/2000	6
Little Applegate abv Yale Ck	5/23/2001	25
Little Applegate abv Yale Ck	6/21/2001	8
Little Applegate @ Yale Ck	7/29/1999	15
Little Applegate @ Yale Ck	9/12/1999	4
Little Applegate @ Yale Ck	12/1/1999	5
Little Applegate @ Yale Ck	12/9/1999	5
Little Applegate @ Yale Ck	1/11/2000	32
Little Applegate @ Yale Ck	2/14/2000	63
Little Applegate @ Yale Ck	2/29/2000	77
Little Applegate @ Yale Ck	6/8/2000	114
Little Applegate @ Yale Ck	6/12/2000	64
Little Applegate @ Yale Ck	6/20/2000	44
Little Applegate @ Yale Ck	6/26/2000	35
Little Applegate @ Yale Ck	7/17/2000	24
Little Applegate @ Yale Ck	8/2/2000	4
Little Applegate @ Yale Ck	8/22/2000	2
Little Applegate @ Yale Ck	5/14/2001	35
Little Applegate @ Yale Ck	5/23/2001	7
Little Applegate @ Yale Ck	6/21/2001	3
Little Applegate @ Yale Ck	6/14/2002	44
McDonald Ck	8/23/2001	3
McDonald Ck	5/14/2002	19
McDonald Ck	7/5/2002	2
McDonald Ck	9/17/2002	2
Munger Ck	5/12/2000	7
Munger Ck	6/15/2000	3
Palmer Ck @ FS Boundary	2/18/2000	7
Palmer Ck @ FS Boundary	6/8/2000	2
Palmer Ck @ FS Boundary	6/9/2000	1
Palmer Ck @ FS Boundary	6/13/2000	2
Palmer Ck @ FS Boundary	6/26/2000	1
Palmer Ck @ FS Boundary	7/19/2000	1
Palmer Ck @ FS Boundary	8/1/2000	1

Applegate River Watershed Council Stream Flow Measurements

Location	Date	Discharge (cfs)
Palmer Ck @ FS Boundary	8/24/2000	0.4
Palmer Ck u/s of diversion	7/17/2003	0.9
Palmer Ck u/s of diversion	8/8/2003	0.5
Palmer Ck u/s of diversion	8/15/2003	0.2
Palmer Ck d/s of diversion	7/17/2003	0.6
Palmer Ck d/s of diversion	8/8/2003	0.4
Palmer Ck d/s of diversion	8/15/2003	0.3
Powell Ck @ 1.9 mile	6/15/2000	2
Powell Ck @ 1.9 mile	6/1/2701	1
Powell Ck @ 1.9 mile	6/13/2001	1
Powell Ck @ 1.9 mile	7/30/2001	1
Powell Ck @ 1.9 mile	7/19/2001	1
Powell Ck @ 1.9 mile	7/30/2001	1
Powell Ck @ 1.9 mile	6/27/2002	2
Powell Ck @ 1.9 mile	7/23/2002	2
Ramsey Ck @ Upper Slate Rd	12/18/2002	41
Slate Ck	6/22/2000	6
Slate Ck	7/27/2000	2
Slate Ck	12/18/2002	69
Sterling Ck nr Mouth	8/10/1999	1
Sterling Ck nr Mouth	10/13/1999	0
Sterling Ck nr Mouth	11/3/1999	0
Sterling Ck nr Mouth	8/1/2000	1
Thompson Ck blw Tallowbox	7/15/1999	4
Thompson Ck blw Tallowbox	2/24/2000	38
Thompson Ck blw Tallowbox	6/14/2000	8
Thompson Ck blw Tallowbox	6/22/2000	3
Thompson Ck blw Tallowbox	7/27/2000	1
Thompson Ck blw Tallowbox	8/24/2000	1
EF Williams Ck @ Mouth	2/24/2000	30
EF Williams Ck @ Mouth	3/14/2000	29
EF Williams Ck @ Mouth	3/3/2000	44
EF Williams Ck @ Mouth	5/12/2000	13
EF Williams Ck @ Mouth	6/2/2000	9
EF Williams Ck @ Mouth	6/15/2000	9
EF Williams Ck @ Mouth	6/26/2000	6
EF Williams Ck @ Mouth	7/19/2001	3
EF Williams Ck blw Rock Ck	5/26/1999	6
EF Williams Ck blw Rock Ck	9/8/1999	4
EF Williams Ck blw Rock Ck	5/12/2000	16
EF Williams Ck blw Rock Ck	6/2/2000	12
EF Williams Ck blw Rock Ck	6/15/2000	8
EF Williams Ck blw Rock Ck	6/26/2000	5
EF Williams Ck blw Rock Ck	7/19/2001	3
WF Williams Ck @ Mouth	5/12/2000	41
WF Williams Ck @ Mouth	6/2/2000	19
WF Williams Ck @ Mouth	6/15/2000	14
WF Williams Ck @ Mouth	6/26/2000	9
WF Williams Ck @ Mouth	7/19/2001	1
WF Williams Ck @ Mouth	9/19/2002	3
WF Williams @ Mile 2	6/15/2000	9
Williams Ck @ Mouth	3/3/2000	284
Williams Ck @ Mouth	4/19/2000	86
Williams Ck @ Mouth	5/12/2000	74
Williams Ck @ Mouth	6/2/2000	35
Williams Ck @ Mouth	6/15/2000	21
Williams Ck @ Mouth	2/24/2000	149
Williams Ck @ Mouth	6/26/2000	10

Applegate River Watershed Council Stream Flow Measurements

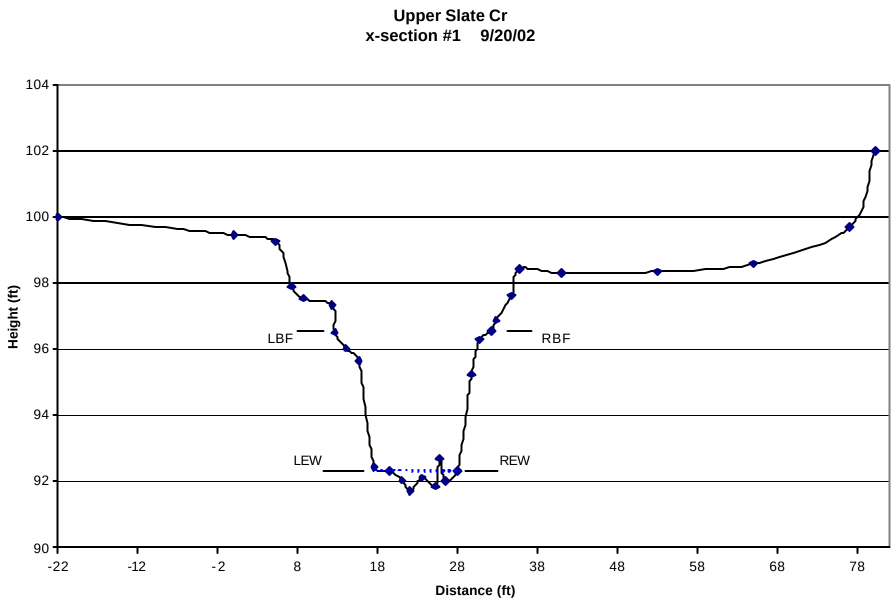
Location	Date	Discharge (cfs)
Williams Ck @ Mouth	8/4/2000	3
Williams Ck @ Mouth	5/29/2002	1
Williams Ck @ Mouth	6/27/2002	1
Williams Ck @ Mouth	1/3/2003	483
Williams Ck @ Hwy 238 Bridge	5/16/2000	56
Williams Ck @ Hwy 238 Bridge	6/2/2000	29
Williams Ck @ Hwy 238 Bridge	6/15/2000	21
Williams Ck @ Hwy 238 Bridge	6/26/2000	15
Williams Ck @ Hwy 238 Bridge	8/4/2000	5
Williams Ck @ Hwy 238 Bridge	8/17/2000	6
Williams Ck @ Hwy 238 Bridge	4/23/2001	24
Williams Ck @ Hwy 238 Bridge	5/15/2001	23
Williams Ck @ Hwy 238 Bridge	5/30/2001	5
Williams Ck @ Hwy 238 Bridge	6/19/2001	3
Williams Ck @ Hwy 238 Bridge	6/27/2001	9
Williams Ck @ Hwy 238 Bridge	7/9/2001	3
Williams Ck @ Hwy 238 Bridge	7/19/2001	2
Williams Ck @ Hwy 238 Bridge	7/30/2001	2
Williams Ck @ Hwy 238 Bridge	9/7/2001	2
Williams Ck @ Hwy 238 Bridge	5/29/2002	22
Williams Ck @ Hwy 238 Bridge	6/27/2002	6
Williams Ck @ Hwy 238 Bridge	7/23/2002	4
Williams Ck @ Hwy 238 Bridge	9/19/2002	1
Williams Ck @ Hwy 238 Bridge	7/15/2003	8
Williams Ck @ Hwy 238 Bridge	8/28/2003	5
Williams Ck @ Hwy 238 Bridge	9/18/2003	11
Williams Ck @ Williams Hwy Bridge	9/19/2002	3
Williams Ck @ Williams Hwy Bridge	6/30/2003	13
Williams Ck @ Williams Hwy Bridge	7/15/2003	9
Williams Ck @ Williams Hwy Bridge	7/31/2003	3
Williams Ck @ Williams Hwy Bridge	8/7/2003	7
Williams Ck @ Williams Hwy Bridge	8/14/2003	6
Williams Ck @ Williams Hwy Bridge	8/20/2003	4
Williams Ck @ Williams Hwy Bridge	8/28/2003	3
Williams Ck @ Williams Hwy Bridge	9/18/2003	8
Williams Ck @ Williams Hwy Bridge	10/20/2003	10
Williams Ck abv Powell Ck	6/30/2003	12
Williams Ck abv Powell Ck	7/15/2003	5
Williams Ck abv Powell Ck	7/31/2003	1
Williams Ck abv Powell Ck	8/7/2003	3
Williams Ck abv Powell Ck	8/14/2003	2
Williams Ck abv Powell Ck	8/20/2003	1
Williams Ck abv Powell Ck	8/28/2003	1
Williams Ck abv Powell Ck	9/18/2003	8
Yale Ck @ Mouth	7/1/1999	63
Yale Ck @ Mouth	10/13/1999	4
Yale Ck @ Mouth	11/3/1999	13
Yale Ck @ Mouth	12/1/1999	5
Yale Ck @ Mouth	12/9/1999	5
Yale Ck @ Mouth	7/29/1999	15
Yale Ck @ Mouth	9/12/1999	4
Yale Ck @ Mouth	1/11/2000	32
Yale Ck @ Mouth	2/14/2000	63
Yale Ck @ Mouth	2/29/2000	41
Yale Ck @ Mouth	6/8/2000	24
Yale Ck @ Mouth	6/12/2000	14
Yale Ck @ Mouth	6/20/2000	14
Yale Ck @ Mouth	6/26/2000	11

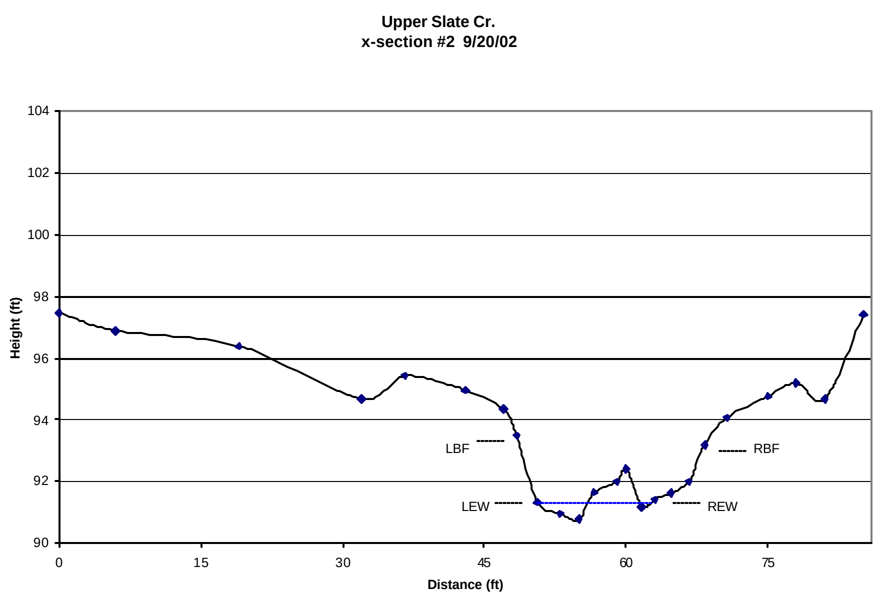
Applegate River Watershed Council Stream Flow Measurements

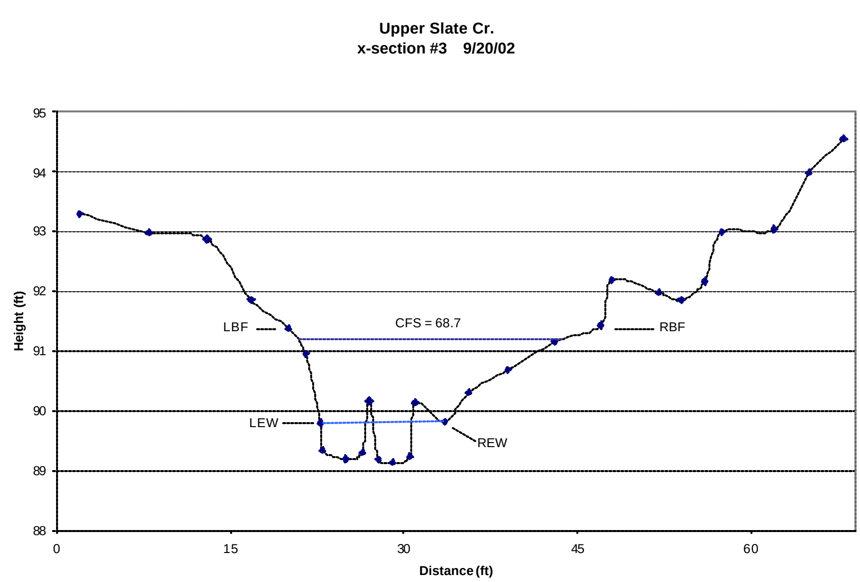
Location	Date	Discharge (cfs)
Yale Ck @ Mouth	7/17/2000	6
Yale Ck @ Mouth	8/2/2000	4
Yale Ck @ Mouth	8/22/2000	2
Yale Ck @ Mouth	6/21/2001	3
Yale Ck @ Mouth	7/2/2003	8
Yale Ck @ Mouth	7/30/2003	2
Yale Ck @ Mouth	8/13/2003	3

APPENDIX E

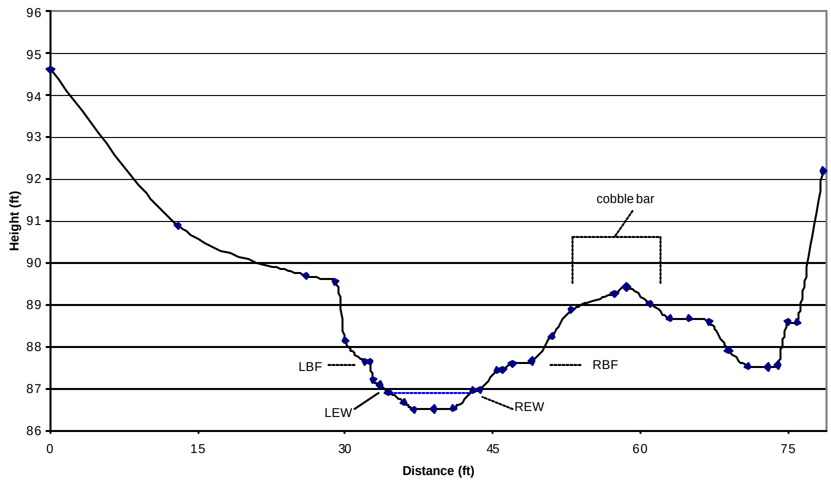
Slate and Waters Creeks Cross Sections


Upper Slate Cr
x-section #1 9/20/02
Height (ft)
Distance (ft)
LBF
RBF
LEW
REW
104
102
100
98
96
94
92
90
-22
-12
-2
8
18
28
38
48
58
68
78

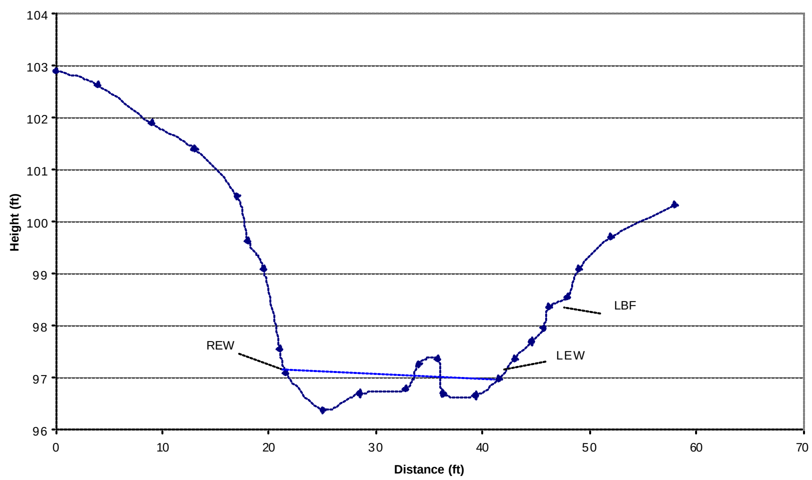

Upper Slate Cr.
x-section #2 9/20/02
Height (ft)
Distance (ft)
LBF
RBF
LEW
REW
104
102
100
98
96
94
92
90
0
15
30
45
60
75


Upper Slate Cr.
x-section #3 9/20/02
Height (ft)
Distance (ft)
CFS = 68.7
LBF
RBF
LEW
REW
95
94
93
92
91
90
89
88
0
15
30
45
60

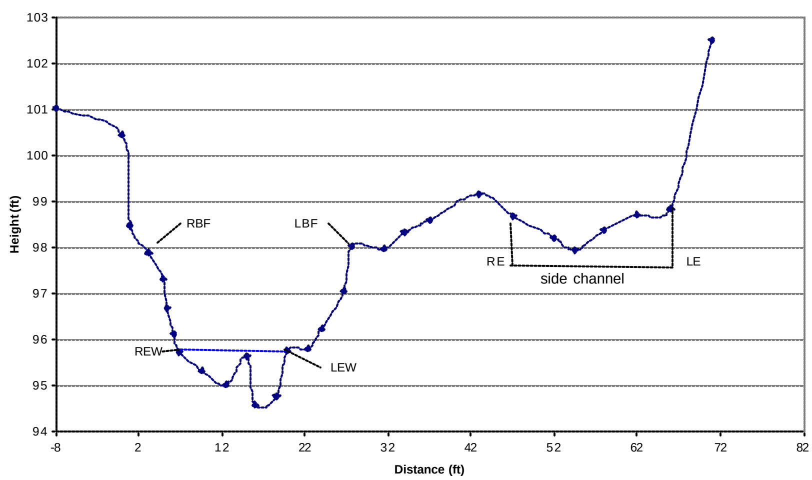
Upper Slate Cr.
x-section #4 10/14/02

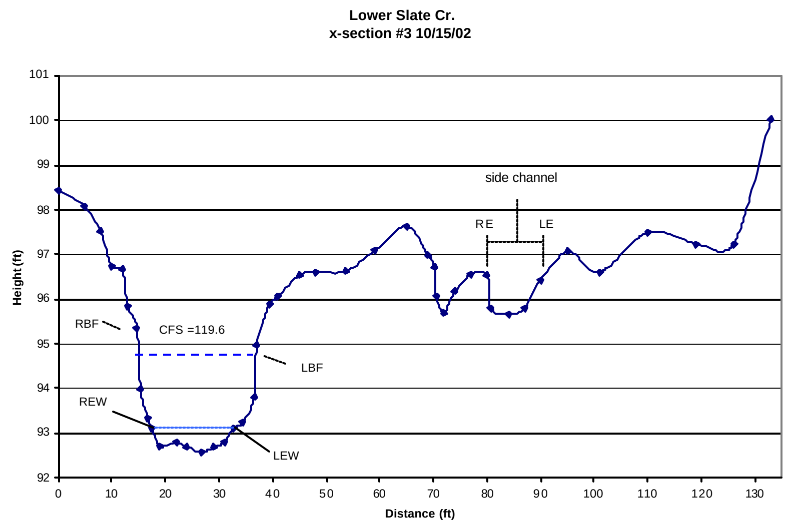


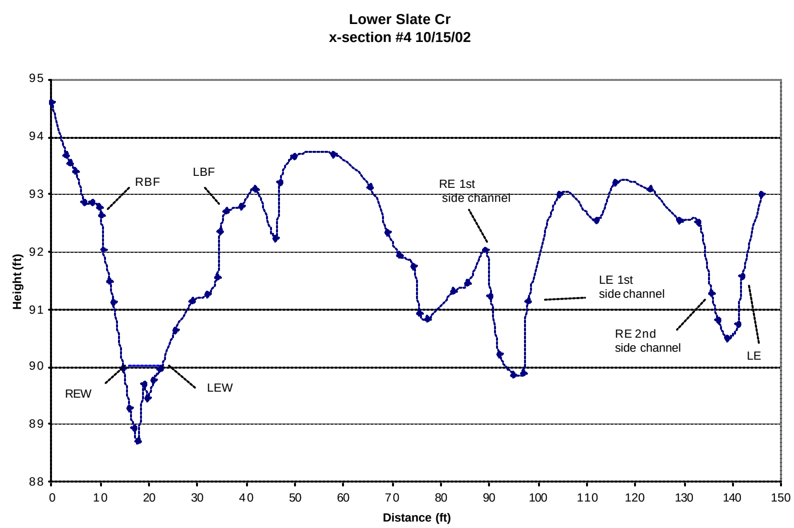
Lower Slate Cr
x-section #1 10/15/02



Lower Slate Cr
x-section #2 10/15/02

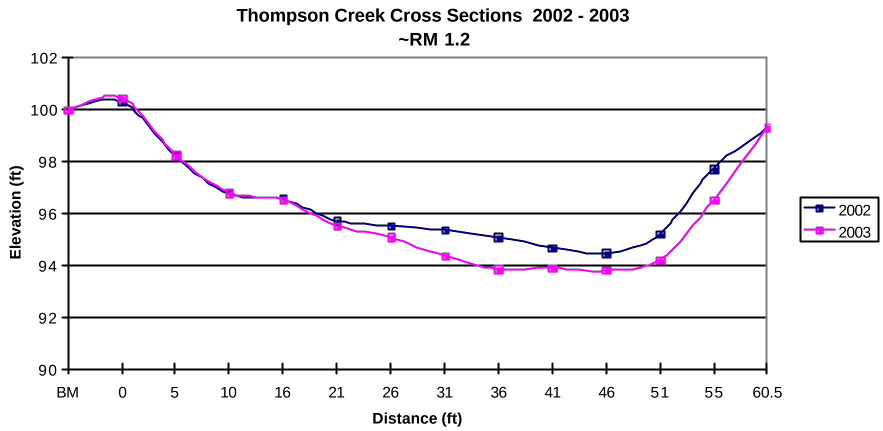


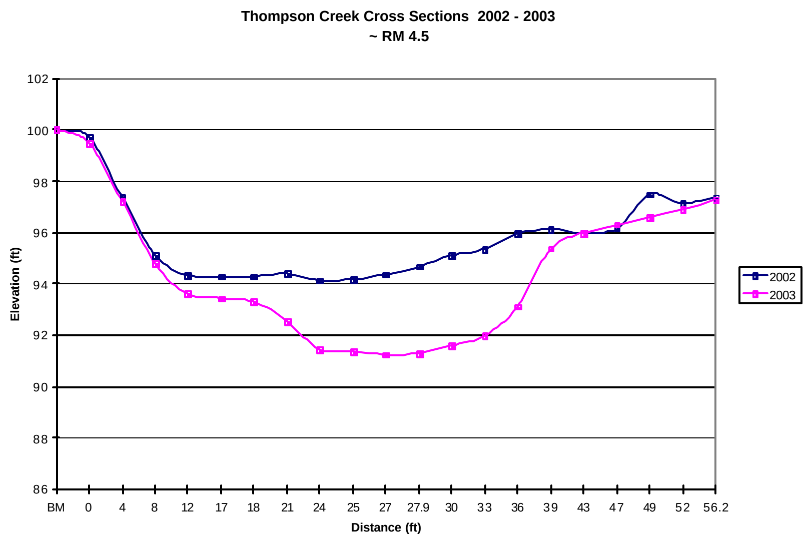

Lower Slate Cr.
x-section #3 10/15/02
Height (ft)
Distance (ft)
side channel
RE
LE
RBF
CFS =119.6
LBF
REW
LEW
101
100
99
98
97
96
95
94
93
92
0
10
20
30
40
50
60
70
80
90
100
110
120
130

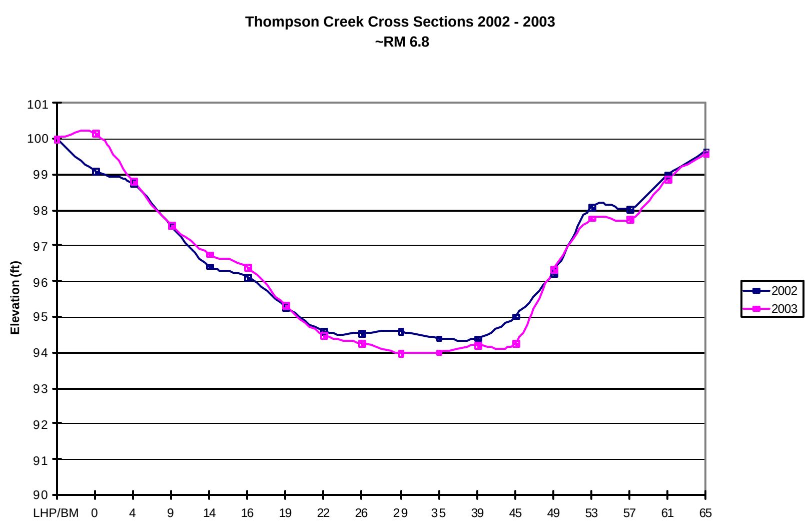

Lower Slate Cr
x-section #4 10/15/02
Height (ft)
Distance (ft)
RBF
LBF
RE 1st
side channel
LE 1st
side channel
RE 2nd
side channel
LE
REW
LEW
95
94
93
92
91
90
89
88
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150

APPENDIX F

Thompson Creek Cross Sections


Thompson Creek Cross Sections 2002 - 2003
~RM 1.2
Elevation (ft)
102
100
98
96
94
92
90
BM 0 5 10 16 21 26 31 36 41 46 51 55 60.5
Distance (ft)
2002
2003


Thompson Creek Cross Sections 2002 - 2003
~ RM 4.5
Elevation (ft)
102
100
98
96
94
92
90
88
86
BM 0 4 8 12 17 18 21 24 25 27 27.9 30 33 36 39 43 47 49 52 56.2
Distance (ft)
2002
2003


Thompson Creek Cross Sections 2002 - 2003
~RM 6.8
Elevation (ft)
101
100
99
98
97
96
95
94
93
92
91
90
LHP/BM 0 4 9 14 16 19 22 26 29 35 39 45 49 53 57 61 65
Distance (ft)
2002
2003